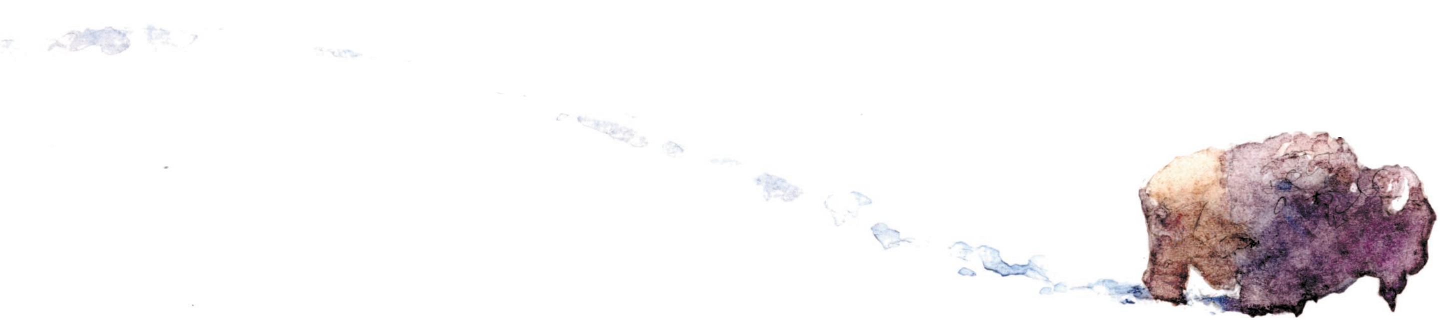
Bison Management Plan

for the State of Montana and Yellowstone National Park

FINAL ENVIRONMENTAL

IMPACT STATEMENT



VOLUME ONE

FINAL ENVIRONMENTAL IMPACT STATEMENT FOR THE INTERAGENCY BISON MANAGEMENT PLAN FOR THE STATE OF MONTANA AND YELLOWSTONE NATIONAL PARK

AUGUST 2000

This final environmental impact statement documents the additions and changes made to the *Draft Environmental Impact Statement* released to the public in June 1998 that are now contained in volume 1 of this final environmental impact statement. Original text from the *Draft Environmental Impact Statement* is shown in black, while changes and additions to the draft are shown in green. The exception to this is headings. Both original and new headings are shown in black.

Bison are an essential component of Yellowstone National Park because they contribute to the biological, ecological, cultural, and aesthetic purposes of the park. However, Yellowstone National Park is not a self-contained ecosystem for bison, and periodic migrations into Montana are natural events. Some bison have brucellosis and may transmit it to cattle outside the park boundaries in Montana. Left unchecked, the migration of brucellosis-infected bison from Yellowstone National Park into Montana could have not only direct effects on local livestock operators, but also on the cattle industry statewide. The cooperation of several agencies is required to fully manage the herd and the risk of transmission of brucellosis from bison to Montana domestic cattle.

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The purpose of the proposed interagency action is to maintain a wild, free-ranging population of bison and address the risk of brucellosis transmission to protect the economic interest and viability of the livestock industry in the state of Montana.

The U.S. Department of the Interior, National Park Service, and the U.S. Department of Agriculture, Forest Service, are the federal lead agencies. The U.S. Department of Agriculture, Animal and Plant Health Inspection Service (APHIS), is a cooperating agency. Until December 1999, the state of Montana was the state lead agency in the preparation of the environmental impact statement.

In 1992, the National Park Service, U.S. Forest Service, APHIS, and the state of Montana executed a Memorandum of Understanding to establish an understanding regarding the roles and responsibilities of those agencies in the preparation of a long-term bison management plan and environmental impact statement for the Yellowstone area. This Memorandum of Understanding is included in volume 1, appendix C of the final environmental impact statement. The Memorandum of Understanding identified the National Park Service, the U.S. Forest Service, and the state of Montana as joint-leads for the project and identified APHIS as a cooperating agency. The agreement provided that the joint-lead agencies must agree on the planning procedures and plan contents at each stage of the planning process. Finally, the agreement provided that any agency could terminate the agreement by providing a 30-day notice to the other parties that the agency would withdraw from the agreement.

In 1995 the state of Montana sued the National Park Service and APHIS, claiming, among other things, that their actions were delaying the completion of the environmental impact statement and long-term bison management plan. To resolve that case, the parties signed a settlement agreement that provided a schedule for the completion of the bison management plan. The settlement agreement incorporated the Memorandum of Understanding and expressly recognized that the termination provision of the Memorandum of Understanding would continue to apply to the process. The settlement agreement also required that if a party were to withdraw from the Memorandum of Understanding process, it must provide a written explanation of the reasons for the withdrawal. Finally, the settlement agreement provided that the court would dismiss the suit if a party terminated the Memorandum of Understanding.

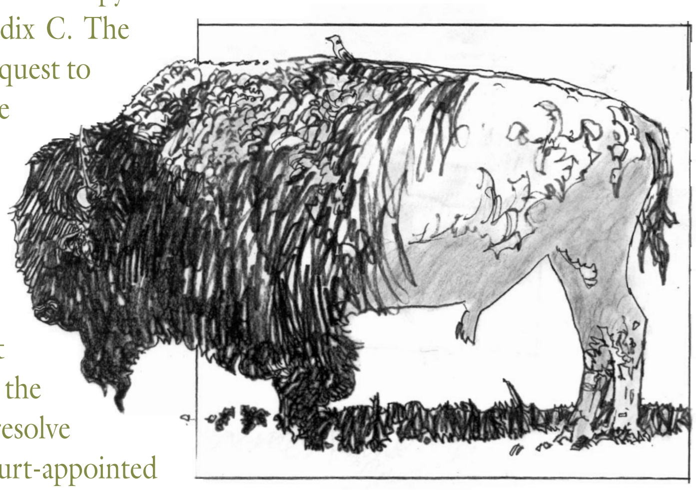
Following the receipt and analysis of public comments on the *Draft Environmental Impact Statement* (the review period for which ended in October 1998), the federal agencies developed a strategy for bison management that they presented to the state as a possible modified preferred alternative for the final environmental impact statement. The new strategy would allow greater tolerance for bison outside the park under stringent conditions that would continue to control the risk of transmission of brucellosis from bison to cattle. The strategy would also provide for a larger bison population than the preferred alternative in the *Draft Environmental Impact Statement*. The federal agencies and the state discussed aspects of the strategy over a period of several months. In November 1999, the federal agencies and the state's governor agreed that the agencies were at an impasse. Several items were at issue, including

a population limit for bison in the preferred alternative

the ages and classes of bison to be vaccinated the criteria used to decide whether and when bison would be allowed outside the park north of Reese Creek and in the western boundary area

the federal agencies' support of an adaptive management approach to bison management using spatial and temporal separation as its primary risk management feature. This approach is explained in detail in the alternatives chapter as the modified preferred alternative.

In December 1999, the federal agencies wrote to the state of Montana declaring that they were withdrawing from the Memorandum of Understanding. This action terminated the Memorandum of Understanding and dismissed the 1995 Montana lawsuit. A copy of the 30-day notice is included in appendix C. The state objected to the federal agencies' request to dismiss the case. In February 2000, the court agreed with the position of the federal agencies that they could withdraw from the Memorandum of Understanding and cause the dismissal of the suit. The federal and state agencies agreed, however, that before the court would formally dismiss the suit, the agencies would attempt to resolve their differences with the use of a court-appointed mediator. That mediation occurred in April and May 2000; however, the termination of the Memorandum of Understanding remains in effect as of the date of the release of this final environmental impact statement.



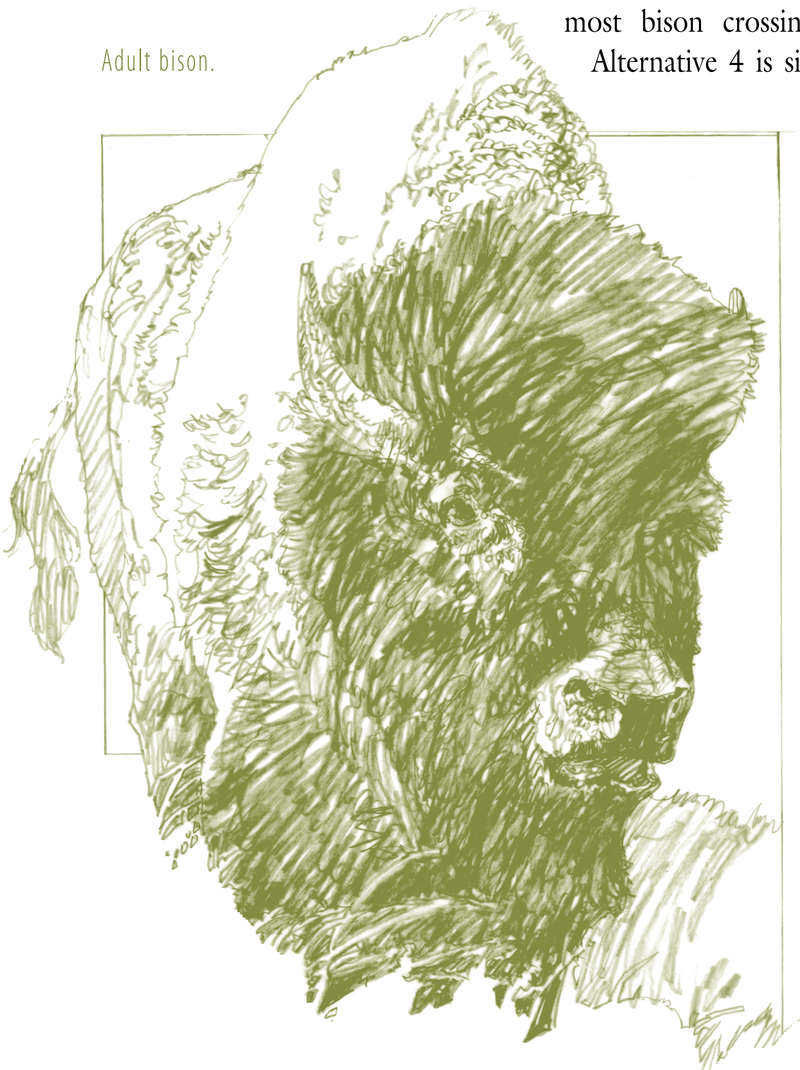
Cowbird resting on the back of a bison.

The primary purpose of revisions in volume 1 and responses to comments in volume 2 is to update factual information and to present and analyze the modified preferred alternative. The withdrawal by the federal agencies from the Memorandum of Understanding has had little effect, therefore, on the content of this final environmental impact statement, and much of the text remains unchanged from the draft. In addition, the state supplied information and some responses to comments on the *Draft Environmental Impact Statement* before the withdrawal by federal agencies from the Memorandum of Understanding.

This final environmental impact statement examines eight alternative means of minimizing the risk of transmitting the disease brucellosis from bison to domestic cattle on public and private lands adjacent to Yellowstone National

Park. These alternatives each include a full range of management techniques, although they focus on one or two in particular. For instance, alternative 3 manages the bison herd primarily through hunting but includes provisions for quarantine. Alternative 5 proposes an extensive capture, test, and slaughter of bison that test positive for brucellosis. Alternative 6 is similar to alternative 5 but requires 10 years of vaccination before the test and slaughter phase begins. Alternative 1 is the no-action alternative. It continues the present plan of capture and slaughter of all bison crossing the north end and most bison crossing the west boundary of the park. Alternative 4 is similar to alternative 1, but would add quarantine, so that bison testing negative for brucellosis would not be slaughtered. Alternative 2 centers on changes in cattle operations and allows bison to range over the largest portion of their historic range. Alternative 7, the agencies' preferred alternative identified in the *Draft Environmental Impact Statement*, focuses on maintaining the bison population below about 2,500 animals to minimize migration into Montana. Alternatives 2, 3, 7, and the modified preferred alternative also include a framework for considering the use of lands acquired from willing sellers as winter range and for other bison management activities. Decisions to implement management actions on acquired lands will be or have already been supported with additional National Environmental Policy Act and/or Montana Environmental Policy Act analyses.

Adult bison.



Implementing the modified preferred alternative would result in no moderate or major adverse impacts compared to the no-action alternative (alternative 1). Both the long-term bison population size and seroprevalence would be very similar to alternative 1. However, unlike alternative 1, bison would be allowed into management zones outside the park under certain conditions. In step 3 of the modified preferred alternative, bison would not be tested or marked before they exit the park, leading to major benefits to those groups and individuals who regard free-ranging, wild bison as culturally important, including positive impacts on those seeking to view bison. Positive impacts from the acquisition and use of about 6,000 acres outside the park for winter range would benefit ungulates, particularly pronghorn. A reduction in the use of the Stephens Creek facility during step 3 of the modified preferred alternative would also benefit wildlife in the vicinity. No adverse effect on any species protected under the Endangered Species Act is anticipated. Slight benefits to livestock operators from measures to mitigate the perception of risk, including additional testing of cattle, possible vaccination of adult cattle, and many other risk management measures at no cost to livestock operators, are expected. Some reduction in risk to the health of personnel handling bison in capture facilities is also expected in step 3 of the modified preferred alternative. Nonmarket benefits associated with the use of acquired winter range north of the park by bison are also predicted.

To summarize impacts from the other seven alternatives analyzed, implementation of alternative 7 would result in adverse impacts on the social values of some people, groups, or tribes, a few ranchers using public allotments on the Gallatin National Forest should those allotments be closed, wildlife species (predators and scavengers), the cultural importance of the herd to some tribes and visitors, and viewing opportunities for those seeking to view bison. Other alternatives might have these same impacts but could also affect winter recreation (particularly snowmobiling), nonmarket values, livestock operations, public funds (to acquire winter range), the trumpeter swan, bald eagle, lynx, and wolverine, and the historic landscape of the area. Alternatives 2, 3, and 7 would have beneficial impacts to wildlife and benefits associated with the nonmarket values attributed to the use of acquired winter range by bison. Similar nonmarket benefits associated with the reduction of seroprevalence achieved in alternative 5 and phase 2 of alternative 6 (which would not occur during the 15-year life of the plan) are also predicted. Mitigating measures and some monitoring would be needed to avoid impacts on threatened or endangered species in alternatives 5 and 6.

This final environmental impact statement will be available for public review a minimum of 30 days prior to issuance of records of decision by the agencies.

SUMMARY

This summary documents the additions and changes made to the *Draft Environmental Impact Statement* released to the public in June 1998 that are now contained in volume 1 of this final environmental impact statement. Original text from the *Draft Environmental Impact Statement* is shown in black, while changes and additions to the draft are shown in green. The exception to this is headings. Both original and new headings are shown in black.

PROPOSED ACTION

This environmental impact statement analyzes impacts of several different means (alternatives) for the interagency, long-term management (assumed for purposes of analysis to be 15 years) of Yellowstone area bison to ensure domestic cattle in portions of Montana adjacent to Yellowstone National Park are protected from brucellosis, a disease some of these bison carry, and to ensure the wild and free-ranging nature of the bison herd. Each alternative benefits from the cooperation of the U.S. Department of the Interior's National Park Service (NPS), the state of Montana, and the U.S. Department of Agriculture's Forest Service and APHIS. In nearly every alternative, all have jurisdiction over a portion of the management effort, either directly or indirectly. At this time, the modified preferred alternative is the federal agencies' preferred means of bison management.

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PROJECT LOCATION

The analysis area is a part of what is often described as the Greater Yellowstone Area, the largest and most nearly intact ecosystem in the contiguous United States (Greater Yellowstone Coordinating Committee 1991). The portion specifically subject to analysis includes those areas in Yellowstone National Park habitually occupied by bison (approximately 1.75 million acres) and adjacent federal, state, and private lands outside the park in southwestern Montana (parts of Park and Gallatin Counties) that have been periodically occupied by Yellowstone bison over the past 12 years.

The area outside the park includes approximately 568,994 acres, of which about 97% is managed by Gallatin National Forest, 1% by state or local government, and 2% by private owners.

NEED FOR ACTION

Bison are an essential component of Yellowstone National Park because they contribute to the biological, ecological, cultural, and aesthetic purposes of the park. However, Yellowstone National Park is not a self-contained ecosystem for bison, and periodic migrations into Montana are natural events. Some bison have brucellosis and may transmit it to cattle outside the park boundaries in Montana. As bison migrate out of the park and into Montana, they move from one jurisdiction with management objectives to a different jurisdiction with different management objectives. Therefore, the cooperation of several agencies is required to fully manage the herd and the risk of transmission of brucellosis from bison to Montana domestic cattle.

PURPOSE OF ACTION

The purpose of the proposed interagency action is to maintain a wild, free-ranging population of bison and address the risk of brucellosis transmission to protect the economic interest and viability of the livestock industry in the state of Montana.

Bison exiting Yellowstone National Park through north entrance near Gardiner, Montana.

BACKGROUND

The Yellowstone Area Bison Herd

Bison are native to the Greater Yellowstone Area and were observed there by early travelers both before and after the creation of Yellowstone National Park in 1872 and the Yellowstone Timber Land Reserve in 1891.

Hunting and poaching of bison in the late 1800s substantially reduced the number of bison in the Yellowstone herd, and by 1901, only 25 bison were counted. Fearful the small wild herd might vanish, park managers imported 21 bison from captive herds into the park in 1902. These bison were raised using livestock techniques on the "Buffalo Ranch" in Lamar Valley until the 1930s, when the National Park Service gradually began efforts to restore the bison to a more natural distribution (NPS, USDI, Meagher 1973). Although the native and captive herds were initially kept separate, they began to intermingle between 1915 and 1920. After the 1920s, little or no effort was made to keep the two populations separate.

By 1922, the park suggested that a law be passed authorizing the sale or disposition of some bison (Albright 1922, as cited in Skinner and Alcorn 1942–1951). Authority for this was granted in the Appropriation Act of 1923.

By the 1930s, the total number of bison wintering in the Lamar area had increased to over 1,000, and the park began reductions by shipping bison to public parks, zoos, and private estates. Bison were also used to begin herds in other areas of the park. Artificial feeding of the Lamar Valley herd, herd reductions to achieve range management goals, and other manipulation of the population continued from the 1920s until the late 1960s, and were often quite intensive. The highest reported bison count during this period was 1,477 in 1954.

In 1967, when herd reductions in the park ceased as part of a larger redirection of park policies, 397 bison were counted. Since that time bison, elk, and other animals have been allowed to reach population levels dictated by environmental conditions.

Brucellosis was first diagnosed in the Yellowstone herd in 1917 (Mohler 1917, as cited in Tunnicliff and Marsh 1935). In 1968, in response to livestock industry concerns over brucellosis, the National Park Service proposed a program to control bison at the boundary of the park. In addition, an early version of parkwide capture, test, and slaughter or vaccination efforts took place in the mid-1960s (Yellowstone National Park Bison Management Plan 1964–65). These efforts were reviewed by park management and determined to be ineffective and “never-ending” (Meagher 1972). Beginning in 1967, this type of bison management ceased in the park. More recently, a series of four interim bison management plans (the latest in 1996) put specific boundaries and lethal control measures in place. In 1996–97, a particularly harsh winter with deep snow and ice conditions sent hundreds of bison toward park boundaries, seeking accessible forage at lower elevations. Implementation of the interim plan, combined with the severe winter conditions, resulted in the removal of 1,123 bison in the five months between November 14, 1996, and April 15, 1997 (1,084 bison were shot or slaughtered, and 39 were used for research purposes). Others died of starvation or other natural causes inside the park, bringing the total population down from an estimated 3,500 in fall 1996 to an estimated 2,000 animals by early spring 1997. The federal agencies and the state of Montana discussed the situation and in 1977 began to implement adjustments to the interim plan that were aimed at reducing the number of bison shot or shipped to slaughter. These adjustments include increased emphasis on hazing bison back into the park, holding bison up to the capacity of the Stephens Creek capture facility until weather conditions moderate, and allowing low-risk bison that evade capture in the West Yellowstone area to remain on public lands for 30 to 60 days before cattle are released on federal grazing allotments.

Brucellosis in Cattle and Bison

Brucellosis is a contagious bacterial disease, caused by various species of the genus, *Brucella*, that infects domestic animals, wildlife, and humans worldwide. *Brucella abortus* is the species that infects both cattle and bison. There is no cure for brucellosis in these species. Vaccines developed so far are not 100% effective, and are to date less effective with bison than with cattle. The first known case of brucellosis in the bison herd was reported in 1917. It is generally agreed that the transmission of brucellosis to the Yellowstone bison herd was from cattle, and occurred either through contact with infected cattle or from infected cows' milk fed to captive bison calves.

In cattle, the organism is shed primarily in aborted tissues, reproductive tissues, and discharges, especially just before, during, or soon after abortion or live birth. Ingestion by other cattle of contaminated material is the primary route of infection. Cows infected with brucellosis characteristically abort their first calf after the fifth month of gestation.

Less is known about the disease in bison, particularly free-ranging bison. Transmission from bison to cattle has occurred under experimental conditions in confined spaces, but has not been documented under free-ranging conditions. Since the release of the *Draft Environmental Impact Statement*, the National Academy of Sciences finalized a summary of pertinent literature on several aspects of brucellosis (NAS 1998). Relevant material from this summary is used throughout volumes 1 and 2 of this final environmental impact statement to clarify discussions on epidemiology and pathology of the disease in both cattle and bison.

Diagnosis. In cattle, diagnosis is based on the results of blood tests, herd history, clinical signs, and other information. The diagnosis can be confirmed by positive cultures. *B. abortus* may be isolated from tissues collected at slaughter, milk or udder secretions, biopsy of lymph nodes, reproductive tract exudates, discharges from live animals, or fetal or placental materials collected at the time of abortion or calving. In Yellowstone bison, agencies have used a blood test for the presence of *Brucella* antibodies. For a number of reasons, these blood tests tend to overestimate the number of bison actually harboring the bacteria. Difficulties in isolating the bacteria from tissues and other factors have also meant fewer positive culture tests than the number of infected bison.

Risk of Transmission. Scientists and researchers disagree on even some of the most basic factors influencing the risk of transmission. These include whether studies on cattle are applicable to bison, whether controlled studies are applicable in the field, and the best ways to conduct additional research to determine the risk of transmission.

These disagreements and a paucity of information on brucellosis in bison make it impossible to quantify the risk of *B. abortus* transmission from bison (and elk, although this environmental impact statement does not analyze brucellosis in elk) in the Yellowstone area to domestic livestock. Instead, the agencies have identified factors that affect risk. They include the following:

1. The degree of association between potentially infectious and susceptible animals. Management actions emphasize separation to minimize risk.
2. The number and density of infectious animals in the host population.
3. The number of susceptible animals that may associate with infectious animals.
4. Environmental factors such as weather, sunlight, and other factors that determine the viability of the organism outside its host.
5. The class of the infectious animals. Because the disease is transmitted in cattle through ingestion of contaminated birth materials, pregnant bison are considered higher risk than other classes.
6. Vaccination and neutering reduce the transmission of the disease.
7. Some animals are naturally resistant to infection.

Since bison and cattle are prevented from interacting under each of the alternatives in this environmental impact statement, it is the presence and persistence of bacteria in birth materials that are at issue in determining the risk of transmission. Research completed since the release of the *Draft Environmental Impact Statement* has direct bearing on this discussion. In one study, 30 known bison birth or abortion sites in the park from 1996 to 1998 were sampled. The *B. abortus* bacterium was isolated at two of those sites immediately following the birth or abortion event and persisted for a maximum of 18 days (Coffin, pers. comm.). Cook (1999) studied *B. abortus* strain RB51 on samples taken from the exposed surface of bovine fetuses in Wyoming under natural environmental conditions. While some environmental conditions may vary in Wyoming from those found in the impact area, Cook found that the bacteria were vulnerable to light and desiccation and concluded that by June, when cattle are scheduled to return to public grazing allotments in the impact area, as few as 4.7 days would be required to ensure the absence of any live bacteria. Under all alternatives, susceptible cattle would not be allowed to graze until a minimum of 30 days have elapsed since bison were hazed back into the park.

Alternative Interpretation of Risk. The above information represents areas where scientists generally agree on the interpretation of available data. However, considerable debate and need for additional research remain. The bulk of brucellosis research and disease management has focused on domestic livestock, yet limited published information suggests the disease may be transmitted differently and have different clinical, pathological, and population effects in bison (Williams et al. 1994; Meyer and Meagher 1995a).

Those who suggest the risk is negligible point out that there have been no documented cases of brucellosis transmission from wild, free-ranging bison to cattle.

It is possible that, although brucellosis may be endemic in the Yellowstone area bison herd, few of the animals are capable of transmitting the disease. This suggestion is supported by noting the discrepancy between the number of bison that test seropositive for brucellosis but culture tissue negative (Roffe et al. 1999). This discrepancy and the infrequency of observed abortions in the Yellowstone bison herd (usually required for transmission of the disease between cattle) has led to the theory that the primary route of transmission among cattle (abortions and birthing events) may be different from that among bison. In bison, the bacteria may be transmitted through milk (Meyer and Meagher 1995a).

Bison Distribution

The Yellowstone bison population uses three different wintering areas in the park: Pelican Valley (the smallest), Mary Mountain (the largest, in the Hayden Valley-Firehole River area), and the northern range. Yellowstone National Park grooms roads in the winter for snowmobile use, which allows bison to easily traverse the park. Bison seem to use the roads to exit in severe winters, such as the 1975–76 and 1996–97 winters, and retain the memory of the access routes (Meagher 1989a). While experts agree that bison traveling on groomed routes are traveling in a more energy-efficient manner than bison traveling through deep snow, there is disagreement about what bison would do if grooming ceased. What result this would have on bison numbers and distribution is not known. Bison migrate across the north and west ends of the park during the winter into Montana. In the north they exit primarily across the Reese Creek boundary of Yellowstone National Park, and move immediately onto adjacent private land where several hundred cattle are present year-round. Through the purchase of lands and conservation easements, a portion of this adjacent private land has been acquired by the U.S. Forest Service since the release of the *Draft Environmental Impact Statement*. One of the designated uses is as a wildlife winter range. After an existing cattle lease on them expires in 2002, it is anticipated that bison would be allowed to use these acquired lands under alternatives where the lands are designated as a bison management area. These alternatives include 2, 3, 7, and the modified preferred alternative.

Bison may also enter national forest land in the Eagle Creek/Bear Creek area east of Reese Creek, where they occasionally enter private lands in the Gardiner area by traveling along the Maiden Basin hydrographic divide and Little Trail Creek drainage. These lands are collectively referred to as the Eagle Creek/Bear Creek "special management area" (areas outside the park where bison are allowed) in this document. To the east of these lands (and north of the park) lie Hellroaring and Slough Creek drainages and the Absaroka-Beartooth Wilderness, part of the national forest where cattle are not present. A few bison use these higher elevation, more rugged lands in winter and summer.

From the west side of the park, bison move along the Madison River, Duck Creek, and Cougar Creek in the vicinity of West Yellowstone. From here, bison infrequently move north (usually along Highway 191) onto public lands administered by the U.S. Forest Service in the Cabin Creek Recreation and Wildlife Management Area and the Monument Mountain Unit of the Lee Metcalf Wilderness. The western special management area (SMA) in this document includes these lands south to the West Yellowstone area. Up to a few hundred cattle may occupy select public and private lands in the West Yellowstone area in the summer months. No cattle are present in the winter.

Economic Impacts of Brucellosis in Cattle

Brucellosis (*B. abortus*) has the following direct impacts on the livestock industry:

- Abortion of calves
- Decreased weight gain by calves
- Delays in calf production
- Increased rates of culling and replacement
- Increased testing and vaccinating costs

The presence of livestock disease may also affect each state's classification by the Animal and Plant Health Inspection Service. Montana is currently "class-free" and can transport its cattle across state lines without testing for brucellosis. Downgrading could have extensive economic ramifications throughout the livestock industry in Montana by restricting ranchers' access to interstate and international livestock markets. However, it is possible under

APHIS rules, that only a portion of the state would be downgraded in the event of a transmission, resulting in less severe economic impacts than for a full-state downgrade. Interstate limits on Montana producers' ability to market livestock may also come about from actions of state veterinarians whose states import Montana cattle and who see Yellowstone bison as a potential disease threat (since no cure for brucellosis in cattle or bison exists). In response to this possible threat, the modified preferred alternative includes a commitment by APHIS to work with Montana to educate any state indicating it would take such action and convince them that such sanctions are unwarranted. It also includes provisions for additional monitoring and regular testing of cattle herds in the impact area and possible adult vaccination of these cattle at government expense. The potential for widespread economic consequences is a primary motivating factor in taking management actions described in the alternatives in this environmental impact statement.

OBJECTIVES AND CONSTRAINTS IN TAKING ACTION

In addition to the above-stated purpose, the agencies have agreed that nine objectives would guide them in determining whether an alternative is reasonable, and in selecting the preferred alternative. Each alternative must meet the following objectives:

1. Address bison population size and distribution; have specific commitments relating to size of bison herd.
2. Clearly define a boundary line beyond which bison will not be tolerated.
3. Address the risk to public safety and private property damage by bison.
4. Commit to the eventual elimination of brucellosis in bison and other wildlife.
5. Protect livestock from the risk of brucellosis.
6. Protect the state of Montana from risk of reduction in its brucellosis status.
7. At a minimum, maintain a viable population of wild bison in Yellowstone National Park, as defined in biological, genetic, and ecological terms.
8. Be based on factual information, with the recognition that the scientific database is changing.
9. Recognize the need for coordination in the management of natural and cultural resource values that are the responsibility of the signatory agencies.

Another important factor in deciding the reasonableness of alternatives are agency constraints imposed by laws, regulations, or other requirements. All alternatives must be within these constraints to be a viable choice. A summary of legislative and regulatory requirements of each of the four agencies involved in bison management is provided in part 1, "Purpose of and Need for Action."

Bison calf.

ISSUES

Public scoping identified several environmental problems (issues) that should be addressed in a cooperative bison management plan. Scoping also identified other objectives and alternatives the public wished agencies to consider in their planning. The resources that agencies believed would experience more than negligible impacts are listed below, and each is analyzed in the environmental impact statement:

- the Yellowstone area bison population size, distribution, and seroprevalence
- recreation
- socioeconomics, including the regional economy, minority and low-income populations, social values, and nonmarket values
- livestock operations in the region
- threatened and endangered species, such as the grizzly bear, and sensitive species or species of special concern
- other wildlife
- human safety
- cultural resources
- visual resources

ALTERNATIVES

This environmental impact statement evaluates eight alternatives for the long-term management of bison. Alternative 1 is the no-action alternative (continue with existing interim plan), and the federal agencies have identified the modified preferred alternative (adaptive management approach) as its preferred plan.

The eight alternatives have several features in common, including the following:

- All alternatives benefit from, and in some cases require, the cooperation of the state of Montana, the U.S. Forest Service, the National Park Service, and the Animal and Plant Health Inspection Service.
- Every alternative envisions the bison population would be managed primarily through natural processes inside Yellowstone National Park.
- In all alternatives (except alternative 5 in the short term), the use of lethal controls to manage bison is minimized as the population size approaches 1,700 animals.
- All alternatives include large geographic areas where bison are able to range with little human intervention. In alternative 5, this area is limited to Yellowstone National Park.
- Monitoring is an integral part of every alternative, especially as bison approach designated border areas in Montana.
- All alternatives define a management boundary beyond which agencies would take action to ensure bison do not remain.
- If a capture facility is sited as part of an alternative, it would meet certain environmental criteria and comply with requirements of the Endangered Species Act and the National Historic Preservation Act before construction began.
- All alternatives include humane treatment of bison held in capture or quarantine facilities.
- All alternatives except alternative 5 allow bison outside the park. To do so and not affect Montana's class-free status, special management areas (SMAs) or management zones (in the case of the modified preferred alternative) would be created. The creation of these SMAs or management zones would not require changes to current APHIS regulations, but would require the approval of the state of Montana as specified by Montana law.
- Slaughtered bison could be auctioned or distributed to social service organizations. Bison shot in the field may be released to tribes. Live bison would be available if they had completed the approved quarantine protocol.
- In Montana, private landowners may shoot bison on their land with permission from the Department of Livestock, or they may ask the department to remove bison.

- All alternatives include the suggested vaccination of female cattle calves in areas adjacent to the park or in SMAs, as well as surveillance testing of these herds should contact with bison be suspected or occur. All alternatives also assume vaccination of bison calves and captured adult bison when a safe and effective vaccine is available.
- All alternatives include future research efforts.

Alternative 1: No Action – Continuation of the Current Interim Bison Management Plan

Adopting this alternative would continue current bison management as set forth in the 1996 *Interim Bison Management Plan* as defined by National Environmental Policy Act guiding regulations (40 CFR 1502.14). The interim plan relies on strict border enforcement to keep bison and cattle separate, and has no provision for the quarantine of bison. Bison are prevented from crossing the northern park boundary at Reese Creek because the adjacent land is private and occupied by cattle throughout the year. All bison captured at the Stephens Creek facility are shipped to slaughter.

Bison are allowed in the Eagle Creek/Bear Creek area, a large tract of public (U.S. Forest Service) land north and east of Reese Creek. The Department of Livestock, with help from the agencies, maintains a boundary at Little Trail Creek/Maiden Basin hydrographic divide in the Eagle Creek/Bear Creek area. Bison moving north of this boundary and approaching private land in the Gardiner area are removed by agency personnel with the permission of the landowner.

In the West Yellowstone area, public lands administered by the U.S. Forest Service are adjacent to the park. Cattle are more dispersed than at Reese Creek and are not grazed during the winter months. Up to 50–100 seronegative nonpregnant bison in the West Yellowstone area are able to overwinter successfully outside the park without coming in contact with cattle. Seropositive, untested, or any pregnant bison are removed. Bison are excluded from the West Yellowstone area from May through October to prevent contact while cattle occupy the region. Bison located outside the park in the west boundary area would be hazed back into the park in the spring, 30 to 60 days before cattle occupy the area. The exact number of days, between 30 and 60, would be at the discretion of the state veterinarian. Those bison that could not be hazed back into the park would be shot. In addition, a handful of bison (usually single bulls) use the Cabin Creek/Lee Metcalf area on the west, or Hellroaring and Slough drainages to the north and east of Eagle Creek/Bear Creek. Those few that do move beyond the borders of either of these large tracts of public land would be hazed or shot.

Adjustments to the interim plan aimed at reducing the number of bison shot or shipped to slaughter were implemented beginning in 1997. These include increased emphasis on hazing bison back into the park, holding bison up to the capacity of the Stephens Creek capture facility until weather conditions moderate, and allowing low-risk bison that evade capture in the West Yellowstone area to remain on public lands for 30 to 60 days before cattle are released on federal grazing allotments.

Alternative 2: Minimal Management

The purpose of this alternative is to restore as near-natural conditions as possible for bison, including a small portion of their historic nomadic migration patterns. The area outside Yellowstone National Park over which bison would be able to range (e.g., the SMAs) without interference from agencies is the largest of all alternatives.

In each alternative, including alternative 2, many changes, such as land acquisition, changes in cattle operations, and a safe and effective bison vaccine, are described. Each of these involves some unknowns, as well as time to implement. Therefore, until these changes were in place, relevant management tools in the interim plan would remain in effect. The description below assumes these changes have been made. Since completion of the *Draft Environmental Impact Statement*, the federal Departments of the Interior and Agriculture and the Rocky Mountain Elk Foundation teamed in February and again in August 1999 to purchase lands and conservation easements totaling 6,131 acres between the Reese Creek boundary and Yankee Jim Canyon. The purchased lands would be under the jurisdiction of the Gallatin National Forest and available for use by wildlife. It is expected that bison would be able to use the acquired lands for winter range when a cattle lease currently in operation on part of this property expires in 2002.

The primary means to minimize the risk of disease transmission would be changes in cattle operations in the SMAs. This alternative would provide for lethal control of bison only in cases where human safety was in immediate danger, on private property at the request of the landowner, or outside the SMA border. Bison would not be captured or slaughtered by agencies. A key tool available to restore natural conditions and help control bison distribution would be the closure (e.g., discontinuing grooming) of winter groomed roads in Yellowstone National Park that the animals now use to traverse the park. Bison have "discovered" these pathways from the interior to both the northern and western boundaries of the park, and can use them routinely during the winter to access areas they would otherwise have more difficulty reaching. It is hypothesized that the energetic cost of traveling long distances on groomed roads would be low, and they in effect could be allowing bison to access other foraging areas, leave the interior, and move to boundary areas. Alternative 2 would be the only alternative to propose changes in winter operations in some segments of park roads to control bison distribution, although other alternatives include research on the use of roads and potential barriers to bison travel (alternative 3), and plowing to access capture facilities (alternatives 5 and 6).

In addition to leaving road segments ungroomed, the agencies would maintain boundary lines through hazing and shooting. Landowners could request bison on their property be removed, or could shoot them with permission of the Montana Department of Livestock. Cattle operators on private lands inside designated SMAs might be offered incentives to remove susceptible (breeding) cattle, or grazing rights, easements, or property in bison winter range might be purchased from willing sellers to remove cattle altogether. In addition, public grazing allotments might be modified to accommodate bison.

Alternative 3: Management with Emphasis on Public Hunting

Alternative 3 would rely on hunting of bison to regulate population numbers and distribution of bison outside the park, and on separation of bison in time and space to preclude contact of bison with cattle. Where hunting was infeasible or inappropriate, capture and shipment of seropositive bison to slaughter and seronegative bison to quarantine would be used to maintain separation and manage the risk of disease transmission. As in other alternatives, bison would be vaccinated when a safe and effective vaccine was developed to further reduce this risk. This alternative would have both a distinct short-term (phase 1) and a long-term (phase 2) management strategy.

In the short term, the separation of cattle and bison on the northern (Reese Creek) boundary would be maintained through capture at Stephens Creek and the shipment of seropositives to slaughter and seronegatives to quarantine (or slaughter until the quarantine facility was built). Under the provisions of the interim management plan, the agencies now ship some of the bison captured at Stephens Creek to slaughter. A quarantine facility would give the agencies flexibility in the disposition of seronegative bison they do not now have.

Bison that completed the entire quarantine procedure would be shipped live to requesting tribes or organizations, or used to repopulate herds on public lands. The location, design, and operation of a quarantine facility has not been determined, and an appropriate range of alternatives with different features would be evaluated before one was built. Additional NEPA and other compliance would be required to build such a facility on federal land or use federal money. Until the time a quarantine facility was constructed, all seronegative bison captured at Stephens Creek would be sent to slaughter.

The Department of Livestock, with help from the agencies, would maintain a boundary at Little Trail Creek/Maiden Basin hydrographic divide similar to alternative 1. Bison moving north of this boundary would be removed by agency personnel with the permission of the landowner.

Bison would be hazed back into the park in the spring, 30 to 60 days before cattle occupy the area. The exact number of days, between 30 and 60, would be at the discretion of the state veterinarian. Those bison that could not be hazed back into the park would be shot. As in alternatives 1 and 4, agencies would also maintain a boundary at the north end of the Cabin Creek Recreation and Wildlife Management Area/Monument Mountain Unit of the Lee Metcalf Wilderness. Hunting would be used in both the Eagle Creek/Bear Creek and western SMAs to help control population numbers and distribution. Research on the degree to which the winter grooming of park roads contributed to migration out of the park would continue, and changes in road grooming practices would be made in the long term if research showed they were warranted. These changes would be implemented through amendments to the park's winter use plan and appropriate NEPA documentation.

In the long term, alternative 3 would call for acquisition of bison winter range through purchase of grazing rights, easements, or property from willing sellers, alterations in cattle allotments, and/or changes in livestock operations to remove susceptible cattle. This newly acquired winter range would be designated as the Reese Creek SMA, and would include lands on the west side of the Yellowstone River between Reese Creek and Yankee Jim Canyon. Since the release of the *Draft Environmental Impact Statement*, these lands have been acquired. It is anticipated they would be available for use by bison when a current cattle lease on a portion of them expires in 2002. The Department of Livestock, with help from the agencies, would maintain a boundary at Yankee Jim Canyon, and hunting in the Reese Creek SMA would be used to help control population size and distribution of the bison herd. The Stephens Creek capture facility would be dismantled and moved between the park boundary and Yankee Jim Canyon to help maintain this boundary during phase 2, when bison would be allowed to use the Reese Creek SMA.

If this alternative was selected, the agencies would request the 2001 Montana Legislature to authorize a fair-chase hunt for bison. Public hunting would then become the primary tool for agencies to control population sizes in the new Reese Creek SMA, and would also be allowed in the Eagle Creek/Bear Creek area and western SMA.

Modifications in grazing allotments, acquisition or easement of private land, or conversion from cow-calf to steer or spayed heifer production are options in this alternative for the West Yellowstone area to further reduce the risk of bison commingling with susceptible cattle.

Alternative 4: Interim Plan with Limited Public Hunting and Quarantine

The interim plan (no action, or alternative 1 in this analysis) has served to ensure spatial separation of the bison herd from domestic cattle on the northern and western borders of Montana. However, it has given agencies few options when harsh winters force more than the average number of bison toward the boundaries of Yellowstone National Park. For this reason, alternative 4 includes a quarantine facility to preserve seronegative bison captured at Stephens Creek. Bison completing the quarantine protocol would be released to tribes, requesting organizations, or to repopulate herds on public lands. The location of the facility has not been determined, and locating it on federal land or using federal money would mean subsequent NEPA analysis, including public input, would be required.

Hunting, should it be approved by the Montana Legislature, would be another tool proposed to help agencies control population numbers and distribution. A limited hunt, primarily for recreation, would be allowed in the West Yellowstone and Eagle Creek/Bear Creek areas.

Except for these differences, alternative 4 would be identical to the interim management plan, alternative 1.

Alternative 5: Aggressive Brucellosis Control within Yellowstone National Park through Capture, Test, and Removal

This alternative would implement an aggressive three-year capture and test program for all bison in the park, including those in its interior. Those testing negative would be released in the park, and seropositives would be shipped to slaughter. If a safe and effective vaccine was available, seronegative bison would also be vaccinated. Bison would not be allowed outside the park anywhere in Montana, and agencies would maintain northern and western boundaries. Bison at these boundaries would be hazed back into the park if possible, but shot if they were unresponsive to hazing. Capture facilities would be set up in nine areas. All untested bison would be shot in the latter stages of the capture, test, and slaughter program. When subsequent testing indicated brucellosis had been eradicated from the bison population, a new bison management plan would be prepared.

Alternative 6: Aggressive Brucellosis Control within Yellowstone National Park through Vaccination

This alternative, like alternative 5, would pursue the aggressive reduction of brucellosis from the Yellowstone bison herd. However, the entire bison herd would first be vaccinated (when a safe and effective vaccine was available), primarily through remote means, and tested as they attempted to exit at park boundary locations. When tests showed the incidence of exposure to *B. abortus* had stabilized as a result of vaccination, (estimated to occur in 10 years) the herd-wide capture, test, and slaughter of seropositive bison outlined in alternative 5 would begin.

Unlike alternative 5, bison would be allowed in the Eagle Creek/Bear Creek and western SMAs, although the majority of bison in the western SMA would be tested and released seronegatives. The National Park Service would construct and operate a capture facility at Seven-Mile Bridge inside the park on the west side. Nearly all bison migrating toward the West Yellowstone area cross through this narrow area. These facilities (at Duck Creek and the Madison River) would be dismantled, although a small, backup capture facility near Horse Butte, might be maintained.

Alternative 7: Manage for Specific Bison Population Range

This alternative departs from all other alternatives in that a range of bison population numbers would be the focus, and specific management scenarios would be put in place as the population approached either end of that range. This range would be from 1,700 to 2,500 bison. Agency controls would decrease as the bison population approached 1,700 and would cease at 1,700 bison in certain areas as described in management sections for each area. Additional measures to remove increasing numbers of bison would be implemented near the 2,500 mark if bison left the park or SMAs described in this alternative. Because bison removals occur at or outside the park boundary, the bison population could at times exceed 2,500 inside the park.

In the long term, the agencies might acquire access to additional winter range in the Gardiner Valley on the west side of the Yellowstone River through purchase of grazing rights, easements, or property from willing sellers. Since the release of the *Draft Environmental Impact Statement*, these lands have been acquired. It is anticipated they would be available for use by bison when a current cattle lease on a portion of them expires in 2002. This tract would be designated an SMA subject to the approval of the state of Montana as specified by Montana law. The capture facility now located at Stephens Creek could be dismantled and moved to an appropriate location in the SMA. Modifications have been made in grazing permits for the allotments near the park such that the Montana state veterinarian may request a change in the date that livestock return to federal allotments, depending on how long bison have been out of the park in the west boundary area. No other modifications in grazing allotments, property acquisitions, or easements in the western SMA would occur.

Although alternative 7 is distinct, it has elements similar to other alternatives. Capture and slaughter of seropositives would be the primary means of managing risk, as it is in alternatives 1, 4, and 5. Most seronegative bison would be shipped to quarantine, as described in alternative 4. Also like alternative 4, low levels of hunting would be allowed in one or more of the SMAs outside the park. As in alternative 3, alternative 7 has a long-term phase that proposes the acquisition of winter range north of the park boundary. However, as described above, this alternative is much more specific in defining a population size and management tools to keep it at that size. It is also true that alternatives 1 through 6 are unique, as each emphasizes a particular strategy to manage bison or combination of strategies not analyzed in alternative 7.

Modified Preferred Alternative

The modified preferred alternative employs an adaptive management approach that allows the agencies to gain experience and knowledge before proceeding to the next management step, particularly with regard to managing bison on winter range outside Yellowstone National Park. The alternative uses many tools to address the risk of transmission, but primarily relies on strict enforcement of spatial and temporal separation of potentially infectious bison or their birth products and susceptible cattle. Until an existing cattle lease on acquired lands north of the park's Reese Creek boundary expires, step 1 would follow the interim plan with the exception that seronegative pregnant bison would be released onto the western boundary area along with other seronegative bison (up to a designated 100-bison tolerance level). When the lease expires, it is assumed step 2 of the plan would begin, and seronegative bison would be released into the boundary area north of Reese Creek as well, up to a designated 100-bison tolerance level. After a minimum of two years of experience managing bison outside the park in both the northern (or Reese Creek) and western boundary areas, step 3 would begin, which allows untested bison (up to the 100-bison tolerance level) to occupy them. Parkwide vaccination of vaccine-eligible bison would begin when a safe and effective vaccine and remote delivery system become available.

Spatial and temporal separation would be maintained by monitoring both boundary areas 7 days a week. As bison move further from the park, management would become increasingly aggressive. All bison outside the park in these areas would be hazed back into the park in the spring, approximately 45 days before cattle return to these same lands. Research performed since the completion of the *Draft Environmental Impact Statement* (K. Coffin, pers. comm.; Cook 1999) indicates that as few as 4.7 days would be required to ensure the die-off of any remaining bacteria in weather typical of a Wyoming June. As an additional risk management measure, the agencies would maintain a population target for the whole herd of 3,000 bison. This is the number above which the NAS (1998) report indicates bison are most likely to respond to heavy snow or ice by attempting to migrate to the lower elevation lands outside the park in the western and northern boundary areas. Seronegative bison attempting to leave the park and not amenable to hazing when either the population exceeds 3,000 or tolerance levels outside the park have been met or exceeded, would be removed to quarantine. If the quarantine facility is full or otherwise unavailable, they would be sent to slaughter. If population numbers are low, bison, up to the capacity of the Stephens Creek capture facility, would be held until weather moderates or until spring green-up begins and then released back into the park. Additional risk mitigation measures under the modified preferred alternative include the following:

Stephens Creek capture facility.

Vaccination of cattle in the impact area would be required if 100% voluntary vaccination is not achieved.

APHIS and Montana would conduct additional monitoring of cattle herds grazed in the impact area, including regular testing of test-eligible cattle and possible adult vaccination of these cattle herds.

Seronegative pregnant females allowed into the boundary areas would be fitted with radio collars and vaginal transmitters (in step 1 in the West Yellowstone area and in step 2 in the Reese Creek area) so that agencies can monitor the birth site for bacteria if bison give birth or abort while outside the park.

To minimize lethal control, agencies would maximize the use of hazing to keep bison off private lands, to keep them from exiting the park, and to return them to the park if exiting would mean their removal to slaughter or quarantine.

ENVIRONMENTAL CONSEQUENCES

The environmental impacts of each alternative were analyzed and compared to No Action. Below is a summary of those impacts.

Impacts on Bison Population

A simple model based on averages (deterministic) was used to predict changes in bison populations and/or seroprevalence rates should a given alternative be implemented. Because a single severe winter, such as the 1996–97 winter, could alter estimates of bison numbers significantly, the analysis also includes a section on the effects of "stochastic" events on the population size.

The deterministic model predicts the continued implementation of alternative 1 would result in a growing bison population. From 1997 to 2006, the bison population would increase at 4% per year to approximately 3,100. Management actions in this alternative would not measurably affect the age/sex distribution or reproductive rates of bison in this or any alternative except for alternative 5. Bison distribution outside the park is indicated in chart 1. In this, and all other alternatives except alternative 5, 100–200 bison would freely range on public lands in the Eagle Creek/Bear Creek area.

Alternative 2 would result in the largest and fastest growth of the bison population of all alternatives. From 1997 to 2006, the population is expected to increase to 3,500, moderately more bison (14%) than in alternative 1.

Alternative 3 would result in growth of the bison population, with numbers controlled primarily through hunting. From 1997 to 2006, the bison population would be expected to increase from about 2,200 to 3,500 (average increase 6%/year). Limited capture operations, agency shooting, hunting, and periodic severe environmental conditions would likely maintain the bison population near the upper management range of 1,700 to 3,500. It is estimated that alternative 3 would result in moderately more bison in the population (14% increase) compared to alternative 1.

In alternative 4, bison population numbers would be controlled through capture, shipment of seropositive bison to slaughter, and hunting. This alternative would result in a slowly increasing bison population with lower population numbers than alternatives 1, 2, 3, or 6. From 1997 to 2006, the bison population would be expected to increase from about 2,200 bison to 2,800 (average increase 3%/year). This would be a minor decrease (8% lower) in bison population size relative to alternative 1.

For alternative 5, the bison population would be expected to decline from 2,200 bison to approximately 1,250 bison by 1999. The bison population would be expected to number approximately 2,000 by 2006, and approximately 2,900 bison by 2011, 10 years after capture, test, and slaughter operations have ceased. No bison would be expected in Reese Creek, Eagle Creek/Bear Creek, or West Yellowstone in this alternative. The bison population would experience a major decrease in this alternative, representing a nearly 47% reduction, compared to alternative 1, over a period of only three years.

No bison would be allowed anywhere outside Yellowstone National Park boundaries under alternative 5. Management actions in alternative 5 could affect the age/sex distribution or reproductive rate of the bison population. Bison distribution within the park would likely be affected, and several areas would likely have few or no bison for as long as 10 years.

In alternative 6, all bison would be vaccinated for approximately 10 years (beginning in the year 2000) to reduce seroprevalence in the population. After whole herd vaccination, bison would be captured, tested, and seropositives slaughtered, similar to alternative 5. Two different estimates of population size were calculated based on the effectiveness of the vaccine. Assuming a 70% effectiveness, the bison population would be expected to increase during the vaccination phase from 2,200 bison to approximately 3,500 bison in 2010, a negligible to minor increase compared to alternative 1. After 10 years of vaccination (2010), capture and slaughter would begin, and the population would drop from 3,500 to about 2,900 in a single year, a moderate (17%) decrease compared to alternative 1. If the vaccine was only 25% effective, the population would drop from 3,500 animals in 2010 to 2,500 the following year, when parkwide capture and slaughter began. This would represent a major short-term adverse impact (28% reduction) on the population. The herd would begin to increase following completion of the test and slaughter program; from 2,900 to 3,400 bison by 2014 (assuming 70% effectiveness), or from 2,500 to about 3,000 animals (assuming 25% effectiveness) by 2014.

Unlike other alternatives, in alternative 7 the agencies would attempt to manage the bison population within the more narrow range of 1,700 to 2,500 animals. Given the mix of management tools described above in "The Alternatives," the model predicts the bison population would be expected to increase from about 2,200 bison to 2,700 (average increase 2.6%/year) in 2004, and level off at or about 2,700 throughout the remainder of the 15-year plan. This alternative would result in a bison population 12% lower than alternative 1 in 2006 and 23% lower in 2011. However, because of limitations with the deterministic model, the differences between alternatives 1 and 7 might be less. Slaughter, quarantine, agency shooting, and hunting are predicted to remove an average of 132 to 137 bison per year. If bison exited the park in larger numbers during severe winters, more would be killed if the bison population was near or above 2,500 animals. During mild winters, fewer bison would exit the park and thus fewer bison would be killed.

The modified preferred alternative provides for an increasing bison population and would maintain a population of around 3,000. The use of management tools described in "The Alternatives" would likely maintain the population near 3,000; modelling indicated the mean population would be similar to alternative 1 in the long term and was consistently about 20% higher than alternative 7 (identified as the preferred alternative in the *Draft Environmental Impact Statement*). This is considered a moderate to major benefit of the modified preferred alternative.

Stochastic Influence on Bison Population. In the period following the release of the *Draft Environmental Impact Statement* and the publication of this final environmental impact statement, the National Park Service funded development of a stochastic model to examine the influence of random events, such as severe winters, on bison management. Chart 2 shows the model predictions of impacts on the bison population for all eight alternatives.

Seroprevalence Rate. Modelling efforts using the deterministic model to predict impacts of management scenarios on seroprevalence in the *Draft Environmental Impact Statement* assumed 50% seroprevalence in the bison population. The more refined stochastic model described above was also used to check predictions of impact on seroprevalence; however, research after the release of the *Draft Environmental Impact Statement* indicated seroprevalence in 246 bison tested in the winter of 1996–97 was 39% (NPS, unpubl. data). Both models assumed either a 70% rate of effectiveness of the bison vaccine (based on current success with cattle) or 25% rate of effectiveness (based on effectiveness in bison calves). Bison calves were assumed to be vaccinated with a safe and effective vaccine beginning in 2000 in the deterministic model;

however, additional research has indicated a safe and effective vaccine for calves would probably not be available until later (2002/2003), so vaccination was assumed to begin in 2002 in the stochastic model.

Using the deterministic model, and assuming a vaccine that was 70% effective and calfhood vaccinations began in 2000, the population seroprevalence rate under alternative 1 would be expected to decline from a starting point of 50% seropositive in 1997 to at least 33% seropositive in 2006 (see chart 3). If the vaccine was 25% effective, seroprevalence was predicted to drop from 50% to 40% by 2006. Continued management efforts and calfhood vaccination (assuming 70% efficacy) would reduce seroprevalence to 24% in 2011. The stochastic model predicted mean seroprevalence would fall to about 11% in 2013 (assuming 70% efficacy). This is a 69% reduction in the first 11 years of vaccination compared with a 49% reduction in 11 years of vaccination predicted by the deterministic model.

In alternative 2, the population seroprevalence rate would be expected to decline to at least 34% seropositive in 2006 (assuming 70% efficacy) or to 42% by 2006 (assuming 25% efficacy). Continued management efforts and calfhood vaccination (70% efficacy) would reduce seroprevalence to 26% in 2011. This would represent a minor adverse impact (3% to 8% less reduction) compared to alternative 1. The stochastic model predicted the seropositive rate would drop to about 13% by 2013, or a 62% reduction in 11 years, compared with a 42% reduction in 11 years of vaccination estimated by the deterministic model under this alternative.

Chart 1: Population Changes Predicted to Occur Using Deterministic (Averaging) Model

Alternative	Population Size (1997)	Population Size (2006)	Population Size (2011)	Number of Bison in Western SMA	Number of Bison in Reese Creek SMA
1	2,200	3,100	3,500	18–52	0
2	2,200	3,500	3,500	20–60	0–120
3	2,200	3,500	3,500	16–120	60–80
4	2,200	2,800	3,200	1–52	0
5	2,200	2,000	2,900	0	0
6	2,200	3,100	2,900	22–60	0
7	2,200	2,700	2,700	13–51	0–100
Modified Preferred	2,200	3,245	3,246	22–60	0–100

Chart 2: Stochastic Model Results of Mean Bison Population for Selected Years after Implementing Alternative*

Year	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7	Modified Preferred
Year 1 (1997)	2108	2108	2108	2108	2108	2108	2108	2108
Year 5 (2001)	3113	3089	3186	3118	2080	3029	3033	3117
Year 6 (2002)	3326	3358	3393	3221	2157	3210	3191	3282
Year 8 (2004)	3600	3892	3616	3541	2494	3569	3331	3520
Year 10 (2006)	3825	4355	3716	3703	2828	3689	3534	3668
Year 12 (2008)	3942	4868	3803	3687	3140	3826	3539	3714
Year 14 (2010)	3831	5217	3740	3699	3357	3711	3644	3650
Year 16 (2012)	3721	5175	3726	3592	3487	3683	3575	3660
Year 18 (2014)	3734	5247	3752	3669	3587	3681	3640	3703

* Implementation of the plan was assumed to begin in the year 2000, or year 4 of the model.

Chart 3: Predicted Seroprevalence Rates for Each Alternative Using Deterministic (Averaging) Model

Alternative	Seroprevalence 2006 (assuming 70% efficacy)	Seroprevalence 2006 (assuming 25% efficacy)	Seroprevalence 2011 (assuming 70% efficacy)
1	33	40	24
2	34	45	26
3	36	45	28
4	34	42	26
5	0	0	0
6*	32	40	0
7	32	40	23
Modified Preferred	33	Not calculated	25

* For both vaccine efficacies, seroprevalence would be 0% after completion of capture, test, and slaughter operations by 2013.

In alternative 3, the population seroprevalence rate would be expected to decline to at least 36% seropositive in 2006, assuming a 70% vaccine efficacy. With calfhood vaccination and a vaccine efficacy of 25%, seroprevalence was predicted to drop to 45% by 2006. Continued management efforts and calfhood vaccination (70% efficacy) would reduce seroprevalence to 28% in 2011.

This would be a minor to moderately higher seroprevalence (9%–17% higher) than that predicted for alternative 1. The stochastic model predicted a 60% drop in seroprevalence from 11 years of vaccination to 15% seropositive, compared to a 40% reduction predicted by the deterministic model.

In alternative 4, capture and removal of seropositive bison, and calfhood vaccination (70% efficacy) was predicted to decrease seroprevalence to at least 34% in 2006 and 26% in 2011. Assuming a 25% vaccine efficacy, seroprevalence would drop to 42% by 2006. This would be a minor adverse impact (3%–5% higher seroprevalence) compared to alternative 1. The stochastic model predicted seroprevalence would fall to 13% in 11 years of vaccination. This is a 65% reduction compared to a 42% reduction predicted by the deterministic model.

In alternative 5, the seroprevalence rate in bison would be expected to drop from 50% in 1997 to 0% in 2001, assuming 70% vaccine efficacy, capture, test, slaughter operations, and whole-herd vaccination. In the 25% vaccine efficacy model the seroprevalence rate dropped to 0% by 2001. This would be a significant decrease in the seroprevalence rate and a major beneficial impact compared to alternative 1. Results using the stochastic model were comparable.

In alternative 6, the seroprevalence rate would remain similar to alternative 1 during the vaccination phase (2000–2010), and then drop to 0% by 2013. This would be a major reduction in seroprevalence compared to alternative 1. The stochastic model predicted that stabilization of seroprevalence (e.g., the end of phase 1) would take longer than the 15-year life of the plan. Phase 2 would drop seroprevalence to near zero by 2020.

In alternative 7, the population seroprevalence rate would be expected to decline from a starting point of 50% seropositive in 1997 to at least 32% seropositive in 2006 due to removal of seropositive bison leaving Yellowstone National Park in the West Yellowstone and Reese Creek area, and calfhood vaccination (70% efficacy) beginning in 2000. Continued management efforts and calfhood vaccination (70% efficacy) would reduce seroprevalence to 23% in 2011. With calfhood vaccination and a vaccine efficacy of 25%, seroprevalence was predicted to drop from 50% to 40% by 2006. This would be a negligible to minor beneficial impact (0–4% lower seroprevalence rate) compared to alternative 1. The stochastic model predicted a 61% decline to 14% in 2013 compared with a 49% decline in seroprevalence predicted in the same period of time by the deterministic model.

The deterministic model predicts that seroprevalence under the modified preferred alternative would decline to about 33% in 2006 due to removal of seropositive bison and remote calfhood vaccination. Continued management efforts and vaccination would reduce seroprevalence to 25% in 2011, similar to that predicted under alternatives 1 (24%) and 7 (23%). The stochastic model predicted a decline to about 15% in 2012 and 13% by 2013 after 11 years of vaccination. This is a reduction of 63% and is a greater reduction than the 46% drop predicted by the deterministic model in the same period.

Impacts on Recreation

United States citizens and people from all over the world spend more than 9 million visitor days of recreation in developed sites of the Yellowstone area each year. In Yellowstone National Park, recreational visitation has grown by more than 25% in the last 14 years. As is common in most other western national parks, visitor use in Yellowstone is concentrated in the summer months, with 66% of the visitation in June, July, and August. By the year 2003, estimated visitation is expected to range from 3.6 million to 4.3 million visitors per year (NPS 1994). An additional nearly 2.8 million recreation visitor days on the adjacent Gallatin National Forest were logged in 1992.

Wildlife and Bison Viewing. When Yellowstone National Park was set aside in 1872 as the world's first national park, the "wonders of the Yellowstone" were the primary motivation — spectacular geysers, colorful hot pools, and the Grand Canyon of the Yellowstone (Meagher 1974). However, in modern times, wildlife viewing is the primary activity for many visitors who come to Yellowstone National Park. Bison are ranked as one of the top 10 animals visitors hope to see on a visit to the park.

Increases and reductions in bison numbers in and around the park could directly affect visitor wildlife-viewing experiences. Alternative 1 would lead to growth in bison numbers over the next 10 years (42% increase in population by 2006). Alternatives 2 and 3 populations would be 14% greater than alternative 1 populations and lead to a minor to moderate increase in viewing opportunities. Alternative 4 would be expected to result in a population of 2,812 bison in 2006. This is 8% smaller than under alternative 1 and would lead to a minor decrease in viewing opportunities. Alternative 5 would lead to a 35% decrease in bison populations compared to alternative 1 by 2006 and a minor to moderate adverse impact on associated viewing opportunities. Alternative 6 would lead to very similar populations as alternative 1 through 2009 until seroprevalence stabilizes from vaccination (estimated at roughly 10 years), then would reduce them temporarily by 17%, a minor to moderate adverse impact. Alternative 7 calls for the lowest long-range (15+ years) bison population of all the alternatives. By 2006, the population would be nearly 23% lower. These reductions in population size would likely lead to minor to moderate reductions in bison viewing opportunities relative to alternative 1. The bison population would be slightly higher under the modified preferred alternative than under alternative 1 for the first 10 years of the plan and slightly lower for the remaining five years. This would have a negligible impact on bison viewing.

Winter Recreation. Winter use in the park has been growing at an accelerating rate, nearly doubling in the decade between 1984 and 1994, to 140,000 in the 1994–95 winter season. An estimated 46% of winter visitors liked viewing the scenery most, and 17% specifically identified wildlife viewing as what they liked most about the park in the winter (NPS 1990b). In addition, snowmobiling has become a popular sport in the town of West Yellowstone.

Winter recreational use of Yellowstone National Park would be affected under alternatives 2, 5, and 6. Alternative 2 would lead to long-term closure of winter access to the park from the popular snowmobiling town of West Yellowstone and possibly restrict access from Mammoth to the park interior. Proposed alternative 2 road and trail closures would likely affect well over 50% of current winter oversnow visitors to the park, and either displace their activities to other roads and trails in the area or cause them to go to areas other than Yellowstone for winter recreation. Alternative 2 would likely have a minor to moderate effect on winter recreation users in the Yellowstone region. During the three to four years of capture and slaughter operations, alternative 5 would have a higher negative impact on winter recreation than alternative 2 in that the west, north, and east entrances would all be cut off from winter access to the popular Old Faithful area. For the first 10–12 years alternative 6 would have similar negative impacts on winter recreation to alternative 2. During the following two to three years, the impacts on winter recreation under alternative 6 would be similar to those for the capture and slaughter period of alternative 5. Additional site-specific analysis after the release of the *Draft Environmental Impact Statement* indicated that the construction of a capture facility at Seven-Mile Bridge (part of alternative 6 and possibly in the same or similar location as under alternative 5) would have a direct, short-term, moderate to major, adverse impact on visitor use and experience, and operation of the facilities would have moderate to major impacts on visitor use and experience, particularly during summer and winter months.

Hunting. The five-week elk general rifle season in the study area takes place in late October and November. Mean harvest of elk in and near the affected environment is 3,044. By comparison, deer harvest is 2,564, moose is 93, bighorn sheep is 22, mountain goat is 10, and pronghorn is 23.

The American bison is a trophy animal for big-game hunters. Bison hunting takes place on both public lands and private game ranches in North America. Private ranches charge relatively high prices (ranging from $2,250 to $4,000 in the Northern Rocky region) for hunting a trophy-sized bull.

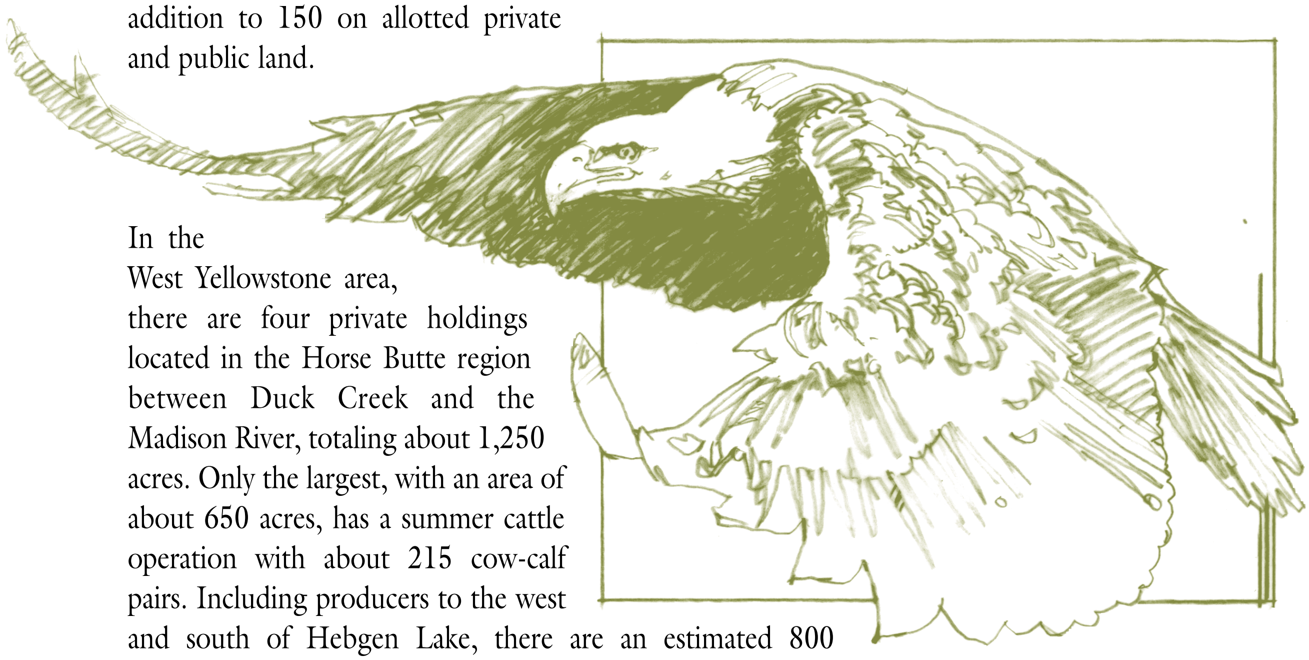
Limited hunting of bison would be allowed under alternatives 3, 4, and 7. Under alternative 3 between 75 and 85 bison hunting permits would be issued per year. Under alternative 4 the number of permits would be approximately 35. Under alternative 7 between 25 and 35 permits would be issued. This change in hunting opportunities in the area would represent a minor increase in overall big game hunting in the Greater Yellowstone Area, but would be a minor to moderate benefit for those receiving permits. No hunting of bison would occur under alternatives 1, 2, 5, 6, or the modified preferred alternative.

Impacts on Livestock Operations

In the Yellowstone area, the livestock industry is composed mainly of cow-calf operations with the exception of a few sheep producers. Cow-calf pairs are grazed on national forest allotments that can include adjacent private land, and on private holdings not associated with grazing allotments. In addition to risks of disease transmission, bison can harm livestock, as well as damage structures.

To the north of Yellowstone National Park, grazing allotments located in the broadest area included in this environmental impact statement have about 434 cow-calf pairs on national forest land and about 191 pairs on adjacent private land included as part of the allotments. When only the Reese Creek area is considered, cow-calf pairs on national forest land number about 86, with about 130 pairs on allotted private land. In the West Yellowstone area, about 364 cow-calf pairs are grazed on national forest land in the Horse Butte and Wapiti areas. An additional 128 pairs (and 2 pairs on allotted private land) are found on allotments to the west and south of Hebgen Lake.

Privately owned lands that are not part of allotments include both livestock holdings and nonranch residences. North of Yellowstone National Park, the largest of the livestock operations is in the Reese Creek area on the Royal Teton Ranch. It has about 100 cow-calf pairs on unallotted private land, in addition to 150 on allotted private and public land.



In the West Yellowstone area, there are four private holdings located in the Horse Butte region between Duck Creek and the Madison River, totaling about 1,250 acres. Only the largest, with an area of about 650 acres, has a summer cattle operation with about 215 cow-calf pairs. Including producers to the west and south of Hebgen Lake, there are an estimated 800 cow-calf pairs on private land in the West Yellowstone area that could be directly affected by the most extensive of the SMAs (alternative 2).

Bald eagle in flight.

Altogether, publicly and privately grazed cattle to the north and west of Yellowstone that could be directly affected are estimated to total about 2,019 cow-calf pairs. They comprise less than 4% of the cattle population of Gallatin and Park Counties.

The impacts of brucellosis on livestock operations involve not only the area adjacent to Yellowstone National Park, but also producers throughout Montana. The threat of disease transmission and the economic effects of disease-exposed bison entering the state have potential impacts that could indirectly affect all producers in the state.

Under alternative 1, cattle producers near Yellowstone National Park currently take precautions against the threat of brucellosis by vaccinating all female calves. In addition, herds from Idaho that graze in the West Yellowstone area are tested both when entering and leaving Montana. The cost of vaccinating and testing is relatively minor, estimated at about 2% of average yearly cow-calf production costs in the western United States. Producers' perceptions of the potentially negative consequences of grazing near Yellowstone National Park underlie recent decisions by two purebred stock owners to no longer graze their cattle in the area.

Alternative 2, characterized by minimal bison management, would involve modification of grazing allotments on the national forest, acquisition or easement of private lands, and conversion of cow-calf operations to steer or spayed heifer production. In the short term, until these changes are accomplished, the interim plan would continue. Public funds would be required for compensating producers who agreed to convert their operations and for acquiring the title or use of the private properties. These transactions would be voluntary with fair remuneration. Nevertheless, they would represent major impacts for the producers involved. Modification of public grazing allotments could affect as many as 926 cow-calf pairs. Incidents of damage by bison would be similar to occurrences under alternative 1 until susceptible cattle were removed from the areas designated as SMAs. Afterward, incidents would be fewer, since the only cattle would be those on converted holdings. Producers near SMA boundaries would likely continue to vaccinate female calves.

Under alternative 3, testing and vaccinating would continue as under the interim plan (alternative 1) in the short term. In the long term, modifications in grazing allotments on the national forest as described under alternative 2 would reduce the need for vaccinating and testing, but within less extensive SMAs. Producers near SMA boundaries would likely continue to vaccinate female calves. Whereas about 2,019 cow-calf pairs are found within the areas designated to be SMAs under alternative 2, the smaller areas of alternative 3 contain about 895 cow-calf pairs. Moderate to major impacts in the long term for these herds would result from possible conversion to steer or spayed heifer enterprises, closure or modification of grazing allotments, and private land acquisitions. Hunting could provide a minor source of income for remaining converted holdings.

Alternative 4 differs from alternative 1 in that bison hunting would be allowed. Hunting in the West Yellowstone area could provide a minor source of income for some private holdings.

Under alternative 5, livestock operators in the vicinity of Yellowstone National Park would likely perceive a reduced disease threat because no bison would be allowed outside the park. Restriction of bison to the park would lessen concerns over brucellosis transmission, although vaccination of cattle could continue, especially in the short term. Relaxation of testing practices in the West Yellowstone area would depend on changes in Idaho's agreement with Montana. Private grazing resources might increase in value due to reduced risks of disease spread and damage by bison. Thus, the overall impact on affected livestock producers could be moderately beneficial.

Consequences of alternative 6 with respect to testing and vaccinating would be the same as in alternative 1 during the first years of vaccination of Yellowstone bison.

Once capture, test, and slaughter of bison were undertaken, consequences for livestock producers would be like those of alternative 5, although seronegative bison would be allowed on public land in the West Yellowstone SMA. Cattle vaccination would probably continue, depending on producers' risk perceptions. Continued testing of herds in the West Yellowstone area would depend on Idaho's agreement with Montana. In the long term, moderate benefits overall would be realized under this alternative, as under alternative 5.

SMAs under phase 1 of alternative 7 would be the same as they are now under the interim plan (alternative 1). Testing and vaccinating would continue, as would possible incidents of damage by bison within the boundaries of the SMAs. No modifications of livestock operations would occur under phase 1. In phase 2 (following acquisition of winter range north of the Reese Creek boundary), impacts could affect at least one private holding and could modify three public grazing allotments along the western side of the Yellowstone River in the Gardiner Valley.

Under the modified preferred alternative, testing costs would be borne by APHIS, a negligible or minor benefit to producers. Monitoring and management of bison outside the park would occur seven days a week. This and a commitment to hazing would keep property damage to a minimum. The modified preferred alternative includes many measures directed at mitigating the perception of risk, as well as efforts to educate state animal professionals on the results of new research and the effectiveness of management measures. None of these measures would result in increased costs to livestock producers. Overall, the modified preferred alternative would have a slight beneficial impact on livestock operations relative to alternative 1.

In addition to direct impacts on local producers outlined above, ranchers throughout the state could suffer from increased testing or vaccinating requirements or interstate sanctions should brucellosis be transmitted to Montana cattle. The possibility of such transmission and associated indirect impacts would be considered remote in all alternatives, although it would be slightly less in alternative 5, slightly greater in alternative 2, and roughly equal in the remaining alternatives.

Impacts on Socioeconomics

Regional Economy. The affected area primarily encompasses two Montana counties, Park and Gallatin, and portions of Yellowstone National Park.

Throughout the Greater Yellowstone Area, public lands provide the basis for much of the economic activity in the region (recreation, mining, forestry, and agriculture). The area's overall economy has been changing for more than 20 years. The economy has shifted from commodity-extraction dependence to a more diversified economy based on recreation, tourism, and service industries. For example, between 1969 and 1989, more than 96% of all new jobs in the Greater Yellowstone Area came from sectors other than timber, mining, and agriculture (Rasker, Tirrell, and Kloepfer 1992).

Approximately 10% of Park County employment and 5% of Gallatin County employment is in the agriculture, forestry, and mining sectors. In addition, some component of employment in manufacturing, wholesale and retail trade, and services is derivative of activity in these resource-based sectors. Most jobs pertaining to the recreation and tourism industry are found in the retail trade and service sectors of a county's economy.

Recreation and tourism are significant to the economic viability of the area. Retail trade and services accounted for approximately 40%–45% of each county's earnings. These sectors, along with the government sector, have a strong tie to the region's resources and would likely continue to be important in sustaining segments of the economy of the Greater Yellowstone Area.

The alternatives described in this environmental impact statement would have the potential to affect jobs and income primarily through changes in visitation levels to Yellowstone National Park. Visitation levels could be affected by changes in winter road grooming, changes in wildlife viewing as a result of lowered population levels of bison, or in response to tourism boycotts. Visitors to Yellowstone National Park from outside Montana, Wyoming, and Idaho spent an average of $840 during their trips (Duffield 1992).

EXPENDITURES RELATED TO RECREATION

A 1994 report on snowmobiling in Montana found nonresidents spend approximately $40 million annually in the state, and three-fourths of those nonresidents spent time in or near West Yellowstone (Sylvester and Nesary 1994). If alternative 2, which would include closing roads now groomed for snowmobile use from West Yellowstone into the park, was implemented, the total economic output in the 17-county Greater Yellowstone Area would be reduced by $13.75 million annually, and 333 jobs would be lost. While this is a minor impact on the overall annual $12.7 billion economic output of the Greater Yellowstone Area, it would have a major adverse impact on the winter economies of the small communities where impacts would be concentrated, such as in West Yellowstone and Gardiner. Similar economic losses during the first 3–4 years under alternative 5, and for the life of the plan under alternative 6, are expected. The loss under all these alternatives would be substantially higher if not for considerable snowmobiling opportunities on the nearby national forest. Losses of winter recreation expenditures under alternatives 1, 3, 4, 7, and the modified preferred alternative would probably be negligible.

Resident elk hunters spent $54 per day while resident deer hunters spent $41 per day. Nonresident hunters expenditures associated with elk and deer hunting are $252 and $115 per day, respectively (Duffield 1988). Expenditures related to bison hunting in alternatives 3, 4, and 7 would add to this base, by as much as $440 per day. Since a maximum of 85 hunting permits for any alternative would be expected, expenditures related to it would be only a negligible benefit to the regional economy.

Expenditures related to wildlife viewing

Although alternatives resulting in a higher number and greater distribution of bison may lead to increased visitation to the park and associated expenditures in the area, the probability or extent of this is unknown. The converse is also true — that decreases in the population, particularly large-scale decreases such as would occur under alternative 5, may have adverse impacts on the number of visitors to the area and consequently on spending. However, the probability or extent of this impact is unknown. Surveys of visitors during 1999 indicated no clear relationship between the number of bison seen on a trip and the value placed on the value of the trip. However, while marginal changes in the number of bison in the park may not impact visitor trip values, a significant number of respondents indicated that seeing bison was one of their reasons for visiting the area.

The management of bison would involve killing through agency shooting, transport of seropositive animals to slaughter, hunting, and other actions that some would find objectionable. People who do take offense might object for any number of reasons: e.g., the killing of any animals is inappropriate, human management of wildlife is not needed, or bison do not need to be controlled to prevent brucellosis transmission from bison to cattle. All alternatives would involve bison management, and thus each would have some potential for adverse public reaction that might result in the call for a tourism boycott, although the potential would likely vary among alternatives. The potential for such a call and the effectiveness of such a boycott would be difficult to judge.

Minority and Low-Income Populations. As of the 1990 U.S. Census, Park County had a per capita income of $11,378, approximately equal to that of the state of Montana. Gallatin County had a substantially higher income level of $17,032 per person. The percentage of the population in poverty across the two counties and the state was relatively consistent in 1990 at between 15.2% and 17.1%. Unemployment in the two counties in 1994 was below the state average of 5.1% (Park County, 4%; Gallatin County, 2.3%).

Montana's Native American population had a much lower per capita income ($5,422) than either the two counties or the state, a much higher percentage of population living in poverty (46.1%) than the counties or the state, and an unemployment rate (26.2%) much higher than the counties or the state.

Several area tribes have expressed interest in receiving bison carcasses, or, more importantly, live bison as seed stock from the Yellowstone herd to begin their own bison operations. Bison meat sells for nearly twice the cost of beef because it is considered a health food by some consumers.

Under the interim management plan, a total of 1,084 bison were killed outside the park in Montana in 1996–97. Of this total, 590 bison were shot on the spot and donated to charities or released to Native Americans in exchange for the labor of gutting, cleaning, and transporting carcasses. Charities received 77 bison, and Indian tribes, tribal members, and affiliated organizations received 513 bison (Siroky 1997).

Alternatives 1, 3, 4, 5, 6, 7, and the modified preferred alternative all would include slaughter and the distribution of carcasses, and all alternatives would include provisions for shooting bison if they crossed boundary lines (and the subsequent gutting, cleaning, and distribution of carcasses, hides, and heads). The estimates for numbers of bison to be sold or donated for consumption would range from an incidental number per year in alternative 3 to 720 over four years under alternative 5. These numbers would represent a very minor portion of the total U.S. annual market for bison meat. The impact of charitable donations or release of carcasses to tribes would generally be negligible.

The release of live bison would require quarantining captured seronegative bison for the completion of a lengthy quarantine protocol. Quarantine facilities would be proposed for alternatives 3, 4, 7, and the modified preferred alternative, and live bison completing the procedure would be available to tribes and other requesting organizations. Live animals received after quarantine would have substantially more value to tribes than would carcasses.

Social Values. Bison are symbolically an icon for the independent, wild, and free American way of life, and are considered by some people to be "a unique symbol of the strength and determination of the people of North America" (National Bison Association 1997a).

Bison embody the culture of many native Plains peoples. They are a link to the spiritual world, spiritual power concentrated in physical form, the "great provider," and ultimately a symbol of power and strength. Bison skulls are used as altars, bone is used on traditional dress, and they are at the heart of the continuing sun dance.

Bison are important to other groups as well. To hunters, they are a trophy animal; to cattle ranchers, bison have historically represented competition with livestock for limited forage; and to many animal rights activists, they are an aesthetic and historic resource.

Written comments collected from the *Interim Bison Management Plan/Environmental Assessment* in 1995 indicated the public was strongly against the slaughter of bison. Ranchers also indicated strong feelings on the need to protect cattle from brucellosis. These are moralistic-humanistic and utilitarian values, respectively (see the "Affected Environment: Socioeconomics — Social Values" section of this document for definitions). No systematic surveys have been conducted, but it appears that alternatives relying on slaughter (1, 4, 5, 6, 7, and steps 1 and 2 of the modified preferred alternative) would have a minor to major adverse impact on those having strong moralistic-humanistic values toward animals.

Attitudes in the Yellowstone region would be more balanced between utilitarian and other attitudes than in the nation as a whole (based on wolf recovery information). Native American values may be more complex, as many of the management actions are viewed as disrespectful or wasteful of bison.

Nonmarket Values. People place value on knowing a species is maintained in a viable state or has been augmented in some way. This "nonmarket" or "existence" value of the bison population was calculated based on results of three 1999 surveys of park visitors, regional residents, and national residents. National results were not used, as the return rate failed to exceed an established threshold. This means actual nonmarket benefits would likely be significantly higher than those reported.

The benefits of having additional winter range outside the park and of improving bison health were estimated using survey results. Measurable benefits associated with the additional winter range were conservatively calculated to be about $4.43 million under alternatives where bison were allowed on additional purchased winter ranges outside the park (alternatives 2, 3, 7, and the modified preferred alternative). A separate analysis of the nonmarket value associated with aggressively reducing seroprevalence through parkwide capture, test, and slaughter (of seropositives) or vaccination (of seronegatives) like that under alternatives 5 and 6 found that resident and nonresident visitor values represent an estimated total nonmarket value of $3.57 million.

Costs and Benefits. Analysis performed in response to comments received on the *Draft Environmental Impact Statement* showed that the costs of the alternatives evaluated in the environmental impact statement would exceed the economic benefits in every case. To the extent that alternatives depend on capture, test, slaughter, quarantine, and/or vaccination, they would be increasingly expensive. Benefits were measured as the extent to which each of the objectives in the environmental impact statement were achieved. The alternative with the lowest costs for bison management was alternative 2; however, land purchase anticipated for phase 2 of this alternative would increase costs significantly. Alternatives 5 and 6 both have large costs associated with parkwide capture, test, slaughter, and vaccination operations. These costs would greatly exceed benefits, even when nonmarket benefits described above were included. Costs of implementing the modified preferred alternative would exceed benefits by about $7.4 million. This is about $1.8 million higher than the excess of costs over benefits in alternative 1.

Impacts on Threatened, Endangered, and Sensitive Species

Bald eagles, grizzly bears, Canada lynx, and gray wolves are the only known species to occur within the affected area that are protected by the Endangered Species Act. Wolverine and trumpeter swan, U.S. Forest Service sensitive species, could also occur in the affected area. These species could be directly affected by bison management actions, such as shooting, hazing, or habitat loss or modification. Because bison are an important food source, predatory species could also be indirectly affected by reduced foraging opportunities caused by changes in bison numbers, distribution, and seasonal migration patterns. The agencies prepared a biological assessment for the modified preferred alternative and sent it to the U.S. Fish and Wildlife Service. The letter of concurrence from the U.S. Fish and Wildlife Service can be found in appendix J.

Bald Eagles. Alternatives 5 and 6 would negatively affect bald eagles that winter and nest near Seven-Mile Bridge because of the location of a capture facility in this area. Other bald eagles in the analysis area would be protected by avoiding their nesting and wintering areas. Change in bison carrion availability would have a negligible effect because it is only a small part of the bald eagle diet. The modified preferred alternative may have a minor positive effect on bald eagles, particularly those nesting on Horse Butte, as a result of the potential for less hazing, capture, and handling of bison than under the no-action alternative.

Grizzly Bears. All alternatives could potentially disturb or displace grizzly bears from areas near bison management activities. The alternatives would affect only a small part of the Greater Yellowstone Grizzly Bear Recovery Zone, an area where seasonal or year-long grizzly activity is common and contains habitats important to the recovery of grizzly bears. Denning bears would not be affected during the winter when most activities would occur. Under alternatives 3, 4, and 7, increased human activity could increase the probability for human/bear conflicts and bear mortality. This probability would be reduced to negligible by educating hunters, removing gut piles, and implementing other mitigating measures.

The degree to which an alternative modifies bison population numbers could likewise affect grizzly bears. Bison, along with other ungulates, rank as one of the highest sources of net digestible energy for grizzly bears in the Yellowstone ecosystem. Bison are particularly important to bears because they provide a high quality food source during early spring before most vegetal foods are available to bears. From March through May, ungulates, mostly elk and bison carrion, are the most important foods in the grizzly bear's diet (Mattson et al. 1991). Grizzly bears that den in the Pelican and Hayden Valleys in the park depend on bison carrion and are most likely to be affected by changes in bison populations.

Under alternative 1, bison numbers would not be maintained within a specific range, and low population levels could result during some periods. Consequently, foraging opportunities could be reduced during some years and negatively impact grizzly bears, particularly during the spring. This impact would likely be negligible unless bison disappeared from Pelican or Hayden Valleys in the park. Alternative 2 would allow the bison population to reach a long-term maximum of 3,500 bison quickly, and would leave park roads ungroomed, which would likely increase winter bison mortalities and carrion in the park. This would increase the availability of bison as a food source and moderately benefit grizzly bears. Alternative 3 would have minor benefits.

Alternatives 4, 6, and 7 would maintain the bison populations within a specific range and cause only minor changes in the population. Thus, the impacts on grizzly bear foraging opportunities would be negligible. Alternative 5 would cause a major decrease in the first few years in the bison population and reduce the carrion supply available to grizzly bears. The modified preferred alternative would result in bison populations similar enough to those under alternative 1 that it is not likely to adversely affect the grizzly bear.

Gray Wolves. The Rocky Mountain gray wolf was reintroduced in Yellowstone National Park in March 1995 and is part of a "nonessential experimental population." This means that the species is listed and protected under the Endangered Species Act, but agencies have additional flexibility in their management. At this time, 11 named packs of wolves exist in the Greater Yellowstone Area (8 breeding pairs existed in 1999), as well as an additional 115 to 120 wolves living independently in the Greater Yellowstone Area as pairs or individuals (Smith 2000).

All alternatives could disturb or displace wolves from areas near bison management activities. However, any impact on the small wolf population would likely be negligible.

Wolves prey primarily on elk, moose, and deer. These species are abundant in the analysis area, and usually account for more than 90% of the biomass consumed. Smaller mammals may be an important alternative food during the snow-free months. Wolves rarely prey on live bison, but do eat bison carrion if it is available. Although wolves could eventually increase their take of bison as prey as the wolf population increased, impacts from changes in the bison population during the 15 years this plan was in effect would be negligible in alternatives 1, 3, 4, 6, 7, and the modified preferred alternative. Alternative 2 would have a moderate beneficial impact and alternative 5 a moderate to major adverse impact to wolves through larger-scale changes in bison population numbers.

On December 12, 1997, the United States District Court for the District of Wyoming ruled that the gray wolf reintroduction program in Yellowstone National Park and northern Idaho violated one provision of the Endangered Species Act. The court ordered the federal government to remove the reintroduced wolves and their offspring. On January 13, 2000, this decision was overturned by the 10th U.S. Circuit Court of Appeals.

Canada Lynx. Canada lynx are very susceptible to some human activities. All the alternatives could displace or disturb lynx from areas near bison management activities. Under alternatives 2, 5, and 6, snowmobile use now on the groomed trails inside the park would be displaced to trails and off-trail areas in the neighboring Gallatin National Forest where lynx occur. Lynx are specialized predators that may face competition from generalist predators given access to their habitat by following packed-snow routes such as those resulting from snowmobile use. Winter recreation activities would be monitored on the national forest and, if necessary, mitigating measures implemented to lynx. Changes in bison numbers would have a negligible impact because lynx seldom feed on bison carrion.

Wolverines. Impacts very similar to those described for lynx could also affect wolverines. These include displacement or disturbance from bison management activities or increased snowmobile activity in the Gallatin National Forest if alternative 2, 5, or 6 were implemented.

Trumpeter Swans. Trumpeter swans could be affected by the location and operation of bison management facilities. The swan occupies meadows and open fields, plus lakes, ponds, or slow-moving water inside the park on the Madison River. In particular, a breeding pair at Seven-Mile Bridge where a capture facility is proposed in alternative 6, would experience major adverse impacts from construction and operation.

Impacts on Other Wildlife Species

Ungulates. The Stephens Creek capture facility occupies 13 acres of critical pronghorn winter range, and has had adverse impacts on the antelope population through displacement, disturbance, and blocked movements. Observations from capture operations during winter 1996–97 showed pronghorn avoided using habitat in the capture facility area, and some pronghorn may have been confused by the wing fences when fleeing from predators. The capture facility at Stephens Creek would continue to exist in all alternatives except alternative 2 (in the short term only in alternatives 3 and 7), and would have a moderate to major adverse impact on the pronghorn population. In steps 2 and 3 of the modified preferred alternative, wildlife in the vicinity may experience a minor beneficial impact and pronghorn may experience a moderate to major benefit from a reduction in the use of the Stephens Creek capture facility. Other capture facilities, such as those in West Yellowstone and planned for different locations within the park in alternatives 5 and 6, could have minor adverse impacts on wildlife through displacement and disturbance.

Acquisition of additional wildlife winter range in the Gardiner Valley, which has occurred since the release of the *Draft Environmental Impact Statement*, is a part of alternatives 2, 3, 7, and the modified preferred alternative. This acquisition will make more winter habitat available to elk, mule deer, bighorn sheep, and particularly pronghorn. Although pronghorn and other ungulates have historically used the acquired area, a minor benefit to most ungulates and a moderate to major beneficial impact on pronghorn would occur from discontinuing a hunt on private lands focused on displacing pronghorn from agricultural land in the area.

Occasional hazing operations associated with all alternatives would be expected to have minor impacts on elk, mule deer, bighorn sheep, and other ungulates through disturbance and temporary displacement.

In alternatives where snowmobile use would be displaced outside the park (alternatives 2, 5, and 6), impacts on ungulates outside the park could be more intense than they are now. This is because snowmobiles would be restricted to trails inside the park, but allowed to travel off trails in many areas of adjacent public lands.

Elk, pronghorn, deer, bighorn sheep, and moose would not likely be affected through competition for forage or space with bison, as each has an ecological niche that differs from bison through food choices, occupied habitat, or tolerance of snow depth. Therefore, increases or decreases in the bison population size would not be expected to affect any other large ungulates.

Predators and Scavengers. Hazing activities directed at moving bison into capture facilities or inside the SMA boundary could disturb and displace predator and scavenger species, including black bear, mountain lion, coyote, fox, wolverine, bobcat, lynx, and a variety of smaller mammalian and avian carnivores and scavengers using those areas. Hazing should be infrequent, however, and displacement and stress would be local and temporary and would have only minor effects on those populations. Changes in the bison population size and resulting availability of carrion would not affect predators and scavengers except during the parkwide capture and slaughter phases of alternatives 5 and 6, when reductions would be severe enough to cause a moderate impact. Displaced snowmobile use associated with alternatives 2, 5, and 6 might affect some of these species more severely than at present, as this activity is restricted to trails inside the park and might not be if it was displaced outside the park. Impacts on some species could be moderate.

Impacts on Human Health

Brucellosis is a zoonotic disease that can infect people, causing undulant fever. Symptoms include intermittent fever, chills, night sweats, body and joint pain, poor appetite, and weakness. The general public would be at no risk of contracting the disease from bison. However, people responsible for carrying out proposed bison management actions such as capturing, vaccinating, gutting, loading for slaughter, and laboratory analysis, could be at moderate risk. Because step 3 of the modified preferred alternative calls for relatively little handling of bison exiting the park into established boundary areas, this alternative would pose fewer health risks to personnel involved with the capture, slaughter, testing, loading, or in-chute vaccination of bison than under alternative 1. Hunters could also be at some risk under alternatives that include hunting. Recipients of auctioned or donated meat could be at minor risk of exposure through the handling of potentially contaminated meat and the consumption of improperly prepared meat. Proper handling and cooking completely kills the bacteria.

Mitigating and preventive measures, such as proper equipment, ventilation, and information, would prevent impacts from being more than negligible to minor in all alternatives except during the parkwide capture and slaughter phases of alternatives 5 and 6, when the risk would be minor to moderate.

Impacts on Cultural Resources

The Great Plains and the northern Rocky Mountains of western Montana and Wyoming served as feeding grounds for bison. This region is also the homeland of various native peoples who hunted these herds.

Bison were and remain critical to the indigenous cultures of North America and were an important part of the landscape covering over half the continent. They once ranged from the Appalachian Mountains to the "deserts" of the Great Basin south into Mexico and as far north as the Yukon territory in Canada. English settlers arriving in what is now Georgia wrote of the "innumerable" bison they encountered. The numbers were so great that early Euro-American explorers could only describe them as "numberless," and wrote that the plains were "black and appeared to be moving" with the herds of bison. The most commonly used estimates of their numbers were between 30 and 65 million.

Bison provide not only food, clothing, fuel, tools, and shelter, but also are central to Plains tribal spiritual culture, viewed as an earthly link to the spiritual world. For many tribes, bison represent power and strength. For example, the Shoshone believe that spiritual power is concentrated in the physical form of the bison. Many contemporary tribes maintain a spiritual connection with bison.

Traditional use of bison by humans centers on hunting and is evidenced in the archeological record. The remains of game drives, including both the fences and bison jump sites, as well as chipping stations, wickiups, and weapons, are all associated with the importance of hunting bison for tribal economy and culture.

Illustration entitled "By the Millions" by Martin S. Garretson, 1913. (NPS photo)

Most archeological sites in the Yellowstone area have not been evaluated according to the National Register of Historic Places criteria, although Obsidian Cliff, an area particularly rich in cultural remains, has been nominated as a national historic landmark. Several others, including the Yellowstone road system, one archeological site in the Stephens Creek area, and one archeological site in the Eagle Creek area, are considered to be eligible for inclusion in the national register.

Since the *Draft Environmental Impact Statement* was published, a site-specific archeological investigation of resources found in the vicinity of Seven-Mile Bridge was conducted for alternative 6. Capture facilities proposed there would have major impacts on archeological resources, but with mitigation, could be minor. However, the cost of mitigation could reach over a million dollars.

In all alternatives, bison would be killed while occupying their historic range. Bison populations would be slightly higher than under alternative 1 for the first 10 years of the modified preferred alternative and slightly lower for the remaining five years of this bison management planning period. In addition, some alternatives, including 2, 3, and the modified preferred alternative, would allow bison to occupy a greater portion of their historic range. This would have a minor to major positive impact on tribes and individuals who regard wild and free-ranging bison as culturally important. Reductions in the population size compared to the no-action alternative (alternative 1) would occur on a short-term basis in alternatives 5 and 6, might occur on a short-term basis in alternative 4, and would occur on a long-term basis in alternative 7. Alternative 5 and phase 2 of alternative 6 are also more restrictive than under current management. Those alternatives that restrict bison movements and result in moderate or major reductions in the size of the herd would have a major adverse impact on tribes viewing bison as culturally important. These include alternative 5 and phase 2 of alternative 6.

In most alternatives, the process of monitoring and vaccinating bison would change their appearance. Bison would be marked with visible metal ear tags, paper back tags, and paint/peroxide stripes to indicate to managers and others that they have tested negative for the *Brucella* organism. These actions alter the historic image of the bison and would have a temporary, moderate impact on the historic landscapes. This would not be true of alternatives where untested bison would be allowed outside the park, including step 3 of the modified preferred alternative.

The construction of new capture or quarantine facilities would have the potential to affect archeological resources. In all alternatives proposing construction of bison management facilities (all except alternative 2), site-specific surveys would be conducted prior to ground-disturbing activities, and every effort would be made to avoid known archeological resources. Should avoidance prove impossible, the National Park Service, U.S. Forest Service, and state agencies would develop mitigating measures in consultation with the state historic preservation officer and the advisory council. Therefore, the impact would likely be negligible or minor.

Removal of the capture facilities, as proposed in alternative 2, would have a beneficial impact on the historic landscape. The construction of several new capture facilities in alternatives 5 and 6 would have a temporary but significant adverse impact on the historic landscape of Yellowstone National Park.

Impacts on Visual Resources

Visual resources consist of landform (topography and hydrology) and land cover (vegetation, buildings, roads, etc.). Visual resources are centered on significant features and intrinsic features. Also included is visibility of the undertaking, such as exposure and location.

The Greater Yellowstone Area is world renown for its scenery, wildlife, wilderness, rivers, fishing, hunting, outdoor recreation opportunities, and geologic and thermal features. The natural landscape is rugged and formidable due to the rapid gains in elevation, and most of the area remains in a wilderness state. Bison and other wildlife are frequently observed meandering through the landscape.

Visual resources within Yellowstone National Park fall into two general zones — the natural zone and the park development zone. Bison are observed within both, although they are most frequently observed within the natural zone.

Vehicle pullouts in the park are designed for visitors to stop and experience the visual resources, and are placed in areas where bison are most frequently found —

e.g., valley lowlands off the main loop roads. Some locations include the open areas within Hayden Valley, Old Faithful/Firehole area, the Madison River (past Seven-Mile Bridge), Indian Creek in the Mammoth area, the Norris Campground, Gibbon Meadows, Elk Park, and others. The view from these pullouts includes an unobstructed natural setting containing habitat desirable to bison as well as other wildlife species.

The process of capturing and/or vaccinating bison would temporarily change their natural appearance. Bison would be visibly marked with tags and peroxide stripes due to vaccination and testing procedures. These processing marks would detract from the natural appearance of the animal. This would be a short-term, moderately adverse impact on the viewer, photographer, and anyone interested in seeing bison. Capture would be a part of all alternatives except phase 2 of alternative 2. In step 3 of the modified preferred alternative, there is potential for less marking and trapping of bison, and this would be a moderate to major positive impact on visual resources.

Agency shooting of bison and some hazing operations would be visible if bison ventured beyond delineated management areas. Hunting of bison outside the park in designated SMAs is also part of alternatives 3, 4, and 7. These bison management actions would have a minor to major short-term (winter only) visual impact on the landscape, or on some viewers, who might be opposed to shooting, hunting, or hazing bison, or might be sensitive to these activities.

The existing capture and test facility would continue to intrude on the viewshed at Stephens Creek in all alternatives except alternatives 2, 3, and 7. Because this facility is of a compatible design with the nearby Yellowstone National Park wrangling facilities, the impact on visual resources would be minimal. Also, this facility would not be readily visible to the majority of visitors to the park and surrounding areas.

Capture and test facilities within the viewshed on the western boundary of Yellowstone National Park would continue to adversely impact visual resources in alternatives 1, 4, 6, 7, and the modified preferred alternative. The visual impact of capture facilities at West Yellowstone would be minor to moderate. These facilities would not be visible in major viewsheds, but some park visitors, national forest users, and local residents would see them. Bison management actions, such as hazing, shooting, and gutting, could be a major adverse visual impact on some of these viewers. To the extent they do not include these activities, alternatives, such as phase 2 of alternative 2 or 3 or step 3 of the modified preferred alternative, would have a relatively positive impact on visual resources. Construction of capture and testing facilities in the Seven-Mile Bridge viewshed near the western boundary of the park in alternative 6 would be a major impact on visual resources.

The proposed construction of capture and test facilities within Yellowstone National Park at the Lamar Valley/Crystal Bench, Blacktail Plateau, Madison River, West Yellowstone boundary area, Old Faithful/Firehole River, and Hayden/Pelican Valleys, which is part of alternatives 5 and 6, would have a major impact on visual resources. These areas are highly sensitive to visual intrusions, and while measures would be taken to minimize impacts, the presence of these facilities would be highly noticeable.

A quarantine facility is part of alternatives 3, 4, 7, and the modified preferred alternative. Although the location or design of a quarantine facility for bison has not been determined, the facility would probably appear as large-scaled corrals and pens within which bison would be visible. Siting of a relocated capture facility and a new quarantine facility would be sensitive to views and features of the viewshed; therefore, impacts are expected to be minor.

In alternatives 2, 3, 7, and the modified preferred alternative, grazing allotments might be modified and could cause negligible to minor changes in the rural landscape near park boundaries. In the long term, cattle grazing would be modified in some allotments on lands adjacent to Yellowstone National Park, and the scenery would change to views of bison and wildlife habitat.

Changes in the size of the bison population could affect viewers. Although negligible or minor increases or decreases in the size of the population are not expected to affect viewing, larger scale changes are. In addition, those alternatives that allow bison outside the park are likely to have a greater positive effect on viewers. Minor or moderate benefits to visitors seeking to view bison are expected from alternatives 2, 3, and the modified preferred alternative. Minor to moderate adverse impacts to visitors seeking to view bison are anticipated from alternatives 5 and phase 2 of alternative 6.

Alternatives 2, 5, and 6 include provisions for closing roads to snowmobile traffic. This would help restore the winter visual scene inside the park to a more natural one, but would adversely affect visual resources on adjacent Gallatin National Forest where much of the snowmobile traffic would be displaced.

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Purpose of and need for action

INTRODUCTION

The "Purpose of and Need for Action" part of the draft environmental impact statement (EIS) explains why the document is being developed. It describes the EIS planning process, details the need for action, provides background on why action is required, and identifies the specific purpose, objectives, and constraints in taking action. It also outlines the public input received to date on the bison management plan, including additional objectives, alternatives, or environmental issues the public has asked that this environmental impact statement analyze. A summary of all environmental issues analyzed, including those from the public, and an explanation of why some have been dropped from further analysis, concludes this part of the document.

PROPOSED ACTION

The National Park Service (NPS), the U.S. Forest Service (USFS), the Animal and Plant Health Inspection Service (APHIS), and the state of Montana have proposed several options for the interagency, long-term management of Yellowstone area bison to ensure domestic cattle in portions of Montana adjacent to Yellowstone National Park are protected from brucellosis, a disease that some of these bison carry, and to ensure the viability of the bison herd. Each option requires the cooperation of all agencies as all have jurisdiction over a portion of the management effort, either directly or indirectly. Members of these agencies working on this environmental impact statement are referred to as the "interagency EIS team," "interagency team" or simply "agencies" throughout the document. Even though Montana no longer is part of the interagency team, the use of these terms includes Montana unless otherwise noted.

The "Purpose of and Need for Action" part of the draft environmental impact statement (EIS) explains why the document is being developed.

The management actions proposed for evaluation in this environmental impact statement were developed with consideration for the current authorities of these cooperating agencies and information relevant to the management of the bison herd that periodically migrates across their jurisdictional boundaries.

Management decisions that are made pursuant to this environmental impact statement would remain in effect until the purpose of the plan has been achieved (see "Purpose of Action" in this chapter); agency authorities change; or, new information, gained through implementation of those decisions, suggests a need for change. Future decisions to revise bison management procedures will be supported with additional NEPA analysis if necessary. For purposes of analysis, this environmental impact statement assumes that the selected alternative will remain in effect for 15 years.

PROJECT LOCATION

This project involves the northern Rocky Mountains of the United States, specifically Yellowstone National Park and an area of private, state, and federal lands in Montana to the north and west of the park boundary (see Region map). The study area is within what is known as the Greater Yellowstone Area or GYA (see the Greater Yellowstone Area and Study Area maps).

THE ENVIRONMENTAL IMPACT STATEMENT/PLANNING PROCESS

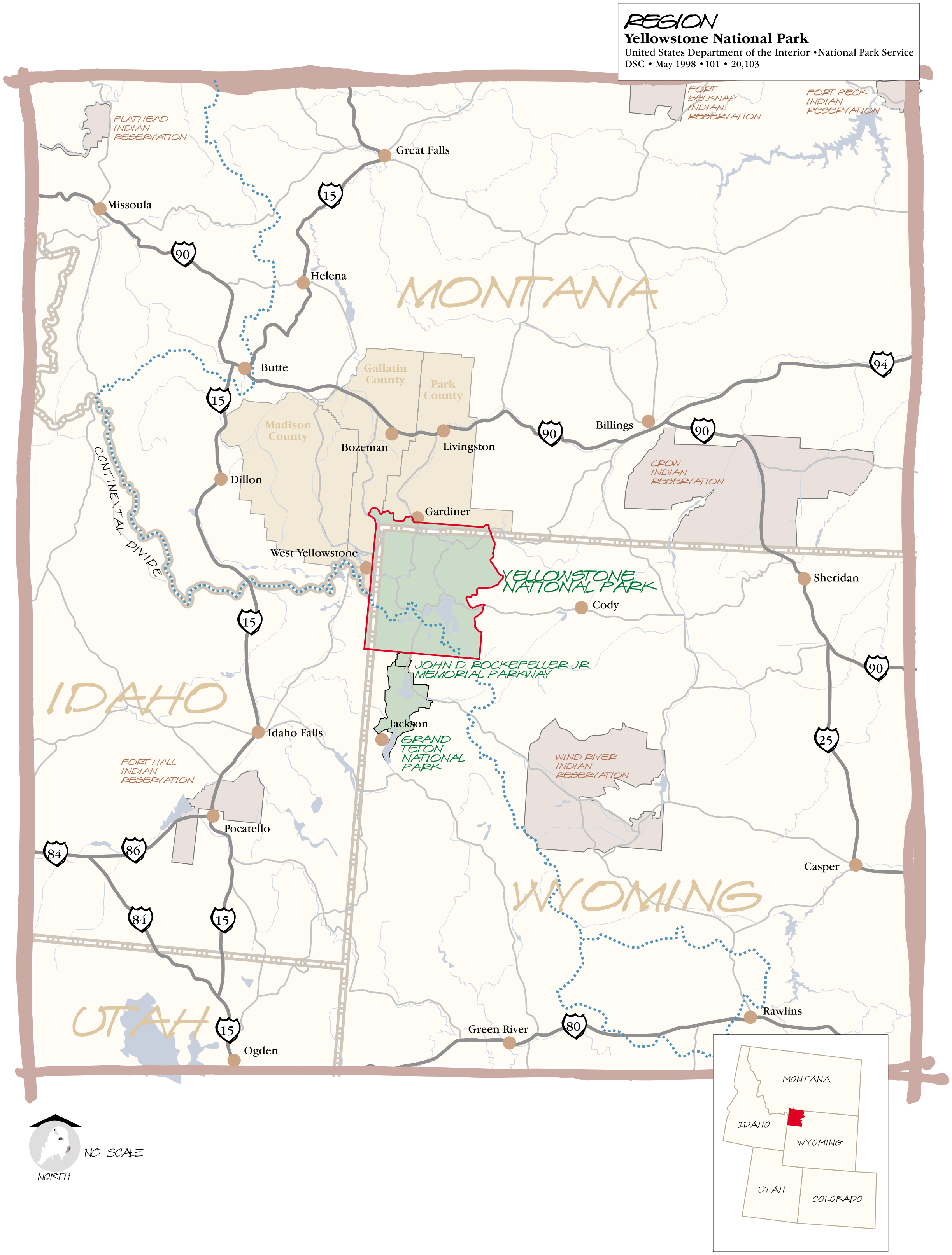
The first step in any planning process is to completely define the problem. In this case, the involved agencies must agree on why action is required. Members of the interagency EIS team are specialists in different fields relevant to the management of bison, cattle, and/or brucellosis, and have composed the need for action statement below as a brief synopsis of the problem they are attempting to solve by proposing action. A more in-depth discussion of the need for action is presented later in the "Background" chapter.

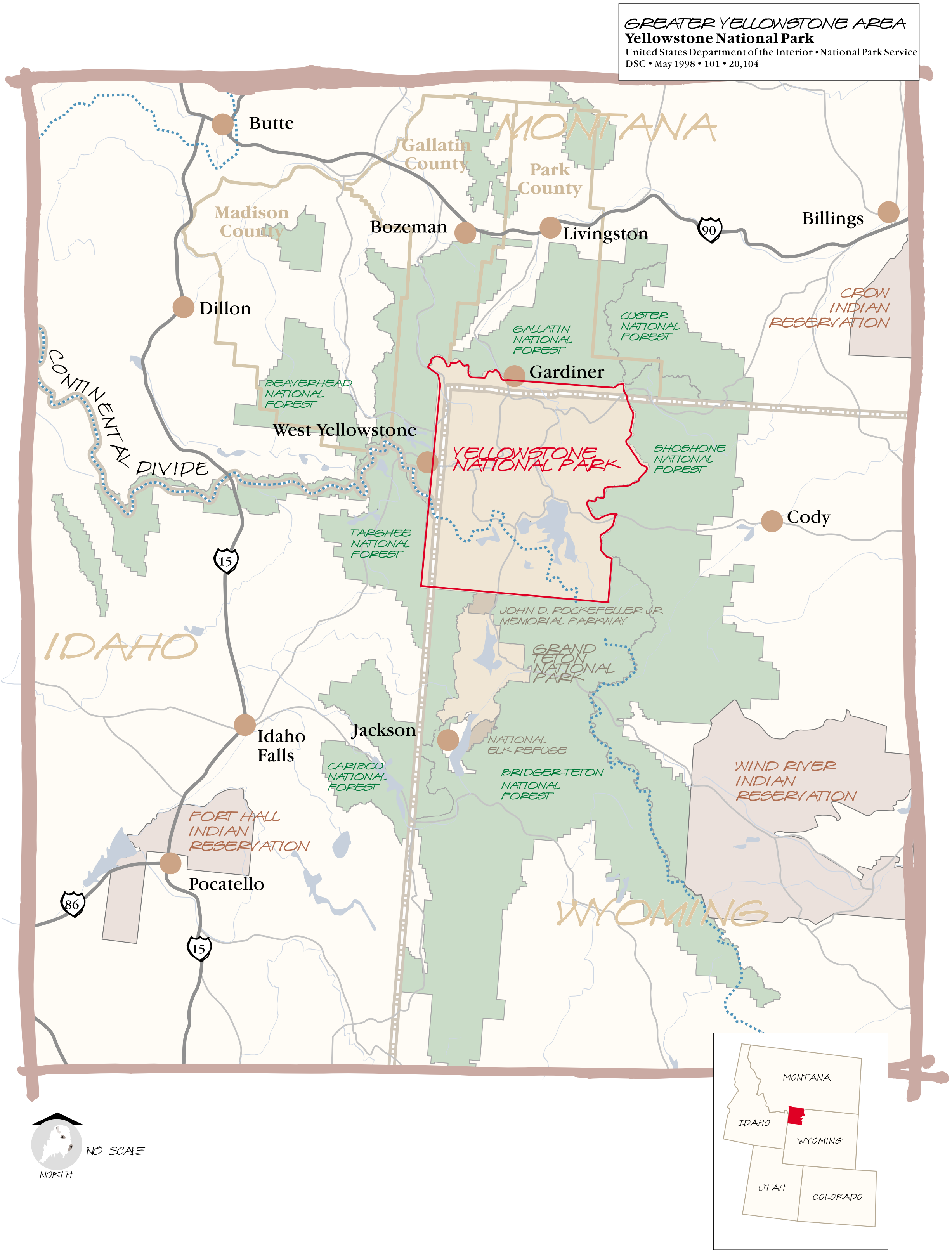
The interagency team also identified the general and specific purposes or goals it felt the action must accomplish to be successful. The general goal is stated in the purpose section below, and the specifics are presented in the "Objectives and Constraints" chapter under "Objectives in Taking Action." The interagency team agreed these objectives would apply to all alternatives, as well as to the selection of a preferred alternative. Any alternative unable to meet one or more of the nine objectives to some degree would be eliminated as unreasonable.

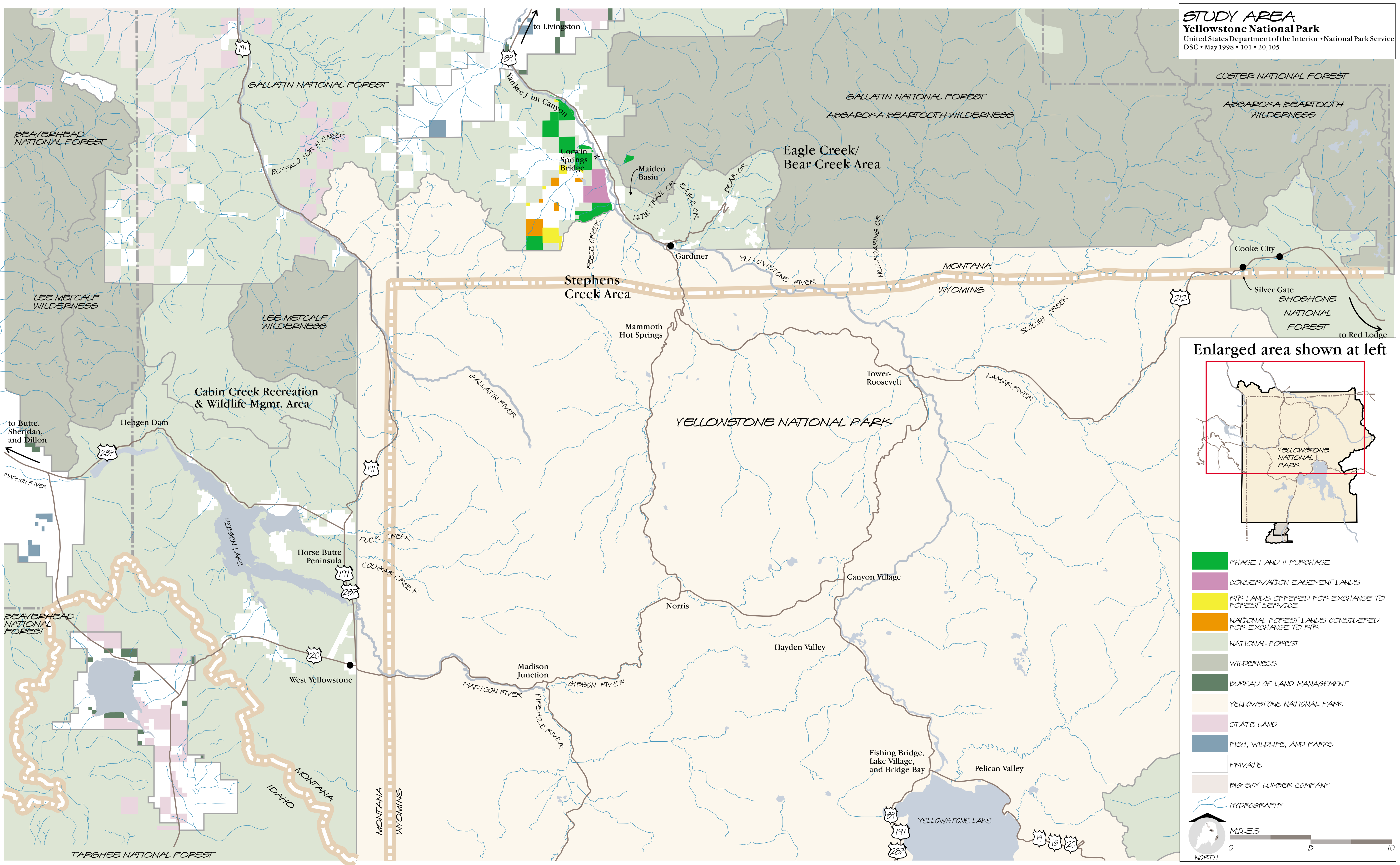
The same was true for any alternative that did not comply with the legal or regulatory mandates of each agency. These mandates are identified in the "Constraints in Taking Action" section.

Public input on additional objectives, as well as on environmental issues and alternatives, was gathered in scoping and document review sessions described in the "Scoping Process and Public Participation" chapter. A more detailed description of public participation is in part 5 of the document, "Consultation and Coordination."

The interagency team then used objectives, constraints, and input from the public to devise a set of alternatives it felt covered the full spectrum of viable options. All were legally implementable and met objectives to some degree.


REGION
Yellowstone National Park
United States Department of the Interior • National Park Service
DSC • May 1998 • 101 • 20,103
FLATHEAD INDIAN RESERVATION
FORT BELKNAP INDIAN RESERVATION
FORT PECK INDIAN RESERVATION
Great Falls
Missoula
Helena
MONTANA
Butte
Gallatin County
Park County
Madison County
Bozeman
Livingston
Billings
CROW INDIAN RESERVATION
Dillon
CONTINENTAL DIVIDE
Gardiner
West Yellowstone
YELLOWSTONE NATIONAL PARK
Cody
Sheridan
JOHN D. ROCKEFELLER JR. MEMORIAL PARKWAY
IDAHO
Idaho Falls
Jackson
GRAND TETON NATIONAL PARK
WIND RIVER INDIAN RESERVATION
FORT HALL INDIAN RESERVATION
Pocatello
Casper
WYOMING
Rawlins
Green River
UTAH
Ogden
15
90
94
84
86
25
80
MONTANA
IDAHO
WYOMING
UTAH
COLORADO
NO SCALE
NORTH


GREATER YELLOWSTONE AREA
Yellowstone National Park
United States Department of the Interior • National Park Service
DSC • May 1998 • 101 • 20,104
MONTANA
Butte
Gallatin County
Park County
Madison County
Bozeman
Livingston
Billings
90
Dillon
CROW INDIAN RESERVATION
GALLATIN NATIONAL FOREST
CUSTER NATIONAL FOREST
Gardiner
BEAVERHEAD NATIONAL FOREST
CONTINENTAL DIVIDE
West Yellowstone
YELLOWSTONE NATIONAL PARK
SHOSHONE NATIONAL FOREST
Cody
TARGHEE NATIONAL FOREST
15
JOHN D. ROCKEFELLER JR. MEMORIAL PARKWAY
IDAHO
GRAND TETON NATIONAL PARK
Idaho Falls
Jackson
NATIONAL ELK REFUGE
CARIBOU NATIONAL FOREST
BRIDGER-TETON NATIONAL FOREST
WIND RIVER INDIAN RESERVATION
FORT HALL INDIAN RESERVATION
Pocatello
86
15
WYOMING
MONTANA
IDAHO
WYOMING
UTAH
COLORADO
NO SCALE
NORTH


STUDY AREA
Yellowstone National Park
United States Department of the Interior • National Park Service
DSC • May 1998 • 101 • 20,105
to Livingston
Yankee Jim Canyon
GALLATIN NATIONAL FOREST
ABSAROKA BEARTOOTH WILDERNESS
CUSTER NATIONAL FOREST
ABSAROKA BEARTOOTH WILDERNESS
BEAVERHEAD NATIONAL FOREST
Corwin Springs Bridge
Maiden Basin
Eagle Creek/
Bear Creek Area
Gardiner
Cooke City
Silver Gate
SHOSHONE NATIONAL FOREST
to Red Lodge
MONTANA
WYOMING
Stephens
Creek Area
Mammoth Hot Springs
LEE METCALF WILDERNESS
Cabin Creek Recreation
& Wildlife Mgmt. Area
Hebgen Dam
to Butte, Sheridan, and Dillon
Tower-Roosevelt
YELLOWSTONE NATIONAL PARK
Horse Butte Peninsula
Canyon Village
Norris
Hayden Valley
Madison Junction
West Yellowstone
Fishing Bridge, Lake Village, and Bridge Bay
Pelican Valley
YELLOWSTONE LAKE
TARGHEE NATIONAL FOREST
IDAHO
Enlarged area shown at left
PHASE I AND II PURCHASE
CONSERVATION EASEMENT LANDS
RTK LANDS OFFERED FOR EXCHANGE TO FOREST SERVICE
NATIONAL FOREST LANDS CONSIDERED FOR EXCHANGE TO RTK
NATIONAL FOREST
WILDERNESS
BUREAU OF LAND MANAGEMENT
YELLOWSTONE NATIONAL PARK
STATE LAND
FISH, WILDLIFE, AND PARKS
PRIVATE
BIG SKY LUMBER COMPANY
HYDROGRAPHY
MILES
0
5
10
NORTH

None was considered to have such severe environmental, technical, or economic impacts or constraints as to be considered infeasible. All were distinct enough from each other to be separate alternatives. A description of each of the eight alternatives, as well as summary comparisons of the features and impacts of each, is found in part 2 of the document, "The Alternatives."

The environmental impacts of each alternative were analyzed and compared to existing conditions. A summary of this information is presented in part 3, "Affected Environment," and part 4, "Environmental Consequences."

This environmental impact statement has both policy, or programmatic elements, as well as site-specific elements. Bison range over most of the 2.2-million-acre park, as well as into areas outside the park. Management actions may affect distribution of bison within this area, or may cause regional changes in one or more of the resources analyzed. These are discussed primarily qualitatively, and since they occur over such a large scale, impact analysis is less precise. Conversely, impacts of specific management actions at a capture facility, or the impacts of locating a new capture facility (such as at Seven-Mile Bridge) are discussed in more site-specific detail. Because some choices are by design policy or program ones, additional site-specific environmental impact analysis may be required to implement them at some future date. For instance, the construction and operation of a quarantine facility on federal land or built with federal money, should quarantine be a selected management strategy, would be analyzed in a subsequent document. That document would be prepared, as is this one, to comply with NEPA requirements, and would be tiered to this environmental impact statement. This means the policy guidance derived from this environmental impact statement would apply to the subsequent analysis, and agencies would not evaluate nonquarantine options. Rather, they would focus on sites, designs, operation choices, etc., for the facility.

Information in this environmental impact statement was used by decision makers from the interagency team to help in selecting a preferred alternative from the alternatives analyzed.

FEIS Note: The combination of volumes 1, 2, and 3 are the final environmental impact statement referenced in this paragraph. Volume 1 is the corrected and updated text of the environmental impact statement. Volume 2 contains responses to all substantive comments submitted to the agencies as a result of public review of the *Draft Environmental Impact Statement*. Volume 3 contains copies of all public agency letters, those of elected officials, as well as organizations, educational institutions, businesses, tribes and tribal organizations letters submitted during public review.

OTHER ONGOING PLANNING EFFORTS

Bison management is only one of many management issues in Yellowstone National Park. Ongoing planning on these management issues may ultimately affect or guide the decision made on bison management. Therefore, the decision on bison management will need to be coordinated with other ongoing planning efforts. Related documents are listed and described below.

- The park is in the process of preparing a commercial services plan to address visitor services throughout the park. There is currently no schedule for completing this document.

- Pursuant to the settlement of litigation, Yellowstone National Park and Grand Teton National Park, and the John D. Rockefeller, Jr., Memorial Parkway are completing a plan and environmental impact statement for winter visitor use management. A *Draft Environmental Impact Statement* was released in August 1999 with a record of decision proposed for fall 2000. In the *Draft Winter Use Plan* and environmental impact statement, the alternatives ranged in actions that would achieve a desired condition in the park while minimizing impacts to some or all park resources. The following is a list of the *Draft Winter Use Plan* alternatives and the proposed changes to visitor access for each alternative.

  Alternative A, the no-action alternative, would continue to groom roads.

  Alternative B, the preferred alternative, would provide for a range of affordable and appropriate winter visitor experiences. This alternative proposes to allow all-wheeled public shuttle vehicle access by plowing the road from West Yellowstone to Old Faithful.

  Alternative C would maximize winter visitor opportunities for a range of park experiences, while preserving natural resources and addressing safety concerns. The road would be plowed from West Yellowstone to Old Faithful for public and private all-wheeled vehicle access. In addition, the road from Mammoth to Norris to Madison would be plowed from mid-February to mid-March for late season all-wheeled vehicle access.

  Alternative D would provide opportunities for visitor access to the unique winter aspects of the park and would protect those qualities and natural resources by phasing in clean and quiet modes of travel. Groomed roads for oversnow motorized travel would remain the same as in alternative A, except that Fishing Bridge to the east entrance road would be closed for safety.

Alternative E would protect wildlife and other natural resources while allowing park visitors access to a range of winter recreation experiences. Road segments could be closed if research and monitoring indicated that no other mitigation method could protect wildlife or other natural resources.

Alternative F would protect wildlife resources by focusing winter visitor activities near scenic areas in the eastern and southern portions of Yellowstone National Park. The following road segments would be closed: the west entrance to Madison to Old Faithful and Mammoth to Norris to Madison.

Alternative G would emphasize clean, quiet, oversnow access to Yellowstone and Grand Teton National Parks using existing technologies. The only type of oversnow motorized travel allowed in the park would be snowcoach.

- Implementation of certain elements proposed in the winter use plan for Yellowstone and Grand Teton National Parks could be deferred if the road plowing or closures analyzed in alternatives 2, 5, or 6 of the Bison Plan were selected.

- On October 27, 1997, the United States District Court in Washington D.C., approved a settlement agreement that called for the National Park Service to prepare an environmental assessment evaluating the closure of a winter road segment in Yellowstone National Park. The agreement settled a lawsuit filed by The Fund for Animals and others, which asserted, among other issues, that the National Park Service had failed to evaluate the effects of trail grooming in the parks on wildlife and other park resources. The *Environmental Assessment — Temporary Closure of a Winter Road* in Yellowstone National Park was published in November 1997. The "Finding of No Significant Impact," signed in January, stated that the decision whether to close a road segment will be made by December 1, 2000, and will be based on monitoring and research of baseline information on wildlife movements. A one-year grace period before implementation would delay a road closure, if necessary, until the winter of 2001–2002. The "Finding of No Significant Impact" also states that the National Park Service may modify or change this decision as a consequence of other planning processes such as the Yellowstone National Park winter use plan or the bison management plan.

- The U.S. Forest Service's Gallatin National Forest Plan (1987) would also be considered.
- At the time this final environmental impact statement went to press, the National Park Service, U.S. Fish and Wildlife Service, USDA Forest Service, and the Wyoming Game and Fish Department were participating in the early stages of a planning process for the management of the Jackson bison and elk herds in Wyoming.

NEED FOR ACTION

Bison are an essential component of Yellowstone National Park and the Gallatin National Forest because they contribute to the biological, ecological, cultural, and aesthetic purposes of the park. However, Yellowstone National Park is not a self-contained ecosystem for bison, and periodic migrations into Montana are natural events. Some bison have brucellosis and may transmit it to cattle outside the park boundaries in Montana (see "Background" in this part). As bison migrate out of the park and into Montana, they move from one jurisdiction with management objectives to another jurisdiction with different management objectives.

Bison migrating outside Yellowstone National Park.

Therefore, the cooperation of several agencies is required to fully manage the herd and the risk of transmission of brucellosis from bison to Montana domestic cattle.

PURPOSE OF ACTION

The purpose of the action (that is, the bison management plan) is to maintain a wild, free-ranging population of bison and address the risk of brucellosis transmission to protect the economic interest and viability of the livestock industry in the state of Montana.

BACKGROUND

THE YELLOWSTONE AREA BISON HERD

Bison are native to the Greater Yellowstone Area and were observed there by early travelers before and after the creation of Yellowstone National Park in 1872 (see the Historic Bison Range map). In the 1870s and 1880s, the North American bison was driven nearly extinct by market hunting. In 1880, after a decade of intensive market hunting (for elk, bison, and other large mammals) in the park, the superintendent reported three herds totaling about 600 animals (Schullery and Whittlesey 1992). Over the next 15 years, this number was substantially reduced by poaching, but improved policing of the park by the U.S. Army (after 1886), combined with strengthened legal protection (after 1894), prevented complete elimination of park bison (NPS, Meagher 1973).

FEIS Note: A more complete history of the bison herd in the Yellowstone area has been updated in "Affected Environment: Bison Population" chapter. Please refer to that chapter for the most accurate and detailed information on this topic.

Bison are native to the Greater Yellowstone Area and were observed there by early travelers before and after the creation of Yellowstone National Park in 1872…

BRUCELLOSIS IN THE YELLOWSTONE BISON HERD

It does not appear that brucellosis is a threat to the long-term survival of park bison. Although brucellosis-related abortions are known to occur, studies have demonstrated that the park bison population has been generally increasing, in spite of the disease and intermittent control actions outside the park, for the last 30 years.

In 1997, the secretary of the interior commissioned the National Academy of Sciences (NAS) to complete a report on brucellosis in the Greater Yellowstone Area. In December 1997, the National Research Council of the National Academy of Sciences issued a prepublication draft, "Brucellosis in the Greater Yellowstone Area."

This report was finalized in 1998 following the release of the *Draft Environmental Impact Statement*. Relevant material from the NAS report (cited as NAS 1998 throughout this *Final Environmental Impact Statement*) has been used to respond to public comments on the *Draft Environmental Impact Statement* and to update text.

BRUCELLOSIS IN CATTLE AND BISON

One of the most difficult aspects of developing a management plan for the wild, free-ranging bison that migrate from Yellowstone National Park is that some animals in this herd are infected with *Brucella abortus*. This organism causes the disease brucellosis , which can occur in humans, domestic livestock, bison, elk, and other mammals. Within the scientific community and among the people who are interested in bison management, there are differing opinions about the appropriateness or necessity of a management emphasis on the control or elimination of *B. abortus*, the environmental consequences of actions necessary to control or eradicate the disease, and the consequences of not controlling or eradicating brucellosis from this bison herd.

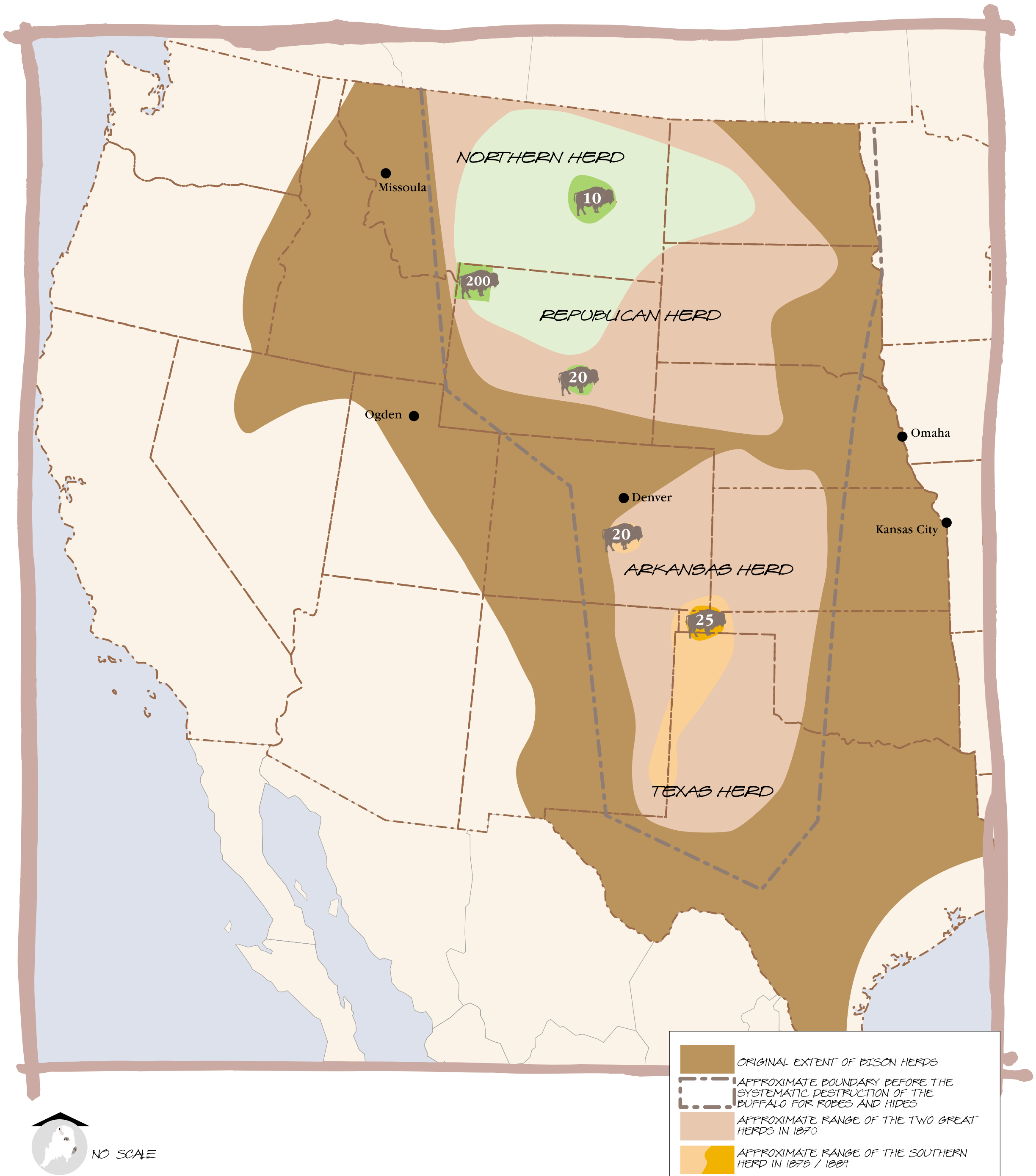
Given the controversy about brucellosis in wildlife, the Greater Yellowstone Interagency Brucellosis Committee (GYIBC) developed and approved at its April 1997 meeting a paper entitled "Brucellosis in the Greater Yellowstone Area," which summarizes some of the information about brucellosis as it might relate to management of bison and elk. This paper represents the factual information for which there is general agreement among the technical experts employed by the responsible state and federal agencies that are members of the GYIBC. The following summary of brucellosis, as it relates specifically to the management of bison that migrate from Yellowstone National Park into Montana, is based largely on that paper, a summary of relevant research findings since the release of the *Draft Environmental Impact Statement* and the NAS report.

What is Brucellosis?

Brucellosis is a contagious bacterial disease caused by various species of the genus *Brucella* that infect domestic animals, wildlife, and humans worldwide. In North America, the primary livestock hosts of *Brucella* spp. are cattle (*B. abortus*), goats (*B. melitensis*, Mexico only), swine (*B. suis*), and sheep (*B. ovis*). The principal North American wildlife hosts for *Brucella* spp. are bison and elk (*B. abortus*), caribou and reindeer (*B. suis*), and feral and wild swine (*B. suis*). Brucellosis also may occur in carnivores, including dogs, and it is usually caused by *B. canis*. Wild canids also may develop antibodies to *B. abortus* without developing clinical infections or shedding the organism.

In cattle and possibly wild ungulates, transmission of *B. abortus* typically occurs through ingestion of the bacteria in birth materials shed from infected animals. The incubation period (the time between exposure and onset of infection) varies widely depending on exposure dose, previous vaccination, species, age, sex, stage of gestation, and susceptibility. Following a brief systemic (bodywide) infection, the organism typically localizes in the udder and/or lymphatic system and, depending on the stage of gestation, in reproductive tissues. Abortion is the characteristic sign of acute brucellosis. Other signs include retained placenta, infertility, reduced milk production, lameness, swollen joints, and swollen testicles. Microscopic lesions may also occur in lymph nodes. Following

HISTORIC BISON RANGE
Yellowstone National Park
United States Department of the Interior • National Park Service
DSC • May 1998 • 101 • 20,106



HISTORICAL ATLAS OF THE AMERICAN WEST
BY BECK AND HAASE
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pregnancy, the *Brucella* organism may become dormant, persisting only within cells of the lymphatic system. Following a dormant period, acute infection may recur during subsequent pregnancy.

The organism is shed in aborted tissues, reproductive tissues, and discharges, especially just prior to, during, or soon after abortion or live birth. The organism also may be shed in milk for variable lengths of time. Some infected cattle, bison, and elk intermittently shed the organism. The quantity of *Brucella* organisms shed at any particular time is variable and the number of organisms that comprise an infectious dose also is variable.

There is no feasible treatment or cure for animals infected with *Brucella*. Some animals may develop immunity and never have the disease. Animals that overcome the clinical signs of brucellosis may develop recurrent infections and thus may be a source of exposure and possible infection for other animals. Some animals may completely clear the bacterium. Some individual cattle are reported to have a natural resistance to brucellosis, and this trait may be inherited. Natural resistance may also occur in other species including bison.

Brucellosis Transmission

The primary mechanism for transmission of *B. abortus* in cattle is well understood. Typically, transmission occurs when susceptible animals come into direct contact with contaminated aborted fetuses, newborn calves, birth membranes, uterine fluids, or vaginal discharges from infectious animals. Ingestion of contaminated material is the primary route of infection. A female calf born to an infected dam (female parent) can also become infected in utero, but may not manifest the disease until it has matured and either aborted or calved. Infected females typically abort their first pregnancy following infection. Abortion usually occurs during the third trimester. Thereafter, the bacteria usually localizes in lymph nodes surrounding reproductive organs and the udder.

Transmission of *B. abortus* is less understood in wild ungulates. *B. abortus* induces disease in bison and elk that differs from the disease in cattle; however, these differences have not been shown unequivocally to underlie major differences in the pathogenesis of the disease between cattle, elk, and bison (NAS 1998). It is believed that the greatest risk of transmission arises from exposure to and ingestion of contaminated material from the reproductive tract of females (Wray 1975; Stabelforth 1959; Nicoletti 1986; NAS 1998). *B. abortus* is most likely to be found in the organs and tissues of the reproductive system and mammary glands. If not present in those sites, *B. abortus* is largely confined to the lymph nodes, spleen, and other lymphatic organs. Bison with nonreproductive tract infection(s) rarely develop the presence of viable bacteria in the blood system or shed the bacteria (NAS 1998). Transmission of the disease by animals with reproductive tract infections is believed to be similar to that described above for cattle. Research projects now underway are designed to provide additional data on the epidemiology and pathogenisis of *B. abortus* in bison.

Brucellosis Diagnosis

Standard serologic tests for the presence of *Brucella* antibodies in milk and blood are used to identify potentially affected cattle herds. An affected herd is one in which one or more animals have been determined to be infected. The presence of antibodies is used as an indication of infection, particularly on a herd basis. Diagnosis is based on the results of serologic tests combined with other information, including individual animal and/or herd history, clinical signs, epidemiology, and bacteriology. The bacteriological procedures used to identify *Brucella* infection include culturing the bacteria from tissues, milk, udder secretions, aborted fetuses, and uterine discharges.

Tests designed for cattle have been used for years to detect seropositivity in bison, but diagnostic tests currently used for cattle have not been validated in bison (NAS 1998).

Some animals may lack antibodies but still may be infected, especially those incubating the bacteria. In contrast, antibodies may be present in an animal from which the bacteria have not been cultured. An animal with natural resistance to the *Brucella* organism that has been challenged with *B. abortus* will generally experience a short-lived antibody response. Tissues collected from these animals will be culture negative, supporting their resistance to infection. A herd is classified as an affected herd after *B. abortus* has been isolated from at least one animal in a suspect and/or reactor herd, or epidemiological data support that conclusion.

The diagnosis can be confirmed by positive cultures. *B. abortus* may be isolated from tissues collected at slaughter, from milk or udder secretions, biopsy of lymph nodes, reproductive tract exudates, discharges from live animals, or fetal and placental materials collected at the time of abortion or calving. Biopsy is not currently a routine diagnostic technique, but is being evaluated as a research tool for studies of wild bison. Interpretation of culture results is difficult because the ability to isolate the bacteria varies with the location and abundance of *B. abortus* in the animal. The culture of *Brucella* organisms from tissue or blood is a definitive indication of infection; however, the organism may not always be recovered even though it is present. Failure to culture the bacteria may be due to inappropriate techniques, improper storage of specimens, failure to collect tissues containing the bacteria, or failure to use sufficient amounts of tissue.

It is not possible to determine or quantify the risk of bacterial transmission based on the results of these standard serologic and culture tests. Within a herd, the number of animals capable of transmitting the bacteria generally is less than the number of animals with positive blood tests. The number of infected animals is generally greater than the number of animals with positive culture tests, i.e., culture status alone is not a direct indicator of infection (see "Affected Environment: Bison Population — *Brucella Abortus* in Yellowstone Bison"). Seropositive animals, especially those with very high titers (indicating a high concentration of antibodies), may be harboring the organism, yet may be culture negative if the organism is in insufficient numbers at the location cultured, or the culture technique is such that isolation is not likely. By contrast, of all seronegative bison cultured between 1991 and 2000, only two male bison were culture positive (Montana Fish, Wildlife and Parks, unpubl. data).

There is no single test to specifically identify those animals currently capable of transmitting brucellosis. Multiple serologic and bacteriologic culture tests over time are the only reliable method to determine infection in live animals (NAS 1998).

Brucellosis in Other Wild Ungulates

Approximately 1%–2% of elk in the northern range herd and between 0.3%–9.5% of elk in the Madison-Firehole herd (both of which are in or adjacent to the Montana portion of the Greater Yellowstone Area) test positive for exposure to brucellosis (Ferrari 1999). Six of the 104 elk (5.8%) harvested during the 1997 late hunt near Gardiner, Montana, tested positive for exposure to brucellosis, but it is too early to determine what this rate of seroposivity in one limited sample means. Other elk herds using portions of the Greater Yellowstone Area in Montana, including the upper Madison, Gallatin, Gravelly-Snowcrest, and Absaroka herds, have seroprevalence rates of approximately 1%–2%.

In contrast to the Montana elk herds, elk associated with the National Elk Refuge and the feedgrounds managed by the state of Wyoming in the southern portion of the Greater Yellowstone Area have seroprevalence rates ranging from 3%–65% (NAS 1998). Recent evaluation of elk on feedgrounds in the Idaho portion of the Greater Yellowstone Area indicate seroprevalence rates of 32% (B. Hillman, ID Dept. of Agriculture, pers comm.). These high seroprevalence rates are probably maintained through increased exposure while on the feedgrounds.

The National Academy of Sciences (1998) assessed elk transmission risk relative to that of bison. Unlike bison, elk tend to exhibit a “hiding” strategy during the calving period, separating themselves from the herd to calve. Elk also are meticulous at cleaning up afterbirth and soil and vegetation from calving sites. Both of these behaviors tend to reduce the opportunity for transmission of brucellosis among elk that are not artificially concentrated on feedgrounds (NAS 1998). This has probably contributed to the relatively low seroprevalence rate in the northern Yellowstone elk herd. This low seroprevalence rate of both the northern herd and the Madison-Firehole herd, despite occasional seasonal concentrations that result in densities similar to those found on winter feeding grounds (Ferrari 1999), suggests that the risk of transmission from those elk to cattle is lower than that of bison (NAS 1998).

Therefore, elk in the Montana portion of the Greater Yellowstone Area are not considered to present enough of a risk of transmission to warrant risk management actions such as those being proposed for bison. The agencies recognize, however, that the presence of brucellosis in elk in other portions of the Greater Yellowstone Area may result in reinfection of the Yellowstone bison population should management actions such as those described in alternatives 5 and 6 result in major reductions of bison brucellosis infections (NAS 1998). Separate discussions and planning efforts are underway to address the issue of high seropositivity in southern Greater Yellowstone Area elk herds and the risk they present of transmitting brucellosis to cattle.

Bovine brucellosis only rarely occurs in deer, pronghorn, and mountain sheep, and any infection in these species is inconsequential to the management of brucellosis-affected bison and elk populations. Brucellosis has not been documented in any of these species within the Greater Yellowstone Area. One study suggested that when brucellosis occurs in moose, the disease appears to be systemic and typically causes death (Forbes et al. 1996). Whether moose are exposed is unknown.

Process for Bison Quarantine

In the context of managing Yellowstone bison, quarantine means the bison initially testing negative for exposure to brucellosis would be held for a specified minimum period of time until they have completed a prescribed series of tests to determine that they are indeed free of the bacteria. At that time, they can be released to Native American tribes, parks, preserves, or other appropriate recipients. Table 1 reflects the minimum time bison are required to remain in an approved quarantine facility.

A draft quarantine protocol was developed in 1998 for bison from Yellowstone and Grand Teton National Parks. According to the protocol, a bison quarantine facility can be used to test bison from either national park to qualify the animals as brucellosis-free. The facility must be approved by state and federal animal health officials. The complete protocol is included as appendix B.

Prior to entering the facility, bison must test negative on official brucellosis serological tests that are conducted at the National Veterinary Services Laboratories or at an approved cooperative state-federal brucellosis laboratory. Those bison found to be reactors (seropositive) must go either to slaughter or to an approved research facility. Bison not properly separated by fencing are considered one test group and will go through the quarantine testing protocol together. If any in the group are found to be reactors at any time, the rest of the group must start the testing protocol over. Thus, it would be advantageous to have a number of small test groups of bison rather than one or a few large test groups because fewer bison would have to start the testing protocol over if a reactor were found.

As a minimum, all bison must have three consecutive negative serological tests with at least 12 months between the first and last tests. In addition, specific age/sex groups have additional requirements.

For example, all female bison not born in the facility must be bred and calve in the facility, and all bison in a test group having such female bison must be tested 30–90 days after calving and again six months after calving.

Some pregnant bovine heifers, although infected, may remain seronegative until after they have calved. It is assumed that the same may be true of bison heifers.

Calves born in the facility may be released at six months of age provided certain conditions specified in the protocol are met.

Those bison that qualify as brucellosis-free could be moved intrastate or interstate provided the state animal health authorities in the receiving state authorize movement into their state. The new owners must agree to have the bison tested approximately six months and one year after release from the quarantine and must keep the bison separate from all other animals until the six-month test has been completed.

Table 1: Minimum Time Various Age- and Sex-Class Bison Would be Required to Remain in an Approved Bison Quarantine Facility

Age and Sex at Time of Entrance to Quarantine Facility	Minimum Tests Required for Release	Minimum Test Intervals	Minimum Quarantine Period
Males age 3+	3	1st: start of quarantine 2nd: at least 180 days after the first test 3rd: at least 12 months after the first test	1 year
Male calves not born in the facility or born to a female pregnant at the time of entering the facility or born in an individual test group in which a reactor has been disclosed	3	1st:: start of quarantine 2nd: at least 180 days after the first test 3rd: at least 12 months after the first test and at least 3 years of age	3 years
Male yearlings	3	1st: start of quarantine 2nd: 180 days 3rd: 12 months after the first test and at least 3 years of age	2 years
Male 2 year olds	3	1st: start of quarantine 2nd: 180 days 3rd: 12 months after the first test and at least 3 years of age	1 year
Pregnant females age 3+	5	1st: at start of quarantine, prior to first calving 2nd: 30–90 days postcalving for first and second calvings Last: 6 months after last bison in the individual test group has calved during the first and second calvings; must be at least 12 months between first and last negative individual test group test	1 1/2 years

Table 1: Minimum Time Various Age- and Sex-Class Bison Would be Required to Remain in an Approved Bison Quarantine Facility *(continued)*

Age and Sex at Time of Entrance to Quarantine Facility	Minimum Tests Required for Release	Minimum Test Intervals	Minimum Quarantine Period
Nonpregnant Females age 3+	3	1st: start of quarantine before bred 2nd: 30–90 days postcalving 3rd: 6 months after last female bison in the individual test group has calved; must be at least 12 months between first and last negative individual test group test	1½ years
Female calves not born in the facility or born to a female pregnant at the time of entering the facility or born in an individual test group in which a reactor has been disclosed	3	1st: before bred 2nd: 30–90 days postcalving 3rd: 6 months after last female in the individual test group has calved; must be at least 12 months between first and last negative individual test group	4½ years if bred as a full 2 year old
Female yearlings	3	1st: before bred 2nd: 30–90 days postcalving 3rd: 6 months after last female in the individual test group has calved; must be at least 12 months between first and last negative individual test group test	3½ years if bred as a full 2 year old
Female 2 year olds	3	1st: at start of quarantine, before bred 2nd: 30–90 days postcalving 3rd: 6 months after last female in the individual test group has calved; must be at least 12 months between first and last negative individual test group test	2½ years if bred as a full 2 year old
Calves born in the facility in an individual test group with 3 consecutive negative tests over 12 months	1	6 months	½ year

Risk of Transmission

There is considerable disagreement regarding the risk of *B. abortus* transmission from bison and elk to domestic livestock, the applicability of information derived from studies of the disease in domestic bison and cattle, and appropriate methods for the conduct of additional research to determine the risk of transmission. However, some point to seropositive rates of 35%–50% in the bison population as strong evidence that transmission at least between bison is occurring. Prior to 1995 there had been no controlled field studies, specific to bison in Yellowstone National Park, to determine either the mechanism of *B. abortus* transmission from bison to livestock or the frequency of brucellosis-induced abortions. In 1995 a multiyear research project was initiated to study brucellosis transmission and the natural course of the disease in Yellowstone bison.

FEIS NOTE: See appendix D for the 1995 study and update on current research.

Most of the knowledge regarding brucellosis has been developed from studying the disease in cattle and captive bison, although a limited amount of published information has been developed from controlled and field studies of brucellosis in bison. Brucellosis may behave differently in cattle than in bison (see "Alternative Interpretation of Risk" section below). It is also known that the infection behaves differently in chronically infected herds as compared to cattle or captive bison herds that experience a new outbreak of the disease. For instance, chronically infected bison and cattle have a lower frequency of brucellosis-induced abortions because they have a higher acquired immunity in response to frequent exposure to noninfectious doses. Chronically infected bison herds also have lower calving rates than uninfected herds.

An important factor to consider in managing bison (see item 1 below) is the degree of association between potentially infectious bison or their birth materials and susceptible cattle. Susceptible cattle would be those without natural immunity and that have either not been vaccinated or have been vaccinated but the vaccination did not impart immunity. A potentially infectious bison would be one that is harboring the bacteria in large enough quantities to release a minimum infectious dose from its body in a way and under external conditions that will lead to infection of a susceptible animal. The means of transmission are described in the section "Brucellosis Transmission." The numbers of bacteria in a minimum infectious dose are unknown (NAS 1998).

Since bison and cattle would be prevented from interacting under each of the alternatives considered in this *Final Environmental Impact Statement*, it is the presence and persistence of bacteria in materials that is at issue in determining the risk of transmission. Research completed since the release of the *Draft Environmental Impact Statement* has direct bearing on this discussion. One study sampled 30 known birth or abortion sites in the park from 1996 to 1998. The *B. abortus bacteria* was isolated at two of those sites immediately following the birth or abortion event and persisted for a maximum of 18 days (K. Coffin, pers. comm.). Cook (1999) studied *B. abortus* strain RB51 on samples taken from the exposed surface of bovine fetuses in Wyoming under natural environmental conditions. While some environmental conditions vary in Wyoming from those found in the impact area, Cook found the bacteria were vulnerable to light and dessication and lived in the carcasses from 17.1 days in February to 0.3 days in June. The viability of the organisms dropped off rapidly as the weather warmed during April and May, the months bison give birth. By June, when cattle are scheduled to return to public grazing allotments in the impact area, Cook concluded that as few as 4.7 days would be required to ensure the absence of any live bacteria.

Under all alternatives, bison would be hazed off these lands and back into the park a minimum of 30 days prior to the return of cattle. In a separate study, Cook (1999) placed fetuses in various habitats within the Greater Yellowstone Area and found 90% are scavenged and disappear within 4 days, and the bulk of infectious material was removed by this process. The National Academy of Sciences (1998) concludes that "predation and scavenging by carnivores likely biologically decontaminates the environment of infectious *B. abortus* with an efficiency unachievable in any other way."

The National Academy of Sciences report confirms that the risk of *B. abortus* transmission from Yellowstone bison to cattle is low (NAS 1998). Although it is not possible to quantify this risk because many of the variables that define risk are unknown, it is possible to identify the various factors that affect risk and to qualitatively evaluate how alternative management approaches affect those factors. Important factors include the following:

1. Risk of transmission is affected by the degree of association between potentially infectious and susceptible animals. To become infected, a susceptible animal must come in contact with an infectious animal or discharges that contain a sufficient dose of viable *Brucella* organisms. Separation in space and time reduces the potential for transmission. In addition to separation that occurs as a result of management actions,

separation may occur as a result of differences in behavior, habitat selection, geographic features, and distribution in response to weather.

2. The risk of *B. abortus* transmission increases as the number and density of infectious animals in the host population increases. Conversely, the risk is reduced when the number of infectious animals is lowered through reduction in animal crowding, reduction in population size, and vaccination. Cattle within the impact area are currently vaccinated. Modelling suggests that vaccinating bison is expected to substantially reduce seroprevalence.

3. The risk of transmission increases as the number of susceptible animals that may associate with infectious animals increases, and decreases as the number of animals that may be associated with infectious animals decreases.

4. The risk of transmission is affected by environmental factors. Outside its host, *Brucella* organisms have limited viability. Discharges remain infectious for longer periods during cold weather. Direct sunlight quickly kills the organism. Scavenging by wildlife reduces the occurrence of infectious tissues, but scavengers may also physically transport infectious tissues.

5. The risk of transmission is affected by the class of the infectious animals. The available evidence indicates that the primary risk of *B. abortus* transmission from bison to cattle is contamination resulting from abortions and birthing events by infected adult female bison. However, limited available data documents the presence of *B. abortus* organisms in bison semen. Therefore, the risk of transmission from bull bison, although logically small, cannot be entirely eliminated based on existing information. Neutered animals are unlikely to transmit the disease.

6. The risk of transmission may be reduced by vaccination, neutering, and herd management (such as separation of animals in time and space).

7. Some animals are naturally resistant to infection.

Alternative Interpretation of Risk

As noted above, there is considerable disagreement about the significance of brucellosis in bison, especially the degree to which bison pose a risk of brucellosis transmission to livestock. There is no definitive information with which to resolve this disagreement. The following information summarizes ideas discussed during development but not included in the paper on "Brucellosis in the Greater Yellowstone Area" (GYIBC 1997).

The bulk of brucellosis research and disease management has focused on domestic livestock, yet limited published information suggests the disease may be transmitted differently and have different clinical, pathological, and population effects in bison (Williams, Cain, and Davis 1994; Meyer and Meagher 1995a).

Those who suggest that the risk is negligible point out that there have been no documented cases of brucellosis transmission from wild, free-ranging bison to cattle. No documented cases exist of wild, free-ranging male bison transmitting brucellosis to domestic cattle (bison and cattle may interbreed in captivity). Although a court opinion based on available epidemiological evidence in two cases of suspected elk-to-cattle brucellosis transmission stated that brucellosis in those cattle herds, as well as in four others, likely originated through contact with infected elk or bison (probably elk, according to the court), subsequent examination of the evidence has cast doubt on that opinion. Although infection by elk or bison cannot be ruled out, it is equally plausible that these cases represented residual outbreaks common in the course of brucellosis eradication efforts (NAS 1998). Therefore, due to lack of clear evidence, it is not possible to determine whether wildlife were the source of infection in these six cases (NAS 1998). In cattle, semen from an infected bull did transmit the disease when used in artificial insemination, but has rarely been observed as a result of natural breeding (Nicoletti and Gilsdorf 1994).

It is possible that, although brucellosis may be endemic in this bison herd, few of the animals are capable of transmitting the disease. This suggestion is supported by noting the discrepancy between the frequency of seropositive animals in samples collected at various times since 1917 and the frequency of culture positive animals in samples of tissues collected during 1991–92 to determine the presence of *B. abortus.*

Because of the technical difficulties in the isolation of *B. abortus* from bison tissues, the recovery rate is typically lower than the seroprevalence would suggest. Thus, as a negative culture does not provide conclusive evidence that the animals' tissues are free of bacteria, all seropositive animals are currently considered to be potentially infected. Studies are in progress to more specifically define the relationship between a seropositive animal and the isolation of bacteria from its tissues.

It has been theorized that the primary route of transmission among cattle (abortions and birthing events) may be different from that among bison. This suggestion is based on the infrequency of observed abortions in the Yellowstone area (usually required for transmission of the disease between cattle) and the discrepancy between the frequency of seropositive and culture positive animals. In bison, the disease may transmit through milk from cow to calf, which develops antibody response from repeated exposure (Meyer and Meagher 1995b).

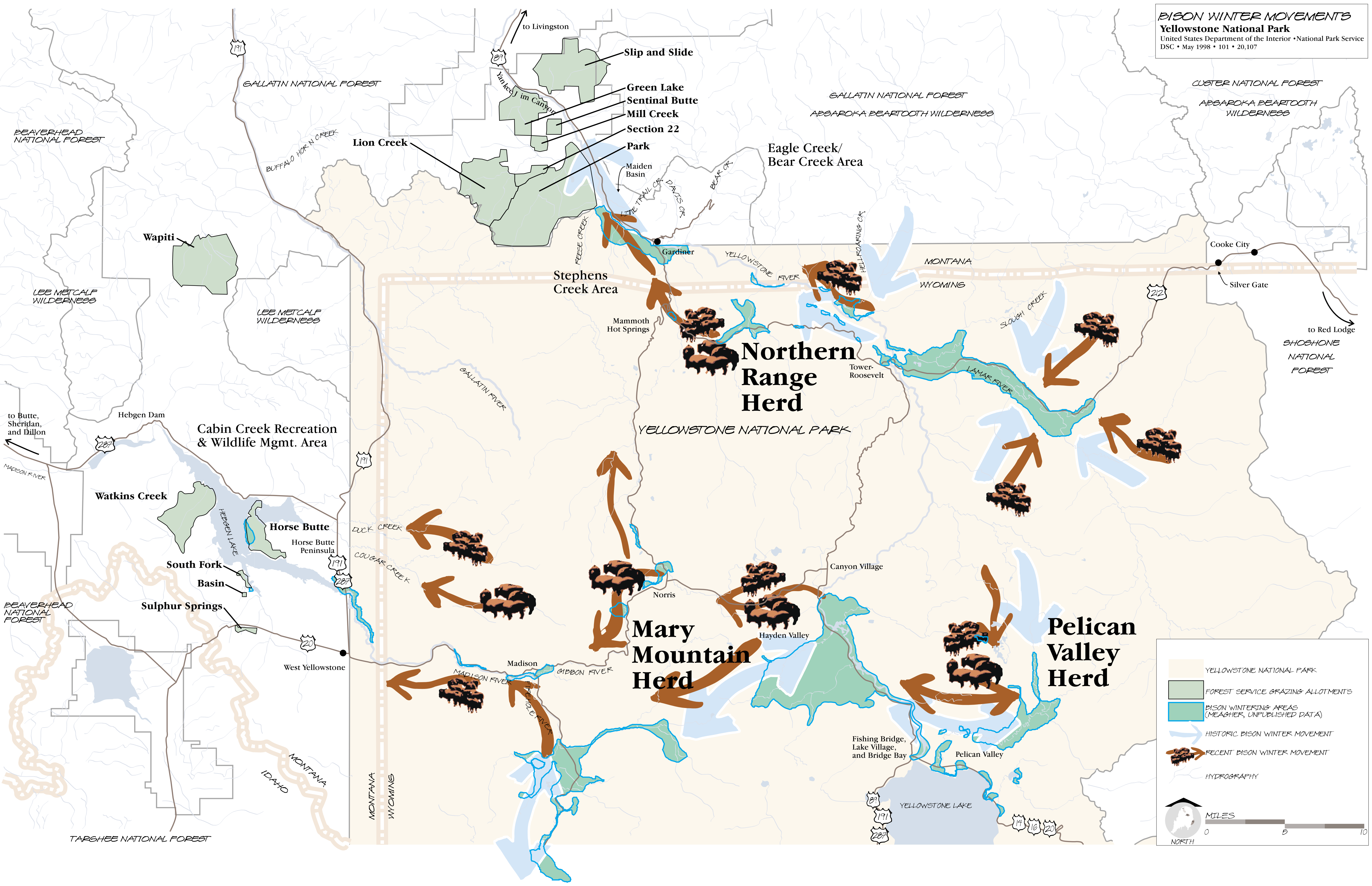
BISON DISTRIBUTION

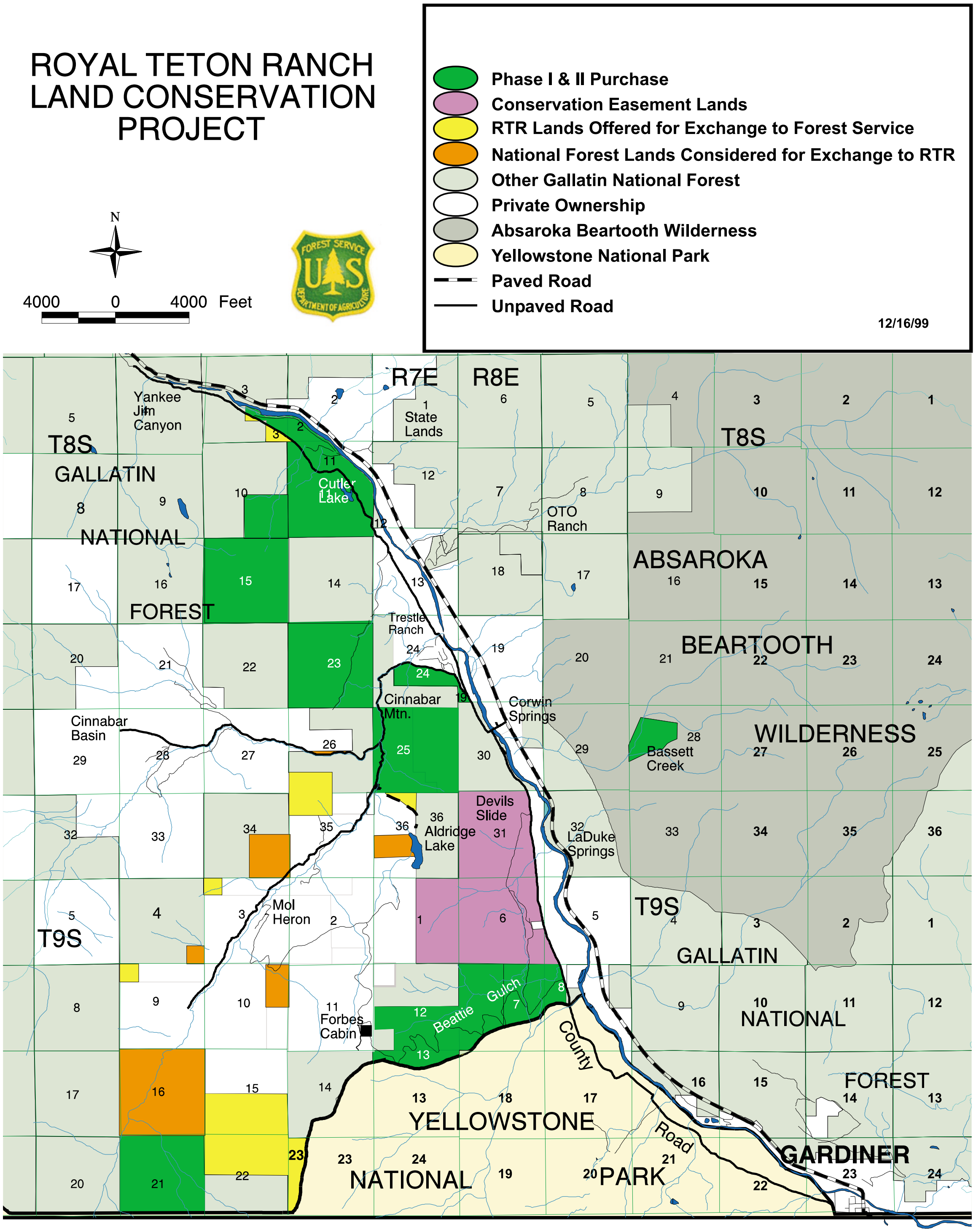
The Yellowstone bison population uses three different wintering areas in the park: Pelican Valley (the smallest), Mary Mountain (the largest, in the Hayden Valley-Firehole River area), and the Lamar Valley or northern range (see Bison Winter Movements map). Individuals or small groups of bison (usually bulls) move to other areas of the park, or occasionally leave the park to the east, south, or southwest, but most movement from the park has been into Montana, along the Madison River to the west and the Yellowstone River to the north. Although at one time these groups were semidistinct subpopulations and continue to winter in these areas, the subpopulations are no longer distinct (Meagher et al. 1994).

Bison drive - Upper Nez Perce Creek, 1966.

Bison migrate from Yellowstone National Park during the winter into Montana in five general areas (also see Bison Winter Movements map). During some years, substantial numbers of bison move north across the Reese Creek boundary of Yellowstone National Park and onto adjacent private land along the Yellowstone River valley near Gardiner (the Gardiner Valley). These lands are leased to cattle operators who graze livestock year round. Bison have historically used the Gardiner Valley, and would likely migrate much farther north without agency or other controls. Through land purchase, exchange, and conservation easements, a portion of this land in the Reese Creek area has been made available for wildlife winter range (see Royal Teton Ranch Land Conservation Project map).

Large numbers of bison also move from Yellowstone National Park onto Gallatin National Forest in the Eagle Creek/Bear Creek area, northeast of Gardiner. Land use in this area emphasizes wildlife and precludes domestic livestock. Although most bison remain in this area all winter, some may move north and west beyond the Little Trail Creek/Maiden Basin hydrographic divide and onto private land in the Gardiner Valley.


BISON WINTER MOVEMENTS
Yellowstone National Park
United States Department of the Interior • National Park Service
DSC • May 1998 • 101 • 20,107
Northern Range Herd
Mary Mountain Herd
Pelican Valley Herd
YELLOWSTONE NATIONAL PARK
GALLATIN NATIONAL FOREST
ABSAROKA BEARTOOTH WILDERNESS
CUSTER NATIONAL FOREST
BEAVERHEAD NATIONAL FOREST
LEE METCALF WILDERNESS
SHOSHONE NATIONAL FOREST
TARGHEE NATIONAL FOREST
Slip and Slide
Green Lake
Sentinal Butte
Mill Creek
Section 22
Park
Lion Creek
Wapiti
Eagle Creek/ Bear Creek Area
Stephens Creek Area
Cabin Creek Recreation & Wildlife Mgmt. Area
Watkins Creek
Horse Butte
South Fork
Basin
Sulphur Springs
Gardiner
Mammoth Hot Springs
Tower-Roosevelt
Cooke City
Silver Gate
to Red Lodge
to Livingston
to Butte, Sheridan, and Dillon
Hebgen Dam
West Yellowstone
Madison
Norris
Canyon Village
Hayden Valley
Fishing Bridge, Lake Village, and Bridge Bay
Pelican Valley
YELLOWSTONE LAKE
MONTANA
WYOMING
IDAHO
YELLOWSTONE FORESTLANDS
FOREST SERVICE GRAZING ALLOTMENTS
BISON WINTERING AREAS (MEAGHER, UNPUBLISHED DATA)
HISTORIC BISON WINTER MOVEMENT
RECENT BISON WINTER MOVEMENT
HYDROGRAPHY
MILES
NORTH


ROYAL TETON RANCH
LAND CONSERVATION
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Conservation Easement Lands
RTR Lands Offered for Exchange to Forest Service
National Forest Lands Considered for Exchange to RTR
Other Gallatin National Forest
Private Ownership
Absaroka Beartooth Wilderness
Yellowstone National Park
Paved Road
Unpaved Road
12/16/99
R7E
R8E
T8S
T9S
GALLATIN
NATIONAL
FOREST
Yankee Jim Canyon
State Lands
Cutler Lake
OTO Ranch
ABSAROKA
BEARTOOTH
WILDERNESS
Trestle Ranch
Cinnabar Mtn.
Corwin Springs
Cinnabar Basin
Bassett Creek
Devils Slide
Aldridge Lake
LaDuke Springs
Mol Heron
Forbes Cabin
Beattie Gulch
County Road
YELLOWSTONE
NATIONAL
PARK
GARDINER

Limited numbers of bison also migrate into the Hellroaring and Slough Creek drainages in the Absaroka-Beartooth Wilderness, a congressionally designated wilderness area to the east of the Eagle Creek/Bear Creek area. These drainages are geographically isolated from areas with permitted cattle. An occasional bison moves even farther east and leaves the park boundary by way of Cooke City or Silver Gate.

A few individual bison and small groups use public lands contiguous with the northwestern boundary of Yellowstone National Park in the area that is generally north of Grayling Creek/Fir Ridge and referred to as the Lee Metcalf Wilderness and Cabin Creek Recreation and Wildlife Management Area. Land use in this area emphasizes wildlife and precludes domestic livestock. Bison that use this area are unlikely to migrate farther but could associate with domestic livestock if they do.

During some winters, substantial numbers of bison move west along the Madison River, Duck Creek, and Cougar Creek and leave Yellowstone National Park in the vicinity of West Yellowstone, although they typically return to the park after snowmelt, normally around May 1. The numbers and timing are highly variable from year to year. After leaving the park, these bison either occupy public lands in the Gallatin National Forest that are allocated to multiple-use management or move onto adjacent private lands, some of which may be occupied by livestock during summer.

The number of bison migrating out of the park in any given year is impossible to predict. The policy of Yellowstone National Park has been to manage park resources with minimal human manipulation and to allow ecological processes, to the extent possible, to determine wildlife population levels. After termination of bison and elk reduction programs in the park in 1968, these wildlife populations have increased. As a result, some experts believe range resource conditions in the northern range of the park do not produce adequate forage for winter habitat resulting in increased bison migration. However, there is scientific evidence that shows that grassland productivity is high, species diversity is stable, and the standing crop is not correlated with wildlife populations (Reardon 1996; Singer 1996; Wallace 1991, 1996; Frank-McNaughton 1996).

It has been further speculated that bison migration out of the park is facilitated by winter road grooming for oversnow machine use, or plowing for wheeled use during the winter (the highway from Mammoth to Cooke City is plowed for wheeled vehicle use during winter). Some bison use the roads for energy-efficient travel, particularly during winter. One line of argument is that energy-efficient travel provided by the roads allows bison to access habitats that would otherwise be too energy costly to use. This allows higher survival and facilitates movements to new areas. The memory of these access routes is retained and used in subsequent years.

On the northern range, where snow depths are significantly lower, it is not likely that bison use of groomed roads in this area provides them any meaningful energy savings.

The precise relationship between road grooming and bison movements is not well defined. Research to better understand these relationships has been initiated. As a result of the settlement agreement in “Fund for Animals v. Babbitt” (D., D.C., Civ. No. 97-1126), Yellowstone National Park has recently (January 1998) decided to formally monitor wildlife movements and wildlife use of two segments of groomed roads (in Hayden Valley and along the Gibbon River) inside the park. Preliminary results from this study indicate that in the winters of 1997–98 and 1998–99 less than 10% of the observed bison movements occurred on the groomed road surface in these study areas (NPS, unpubl. data).

Stochastic events such as winter severity, snow depth, and access to forage and other periodic events are known to be important influences on bison migration. For instance, large migrations occurred in the severe winters of 1988–89 after large-scale fires burned much of the Greater Yellowstone Area and summer drought reduced forage for bison (and other wildlife), and in 1996–97 due to deep snow and ice.

Despite increases in migration during these events, the opportunities for transmission of brucellosis from bison to cattle have been negligible because bison management programs have not permitted bison to freely associate with domestic livestock during high risk periods (see “Administrative History of Bison Management” for more information on management actions).

ECONOMIC IMPACTS OF BRUCELLOSIS IN CATTLE

Agriculture has been and continues to be Montana’s basic industry. It accounts for over 30% of the state’s industrial sector employment, labor income, and gross sales. Approximately 64% of the state’s 93 million acres is used for farming and ranching. In 1995, Montana agriculture generated \$2 billion in cash receipts, of which cattle calves and dairy accounted for 40% of total cash receipts.

Left unchecked, the migration of brucellosis infected bison from Yellowstone National Park into Montana could have not only direct effects on local livestock operators, but also on the cattle industry statewide. Production in infected herds could decline due to a number of consequences of the disease, including the following:

- *Abortions.* Abortion losses constitute the largest single cost of brucellosis in beef cattle. A cow that aborts or has a calf that does not survive because of the debilitating effects of brucellosis has, in effect, been maintained for a year without financial return.
- *Decreased weight gain by calves.* Calves from infected cows may have less than normal weight gains, since milk production from infected cows may be inadequate. Affected calves at the time of sale may weigh 100 pounds less than calves from healthy cows.
- *Delays in calf production.* Brucellosis would result in some infected cows being difficult to breed, resulting in fewer market cattle each year.
- *Increased rates of culling and replacement.* Brucellosis-affected cows are usually culled at a faster than normal rate because of reproductive deficiencies. Another cost for affected herds would be the expenses related to additional testing and vaccinating. Testing for brucellosis is done every 30 days, as long as reactors are found. The herd is then retested after 90 days, and again after another 90 days (three negative tests in 180 days). After the quarantine is lifted, the herd is tested again after six months.

Current incomes from affected herds would be disrupted because of quarantines, and future incomes would be lost due to depopulations. Depopulation costs would be somewhat mitigated by the sale of affected cattle and indemnity payments, but in most instances indemnification would provide only partial compensation.

Producers statewide could suffer the marketing consequences of the disease. Sales at all levels — intrastate, interstate, and international — would be affected. There would be the direct impacts on sales of herd depopulations and quarantines, but far more detrimental to the stateís livestock industry would be the requirement of a negative brucellosis test within 30 days before interstate movement. Of greatest consequence would be diminished interstate and international demand for test-eligible stock because of the presence of brucellosis.

FEIS Note: The paragraph above refers to the “without” plan scenario discussed in the cost-benefit analysis in the “Environmental Consequences: Impacts on Socioeconomics — Summary of Benefits and Costs” section. This scenario of no bison or cattle management in the impact area is used as a baseline for comparing costs and benefits of each of the alternatives.

Increased production and marketing costs and a contraction in demand would mean fewer breeding cattle sold out-of-state, and widespread losses for Montana's cattle producers. Nationally, stockgrowers and livestock disease management agencies have spent $3.5 billion to eradicate the disease from cattle (Frye and Hillman 1994). Any new outbreak would be a setback to this program.

Federal animal-disease regulations declare that the presence and spreading of brucellosis among cattle herds would place Montana's "brucellosis class-free status" in jeopardy. State animal health authorities may levy additional restrictions beyond those imposed by the Animal and Plant Health Inspection Service, which have the same impact as downgrading if they believe a threat exists from importing Montana cattle. In Montana increased testing would not exceed $5.1–$16.3 million for the time a downgrade is in effect (see "Environmental Consequences: Impacts on Socioeconomics — Summary of Benefits and Costs").

If brucellosis is diagnosed in a livestock herd, the affected herd is immediately quarantined. A thorough epidemiological investigation, including brucellosis testing, is immediately conducted to determine the origin and potential spread of the infection. An action plan is developed for potential source and destination herds. This action plan would likely include herd tests and may necessitate quarantine of additional herds.

If the affected herd is in a brucellosis class-free state such as Montana and is imported into the state, the herd must be either depopulated or returned to the state of origin to maintain class-free status. If the infection is found not to have been imported or has spread to other herds, class-free status could be suspended and the herd is kept under quarantine until it is brucellosis free or sent to slaughter. As a minimum, suspension of class-free status requires brucellosis testing of certain age/sex cattle prior to interstate shipment unless the cattle are going to slaughter or to a quarantine feedlot.

It is possible that if brucellosis infection in cattle herds in the Yellowstone vicinity occurred, it would result in a split status in Montana, i.e., only a portion of the state would be downgraded to class A. If, for example, the downgrade was restricted to Gallatin and Park Counties, additional testing costs would range from $168,000 to $536,000 per year. If it applied only to producers in areas in which bison normally move when outside the park, additional testing costs would total $2,500 to $5,000 per year. If price discounts are included, the total cost for the two-county area could range up to $741,000 per year and for the immediate impact area, up to $7,000 per year. Downgraded or split status would not last longer than a few years at most. See volume 2, "Socioeconomics: Cost to Livestock Operators" for more information on split status and the economic impacts of a full-state downgrade to class A. The state will be responsible for costs for maintaining the separation and boundaries between the class-free and class A sections of the state.

Since Montana producers export a majority of their commodity to other states and to international markets, the perception of diseased animals could impede producers from around Montana from marketing livestock.

FEIS Note: Interviews with livestock producers around the country indicate that shifts from class free to class A in other states have not affected demand or pricing for test-eligible beef cattle. See volume 2, "Socioeconomics: Impacts to Livestock Producers" for more information.

For instance, during the 1996–97 winter the state of Oregon imposed restrictions on the movement of untested livestock from Montana into Oregon. In 1994, APHIS informed the Montana State veterinarian that states surrounding Yellowstone National Park would be downgraded from class-free status if the states failed to take action against bison within the state's borders when bison leave the park (letter to Dr. Clarence Siroky from APHIS dated December 9, 1994). Also in 1994 and 1995 the states of Idaho, Nebraska, North Dakota, Oregon, South Dakota, and Washington informed the Montana State veterinarian that testing requirements would be imposed on Montana cattle due to the emigration of bison into Montana from Yellowstone National Park. In 1994, 1995, and 1996 the Montana State veterinarian also received inquiries from other states regarding the presence of disease-exposed bison emigrating into Montana and whether testing requirements should be imposed.

FEIS Note: Although Montana exports cattle to 47 states and 3 foreign countries, 95% of all privately transacted out-of-state movements are to Colorado, Idaho, Minnesota, North Dakota, Washington, Iowa, Kansas, Nebraska, South Dakota, and Wyoming. Two-thirds of exports are to the latter five states (see volume 2, "Socioeconomics: Cost to Livestock Operators").

The economic consequences of these actions would be felt by other segments of Montanaís economy in communities throughout the state. It is important to note that every dollar of meat animal (beef cattle, sheep, hogs, and poultry) product sold to entities outside Montana results in approximately $1.25 of additional sales by Montana economic sectors tied to the meat sector (Bureau of Economic Analysis, U.S. Department of Commerce). Cash receipts from sales of cattle and calves in 1996 for Montana were $655,770,000 (Montana Agricultural Statistics Service, U.S. Department of Agriculture), and the average for the last five years is $730 million. Also, for every additional job in the meat animal sector, approximately 1.3 jobs are generated in the Montana economy.

The potential for such widespread economic consequences is a primary motivating factor in taking action to ensure brucellosis is not transmitted from Yellowstone bison to Montana cattle, and/or that federal downgrading or state sanctions do not occur. In this regard, all alternatives in this environmental impact statement include measures to "address the risk of brucellosis transmission to protect the economic interest and viability of the livestock industry in the state of Montana" (see "Introduction: Purpose of Action").

The agencies have taken action for several years to meet this goal, and are currently operating under an interim bison management plan (see the following section "Administrative History of Bison Management"). Compliance with the plan has had economic impacts on each of the agencies; these costs are reported in the description of alternative 1 (continuation of the strategies in the interim plan) in this environmental impact statement, as are estimated costs to implement alternatives 2 through the modified preferred alternative.

ADMINISTRATIVE HISTORY OF BISON MANAGEMENT

The need to cooperatively prepare a long-range bison management plan was formally recognized in July 1990, when the National Park Service, Montana Department of Fish, Wildlife and Parks, and U.S. Forest Service filed a "Notice of Intent" in the *Federal Register* to prepare an environmental impact statement examining options for such a plan.

The list of participating agencies was expanded to include the Montana Department of Livestock and U.S. Department of Agriculture, Animal and Plant Health Inspection Service. Both state agencies — Montana Department of Fish, Wildlife and Parks and Montana Department of Livestock — are represented as the state of Montana. All parties signed a May 1992 "Memorandum of Understanding" (see appendix C) to work together in developing a cohesive plan to meet their varying objectives.

During the development of the long-range plan and environmental impact statement, a series of four interim bison management plans and environmental assessments were prepared by the National Park Service (1990, 1992), state of Montana (1995), and National Park Service and state of Montana (1996). In general, these interim plans provided for agency personnel from Montana and the National Park Service to cooperatively shoot bison moving from Yellowstone National Park into Montana in order to achieve the objectives of protecting private property, providing for human safety, and maintaining

Montana's brucellosis class-free status. A finding of no significant impact and decision notice signed in August 1996 approved for implementation of the latest *Interim Bison Management Plan* (see "The Alternatives: Alternative 1"). Adjustments to the *Interim Bison Management Plan* were made by both state and federal agencies in 1997 (see appendix A). This bison management plan provided for capture of bison in Yellowstone National Park near the north boundary in the Stephens Creek area and shipment of bison to slaughter. Bison were allowed to enter the Eagle Creek/Bear Creek area northeast of Gardiner, Montana, as these public lands are wildlife winter range and no domestic cattle are present at any time. Capture of bison also took place outside Yellowstone in the West Yellowstone area, and seropositive bison and seronegative pregnant females were shipped to slaughter. Seronegative nonpregnant bison were released on public lands in the Horse Butte area.

After completion of the interim plan, work resumed on the long-term management plan and environmental impact statement. As part of a court-approved settlement agreement to a lawsuit Montana brought against the National Park Service and the Animal and Plant Health Inspection Service in 1995, the National Park Service, U.S. Forest Service, Animal and Plant Health and Inspection Service, and state of Montana agreed to complete the long-term bison management plan and environmental impact statement (this document) for public review according to a specific schedule.

In December 1999, the federal Departments of the Interior and Agriculture filed a 30-day notice of withdrawal from the 1992 Memorandum of Understanding, which established roles and responsibilities for agencies involved in the preparation of a long-term bison management plan for the Yellowstone area. The notice indicated the federal agencies' would proceed without the state of Montana as a joint lead in the issuance of a final environmental impact statement and record of decision. Several items were at issue, including

a population limit for bison in the preferred alternative

the ages and classes of bison to be vaccinated

the criterion used to decide whether and when bison would be allowed outside the park north of Reese Creek and in the western boundary area

the federal agencies' support of an adaptive management approach to bison management using spatial and temporal separation as its primary risk management feature. This approach is explained in detail in the alternatives chapter as the modified preferred alternative.

OBJECTIVES AND CONSTRAINTS

OBJECTIVES IN TAKING ACTION

This section elaborates on the general and specific statements of purpose (objectives). The purpose statement agreed upon by the interagency team is as follows:

> to maintain a wild, free-ranging population of bison and address the risk of brucellosis transmission to protect the economic interest and viability of the livestock industry in the state of Montana.

…to maintain a wild, free-ranging population of bison and address the risk of brucellosis transmission to protect the economic interest and viability of the livestock industry in the state of Montana.

The interagency team has defined a "wild, free-ranging population" of bison as one that is not routinely handled by humans and can move without restrictions within specific geographic areas. The operation of a capture facility would not affect the wild, free-ranging character of the herd. However, assigning bison to a quarantine facility would affect individual bison. These animals would be unlikely to return to Yellowstone National Park, but would be available to requesting organizations to establish or augment populations elsewhere.

The "economic interest and viability of the livestock industry in the state of Montana" is tied directly to the maintenance of a class-free designation by the Animal and Plant Health Inspection Service (see the section "Economic Impacts of Brucellosis in Cattle" above, the "Environmental Consequences: Impacts on Socioeconomics" chapter, and the "Affected Environment: Socioeconomics" chapter). The secretary of agriculture is authorized to make such regulations and take such measures as are deemed necessary to prevent the introduction or dissemination of any contagious, infectious, or communicable disease of livestock or poultry from a foreign country into the United States or interstate. The department has the authority to cooperate with states and political subdivisions in the control and eradication of diseases of livestock and poultry. The Cooperative State-Federal Brucellosis Eradication Program was implemented in partnership with the states to use the combined authorities to control and eradicate brucellosis. Under the program, individual states progress through various classifications by reducing the prevalence of brucellosis until brucellosis class-free status is attained.

To obtain class-free status under the requirements in Title 9, *Code of Federal Regulations*, Part 78 (9 CFR 78), a state must, among other things, conduct brucellosis ring tests on all dairy herds at least twice a year, test at least 95% of cows and bulls slaughtered annually, and successfully trace 90% of reactors back to the herds from which they originated. If field strain *Brucella* is found, an epidemiological investigation is conducted to identify possible sources of brucellosis. Appropriate action must be taken based on the results of this epidemiological investigation to eliminate the potential spread of brucellosis.

The Animal and Plant Health Inspection Service (APHIS) has agreed not to initiate a downgrade of Montana's brucellosis class-free status if Montana has complied with its responsibilities under the selected bison management plan. APHIS anticipates that any of the bison management plans (alternatives) outlined in this document would be sufficient to prevent the actual outbreak of disease in domestic livestock and the subsequent spread of brucellosis. Therefore, APHIS would not downgrade the brucellosis status of Montana based on the mere presence of bison migrating out of Yellowstone National Park into special management areas, or SMAs (management areas along the park boundary), in accordance with the selected bison plan (see "The Alternatives: Actions Common to All Alternatives" for the definition of an SMA).

The "risk of brucellosis transmission" to cattle and ranched bison is addressed through specific objectives, particularly numbers 5 and 6, identified below:

The nine objectives that the interagency team agreed would be used to help determine reasonableness of each alternative, and that would be applied to the selection of a preferred alternative are as follows:

1. *Address bison population size and distribution ; have specific commitments relating to size of bison herd* — The policies of the National Park Service direct that native populations of wildlife be managed by natural processes in a relatively undisturbed setting to the maximum extent possible. Therefore, inside the park, bison population sizes would be determined by weather, winter snow depth, competition for forage, predation, and other environmental conditions. However, since uncontrolled movements of bison outside the park would be inconsistent with the purpose of the plan, each alternative also includes measures to control bison distribution. Each alternative also includes measures to prevent the population from dropping below low numbers as a result of increased kills by agencies controlling bison entries into the state. The agencies used mathematical models published in scientific literature to estimate the number of bison, based on plant forage production and winter severity, the park could support (Boyce and Gaillard 1992); see "Environmental Consequences: Impacts on Bison Population." The modified preferred alternative has a set of measures designed to maintain the herd size at or near this number.

2. *Clearly define a boundary line beyond which bison will not be tolerated* — Each alternative defines a boundary on both the west and north where

management actions take place. In some cases, the boundary is maintained through hazing or shooting; in others, capture facilities are also used.

3. *Address the risk to public safety and private property damage by bison* — The risk to public safety and private property damage by bison outside Yellowstone National Park is addressed as an environmental issue in the "Affected Environment" (part 3) and "Environmental Consequences" (part 4) of this document. With permission from the Department of Livestock, current state law allows private landowners to shoot bison occurring on private land and causing damage or considered a threat to safety.

4. *Commit to the eventual elimination of brucellosis in bison and other wildlife* — The interagency team concluded that the elimination of brucellosis, even in bison, is not within the scope of this management plan. This is because elk in the Greater Yellowstone Area also carry the disease, and it is potentially mutually transmissible between the two species. However, all agencies are committed to the eventual eradication of brucellosis from the Greater Yellowstone Area. This management plan is one of several steps in that process. The eventual elimination of brucellosis from the Greater Yellowstone Area may be discussed in the future in a plan with a larger scope. The interagency EIS team agreed actions in the bison management plan must not detract from this objective, and must demonstrate progress toward it.

5. *Protect livestock from the risk of brucellosis* — All alternatives include specific measures aimed at meeting this objective.

6. *Protect the state of Montana from risk of reduction in its brucellosis status* — The interagency team agreed this objective was referring to the federal status conferred by the Animal and Plant Health Inspection Service. Montana is currently identified as class-free. Producers are able to ship their cattle interstate to national and international markets with minimal program restrictions. Any change in this status could mean significant economic impacts for the livestock industry in Montana.

7. *At a minimum, maintain a viable population of wild bison in Yellowstone National Park, as defined in biological, genetic, and ecological terms* — Currently available information indicates that the bison population should be maintained above 580 animals in order to preserve minimum genetic integrity. This number in no way represents a management objective or goal for the herd, but is the lowest level to which the herd would be allowed to fall. Agencies would undertake actions beforehand to ensure that this number is not reached. This number is based on research from a private bison herd that determined the population size and structure

needed to ensure random intermixing of breeding animals and avoid significant inbreeding (Knowles, unpubl. data). The number may be adjusted as ongoing research provides new information.

8. *Be based on factual information, with the recognition that the scientific database is changing* — Professionals in the fields of wildlife science, livestock disease, wildlife disease, livestock management, and wildlife management do not agree on the central issues relating to brucellosis in Yellowstone bison. The disagreements include (1) the degree of risk of transmission from the bison to livestock, (2) the level of prevalence of brucellosis in the bison, (3) the safety and effectiveness of existing brucellosis vaccines, and (4) which management actions to take with regard to the disease in the bison. The agencies have agreed to support research to help resolve these issues and will update the bison management plan as new information becomes available. A list of research topics approved by the Greater Yellowstone Interagency Brucellosis Committee is found in appendix D.

9. *Recognize the need for coordination in the management of natural and cultural resource values that are the responsibility of the signatory agencies* — The agencies have interpreted this objective as a requirement for the cooperative compliance with statutes designed to protect cultural and natural resources that may be affected by bison management actions proposed in the plan. Impacts are most likely to come from actions called for in various alternatives, effects on bison populations, and effects from actions proposed such as construction and operation of capture or quarantine facilities or acquisition of additional range. Future site-specific NEPA analysis (including public review) may be required.

In addition to the objectives, the agencies have also recognized, as noted in the "Need for Action" section, that Yellowstone National Park is not a self-contained ecosystem for bison. Lower elevation range could provide areas for bison to winter adjacent to the park as well as additional management options. Three of the alternatives (2, 3, and 7) analyzed in this environmental impact statement include provisions for such possible acquisitions, and the modified preferred alternative already includes acquisition of lands to the north of the Reese Creek boundary on the Royal Teton Ranch (see Royal Teton Ranch Land Conservation Project map). Although the agencies agree any acquisition of grazing rights, easements, or property from willing sellers could be by a public entity, Yellowstone National Park has no plans for expansion of the park boundary.

CONSTRAINTS IN TAKING ACTION

Each agency involved in producing this environmental impact statement has well-established mandates. If these mandates conflict, the number of options for management may be affected. Discussions among team members have resulted in some alternatives being dropped from the analysis because they conflicted with agency mandates. None of the alternatives retained for analysis was outside the agencies' legal constraints.

Agency Responsibilities

The National Park Service manages bison inside park boundaries. Outside the park, in Montana, wildlife-management and wildlife-damage cases are supervised by the Montana Department of Fish, Wildlife and Parks. This authority extends onto Gallatin National Forest in the state of Montana. The U.S. Forest Service has the authority to manage wildlife habitat on the national forest, but the management of the wildlife itself is the responsibility of the Montana Department of Fish, Wildlife and Parks.

Because of the presence of brucellosis in Yellowstone bison and the risk of its transmission to domestic cattle, the Montana Department of Livestock and the Animal and Plant Health Inspection Service have a role in bison management. The Animal Health Division of the Montana Department of Livestock adopts rules, policies, and orders fostering the prevention, control, and extirpation of animal diseases.

Legal and Policy Mandates

A brief summary of the respective legal and policy backgrounds of each of these federal and state agencies is provided below (also see appendix E for legal and policy guidance). Each agency must satisfy its particular mandates and operate within its legislative and regulatory constraints. The alternatives analyzed in this environmental impact statement are considered implementable by each of the agencies involved, i.e., they meet these criteria.

The National Environmental Policy Act (NEPA) of 1969 requires consideration of the environmental effects of proposed federal actions. NEPA procedures ensure that environmental information is available to public officials and members of the public before decisions are made and actions are taken. This act has equal effect on all federal agencies involved in the management of Yellowstone bison. A similar state act, the Montana Environmental Policy Act (MEPA), applies to Montana state agency actions.

Yellowstone National Park, National Park Service, U.S. Department of the Interior

An act of Congress on March 1, 1872, established Yellowstone National Park as "a public park or pleasuring ground for the benefit and enjoyment of the people." The act required the secretary of the interior to "make and publish such rules and regulations" that will "provide for the preservation, from injury or spoilation, of all timber, mineral deposits, natural curiosities, or wonders within said park, and their retention in their natural condition." It also required the secretary of the interior to "provide against the wanton destruction of the fish and game found within said Park, and against their capture or destruction for the purposes of merchandise or profit." Fishing and hunting, for sport or personal subsistence, were informally considered appropriate uses of the park at that time.

On January 15, 1883, the secretary of the interior amended park regulations to "prohibit absolutely" public hunting of wildlife species, including bison, in the park, and to restrict fishing to sporting means. The precedent of allowing sportfishing and prohibiting sport hunting was applied in most subsequently created national parks.

The act of May 7, 1894, known informally as the first "Lacey Act," prohibited the "killing, wounding, or capturing at any time of any bird or wild animal, except dangerous animals, when it is necessary to prevent them from destroying human life or inflicting an injury . . . within the limits of said park."This law, which was enacted in response to a bison poaching incident, provided park managers with improved power to punish offenders.

On August 16, 1916, Congress created the National Park Service, whose mission is "to conserve the scenery and the natural and historic objects and the wildlife in parks and to provide for the enjoyment of the same in such manner, and by such means as will leave them unimpaired for the enjoyment of future generations."

The act of January 24, 1923, recognized the authority of the secretary of the interior to "sell or otherwise dispose of the surplus buffalo of the Yellowstone National Park herd."

Several recent planning and policy documents, including the *Yellowstone National Park Master Plan* (NPS 1974), the *Yellowstone National Park Statement for Management* (NPS 1991), and the *National Park Service Management Policies* (NPS 1988), require the protection of ecological processes and native species in a relatively undisturbed setting, and require that park planning be accomplished in a regional context. This latter concern is summarized in the Management Policies as follows: "Recognizing that parks are integral parts of larger regional environments, the National Park Service will work cooperatively with others to anticipate, avoid, and resolve potential conflicts, to protect park resources, and to address mutual interests in the quality of life for community residents, considering economic development as well as resource and environmental protection."

Gallatin National Forest, U.S. Forest Service, Department of Agriculture

The national forests of the United States derive management authority and direction from a variety of laws. Principal among these are the following:

The Creative Act of 1891, which authorized the president to set aside public lands as forest reserves.

The Organic Administration Act of 1897, which specifies the purposes for which forest reserves might be established and provided for their protection and management.

The Multiple Use-Sustained Yield Act of 1960, which established the multiple-use and sustained yield policies for management of the national forests.

The 1974 Forest and Rangeland Renewable Resources Planning Act and the 1976 National Forest Management Act, which direct preparation of strategic plans for all Forest Service activities, including a comprehensive plan for each national forest.

Through these statutes the Gallatin National Forest maintains viable populations of existing native and desired nonnative vertebrate species, and maintains diversity of plant and animal communities to meet overall multiple-use objectives. These broad objectives are further clarified in the 1987 *Gallatin National Forest Land and Resource Management Plan*, which portrays a program of uses for these 1.8 million acres that best meets the demands of a diversified public. In addition to the general laws guiding Forest Service activities, an Act of May 26, 1926 (16 USC 37) is significant to management of the upper Yellowstone River corridor as it gives specific recognition and authority for federal acquisition and management of the northern winter range for migratory animals. This early recognition of need for extensive winter range, especially mentioning elk but not exclusive to them, continues to be expressed in land acquisition efforts by the Gallatin National Forest. In the last decade alone, some 12,000 acres of winter range has been added to the forest to complement acquisitions by the state of

Montana, through partnerships with private organizations. Alternatives 2, 3, 7, and the modified preferred alternative provide for agencies to pursue purchase of property or conservation easements from willing sellers for bison winter range and other bison management purposes and activities. Since the completion of the *Draft Environmental Impact Statement*, 4,623 acres in the impact area have been acquired through purchase from Royal Teton Ranch, with an additional 1,508 acres permanently protected from development through a conservation easement. Discussions and negotiations for additional lands are continuing. A primary purpose of acquiring these lands is their use as wildlife winter range, including for bison (see volume 2, "Bison: Special Management Area" for more information).

State of Montana, Department of Fish, Wildlife and Parks

Montana statutes authorize the Fish, Wildlife and Parks Commission to set the policies for the protection, preservation, and propagation of the wildlife, fish, game, furbearers, waterfowl, nongame species, and endangered species of the state. Within the policies established by the commission, the Montana Department of Fish, Wildlife and Parks is responsible for supervising the management and public use of all the wildlife, fish, game, furbearing animals, and game and nongame birds of the state.

The 1985 Montana Legislature authorized a hunting season for bison. This legislation was repealed during the 1991 legislative session, making bison a game animal that cannot be legally hunted. This 1991 legislation and a House Joint Resolution adopted during the 1989 session are consistent expressions of Montanaís concern for (1) the possible transmission of brucellosis from Yellowstone bison to domestic livestock, (2) the possibility of damage to private property when bison leave Yellowstone National Park, and (3)the implementation of a long-term, flexible management program in cooperation with Yellowstone National Park, Gallatin National Forest, the Montana Department of Livestock, and the Animal and Plant Health Inspection Service.

State of Montana, Department of Livestock

The Animal Health Division of the Montana Department of Livestock has statutory authority to protect and promote the Montana livestock industries through the adoption of rules, policies, and orders fostering the prevention, control, and extirpation of animal disease. The Department of Livestock has the power to, inspect, test, and slaughter animals in the interest of its mandated mission. The department may cooperate with the U.S. Department of Agriculture and other federal agencies to remove infection and suppress disease. The department may, in fact, adopt applicable portions of federal policies and rules to attain its goals. Some state statutes define specific prohibitions of certain actions that are counterproductive to sound disease suppression. These center primarily on requirements for entry of animals into Montana and for animals in known diseased herds or premises.

Between 1952 and 1985, eradication of brucellosis in cattle from Montana was a major control endeavor. Upon completion of the goal of eradication from cattle in 1985, the efforts against brucellosis have concentrated on preventing its reintroduction.

The Department of Livestock has specific statutes and rules pertaining to bison. The department has the authority to regulate estrayed or improperly disposed of animals that fit within Montanaís legal definitions; this includes bison. Most legislative or regulatory authorities applied to diseased bison have evolved from experiences with privately owned bison classified as livestock. The Department of Livestock, however, makes no legal or medical distinction in addressing the disease risks presented by publicly owned bison versus privately owned bison. The department believes that this is appropriate when conflict areas lie within the jurisdictional boundaries of the state of Montana. Specific statutes (81-2-120 MCA) address the removal from the state of publicly owned bison originating from a herd infected with a dangerous disease when the disease may spread to persons or livestock or jeopardize the state's compliance with other state-administered or federally administered livestock disease control programs. In essence, wild bison may be summarily removed from within the state's boundaries by the safest and most expeditious means if they originate from a diseased herd. In Montana, Yellowstone National Park bison fit within these specific statutory obligations.

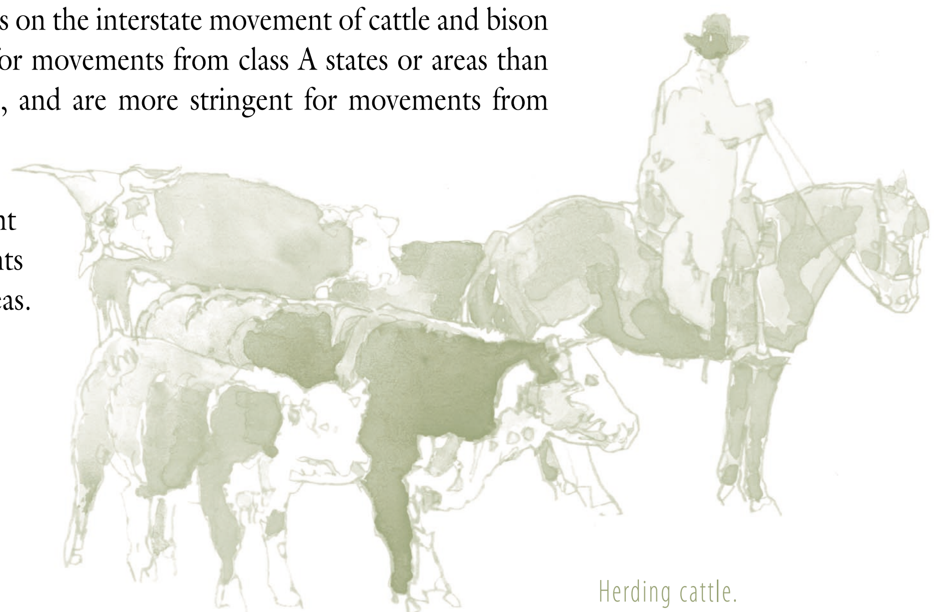
The Montana Department of Livestock, Animal Health Division, is funded by "State Special Revenue (per capita tax) sec. 15-24-901 through 931 (MCA), Article 12, sec. 1 sub (2) Montana Constitution." This tax is paid by all Montana livestock producers and no general fund monies are expended by the department.

Animal and Plant Health Inspection Service, U.S. Department of Agriculture (cooperating agency)

The mission of this agency is to lead the national effort to protect, sustain, and improve the health, quality, and productivity of United States' agricultural resources. The Act of May 29, 1884, established the Bureau of Animal Industry and authorized the commissioner of agriculture to cooperate with states to prevent the spread of livestock diseases. The act also prohibited the transportation of diseased livestock from one state or territory to another.

Subsequent acts authorized the secretary of agriculture to establish regulations to prevent the introduction or spread of animal disease from a foreign country or from one state or territory into another, and to quarantine any state or portion of a state and prohibit transportation of animals to and from quarantine, and in other ways defined in detail the scope and effect of APHIS authority. Extensive authority was granted for cooperation with other agencies (state and federal), not only in eradication and control of diseases, but also in research on those activities.

Title 9, *Code of Federal Regulations*, Part 78 governs the interstate movement of animals reacting to the tests for brucellosis and provides a system for classifying states or portions of states (areas), herds, and individual animals with respect to brucellosis status. States or portions of states are classified according to their rate of *Brucella* infection present in cattle and the general effectiveness of their brucellosis control and eradication program. The classifications are class free, class A, class B, and class C. States or areas that do not meet the minimum standards for class C are required to be placed under federal quarantine. Restrictions on the interstate movement of cattle and bison are generally more stringent for movements from class A states or areas than from class-free states or areas, and are more stringent for movements from class B states or areas than from class A states or areas, and so on. The most ringent restrictions are for movements from quarantined states or areas.



Herding cattle.

SCOPING PROCESS AND PUBLIC PARTICIPATION

The National Park Service, U.S. Forest Service, and Montana Department of Fish, Wildlife and Parks initiated the process of preparing an environmental impact statement for an interagency bison management plan by publishing a "Notice of Intent" in the *Federal Register* in July 1990 (the Montana Department of Livestock and the U.S. Department of Agriculture's Animal and Plant Health Inspection Service joined the planning process shortly thereafter). In order to identify issues and alternatives to be considered, a public participation and interagency coordination program was developed. This effort, called "scoping," included the review of all relevant previous planning and management documents, as well as scientific and popular literature related to the issues involved.

In November 1989, prior to the publication of the notice of intent, a brochure entitled *The Yellowstone Bison: Managing a National Heritage* was published and distributed to provide an interested public with current information on the bison management issue. As a way of more completely informing the public on the issueís background, and of initiating public involvement, a booklet entitled *Yellowstone Bison: Background and Issues* was then published in May 1990. This booklet, distributed to the interested public, was accompanied by a scoping letter that suggested a range of alternatives for bison management.

In order to identify issues and alternatives to be considered, a public participation and interagency coordination program was developed.

Written and verbal public comments identifying issues and concerns about these suggested alternatives were sought from August 11 through October 31, 1990. Public scoping meetings were held in Gardiner, West Yellowstone, and Bozeman, Montana, on October 9, 10, and 11, 1990, respectively. Public responses to the scoping document were summarized and the comment summary was distributed to those interested in December 1990. A second public input session in spring 1991 focused on the review of a short list of alternatives.

During development of the long-range plan and environmental impact statement, a series of four interim bison management plans and environmental assessments have been prepared (NPS 1990, 1992; State of Montana 1995; NPS and State of Montana 1995). All have been publicly available or included public comment periods. The most recent of these was released to the public on December 20, 1995 (NPS and State of Montana 1995). This environmental assessment was on public review through February 2, 1996. The agencies received 260 comments from state and federal agencies, Native American tribes, organizations, and individuals. The agencies prepared a summary of public comments and issues, responses to issues, and corrections to the environmental assessment. A finding of no significant impact (FONSI) was signed on August 5, 1996, and made available to the public.

Additional information on public participation not related to scoping, including results of the review of the *Draft Environmental Impact Statement*, is available by reading the Consultation and Coordination chapter of this volume of the final environmental impact statement.

OBJECTIVES, ALTERNATIVES, AND ISSUES FROM PUBLIC COMMENTS

The scoping and public review processes described above provided the agencies with public input on objectives, alternatives, and environmental issues. Many of these suggestions became part of the analysis for this environmental impact statement and are enumerated below.

Objectives

The following objectives gathered through public commentary were incorporated by the interagency team in creating its list, discussed above (see "Objectives and Constraints — Objectives in Taking Action" in this chapter):

Minimize impacts on bison population dynamics and behavior. (Objective #1, general purpose statement)

Develop an ecosystem based, bison disease management plan. (Objective #1, general purpose statement)

Control bison distribution (movements) and numbers. (Objectives #1 and #2)

Protect human health and safety. (Objective #3)

Maintain Montanaís brucellosis-free status. (Objective # 6)

Maintain a self-sustaining, genetically diverse bison population (a minimum viable population). (Objective #7)

Determine impacts and cooperatively manage impacts on threatened and endangered species, wetlands, and historic and cultural resources. (Objective #9)

Alternatives Included in this Environmental Impact Statement

The following options suggested by the public were included in the range of alternatives analyzed in this environmental impact statement. Some were slightly modified, but are considered similar enough to the original suggestion to be included in this section.

Manage bison without lethal controls. Although alternatives minimize the use of lethal controls in some cases (alternative 2), none completely eliminates the option of shooting bison. This is because agencies could not meet the objective to "clearly define a boundary line beyond which the bison will not be tolerated" without the ability to use lethal means to control bison.

Provide opportunities for Native American tribes, other organizations, and the general public to obtain live bison. Concerns were expressed that live bison be made available to Native Americans, other organizations, or the general public as an alternative to the killing of bison by government agents or hunters. Many of these concerned citizens thought that Native Americans and other people would have the opportunity to benefit culturally, spiritually, and economically by receiving Yellowstone bison. Bison can be shipped live only after meeting the release requirements of an approved quarantine protocol. Alternatives 3, 4, 7, and the modified preferred alternative include quarantine.

Some of these Native American groups have contacted various agencies expressing an interest in the participation of a quarantine facility program. One group, the Inter-Tribal Bison Cooperative, consisting of 42 tribes in 17 states, has developed a proposal for a program for a quarantine facility. Another such group, One People, One Nation, is a nonprofit organization dedicated to returning the buffalo to native lands and is actively raising funds to assist the state of Montana in the cost of building and maintaining a quarantine facility. If the selected alternative includes quarantine, the location, funding, and design of the quarantine facility would be analyzed in a future NEPA process. The two proposals specifically mentioned, and others the agencies receive, will be among those considered and analyzed.

Provide opportunities for Native American Tribes, other organizations, and the general public to obtain bison carcasses. All alternatives include provisions to provide carcasses to social service organizations, tribes, or the general public or other organizations through auction.

Acquire additional lands for bison. Recent initiatives and public-private partnerships in acquiring elk winter range north and west of Yellowstone National Park were cited as effective ways to improve wildlife habitat availability north of the park. Alternatives 2, 3, 7, and the modified preferred alternative in this environmental impact statement allow for acquiring additional winter range from willing sellers, or for altering cattle operations on those lands to remove susceptible cattle, or both.

Since completion of the *Draft Environmental Impact Statement*, the federal Departments of the Interior and Agriculture and the Rocky Mountain Elk Foundation teamed in February, and again in August 1999, to purchase lands and conservation easements north of the Reese Creek boundary of the park. The purchased lands would be under the jurisdiction of the Gallatin National Forest. U.S. Forest Service lands are multiple use lands including use by wildlife. The Gallatin National Forest would also administer and monitor the terms and provisions of the conservation easement. However, as noted above, Montana approval may be required to establish SMAs to allow bison onto these lands.

Establish bison management areas outside Yellowstone National Park.

A central question for the public and for land managers is which lands bison would be allowed to occupy. The alternatives provide a variety of answers to this question, including restricting bison distribution to Yellowstone National Park (alternative 5); allowing bison unrestricted access to most public lands they may seek to occupy (alternative 2); and allowing bison restricted access to designated public lands in and immediately adjacent to Yellowstone National Park (alternatives 1, 3, 4, 6, 7, and the modified preferred alternative).

Many concerns center, favorably or unfavorably, on the establishment of special management zones on public lands along the park boundary. The creation of special bison management areas (SMAs) adjacent to Yellowstone National Park is a part of all alternatives except alternative 5.

Restrict winter recreational use in Yellowstone National Park. Increasing winter recreational use of Yellowstone National Park, with concurrent winter grooming of roads for use by oversnow travel, is seen by some members of the public as contributing to increased bison population size and movement. Concern over these departures from traditional use patterns has resulted in an interest in reducing winter use in the park, presumably to restore more natural limitations on bison. Some changes in winter use activities are a part of alternative 2 and would also be a consequence of alternatives 5 and 6.

In a settlement agreement executed on September 23, 1997, in "The Fund for Animals v. Babbitt" (D. D.C., Civ. No. 97-1126), the National Park Service agreed to prepare a new winter use plan and environmental impact statement to evaluate a full range of alternatives on all aspects of winter use activities in Yellowstone National Park, Grand Teton National Park, and John D. Rockefeller, Jr., Memorial Parkway.

FEIS Note: See "Introduction: Other Ongoing Planning Efforts" in this part for updated information on the *Draft Winter Use Plan Environmental Impact Statement.*

Modify cattle grazing allotments on the national forest to reduce conflict between bison and cattle. Concerns were expressed over existing grazing allotments, and if Gallatin National Forest should manage the allotments to emphasize use by livestock, wildlife, or a combination of both. All alternatives except alternative 5 allow for minor alterations in these allotments, including timing of use to accommodate both cattle and bison. Alternatives 2, 3, and 7 envision more changes to the allotments, including modifying operations to remove susceptible cattle or moving cattle operations.

Make Yellowstone National Park responsible for bison disease management. The bison that have occupied Yellowstone National Park continually since prehistoric times are the remnants of once larger herds that occupied much of the west. These bison have long been almost solely the management responsibility of the National Park Service, and some members of the public expressed a feeling that "this is the park's problem, so the park should solve it." Alternatives 5 and 6 address bison management primarily as a park operation with management operations almost entirely within the park boundary. However, in each of the alternatives analyzed in this environmental impact statement, Yellowstone National Park plans to be an active participant.

Conduct additional research and public education. The agencies agree that continued research and education into many aspects of bison and their management as well as brucellosis in bison and elk is needed. Efforts to collect and analyze research data and improve public education is an ongoing effort by all the agencies, and will in fact continue whether an interagency bison management plan is approved or not approved. The relevant research and its status are listed in appendix D. The agencies have developed this environmental impact statement based on the best currently available knowledge, and have included alternative interpretations when there is disagreement among the scientific community.

Alternatives Suggested but Not Analyzed

Members of the public also suggested a number of alternatives that were considered by the agencies, but precluded from further analysis. A brief discussion of each of these alternatives follows.

Fence the perimeter of Yellowstone National Park to physically prevent bison from migrating beyond the park boundary. Migrating bison are not easily deterred by normal fences. While substantial or electrified fences could limit bison migrations, they would have major impacts on the movements of other wildlife species, such as pronghorn, bighorn sheep, elk, moose, deer, and bear. Restricting these species has serious ecological and social consequences, including prevention of normal migrations of game species onto public lands (some of which are designated for winter use of animals moving from Yellowstone National Park) and concentration of animals in a confined area with resultant damaging effects on local vegetation. These consequences are inconsistent with both state and federal wildlife management policies. Fences also tend to create a zoo-like atmosphere that is contrary to the wildlife management policies of several agencies.

Adequate fences would also be expensive to purchase, install, and maintain, and their installation could cause major site impacts. Estimates for purchase and construction of "bison-proof" fences are $30,000 to $50,000 per mile depending on access and terrain. Yellowstone National Park has a perimeter of about 250 miles, and bison migrations from the park have at times occurred at a number of widely scattered points. Constant monitoring would be required to ensure that fences were not breached by animal damage, falling trees, or other events. Fences would be less effective, or perhaps even useless, during winter months, when snowdrifts could bury them and the bison could leave through the public access points of the park. For the above reasons, fencing the park is not being evaluated further, although limited, site-specific fencing will be retained as a management option.

Provide supplemental forage for bison to prevent them from migrating beyond the park boundary. As an expedient or temporary measure, the distribution of high-quality hay and commercially prepared rations at strategic locations near the park boundary could conceivably have the desired effect of encouraging bison to migrate no farther. However, hay baiting was largely unsuccessful even though it was used extensively in the 1970s to influence bison migrations. If done consistently, providing supplemental forage would do nothing to relieve the pressures of bison migrations. Over time, with such additional food sources, bison numbers might increase to unnaturally high numbers. Undesirable changes in behavior and social organization, and increased incidence of brucellosis infection and other diseases in bison would probably result from such long-term concentrations on artificial feeding sites. These outcomes are contrary to the intended purposes of a bison management plan and National Park Service policy.

Among professional managers and ecologists, supplemental feeding of wild herbivores is widely recognized as a poor range and wildlife management practice. Animals become increasingly dependent on the feedgrounds while they continue to forage heavily on vegetation in the vicinity, resulting in serious damage to native range.

Artificial feedsites are recognized as reservoirs of disease. Bison concentrated at such a feed site would be increasingly exposed to risk of infection by brucellosis, other diseases, and parasites. Other ungulates, especially elk, would be attracted to the feedgrounds, increasing their exposure to disease as well. The potential for subsequent transmission of brucellosis from these elk to domestic livestock also could increase.

For these reasons, supplemental feeding of bison to stop their migrations will not be evaluated further in this environmental impact statement.

Relocate bison to other public ranges or private lands. The option of relocating bison has been addressed in several of the alternatives but with specific restrictions. The Animal and Plant Health Inspection Service's *Uniform Methods and Rules for Brucellosis Eradication* and relevant regulations control the relocation of brucellosis-exposed livestock. Once captive, these methods and rules would apply to bison. The unrestricted relocation of the captive bison would not be allowed and is therefore not analyzed further in the environmental impact statement. The relocation of bison successfully completing quarantine procedures is a part of alternatives 3, 4, 7, and the modified preferred alternative.

Stop oversnow vehicle (snowmobiles and other tracked vehicles) travel on all roads in Yellowstone National Park. *A Winter Use Plan for Yellowstone and Grand Teton National Parks and John D. Rockefeller Jr., Memorial Parkway* (approved in 1990) (NPS 1990) identified that use of snowmobiles and snowcoaches along road corridors, and maintenance of the road corridors (through grooming) for this use, were appropriate activities that would not result in significant impacts. Winter use of Yellowstone National Park is growing rapidly, and winter activities are undergoing monitoring and research. Yellowstone National Park, Grand Teton National Park, and the six surrounding national forests recently issued a joint assessment of winter use on federal lands within the greater Yellowstone ecosystem. Operationally, some oversnow travel is required for park maintenance and protection purposes during the winter months. Discontinuing maintenance (winter grooming) of some segments on some key roads within the park to reduce the number of bison migrating toward

Montana boundaries is part of alternative 2. In resolving litigation challenging the winter use program in Yellowstone National Park, Grand Teton National Park, and John D. Rockefeller, Jr., Memorial Parkway, the National Park Service agreed to prepare a new winter use plan and environmental impact statement. The National Park Service agreed to consider a full range of alternatives for all winter use activities, and is scheduled to commence scoping on that document in 1998.

FEIS Note: See "Introduction: Ongoing Planning Efforts" in this part for updated information on the *Draft Winter Use Plan Environmental Impact Statement*, which is well underway.

Control bison population numbers using current wildlife birth control methods. The purpose of actions proposed in this environmental impact statement is to maintain a wild, free-ranging bison population and maintain the brucellosis class-free status of Montana by ensuring a low potential risk of brucellosis transmission between bison and cattle. However, unlike this specific goal, contraception is broad-based and a nonspecific population control method.

The latest (January 2000) bison count was 2,410 animals. However, as population sizes increase to a point where numbers management is important, the ability to effectively use contraception falls. Research has been done on using contraception as a technique to limit the growth of certain nonnative wildlife populations elsewhere in North America. A six-year study of wild horses at Assateague Island National Seashore in Maryland showed promising results. However, researchers at Assateague indicated that a major factor in the success of that program was that they were dealing with a small population of animals (165 horses) confined to a relatively small island habitat (8,500 acres).

Bison population control using contraceptives would be a highly technical program, requiring professional personnel and specialized supplies and equipment. Some contraceptive agents must be delivered by hand, requiring handling of the animals. Others could be delivered remotely (by hypodermic darting, for example), up to a distance of 50 yards. In both cases, bison could develop conditioned avoidance, making it increasingly difficult to administer the agent.

Long-term effects of having a large number of nonreproducing animals in a herd are unknown. Hormonal contraception of females would suppress ovarian function, prevent estrous cycles, and reduce male attraction to females (McCullough et al. 1993). Immunocontraception does not prevent ovarian cycling, and males could be repeatedly attracted to females. The breeding season likely would be extended because of the polyestrous (multiple ovulation) nature of nonpregnant animals and could have physiological effects on males and females. It is also unknown if immunocontraception would affect the immune system of bison and potentially make them more susceptible to disease.

For these reasons, contraception will not be considered as a population control strategy for bison in this environmental impact statement.

To date, no free-ranging large mammal population has been effectively controlled using available contraception techniques (B. Garrott, Montana State University, pers. comm.). Aside from uncertainties as to effectiveness, "significant behavioral changes can be expected for all major contraceptive agents currently under investigation" (Garrott 1995). Contraceptive agents could disrupt family and social bonds and extend or alter breeding and birthing seasons (Garrott 1995).

Furthermore, technology does not exist that effectively administers contraceptive agents to free-ranging populations of large mammals (Garrott 1995). For successful treatment, it is necessary to have an optimum combination of animals available, a proportion of these animals that can be successfully treated, and an efficacious treatment method. Currently available techniques are relatively ineffective (Garrott 1995) in free-ranging populations, spread over a large, geographically varied area.

Using sterilization (neutering) as a means of controlling brucellosis in bison in Yellowstone National Park. Brucellosis is a disease usually affecting the reproductive tract of animals, causing abortions. It is transmitted primarily when noninfected animals come into physical contact with aborted materials or birthing products that harbor the *Brucella* organism. Sterilized female bison would be rendered harmless for any potential transmission of brucellosis given the biological circumstances for such transmission.

Neutering, by whatever means and for whatever purpose, may alter the social interactions and behavior of bison, such as family bonds or the dominance of bulls during the rut. Sterilization, if done on a large scale, might have genetic influences on the population by eliminating pre-selected animals from the gene pool. And, neutering would not contribute to controlling migrations.

For these reasons, neutering bison and returning them to Yellowstone National Park will not be considered further in the environmental impact statement, although changing cattle operations to run steers or spayed heifers is a part of alternatives 2 and 3.

Depopulate the entire Yellowstone bison herd and replace it with brucellosis-free bison. The *Uniform Methods and Rules for Brucellosis Eradication* and relevant regulations provide owners of brucellosis-affected herds with the option of depopulation and herd replacement. Depopulation of the Yellowstone National Park bison herd is rejected for the following reasons:

1. While some Yellowstone bison have been exposed to brucellosis, not all are infected. Uninfected bison are no risk to cattle.
2. The removal of thousands of bison that have merely been exposed to brucellosis is unacceptable to most people who have submitted comments thus far.
3. Depopulation operations, by whatever method, would have negative impacts on other wildlife and park resources, including threatened and endangered species.
4. A portion of Yellowstone bison may have desirable genetic materials, such as a demonstrated immunity to brucellosis, to contribute to future genetics research and development, as well as to the biodiversity of the species and the planet. They are also descendants of the only continually wild bison herd in the United States.
5. Brucellosis is also found in elk in the Greater Yellowstone Area, so the risk of elk infecting a replacement bison herd renders depopulation meaningless.

For the reasons listed above, depopulation of the Yellowstone National Park bison herd will not be considered further in this environmental impact statement.

Allow native predatory animals to control the bison population. Yellowstone has an abundance of predators, including grizzly and black bears, mountain lions, coyotes, and wolves, but to date these animals have had limited influence on the bison population. Coyotes, bears, wolves, and mountain lions may take an occasional bison calf, but there are other prey species, such as elk and deer, that are more numerous and more susceptible to predation than a healthy adult bison.

Wolves, which have been recently reintroduced on an experimental basis in Yellowstone National Park, may eventually reduce the bison population by some measurable amount. However, data from Wood Buffalo National Park in Canada indicates that wolf predation on bison is a major factor only in combination with major habitat changes or the lack of alternate prey (Carbyn, Oosenbrug, and Anions 1993). Because there are no indications that changes in the availability of alternate prey species or in major habitat are likely to take place in Yellowstone in the foreseeable future, wolves cannot be expected to have a major impact on bison populations.

While predatory animals will continue to play an important role in the natural systems of Yellowstone, they are not expected to significantly impact bison populations and will not be further evaluated in the environmental impact statement.

Control or eradication of brucellosis in elk. The stated purpose of this plan is to "...maintain a wild, free-ranging population of bison and address the risk of brucellosis transmission..." by those bison to Montana cattle in the impact area. Although each alternative also includes provisions that show a commitment to the eventual elimination of brucellosis in bison, the eradication of brucellosis in bison is not a goal of this plan. One reason is that it cannot be eradicated until it is also eliminated in elk. The primary problem with the perpetuation of brucellosis in elk is in relation to feedground situations in Wyoming and Idaho where elk are congregating at a time when abortions are occurring. However, because seroprevalence in northern Greater Yellowstone Area elk herds is 1%–2% and elk have behavioral differences that may reduce risk of transmission to cattle, elk are not considered by Montana to pose the same risk as bison and so are not subject to management at this time.

Require livestock owners to stop raising cattle, to raise bison instead of cattle, or to graze only steers. Although incentives to eliminate susceptible cattle are parts of some of the alternatives analyzed, requiring livestock owners to modify their operations is not a legal option.

Require cattle to be vaccinated for brucellosis. Cattle producers are encouraged to voluntarily vaccinate cattle in high-risk areas. At this time, all Montana female calves near Yellowstone National Park are voluntarily vaccinated against brucellosis by owners (State of Montana, former state veterinarian, C. Siroky, pers. comm.). State animal health authorities may also require vaccination of female calves grazed on public lands within a bison contact area (e.g., within the SMA).

Vaccination may adversely affect marketing of animals in some international markets, as several foreign countries perceive vaccination as a possible disease risk and know older vaccines can cause positive responses on diagnostic tests for brucellosis (see "Affected Environment: Livestock Operations").

Allow bison to exist without human influence. Allowing bison to exist without human influence would lead to their migration out of the park and eventually onto their historic range. This violates the interagency agreed upon purpose to "address the risk of brucellosis transmission to protect the economic interest and viability of the livestock industry in the state of Montana," as well as objective #2 (clearly define a boundary line beyond which bison will not be tolerated), objective #4 (commit to the eventual elimination of brucellosis in bison and other wildlife), objective #5 (protect livestock from the risk of brucellosis), and objective #6 (protect the state of Montana from risk of reduction in its brucellosis status). For these reasons, the alternative to "do nothing" is considered unreasonable (see "The Alternatives: Alternatives Considered but Rejected").

Restore bison to the Great Plains. Interest was expressed in allowing bison to recolonize large areas of the plains beyond the Greater Yellowstone Area, even "as far as St. Louis." For reasons stated above, this alternative is considered unreasonable and will be not analyzed further. However, all alternatives except alternative 5 do allow very limited numbers of bison to recolonize some public lands beyond the boundary of Yellowstone National Park.

Environmental Issues

The public also asked that certain environmental issues be analyzed. Issues are environmental problems that might occur should action be taken as proposed. They are analyzed in this document in part 4, "Environmental Consequences." The National Environmental Policy Act requires that only important issues, e.g., those with the potential for significant or severe impacts, be discussed in an environmental impact statement, and that the discussion of unimportant issues be minimized or eliminated. Table 2 includes a summary of issues considered by technical experts on the interagency team to be important. Following the table is a brief discussion of issues considered, but eliminated as less important. The list of issues was created by both the public and agency specialists.

FEIS Note: Many additional issues and agency responses are contained in Volume 2: Responses to Comments.

TABLE 2: ENVIRONMENTAL ISSUES AND CORRESPONDING IMPACT TOPICS

Description of Environmental or Other Issues	Corresponding Topics in Part 4, "Environmental Consequences," Where Impact is Discussed
Lethal means of control would reduce bison population numbers, but not below an established minimum (580 bison) required to maintain genetic viability.	Impacts on bison population chapter, methodologies for analyzing impacts section
Slaughter and shooting, used by agencies to maintain separation of cattle and bison and reduce the risk of transmission of brucellosis, would slow natural growth rates of the Yellowstone bison population.	Impacts on bison population chapter, effects on the bison population section
Parkwide slaughter of seropositive bison (in alternative 5) would temporarily drop population numbers below the lower end of the range of bison for which agencies would manage.	Impacts on bison population chapter, effects on the bison population section
Vaccinating calves (alternatives 1 through the modified preferred alternative) would result in lower seroprevalence rates in the bison population.	Impacts on bison population chapter, seroprevalence in the bison population section (alternatives 1 through the modified preferred alternative)
Parkwide vaccination of calves and adults would, in combination with capture and slaughter, reduce seroprevalence rates to near zero.	Impacts on bison population chapter, seroprevalence in the bison population section (alternatives 5 and 6)
Hunting would reduce population numbers in special management areas outside the park in alternatives 3, 4, and 7.	Impacts on bison population chapter, effects on free-ranging status and distribution of bison section (alternatives 3, 4, and 7)
Winters with varying severity or other periodic events would result in varying migrations of bison outside the park.	Impacts on bison population chapter, stochastic influence on bison population section
Increases in bison population numbers, which would occur in alternatives 1 through 4 if winters are normal, would increase viewing opportunities for Yellowstone area visitors.	Impacts on recreation chapter, bison viewing section (alternatives 1 through 4)

Table 2: Environmental Issues and Corresponding Impact Topics (continued)

Description of Environmental or Other Issues	Corresponding Topics in Part 4, "Environmental Consequences," Where Impact is Discussed
Decreases in bison population numbers, which would occur for up to 15 years in alternatives 5 through 7, would decrease viewing opportunities for Yellowstone area visitors.	Impacts on recreation chapter, bison viewing section (alternatives 5 through 7)
Changes in winter road grooming, road plowing, or road closures on some roads inside Yellowstone National Park to keep bison from migrating outside the park boundaries would mean snowmobile and snowcoach traffic on these roads would be displaced.	Impacts on recreation chapter, winter recreation section (alternatives 2, 5, and 6)
Bison hunting, if approved by the Montana Legislature, would supply additional recreational opportunities in the Yellowstone area.	Impacts on recreation chapter, hunting section (alternatives 3, 4, and 7)
Perceived risks of brucellosis transmission to cattle in the Yellowstone area may cause producers to leave the area.	Impacts on livestock operations chapter, cumulative impacts common to all alternatives section
Yearly testing of herds in the parts of Montana adjacent to Yellowstone where bison may range in some alternatives would add to the cost of livestock operations.	Impacts on livestock operations chapter, brucellosis testing and vaccinating section
Changing operations to remove susceptible cattle may be difficult for livestock operators, as changes in equipment, structures, and personnel would be required.	Impacts on livestock operations chapter, conversion from cow-calf to steer or spayed heifer enterprise section (alternatives 2 and 3)
Modifications in public grazing allotments may displace cattle herds to other locations and increase demand for grazing resources.	Impacts on livestock operations chapter, Gallatin National Forest grazing allotments section (alternatives 2 and 3), and impacts on socioeconomics chapter, summary of benefits and costs section
Acquisition of easements or purchase of property from willing sellers as winter range for bison would cost taxpayers money.	Impacts on livestock operations chapter, private land acquisitions and easements section (alternatives 2, 3, 7, and the modified preferred alternative)

Table 2: Environmental Issues and Corresponding Impact Topics (continued)

Description of Environmental or Other Issues	Corresponding Topics in Part 4, "Environmental Consequences," Where Impact is Discussed
Bison may damage fences, livestock, and other private property if they leave the park.	Impacts on livestock operations chapter, property damage by bison section
Upon completion of the quarantine procedure, live bison may be used to seed herds on Native American reservations and improve income for tribes (alternatives 3, 4, 7, and the modified preferred alternative).	Impacts on socioeconomics chapter, minority and low-income populations section
Increases in tourism and individual entrepreneurs are offsetting the decline in resource extraction industries in the Yellowstone area to maintain a prosperous economy in Gallatin and Park Counties.	Impacts on socioeconomics chapter, cumulative impacts common to all alternatives section
Changes in winter road grooming, road plowing, or road closures on some roads would reduce winter tourism-related income in West Yellowstone and the Greater Yellowstone Area.	Impacts on socioeconomics chapter, regional economy section (alternatives 2, 5, and 6)
Bison hunters would benefit the economy of the Greater Yellowstone Area through dollars spent while in the area.	Impacts on socioeconomics chapter, regional economy section (alternatives 3, 4, and 7)
Reducing bison numbers through lethal means may trigger a boycott with economic consequences.	Impacts on socioeconomics chapter
Changes in cattle operations or acquisition of easements or property from willing sellers may change the contribution of livestock-related dollars to the regional or state economy.	Impacts on socioeconomics chapter, regional economy section
Bison that are shot or slaughtered may be released to Native American tribes, and to charitable organizations.	Impacts on socioeconomics chapter, minority and low-income populations section
Bison are perceived many different ways, and their slaughter and shooting offends some.	Impacts on socioeconomics chapter, social values section

Table 2: Environmental Issues and Corresponding Impact Topics *(continued)*

Description of Environmental or Other Issues	Corresponding Topics in Part 4, "Environmental Consequences," Where Impact is Discussed
If bison are perceived as disease-carrying animals, ranchers outside the park boundaries may be worried their lifestyle will be threatened.	Impacts on socioeconomics chapter, social values section (alternatives 2, 3, and 7)
People are willing to pay additional taxes to secure land for bison if it would reduce or eliminate slaughter and return more natural conditions.	Impacts on socioeconomics chapter, nonmarket values section
Increases in the bison population would mean increases in tourism; decreases would mean decreases in tourism.	Impacts on socioeconomics chapter, nonmarket values section
Food sources for grizzly bear, including whitebark pine nuts and cutthroat trout, are decreasing in the Greater Yellowstone Area due to blister rust and the accidental introduction of lake trout to Yellowstone Lake, respectively. This, in combination with increased private development, increased recreation, and timber harvest has influenced the amount and quality of grizzly bear habitat.	Impacts on threatened, endangered, and sensitive species chapter, cumulative impacts common to all alternatives section
Grizzly bears and gray wolves may lose habitat from the construction of capture or quarantine facilities.	Impacts on threatened, endangered, and species chapter, impacts common to all alternatives section
Shooting, hazing and other human activities may displace or disturb grizzly bears and gray wolves in the short term.	Impacts on threatened, endangered, and sensitive species chapter
Bison serve as live prey and carrion for grizzly bears and gray wolves. If more bison are present, these predators may fare better; if bison numbers are decreased, some grizzly bears, wolves, and other species may suffer.	Impacts on threatened, endangered, and sensitive species chapter

Table 2: Environmental Issues and Corresponding Impact Topics *(continued)*

Description of Environmental or Other Issues	Corresponding Topics in Part 4, "Environmental Consequences," Where Impact is Discussed
Grizzly bears feed primarily on bison and elk carrion when they emerge from their dens in the spring in the park interior. However, increased bison populations provide more carrion and more bears enter the summer in good condition.	Impacts on threatened, endangered, and sensitive species chapter (alternative 2)
Grizzly bears feed primarily on bison and elk carrion when they emerge from their dens in the spring in the park interior. If bison are slaughtered in large numbers, bears may be adversely affected.	Impacts on threatened, endangered, and sensitive species chapter (alternative 5)
A decrease in snowmobile use in the park, with a result in increased use on the adjacent national forests, may shift the location of effects on various sensitive wildlife species, including the wolverine and lynx.	Impacts on threatened, endangered, and sensitive species chapter (alternatives 2, 5, and 6)
A capture facility at Seven-Mile Bridge may disrupt nesting trumpeter swans as well as displace wintering swans.	Impacts on other wildlife species chapter (alternative 6)
Large numbers of bison may displace ungulates like elk, deer and bighorn sheep where they overlap.	Impacts on other wildlife species chapter, impacts common to all alternatives section
If bison populations increase, predators and scavengers will benefit. If they decrease, predators and scavengers may suffer.	Impacts on other wildlife species chapter, impacts common to all alternatives section
Capture operations, hazing, and shooting may affect wildlife through displacement and disturbance.	Impacts on other wildlife species chapter
The Stephens Creek facility is located on pronghorn winter range. It removes habitat and displaces animals from the area.	Impacts on other wildlife species chapter
Wing fences and corrals in capture facilities may inadvertently capture other ungulates.	Impacts on other wildlife species chapter

Table 2: Environmental Issues and Corresponding Impact Topics *(continued)*

Description of Environmental or Other Issues	Corresponding Topics in Part 4, "Environmental Consequences," Where Impact is Discussed
Acquisition of additional wildlife winter range in the Yellowstone River valley near Gardiner would provide additional habitat for elk, mule deer, bighorn sheep and pronghorn.	Impacts on other wildlife species chapter
People who work in slaughterhouse, hunters, and veterinarians or laboratory personnel working with infected carcasses or tissues are at risk of exposure from brucellosis if proper procedures are not followed.	Impacts on human health chapter
Shooting, blood, and viscera associated with killing bison is not visually appealing.	Impacts on visual resources chapter

ISSUES CONSIDERED BUT NOT EVALUATED FURTHER IN THE ENVIRONMENTAL IMPACT STATEMENT

If an issue was considered to either be outside the scope of the environmental impact statement, or the best available scientific evidence indicated it would experience only negligible impacts, it was eliminated from further analysis, as per NEPA requirements. The issues considered but not evaluated further in this document are as follows.

State vs. federal authority to manage bison. To some, the bison management issue is perceived as a local situation not requiring the involvement of "outsiders." In this view, which often translates into a state versus federal authority issue, local regulatory and management agencies should take care of their own decisions. This position is not considered further because, as outlined above under "Legal and Policy Mandates," state and federal laws dictate management authorities for each of the cooperating agencies. None of the cooperating agencies has the option to ignore its responsibilities or abrogate its authority to another agency for wildlife or disease management. While working pursuant to a Memorandum of Understanding for nearly eight years, the federal and state agencies made a conscious effort to work together to develop this bison management plan. Even though the federal and state agencies no longer are working under the memorandum of understanding, they still recognize the need to manage bison cooperatively.

Agencies are being influenced by the livestock lobby and protecting the livestock industry. Concern has been expressed that the livestock industry has a disproportionate influence over the planning process. It is probably the belief of those on any side of an issue that those on the opposite side have more power and influence. This issue is beyond the scope of the environmental impact statement, and not relevant as the agencies have made every effort to address all concerns without giving any one individual or group opinion any more weight than any others. This issue will not be further evaluated in the environmental impact statement.

Livestock grazing impacts on public lands. A variety of livestock-related concerns involved the impacts of livestock on public lands administered by the U.S. Forest Service. Concerns expressed included the beliefs that the livestock industry had excessive political power, that livestock should not be grazed on public lands but wildlife should, that livestock are damaging public land ranges, and that bison should be given preference over livestock on grazing lands adjacent to Yellowstone National Park. Livestock grazing is a legally authorized activity on many public lands, and these issues are beyond the scope of this environmental impact statement, although modifications in public allotments on the Gallatin National Forest are part of alternatives 2, 3, and the modified preferred alternative.

Bison should be listed as a threatened or endangered species. In early 1999, the U.S. Fish and Wildlife Service received a petition to list Yellowstone bison under the Endangered Species Act. As of April 2000, the U.S. Fish and Wildlife Service does not have sufficient funds to process petitions in its region 6. U.S. Fish and Wildlife Service does not expect to have such funds in fiscal year 2000.

Vegetation and vegetative communities. The bison diet consists of sedges and grasses, and these plant communities may experience small changes if population numbers in any one area were to increase or decrease dramatically for a long period of time, e.g., if bison density were to change.

Bison would also exert a more intense impact on vegetation in capture facilities and quarantine areas through trampling. Building facilities and associated structures would also result in the removal of some vegetation as land is cleared for construction. Surveys would be conducted before these facilities are built to ensure no threatened, endangered, or sensitive plant species are present. Otherwise, impacts on vegetative communities to build capture and quarantine facilities proposed in the alternatives are negligible compared to total similar vegetation in the study area.

On the Gallatin National Forest, standards for range condition will be met in accordance with the *Gallatin National Forest Plan* (p. G–14). This issue will not be evaluated further.

Overpopulation of humans. Concern exists that wildlife and wildland are primarily threatened by "encroaching civilization" and increasingly intensive use of landscapes by humans. This issue is beyond the scope of the environmental impact statement and will not be analyzed further.

Impacts on bison genetics. Based on data available at present, a minimum of 580 or more bison (Knowles, unpubl. data) is required to maintain genetic viability and diversity in the population. None of the alternatives is expected to reduce the bison population to 580 animals. In fact, in the long term all alternatives would maintain populations at or above 1,700.

FEIS NOTE: The issue of bison genetics is discussed more thoroughly in "Bison Population in the Affected Environment" chapter of this final environmental impact statement. No alternatives would allow the population to drop below the number needed to maintain genetic viability and diversity.

Brucellosis in elk and other wildlife species. One concern involving brucellosis is that it is also present in the Greater Yellowstone Area elk, which raises questions of the value of attempting to eradicate brucellosis from bison when elk will still carry it and may transmit it back to bison. This issue involves, to one extent or another, most or all of the elk herds in the Greater Yellowstone Area, and involves lands in Montana, Wyoming, and Idaho. Additional information on brucellosis in elk and other wildlife species has been added to this chapter and is available in volume 2, "Wildlife: Brucellosis in Other Wild Ungulates." In addition, the impact of brucellosis in Greater Yellowstone Area elk and the effect it would have on seroprevalence in bison in alternatives 5 and 6 has been added to the analysis of those alternatives (see "Environmental Consequences: Impacts on Bison Population" for more information).

Bison and elk at Old Faithful, by D. L. Cole, 1962. (NPS photo)

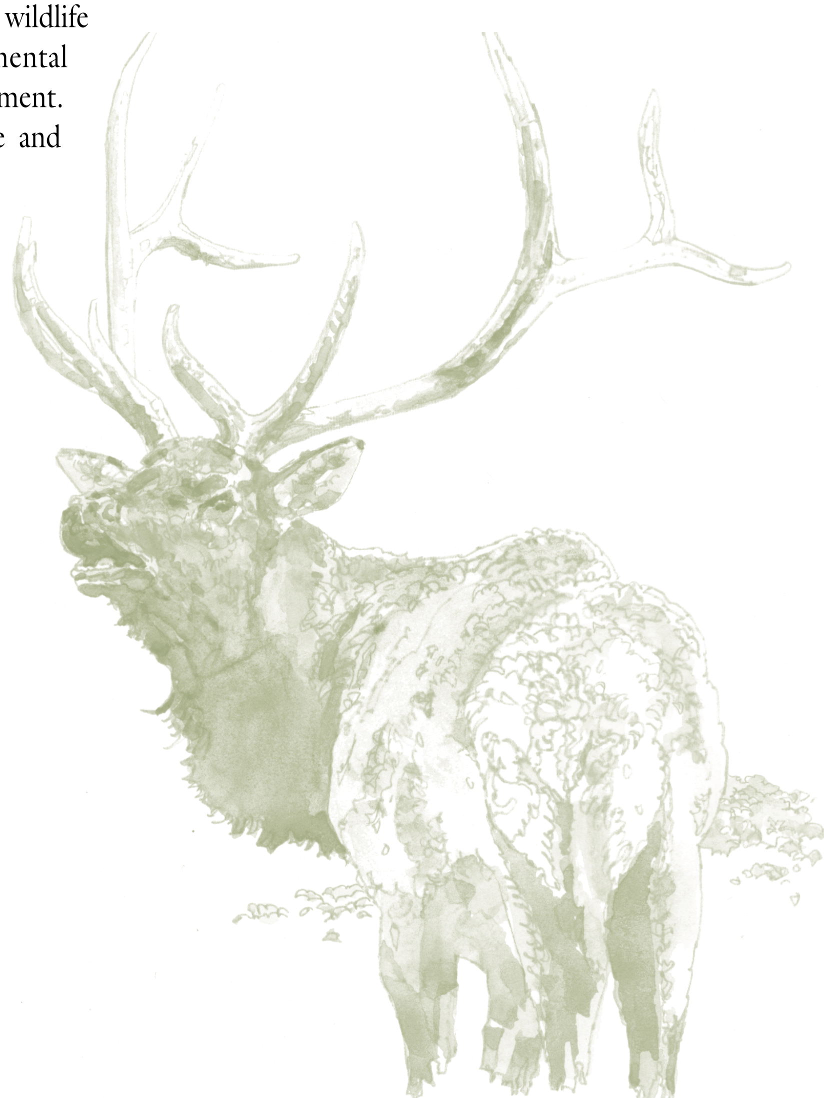
Brucellosis survival value in ungulates. Concern exists that brucellosis may have evolutionary survival value in wild animals that have it and seem to have built up a resistance to it; apparently the implication is that loss of the disease in a given ungulate population could lead to that population's increased vulnerability in the future. Brucellosis was not identified in Yellowstone bison until the 20th century, meaning that the bison presumably survived a variety of environmental conditions for several thousand years without such resistance, just as they survived the disease when it was transmitted to them, probably from domestic livestock. This issue is beyond the scope of the environmental impact statement and will not be analyzed further.

Impact of capture facilities on special natural or cultural resources. Capture facilities would be located using specific criteria outlined in part 2, "The Alternatives." These criteria include minimizing impacts on wetlands, threatened and endangered animals and plants, and important historic or other cultural resources. The exact location of capture facilities is unknown in alternatives 5 and 6. If agency decision makers choose either of these alternatives, the facilities would be located within the general areas described in "The Alternatives" using the above criteria. Additional site-specific compliance, including impact analysis, may be necessary to construct and operate additional capture facilities.

Impact of quarantine facility on special natural or cultural resources. If a quarantine facility is located on public land, or built using federal or state money, it would be located using at least the same specific criteria as outlined for capture facilities. These criteria include minimizing impact on wetlands, threatened or endangered animals and plants, and important historic or other cultural resources. Additional impact analysis and site-specific compliance with environmental laws would be required to build such a facility on public land. Therefore, although these resources and impacts on them are discussed generally in this environmental impact statement, the specifics are not known and cannot be evaluated in detail. In the modified preferred alternative, quarantine is identified as a management action and an additional National Environmental Policy Act would be conducted on the location and design of a facility (see "The Alternatives: Modified Preferred Alternative").

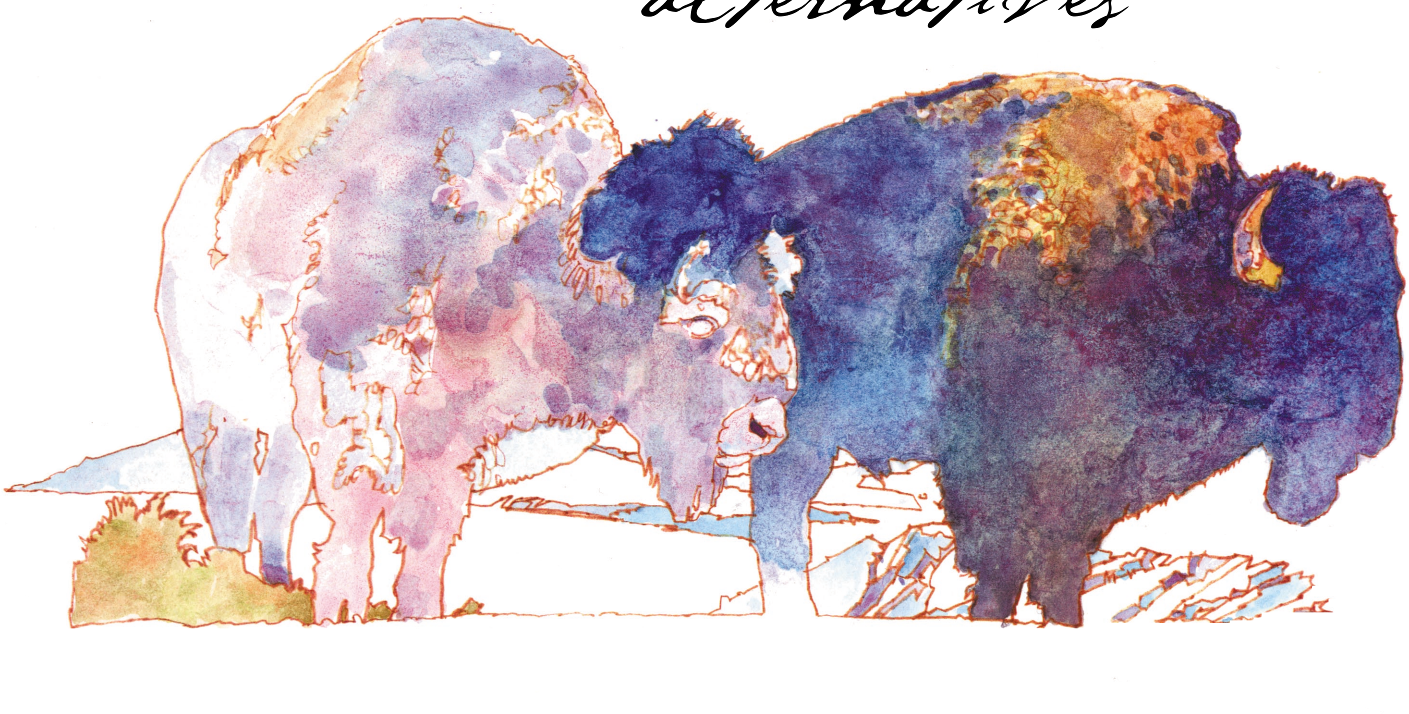
Impacts on air quality. Air emissions from trucks transporting bison to slaughter would occur if any alternative except alternative 2 was selected. In addition, particulates and other pollutants from diesel generators required at any of the capture facilities in alternatives 5 and 6 would have a temporary adverse impact on air quality. Because impacts are expected to be negligible, they will not be analyzed further in this environmental impact statement but would be analyzed in any siting evaluation.

Impacts from noise. Generators, snowmobiles, and management activities may result in temporary, minor disturbances to workers or wildlife. The impact of these disturbances to wildlife is addressed in the "Environmental Consequences" part of this document. The impact to humans is negligible and is not analyzed further in this environmental impact statement.



Bugling elk.

The alternatives



INTRODUCTION

As indicated in “Purpose of and Need for Action,” the agencies developed a statement of need, a statement of purpose, and nine specific objectives they believed each alternative had to meet to a large degree before it could be considered reasonable. If the alternative met these objectives, fulfilled the purpose of taking action, complied with legal or regulatory mandates of each agency, and was technically and economically feasible, it was included in the range of alternatives analyzed in this environmental impact statement. Notably, agency mandates differ, and this difference is reflected in the divergent nature of the purpose statement and objectives, as well as in the range of alternatives analyzed.

The objectives and alternatives were developed through a six-year ongoing planning effort (see “Purpose of and Need for Action: Background — Administrative History of Bison Management” section) that included several opportunities for public input. Alternatives were added in response to this input. Several commenters insisted on management without lethal controls. Although this type of bison management was considered and rejected from further analysis, the agencies developed alternative 2 as the means to minimize lethal controls and accomplish the purpose of and need for this environmental impact statement. Alternative 3 is similar to a proposal, referred to as the “citizens' alternative,” that was developed by representatives from a broad range of conservation, hunting, livestock, and tribal interests. Alternatives 5 and 6 are two different approaches to substantially reduce the incidence of brucellosis in the Yellowstone bison herd, a consistent concern of the livestock industry.

The objectives and alternatives were developed through a six-year ongoing planning effort that included several opportunities for public input.

Agency decision makers met in March 1997 to review a list of objectives they had developed in 1992 (see “Purpose of and Need for Action: Objectives and Constraints”). Originally, this list would have driven the selection of only the preferred alternative. However, decision makers agreed that all alternatives must meet these objectives, resolve need, and fulfill the purpose of action to some degree to be carried forward for analysis. This approach would provide agencies several practical options, all of which are implementable. The decision makers also agreed that the existing six alternatives (alternatives 1 through 6 in this environmental impact statement) the agencies had developed with help from public input represented the full range of options. Like agency mandates, public opinion on how bison should be managed proved to be diverse.

In June 1997 agency decision makers met to review information from the in-house draft environmental impact statement and select a preferred alternative from among the six alternatives. However, the agencies found that none of the six alternatives adequately met all their respective needs, and a seventh alternative was developed. Alternative 7 has features of other alternatives, but is also distinct.

In response to public input and agency needs, the range of alternatives was created to "capture" the most divergent, yet reasonable, scenarios each agency could legally implement. Where one might emphasize the "wild, free-ranging population of bison" piece of the purpose statement, another might focus on "addressing the risk of brucellosis transmission." Some also emphasized different management techniques, such as hunting, quarantine, or vaccination. Alternatives were also built to illustrate the effect of the presence or absence of a particular technique. For instance, the impact of quarantine is best understood by comparing alternatives 1 and 4, as they are similar except for quarantine. The effect of vaccinating the entire herd for several years is illustrated by comparing alternatives 5 and 6, which are nearly identical except for this feature. The impact of acquiring land to the north of the park is most clearly understood by comparing alternatives 4 and 7. The "theme" of each alternative is described below to show some of these differences.

Alternative 1 is the no-action alternative. As defined by the National Environmental Policy Act, the no-action alternative in this case is a continuation of the 1996 *Interim Bison Management Plan*. The description and impacts of alternative 1 have been updated to include the most recent adjustments to the *Interim Bison Management Plan*.

Alternative 2 focuses on changes in cattle operations outside the park and minimal, nonlethal methods of management to ensure separation and minimize the risk of disease transmission between bison and cattle. It assumes acquisition through purchase, easement, or other means of the largest tracts of land from willing sellers on property adjacent to the park for bison winter range. Alternative 5 is at the other end of the spectrum. It assumes bison would not be allowed to leave Yellowstone National Park and maximizes agency management of the herd. The focus of this alternative is the elimination of brucellosis from bison through the capture of all bison in the herd and the slaughter of all seropositives.

The other alternatives are more moderate in the amount of land available to bison and the intensity and use of management techniques than alternatives 2 or 5. Alternative 3 relies on hunting of bison to regulate population numbers and distribution of bison outside the park, and separation in time and space to preclude contact of bison with cattle. Where hunting is infeasible, capture and shipment of seropositive bison to slaughter and seronegative bison to quarantine are used. Alternative 3 includes provisions for acquisition of some winter range to the north of the park's Reese Creek boundary.

Alternative 4 is similar to the *Interim Bison Management Plan*, but it includes quarantine and hunting as additional bison management tools. Although bison leaving the park to the west are allowed to occupy public lands, private land abuts the park to the north. Under the interim plan, all bison leaving the park to the north are shipped to slaughter, regardless of whether they test seropositive or seronegative. A quarantine facility would allow agencies to ship seronegative bison live to complete a protocol, whereupon they would be available to tribal governments or others. A quarantine facility and hunting would also give agencies management tools they do not now have under the interim plan to manage the population size to some degree.

Alternative 6 is a variation of alternative 5, as it, too, focuses on the elimination of brucellosis from the bison herd. However, parkwide capture, test, and slaughter would not begin until a safe and effective vaccine had been applied to the entire herd for a number of years. Bison would be tested, and when seroprevalence had leveled off, capture, and slaughter of remaining seropositives would begin. Alternative 7 departs from all other alternatives in that a range of bison population numbers would be the focus, and specific management scenarios would be put in place as the population approaches either end of that range. As the bison population approaches 2,500, the upper end of the range, the agencies would increasingly use lethal means to enforce separation of cattle and bison and to maintain population limits. At the lower end, 1,700 bison, agencies would cease all but the most necessary lethal means to maintain separation. Beyond this, alternative 7 includes a mix of management techniques similar to alternatives 1, 3, 4, and 6. Capture and slaughter of seropositives is the primary means of managing risk, as it is in alternatives 1, 4, and 5. Low levels of hunting outside the park are also allowed, as they are in alternatives 3 and 4. Land to the north of the park's Reese Creek boundary may be acquired, as is proposed in alternative 3. Parkwide vaccination with a safe and effective vaccine is a part of all alternatives, including the modified preferred alternative.

The modified preferred alternative relies on (1) spatial and temporal separation of bison and cattle through a zone management approach in limited areas outside the park during the winter, and (2) returning bison to the park in the spring well before cattle return to graze. The amount of time between hazing the bison into the park in the spring and the return of cattle to graze is several times much longer than new research indicates the *Brucella* bacteria (strain RB51) lived in bovine fetal carcasses during spring in

Wyoming. Research is proposed to determine whether this is true of the climate in West Yellowstone as well. The modified preferred alternative also limits the number of bison allowed outside the park and the size of the herd to ensure manageability. The whole herd limit would be a late-spring population of 3,000. This number is based on new research cited in the 1998 National Academy of Sciences report NAS.

Using a series of steps, this alternative would progressively allow seronegative bison, and then untested bison, to graze outside the park in predetermined zones during the winter months, thus gaining information on how best to manage the bison. Eventually, at any one time up to 100 bison would be allowed on newly acquired U.S. Forest Service lands north of Reese Creek and another 100 on U.S. Forest Service lands to the west of the park. As noted above, vaccination is a part of every alternative, including the modified preferred. This alternative is different in identifying specific dates when agencies believe vaccines would be available and used for particular classes of bison (such as calf vs. adult, captured vs. free-roaming).

Bison at Old Faithful, 1970.

The agencies believe that these eight alternatives represent a full range of options for management techniques and habitat available to bison to ensure separation between cattle and bison, minimize the risk of transmission of brucellosis to Montana cattle, and maintain a wild, free-ranging bison population. All eight alternatives address the stated agency need for taking action and fulfilling the stated purpose of taking action. Although the alternatives may differ in the degree to which they meet one or more of the objectives (see “Purpose of and Need for Action: Objectives and Constraints”), the agencies have agreed that each alternative meets all nine objectives to a large enough degree to be considered reasonable. All alternatives are analyzed in similar detail in the “Environmental Consequences” part of this environmental impact statement.

In December 1999 the U.S. Department of the Interior and the U.S. Department of Agriculture filed a 30-day notice of withdrawal from the 1992 Memorandum of Understanding, which established roles and responsibilities for agencies involved in the preparation of a long-term bison management plan for the Yellowstone area. The notice indicated the federal agencies would proceed without the state of Montana as a joint lead in the issuance of a final environmental impact statement and record of decision. Several items were at issue, including

a population limit for bison in the preferred alternative

the ages and classes of bison to be vaccinated

the criterion used to decide whether and when bison would be allowed outside the park north of Reese Creek and in the western boundary area

the federal agencies' support of an adaptive management approach to bison management using spatial and temporal separation as its primary risk management feature — this approach is explained in detail in "The Alternatives" part as the modified preferred alternative.

Cow moose with twin calves.

ACTIONS COMMON TO ALL ALTERNATIVES

INTERAGENCY INVOLVEMENT

Cooperation among agencies is essential to maintain a wild, free-ranging bison herd in Yellowstone National Park and to maintain Montana's federal brucellosis class-free status. The bison traditionally spend summers in Yellowstone National Park, which is managed by the National Park Service, and some move in winter outside the park to neighboring U.S. Forest Service and private land. In Montana, wildlife is managed by the state's Department of Fish, Wildlife and Parks, and cattle diseases are managed by the state's Department of Livestock. Both of these agencies are referred to as the state of Montana in this document. The Animal and Plant Health Inspection Service determines whether Montana is class-free, i.e., its cattle can be moved interstate without brucellosis testing. Animal health authorities in each individual state may impose import regulations equal to or more restrictive than APHIS regulations as long as there are no irreconcilable conflicts with APHIS regulations. Within the identified management boundary for each alternative, different agencies would have primary authority for various management activities. However, agencies would share responsibility for bison management actions.

Cooperation among agencies is essential to maintain a wild, free-ranging bison herd in Yellowstone National Park and to maintain Montana's federal brucellosis class-free status.

The federal agencies have prepared a long-range management plan and final environmental impact statement acceptable to the federal agencies. Each alternative evaluated in the range of alternatives in this environmental impact statement is one that the agencies considered technically and legally implementable. The alternatives also represent the further limits of acceptability on each side of the range. Those alternatives considered infeasible or illegal have been eliminated from analysis.

BISON POPULATION NUMBERS

All alternatives, except alternative 1 (no action), employ population numbers to guide management actions. A "minimum viable bison population" for Yellowstone National Park may not be possible to define. Effective breeding population refers to the number of actively breeding animals in a population required to ensure all combinations of genotypes are possible as a result of random intermixing of individuals (Shull and Tipton 1987). Because of social and physiological factors, not all mature bison in a population breed.

Minimum viable population estimates are used to infer the minimum number required for a population to have a certain probability of persistence. Several factors including demographic stochasticity, genetic stochasticity, environmental stochasticity, and catastrophes, affect the minimum viable population. These factors also affect different animal populations differently; hence, no universal estimate of minimum viable population exists. However, management prescriptions that result in nonrandom selective removal of bison from a population through lethal and nonlethal mechanisms (e.g., selective removal of pregnant females, females that carry the NRAMP1 trait [see *"Volume 2: Responses to Comments"* for more information], or prime breeding age bulls) can negatively influence the resultant genetic integrity and viability of a population. Minimum viable population estimates are based on the above factors and estimates of effective genetic population size needed to maintain viable populations. Minimum viable population and effective genetic population size are not estimates of actual census size.

The literature suggests an effective genetic population size of 50 to 500 might be required to maintain a constant level of genetic variation in a population (Lande and Barrowclough 1987; Franklin 1980). Several methods exist for examining the relationship between the effective genetic population size and the actual census size. For example, if the number of breeding animals is assumed to be 25% of the total population (Berger and Cunningham 1995), and the effective genetic population size is related to the ratio of breeding males to breeding females, then the effective genetic population size for the Yellowstone bison population is well above the recommended minimum of 50 for all alternatives where the bison population is maintained between 1,700 and 3,500. Both the deterministic and stochastic models predict an increasing bison population under each alternative, and none of the alternatives is expected to compromise the genetic viability of the Yellowstone bison population.

Population models suggest that the maximum number of bison that can live year-long in Yellowstone National Park varies between 1,700 and 3,500 bison, depending on forage production and winter severity. All of the alternatives are intended to maintain a viable bison herd in Yellowstone National Park. During periods of natural or management-induced population declines and as bison numbers approach 1,700, the agencies would more aggressively employ nonlethal methods to encourage bison to remain within management boundaries. Lethal controls would be employed only to remove those bison that pose the greatest risk of brucellosis transmission. Bison also might be held for extended periods in capture facilities for subsequent return to the park.

According to the finalized National Academy of Sciences (NAS) report (NAS 1998), bison removed during management actions in 1991–92 and 1996–97 were in good to excellent body condition. This indicates that even at a population size of more than 3,500 bison, little or no evidence exists to indicate inadequate forage quantity or quality. The National Academy of Sciences report also suggests that bison migration out of the park is related to both population size and weather, and when the bison population exceeds 3,000, movements out of the park are closely related to measures of winter severity. Although the bison population has adequate forage to maintain itself well above 3,000 animals when winters are mild or normal, factors including the inaccessibility of that forage during harsh winters, drive a larger number of bison out of the park to lower elevations if the population exceeds 3,000. The modified preferred alternative shows how maintaining the bison population at 3,000 would affect bison distribution, seroprevalence, and park resources.

MANAGEMENT AS A WILD, FREE-RANGING POPULATION

The agreed-upon purpose of taking action is to "maintain a wild, free-ranging population of bison and address the risk of brucellosis transmission to protect the economic interest and viability of the livestock industry in the state of Montana." Therefore, each alternative sustains a wild, free-ranging bison population over the long term, although the degree to which each fulfills this goal varies. A wild, free-ranging bison is defined as one that is not routinely handled and that can move without restrictions within specific geographic areas.

None of the alternatives envisions a "no management" strategy, that is, letting bison roam wherever they want with no agency actions to minimize the risk of brucellosis transmission to cattle. Doing so would be inconsistent with the purpose and need for implementing a long-term, cooperative bison management plan (see "Purpose of and Need for Action: Objectives and Constraints — Objectives in Taking Action"). Rather, each alternative features different levels of "hands-on" management actions to reduce seroprevalence in the bison population. However, as described above, even during the periods of most active management, each alternative ensures that a viable population of bison is allowed to range over large areas of Yellowstone National Park.

In some alternatives, bison are captured and tested for exposure to brucellosis. Extraordinary measures, which would include the overwintering of captive bison in agency capture facilities to prevent population numbers from dropping below those required by a particular alternative, would entail a temporary loss of the wild, free-ranging status of the captive animals.

BRUCELLOSIS CLASS-FREE STATUS

As previously stated, the purpose of taking action is to maintain a wild, free-ranging population of bison and address the risk of brucellosis transmission to protect the economic interest and viability of the livestock industry in the state of Montana. Both the risk of transmission and the economic interest and viability of Montana livestock figure heavily into the state's class-free status. Protecting the state of Montana from a reduction of its status (an objective of taking action) requires actions that ensure, among other things, separation of bison and cattle, ensuring that livestock that graze on public and private lands are not exposed to the *Brucella* organism, and implementation of bison management actions that minimize the risk of transmission from a disease perspective. The agencies have made a commitment to the eventual elimination of brucellosis from the Greater Yellowstone Area. This commitment is also a stated objective to which each alternative must be responsive.

Although each alternative meets these objectives, they do so to varying degrees. The distinction among the alternatives lies in the specific actions proposed and the varying methods and adequacy of ensuring these objectives are accomplished (see table 11).

Since the completion of the *Draft Environmental Impact Statement*, APHIS has indicated that for the modified preferred alternative, through its testing protocol, livestock operators in the impact area would have the option to have their individual cattle herds certified as brucellosis-free. This is designed to address the perception of risks that may be associated with herds from this area. APHIS may make funding available to accomplish this certification process for livestock operators who graze cattle during the summer in areas that bison may occupy during the winter.

BISON DISTRIBUTION LIMITS

All alternatives include a management boundary that defines a certain distribution of bison. While the location of the boundary and the blend of management actions differ, in all alternatives, agency actions within the boundary are intended to prevent the movement of bison beyond the boundary. When bison move beyond the designated management boundary, agency personnel may haze bison back into the management area. Hazing may employ a variety of methods including noise, rubber bullets, cracker shells, dogs, and baiting. Hazing may take place on foot, on horseback, in vehicles, or by air. If bison cannot be hazed back into the management area, they may be shot.

Yellowstone National Park extends into the state of Montana along the park's northern and western border. Three specific entries from the park in this area are of concern, and measures to prohibit or restrict bison movement are in place at these entry points in all alternatives (see Bison Winter Movements map). Two entries lie along the northern boundary near the northwestern corner of the park — one a direct approach from the park into the town of Gardiner or across the boundary at Reese Creek onto private land, and the other farther east through the Eagle Creek/Bear Creek drainage. The third entry is along the west side of the park in the general vicinity of the town of West Yellowstone.

Two additional boundary areas are mentioned in the alternatives. One is the combined Monument Mountain Unit of the Lee Metcalf Wilderness and Cabin Creek Wildlife and Recreation Management Area on the west side of the park and north of West Yellowstone (generally north of Grayling Creek/Fir Ridge). Land use in this area emphasizes wildlife and precludes domestic livestock. The other, which includes Hellroaring Creek and Slough Creek drainages in the Absaroka-Beartooth Wilderness lies along the northern boundary of the park to the east of the Eagle Creek/Bear Creek drainage. Both Hellroaring Creek and Slough Creek drainages are geographically isolated from areas with permitted cattle. In most alternatives, bison are allowed into Lee Metcalf/Cabin Creek and Hellroaring and Slough drainages, although very few are able to traverse the rugged terrain and deep snow in the winter.

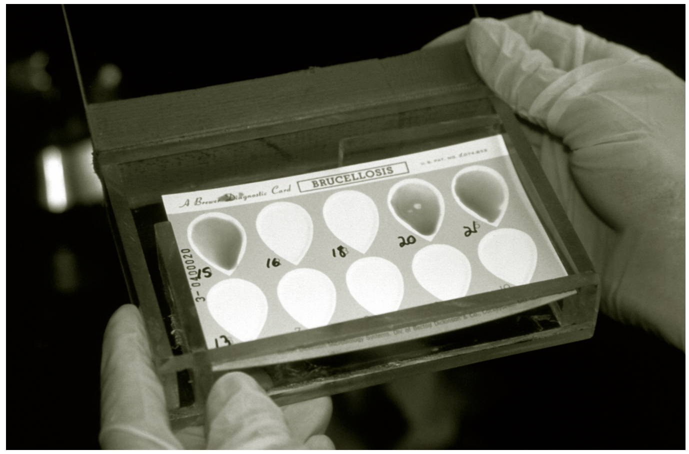
BISON CAPTURE

The agencies have included capture facilities to help keep bison from moving across the boundaries in all alternatives except alternative 2. Bison are either herded into the facility with fences and hazing, or they are baited to enter. Captured bison are card tested for exposure to *B. abortus*, and either slaughtered, quarantined, or released depending on serological status, pregnancy status, population numbers, and the alternative. The size of the capture facility would vary with location, but siting criteria always include at a minimum the following:

- Holding pastures, corrals, handling equipment, and wing fences would be temporary structures.
- Capture facilities would use existing roads inside the park and to the extent practicable outside the park.
- Adequate water for captured bison, and hay if animals are kept longer than 24 hours, would be available.
- Ground disturbance would be kept to the minimum needed to properly construct the facilities.
- Facilities would be located in areas that do not contain significant wetland

and riparian areas, or endangered, threatened, rare, and sensitive plant or animal species.

- If sited on U.S. Forest Service land, the location of the facility would be such that it meets the visual quality objectives of the Gallatin National Forest Plan.
- Natural and cultural resource surveys to comply with applicable laws would be completed before the facilities were built. Facilities would be located to avoid known sensitive or important cultural and natural resources.
- Facilities would be constructed and operated in such a manner that capture and handling of bison would be as humane as possible.



Brucellosis card test, 1997.

HUMANE TREATMENT OF BISON

The agencies are concerned with humanely managing bison (see appendix F for a summary of bison management techniques). Female bison and calves usually travel in groups of 25 to 30. At the Stephens Creek capture facility, the entire group is directed by wing fences and by the National Park Service personnel moving bison slowly and quietly on foot into a large pasture adjoining the capture facility. A few agency personnel may occupy catwalks overlooking the compound to help in moving groups of bison into corrals or chutes for testing. Battery-operated cattle prods to administer electric shocks are used only sparingly. Captured bison are separated into different sex and age groups, and older bulls are not commingled, if possible, with other bison for safety reasons. A recent evaluation by veterinarians and members of the Humane Society of the United States indicated directing fewer animals into the capture facility at one time may reduce stress and injuries to the bison (letter from Humane Treatment Evaluation Team to Gov. Marc Racicot, Feb. 3, 1997). This same evaluation indicated fewer personnel on the catwalks as bison are being driven toward the facility may be helpful as well.

The team also noted personnel used too much noise to herd bison, did not have written protocols to provide guidance on loading and transporting bison to slaughter, and did not employ a person with experience to train members of the bison handling team. Since 1997 the National Park Service has changed its hazing and herding practices to more fully use natural bison behavior and provide training and protocol measures for all bison-handling personnel at Stephens Creek (no bison have been captured at Stephens Creek since 1997).

Bison destined for slaughter would be shipped to one of five slaughterhouses in the state of Montana, all within a 160-mile radius of the Stephens Creek capture facility. The humane treatment team suggested all open grid fences used to direct bison into trucks for shipment be covered so the animals do not catch and rip their horns. The team also advised it would be more humane to shoot bison at the capture facility, rather than transport them live to slaughter. "While gunshots to the brain may be aesthetically unpleasant to some individuals," the report notes, "unconsciousness is instantaneous" if the procedure is performed by skilled personnel.

Agencies provide water at the capture facilities if bison are held less than 24 hours, and both water and food if they are held longer. The humane treatment team found this treatment adequate.

The team concluded that, while some changes could be made in the capture operation, "National Park Service had made a considerable effort to minimize any fatalities and injuries to the bison."

While bison are separated into groups in capture facilities for safety reasons, this practice may separate mothers from calves. It does, however, minimize gore wounds or other injuries from bulls or agitated cows. Transporting live bison to a slaughterhouse, or to a quarantine facility if an alternative includes quarantine, may result in injuries during transport from crowding, fighting, or panic.

Quarantine and hunting also challenge agencies to ensure humane treatment of bison. Covering horns with plastic hose, segregating bison into appropriate age/sex groups, and taking fewer bison per trip to quarantine facilities minimize damage during transport. Although location and design of the facility has yet to be determined, humane treatment at a quarantine facility is easier to accomplish if the facility allows for adequate physical space and separation of females and calves from males. For example, a pasture-type facility in open terrain more closely mimics natural conditions in the park and is presumably more humane. If hunting were part of the selected alternative, only a fair-chase hunt would be allowed. The details of such a hunt, including hunter training, are explained in this final environmental impact statement and would be fully expanded by the Montana Fish, Wildlife and Parks Commission.

MONITORING

All alternatives follow the same monitoring schedule as bison move toward and outside the boundaries. As they approach Yellowstone National Park boundaries from inside the park in the winter, bison are monitored once per week. As they get closer to the boundary areas on the north and west, monitoring is increased to daily during winter months (November 1 to April 30). On the north side, the boundary is identified as the Reese Creek area. If bison move beyond this boundary, their movements may be monitored daily. On the west side, bison are monitored once per week when they are traveling along the Madison River inside the park, and daily as they move into the West Yellowstone area. Once outside the park in the western boundary area, they may be monitored as frequently as three times per week. Monitoring activities would include aerial or ground reconnaissance of individual bison or groups of bison. In the Eagle Creek/Bear Creek area, bison are monitored twice per week during the winter. If bison move toward the Little Trail Creek/Maiden Basin hydrographic divide and Gardiner, their movements are monitored daily.

Bison may also be monitored during other times of the year, but little movement outside the park is expected during June 1 to October 1.

SPECIAL MANAGEMENT AREA

All alternatives (except alternative 5) allow some bison outside the park and envision the creation of special management areas. A special management area is an area contiguous to the park where some or all bison may be tolerated for part or all of the year, as specified in the selected alternative, without increasing the risk of brucellosis transmission to domestic livestock. SMAs and the management within them vary within an alternative and between alternatives. Adequate disease control measures taken within these SMAs would protect Montana's brucellosis class-free status. The risk of transmission is managed in various alternatives through spatial separation of bison and cattle, temporal separation, changes in cattle operations (such as running steers or spayed heifers), disease control in cattle or bison, or a combination of these factors. APHIS has indicated that any of the bison management plans (alternatives) in this environmental impact statement would be sufficient to prevent the actual outbreak of disease in domestic livestock and the subsequent spread of brucellosis. Therefore, it would not initiate a downgrade of Montana's class free status based on the mere presence of Yellowstone bison migrating out of the park into the SMAs in accordance with the selected bison plan (alternative). APHIS has also indicated that no changes in the current requirements for obtaining class-free status (Title 9, *Code of Federal Regulations*, Part 78) would be required for the agencies to establish SMAs.

Pursuant to statutory and regulatory requirements, the establishment, modification, or revision of SMAs may require the approval of the state of Montana as specified by Montana law. These decisions regarding SMA designation, modification, or revision will be based on the best science and information available, including bison management circumstances of the area.

Since completion of the *Draft Environmental Impact Statement*, the federal Departments of the Interior and Agriculture and the Rocky Mountain Elk Foundation teamed in February and August 1999 to purchase lands and conservation easements north of the Reese Creek boundary of the park. The purchased lands would be under the jurisdiction of the Gallatin National Forest. U.S. Forest Service lands are multiple use lands including use by wildlife. The Gallatin National Forest would also administer and monitor the terms and provisions of the conservation easement. However, as noted above, Montana approval may be required to establish SMAs to allow bison onto these lands.

DISTRIBUTION OF CARCASSES

Bison that are captured and test positive for exposure to *B. abortus* are slaughtered (a few may be used for research purposes). Those that cross the designated management boundary or evade capture may be shot. Seropositive bison are not slaughtered at the capture facility, but are trucked to slaughterhouses in the state of Montana within a 160-mile radius of the capture facility.

Under Montana statute (81-2-120, MCA) wild bison "that are certified by the state veterinarian as brucellosis-free may be transferred for full or partial compensation." Accordingly, meat from slaughtered animals is distributed to social service organizations, tribal governments, or is auctioned to help defray state costs of capture and slaughter. In 1997 the state received $185,763 from the sale of bison products, which partially offset its operating costs for bison management activities of $245,703. Heads and hides may be auctioned or released to tribal governments. Some bison that are shot are gutted and dressed by tribal members, who keep meat, heads, and hides. Otherwise, most bison are sent to slaughterhouses. Carcasses may also be left inside park boundaries to serve as a source of food for wildlife in any of the alternatives.

DISTRIBUTION OF LIVE BISON

Live bison are only available for release outside the area if they have successfully completed an APHIS-approved quarantine protocol. Occasional live bison may be used for research purposes.

Once an approved quarantine protocol is completed, the federal agencies support the distribution of live bison to Native American tribes, areas of public land, national park units, wildlife refuges, and approved research programs.

PRIVATE LAND

Under Montana statute (81-2-120, MCA), the Department of Livestock with assistance from other agencies removes bison known or suspected to be carrying a disease on public land or, with landowner permission, on private property. If private landowners want bison removed from their property, the landowner must contact the Department of Livestock and allow ample time to respond. If the Department of Livestock does not respond to the landowner's request, the landowner may shoot the bison, but must contact the department to report the shooting and must retain the carcass for distribution by the department. Other agencies may assist in the effort at the request and with permission of the Department of Livestock.

SMAs do include private property in some cases. If the landowner wishes bison to remain on private property, they would generally be allowed to do so, although the Montana Department of Livestock may request permission to remove individual bison if they are known or suspected to carry brucellosis.

VACCINATION

All alternatives include the suggested vaccination of female cattle calves in higher-risk areas, e.g., those adjacent to the park or to the SMAs. Vaccination of cattle against brucellosis remains a common practice in Montana and other areas across the country. However, because vaccination of cattle does not provide 100% immunity against the disease, vaccination alone will not prevent the transmission of the disease from an infected animal. Within high-risk areas, the Department of Livestock requires surveillance testing of all test-eligible cattle coming into direct contact with bison. Testing requirements for those cattle occupying adjacent areas is conducted at the discretion of the Montana state veterinarian. If a herd is in contact with bison, test-eligible female cattle are tested. State animal health authorities would encourage calfhood (4–12 months old) vaccination with RB51 (the current vaccine for cattle) of all test-eligible cattle on private lands within a 20-mile radius of areas where bison are allowed (SMAs) and encourage vaccination on public lands within the SMA. The Animal and Plant Health Inspection Service would provide the vaccine for all cattle vaccinations required on public land performed within the SMA, although livestock operators would be responsible for costs.

In all alternatives, the agencies are proposing the use of a vaccine for brucellosis in the bison population. In alternatives 1, 2, 3, 4, and 7, vaccination of bison calves or captured adult bison would begin when a safe and effective vaccine is available. In alternatives 5 and 6, whole herd vaccination is planned.

A vaccine known to be safe and effective in bison and safe for nontarget species does not currently exist. The agencies have agreed that a safe vaccine is one that has no long-term pathological effects on the vaccinated bison or its fetus, and no debilitating reaction that would increase mortality in the population. A safe vaccine would also be one in which the bacteria incurs no genetic mutations or reversions, and that causes no pathological effects, death, or disability in nontarget animals exposed to the vaccine or vaccinated bison.

Effectiveness, or efficacy, is the ability to impart protection from abortion and infection when exposed to brucellosis. To date vaccines protect better from abortion than from infection. The decision on when a vaccine is safe and effective "enough" is complex and depends on several factors. The decision to administer a specific vaccine would depend, in part, on the opportunity afforded by the selected management actions for a given location. For instance, bison already in a capture facility and being prepared for testing and marking (as seronegative) may be vaccinated with a safe but relatively less effective vaccine than one slated for remote delivery or through a parkwide roundup and capture program. Research on the vaccine RB51 may show this or a similar strain to be appropriate for the former situation. Also, a vaccine with a relatively high efficacy rate that could be broadcast for oral administration in bait, but which offered a potential hazard to a native nontarget species, might be used if that hazard could be eliminated through timing or method of administration. Therefore, the decision on whether a particular vaccine is safe and/or effective will be made cooperatively and should be based on many factors.

When the National Park Service and the state of Montana agree that a vaccine is safe for bison and nontarget species, and the vaccine is at least somewhat effective in protecting vaccinated bison from infection, the agencies would determine when and where, within the approved management plan, that vaccine might be used. The agencies would review ongoing vaccine research results and assess the consequences of using vaccines as they are developed. Vaccines are effective in reducing the spread of disease in several ways. First, they can enhance the immune-response capability to ward off an infection when the animal is exposed. Second, they can increase the level of bacteria required for an infective dose. And third, since abortion is the major mechanism for transmitting brucellosis (brucellosis is a reproductive-system disease, with abortion being the pathological result), decreasing the frequency of abortion reduces the potential for transmission.

Strain 19 is a live-bacteria vaccine that has been used to immunize cattle against brucellosis since the 1930s. However, the immune response it elicits in bison cannot be distinguished from responses caused by exposure to the bacteria itself (e.g., field-strain infections). A new live vaccine, RB51, which does not have this problem, is now used in cattle calves and appears to be the front-runner for possible use in bison calves.

Criteria and Evaluation Protocols for Vaccines

Because the current most likely brucellosis vaccine candidates for use in bison are forms of live *Brucella abortus* bacteria, criteria regarding the biosafety (i.e., the lack of pathology or other harmful effects) induced by the vaccine have been developed. For domestic livestock, these include (NAS 1998)

- ensuring lack of clinical signs of acute disease do not appear after vaccination
- ensuring bacteria are not present in nasal secretions, saliva, or urine
- ensuring bacteria do not persist in the bloodstream for more than 3 days
- ensuring bacteria do not persist in lymph nodes for more than 16 weeks
- ensuring evidence of humoral or cellular immunity is present 14 days after infection
- ensuring no inflammation or chronic tissue injury appears
- ensuring neither placentitis nor abortion occurs in pregnant animals
- ensuring immunosuppression after 16 weeks does not cause recrudescence
- ensuring bacteria recovered after 12 weeks growth in the host are genetically identical with the vaccine strain

In addition to biosafety, there are other elements to be evaluated for administration of a live bacteria vaccine to free-ranging wildlife. To address this subject, the Technical Subcommittee, at the request of the Greater Yellowstone Interagency Brucellosis Committee (GYIBC), developed a protocol for evaluating safety and efficacy of a wildlife vaccine against brucellosis in the Greater Yellowstone Area. The following indented text is that protocol:

> "The purpose of this protocol is to establish guidelines for the development and evaluation of new brucellosis vaccines to be used in free-ranging elk *(Cervus elaphus)* and bison *(Bison bison)* inhabiting the Greater Yellowstone Area. This protocol is not intended to evaluate current vaccination programs being applied to these species. The recommendations for the following criteria regarding efficacy and safety are based on the

assumption that any brucellosis vaccine evaluated by these criteria would have defined dosage, route of administration, and age restrictions for any application of the vaccine. The vaccine strain would demonstrate stable characteristics following in vitro and in vivo passage. Efficacy evaluations within the principal species should include animals of minimal recommended age, at the minimally recommended dosage and administered in accordance with recommendations. For safety evaluations within the principal species, animals should be of minimal recommended age, at the maximal recommended dosage, and administered in accordance with recommendations. The assumption is also made that the criteria for approval of a vaccine as safe would be the same in both male and female animals in the targeted population. For the purposes of this paper, the definition of a calf would be a bison or elk of less than 12 months of age. Restrictions on use (e.g., sex and age) may be applied without rejection of the vaccine in total. For example, limit use to females because of adverse reactions in males."

Calfhood Vaccination

Safety. To be defined as safe, a vaccine would not have any clinical effects that would increase predation or decrease survivability. However, adverse clinical effects, such as listlessness, anorexia, depression, and arthritis, that are transient and minimal with no long-term effects on survival may be acceptable. There should be no statistical difference between vaccinates and controls on these factors.

A safe calfhood vaccine would not be shed from a vaccinate prior to parturition. The vaccine strain would not persist to the first calving in 95% or greater of the vaccinated individuals, or persistence of the vaccine strain would not be associated with a significant reduction in the survivability (i.e., no pathology) or the reproductive potential of the individual (i.e., repeated fetal loss, infected calves, or decreased fertility). There should be no statistical difference between vaccinates and controls on these factors.

Efficacy. To be defined as efficacious in females, a vaccine must induce statistically greater protection against fetal loss, infected calves, or infection in pregnant vaccinates after experimental challenge when compared with nonvaccinated animals in the same experiment. Infection is defined as either number of colony-forming units (CFU) per gram of tissue and/or number of infected tissues.

Use of model predictions must indicate that the vaccine, when used alone without other management influence, would reduce the prevalence of brucellosis in the targeted wildlife population.

Experiments would need to be conducted to evaluate the duration of immunity of the vaccine but these experiments would not be required for initiation of use of the vaccine if all other safety and efficacy criteria are met. A vaccine should provide long-term immunity and/or be able to be safely boosted during the life of the animal.

Adult Vaccination

Safety. A safe vaccine will not induce significant reductions in survivability or reproductive efficiency as statistically demonstrated in clinical trials.

A safe vaccine will not cause a significant reduction in recruitment in the population of target species.

Efficacy. A vaccine would be determined to be efficacious if it induces statistically greater protection in vaccinates against fetal loss, infected calves, or infection after experimental challenge when compared with nonvaccinated animals in the same experiment. In addition, modelling must indicate that the vaccine, when used alone without other management influence, would reduce the prevalence of brucellosis in the targeted wildlife population.

Other. A major advantage of any vaccine would be the ability to differentiate vaccinates from animals infected with *Brucella* field strain either by a serologic test or by alternative methods.

Nontarget Species

A vaccine candidate cannot cause deleterious effects on the short-term survivability of representative ungulates, rodents, carnivores or avian species under experimental conditions. Candidate species that should be strongly considered for evaluation include: moose, bighorn sheep, antelope, mule deer, coyotes, wolves, ravens, *Microtus, Peromyscus,* and ground squirrels. Other species could be added if scientific data support their inclusion."

Biosafety Research Results

Calfhood Vaccination Biosafety. Evaluation of RB51 vaccine for bison calves has been the subject of several clinical studies, which generally indicate the vaccine is clinically safe, even at doses up to 6×10^{10} (60 to 100 billion) colony-forming units, when administered to bison calves from at least 3 to 6 months of age. Vaccinates remained seronegative on brucellosis serologic tests but generally took longer to clear the vaccine infection (18 to 24 weeks) than expected based on results from tests in cattle calves (12 to 14 weeks) (Olsen et al. 1997; Olson et al. 1998). Research on whether vaccinating calves with RB51 affects later reproductive ability is ongoing using domestic bison. Results are expected by 2001.

YEARLING VACCINATION BIOSAFETY. There is little controlled experimental data available on vaccination or booster vaccination of yearling bison of either sex. Approximately 700 calfhood-vaccinated female bison in a *Brucella*-infected herd in South Dakota received two booster vaccinations of RB51 at one and two years of age (6 to 24 billion colony-forming units) without any detrimental clinical effects noted (Holland, pers. comm.). Available information on vaccination of calves and other nonpregnant adult females and males indicates that the animals incur no morbidity, mortality, or other long-term pathologic effects. One ongoing project at the Agricultural Research Service facility at Ames, Iowa, will evaluate safety and efficacy of RB51 booster vaccination of bison yearlings previously vaccinated as calves. Results of these safety evaluations will be available in 2001, and efficacy data will be available in 2004 (Olsen, pers. comm.).

ADULT MALE VACCINATION BIOSAFETY. Results of studies to date indicate that vaccinated bulls developed some level of antibodies sufficient to conclude that the vaccinations resulted in an immune response. RB51 did not cause morbidity or mortality in bulls; the vaccine persisted in tissues up to 20 weeks and was shed in semen in several study animals. No lesions were observed nor other gross pathologic evidence. It is generally concluded that administration of RB51 to bull bison meets biosafety requirements (Olsen et al. 1999; Elzer et al. 1998).

ADULT FEMALE VACCINATION BIOSAFETY. Available evidence regarding the vaccination of adult females is contradictory. Initial tests of RB51 administered at 1×10^9 (one billion) colony-forming units in pregnant adult females indicated that a substantial number of them had vaccine-induced abortions, fetal RB51 infections, and placentitis (Palmer et al. 1996). Other work by Elzer et al. (1998) indicated that bison females from a *Brucella*-infected herd did not abort when vaccinated with 10^9 colony-forming units at 2 months of gestation. These conflicting conclusions and implications to biosafety of RB51 for pregnant bison may be the result of differences in stage of gestation, dosage, and other stress or physiological, biological, or environmental factors. However, at this time vaccination of pregnant bison with RB51 does not meet the biosafety protocols. Further research on the effect of multiple dosage rates and at multiple stages of gestation with sufficient sample sizes to ensure valid results would require many bison, take a long time, and be very expensive. No projects of this magnitude are being conducted or are in the advanced planning stage. Since it is unknown whether or when RB51 or another vaccine would be researched adequately to be proclaimed safe for pregnant bison, the federal agencies have assumed such a vaccine would not be available in the near future of this Bison Management Plan.

Little data are currently available on the biosafety of vaccinating adult nonpregnant females. It is likely that pregnancy status, including possibly the stage of gestation (depending on future research results), would be required before administering a vaccine to female adult bison either in a capture facility or remotely. Because it would not be possible to determine pregnancy status in the field, and because a safe vaccine for pregnant bison is unknown and unlikely to be available for use in the near future of this bison management plan, the federal agencies have assumed remote vaccination of female adult bison is not possible in any alternative.

Whole Herd Vaccination Biosafety. For the above reasons, it is highly likely that the biosafety results and vaccination would be age- and sex-class specific and would be initiated on specific age and sex classes as biosafety and efficacy information became available. Biosafety on calves and adult bulls is largely complete. Biosafety on boostering yearlings vaccinated as calves is expected to be completed in spring of 2002. Complete biosafety information on pregnant females is problematic, and no completion date is projected. As a result, the remote vaccination of female adult bison or vaccination of captured pregnant bison cannot be assumed in the near future of this plan.

Safety in Nontarget Species. Nontarget species are species that may inadvertently come in contact with the vaccine, but are not the intended recipients of the vaccine. For example, vaccinated bison with a vaccine infection can shed the bacteria into the environment and expose nontarget species to the bacteria. Bison subject to predation or scavenging can also potentially expose nontarget species to the bacteria. A number of species have been selected for evaluation of the consequences of nontarget exposure to RB51. These species include predators, scavengers, and species living throughout the system near killed or scavenged prey. Species were also selected to serve as research surrogates for rare, threatened, or endangered species, such as coyotes, as surrogates for wolves. Species include moose, bighorn sheep, pronghorn, mule deer, coyote, ravens, Richardson ground squirrels, lemmings, deer mice *(Peromyscus)*, and voles *(Microtus)*. Evaluations have been completed on some of the nontarget species while other scientific evaluations are ongoing. The evaluations followed a general set of standard procedures in controlled environments. Test animals were given RB51 in concentrations of 10^7 to 10^{10} (10 million to 10 billion) colony-forming units depending on the particular species and the experimental design. Animals were monitored regularly; swabs and samples were taken regularly to evaluate possible shedding in secretions, urine, or feces. Food intake, behavior, and condition were monitored. Tissues were examined at intervals to determine rate of clearance of the vaccine infection, adverse physiological effects, and potential pathological effects on tissues or organs.

Completed Results by Species. Evaluations on coyote (Kreeger et al. 2000), ravens, ground squirrels, meadow voles, and deer mice (Januszewski et al. in prep.) have been completed. RB51 persisted in tissues of some ground squirrels to 12 weeks, in ravens to 8 weeks, and to 6 weeks in coyotes. RB51 did not cause morbidity, mortality, or significant clinical pathology in any of these species. Previous evaluations of RB51 for use in cattle tested the effects on lemmings with 10^3 colony-forming units of RB51. No adverse effects in the tests on lemmings were observed (Elzer in prep.)

Evaluations have also been completed on moose, mule deer, bighorn sheep, and pronghorn (Kreeger et al. 2000). No morbidity or mortality as a result of exposure to RB51 occurred in any of the test animals. Of note, even though brucellosis is considered lethal in moose, RB51 caused no mortality in moose in this study, although it did persist in one moose for 117 days following vaccination. RB51 was shed in nasal discharge in one bighorn sheep six weeks postvaccination. Based on these results, a single oral dose of 1.0×10^{10} (10 million) colony-forming units of RB51 is considered safe (i.e., did not cause illness or death) for nontarget species tested.

Reproductive Effects in Nontarget Species. Because brucellosis is a disease with a focus on the reproductive system, clinical effects can include abortion or sterility. Several investigations are ongoing and others are planned to evaluate effects of RB51 on the reproductive capability of females of nontarget species. Effects would be measured through assessment of pregnancy rates, abortion rates, and tissue culture results from adults and fetuses. Species that are being examined and the expected completion dates of the projects are coyotes, spring 2000; pronghorn, effects on pregnancy, spring 2000 and effects on conception, spring 2001; grizzly bear, spring 2002; and black bear, summer 2001.

Research Results on Efficacy

Efficacy in Calfhood Vaccination. The ability of a vaccine to impart immunity is called efficacy. The effectiveness of the vaccine is usually measured in two ways. The first method is to measure the ability of the vaccine to prevent infection. This is done by vaccinating the animals and some months later exposing them to a standard dose of a virulent strain of *B. abortus* (usually strain 2308). This process is called “challenge.” The level of antibody titers is measured postchallenge to assess the immune response. Finally, the experimental animals are euthanized; tissues are taken and cultured to determine whether the animal was able to clear the challenge infection. The second method is to measure the ability of the vaccine to prevent pregnant females from aborting. Animals are vaccinated as either calves or adults, later bred, and then challenged in the mid to late stages of gestation. The level of abortion or unsuccessful calving in those vaccinated is compared with those in the control group that did not receive the vaccine. Typically, vaccines against brucellosis are better able to prevent abortions than infection (Olsen 1998). In these vaccine trials, it is very important to have both treatment groups and control groups of sufficient sample size to conduct valid statistical analyses from which valid conclusions can be drawn.

The persistence of immunity from time of vaccination to subsequent exposure to disease infection (ideally immunity will persist for the remaining life of the animal) is also an important factor in vaccine development.

A preliminary study to evaluate effectiveness of strain RB51 vaccination (10^{10} colony-forming units) on bison was inconclusive. Bison vaccinated with RB51 as calves were raised to maturity, bred, and challenged at mid gestation with 1×10^{7} colony-forming units of strain 2308 (standard cattle challenge dose). Although results indicated that RB51 induces some protection in bison, controls were not included. Additional work using 10 vaccinated female bison calves and 4 controls was more definitive (Olsen et al. 1998). At maturity, all were bred. Of the five vaccinates that became pregnant, all delivered noninfected, normal calves. Of the three pregnant controls, one was lost during challenge and the remaining two aborted infected calves at four and five weeks postchallenge. This study gives further evidence that RB51 may be effective in calfhood vaccination of bison; however, a larger sample size is required to make statistical inferences.

Several projects are underway to further evaluate the level of efficacy of RB51 in calfhood vaccination of bison. S. Olsen at USDA Agricultural Research Service facility in Ames, Iowa, is evaluating immune response, rate of clearance, and efficacy of three doses of RB51; the efficacy portion of this study will be completed in spring 2000. Additional investigations on the effect of boostering vaccinates are also underway, and results are expected by spring 2002. Comparisons of hand injection versus ballistic administration of RB51 are ongoing. Bison calves vaccinated in fall 1999 will be bred in fall 2001 and challenged during pregnancy. The study will be completed by spring 2003.

In summary, there are indications that RB51 may be effective in preventing abortions in adult bison vaccinated as calves with RB51. Investigations to confirm efficacy and to estimate level of efficacy using sufficient sample sizes are ongoing, with expected completion dates in spring 2000, 2001, 2002, and 2003.

RESEARCH EFFORTS

Research is underway now and will continue during implementation of the selected management alternative. Research topics include, but are not limited to, testing and development of a safe and effective vaccine for bison, studies on the epidemiology and pathogenesis of *B. abortus* in bison, bison-specific blood tests for the exposure to *B. abortus* and presence of brucellosis, risk assessment of brucellosis transmission from bison to cattle in a wildland setting, and the use of groomed roads and trails by bison (see appendix D). Agencies would use the information from these research efforts to review pieces of the plan as appropriate. Whole bison carcasses and/or blood and tissue samples would be collected from bison for the purposes of disease surveillance, and for research to increase understanding of *B. abortus* in bison. Live seronegative bison may be obtained from winter capture operations for approved research.

Tissue samples would be collected from all seronegative-pregnant bison killed during management operations. Sampling protocols would be based on those developed by the GYIBC. The agencies, including APHIS Veterinary Services and the Biological Resources Division of the U.S. Geological Survey, with assistance from the Montana Departments of Livestock and Fish, Wildlife and Parks and the National Park Service, would provide qualified personnel to conduct necropsies and collect tissues. Test results would be provided to all cooperating agencies.

A comprehensive research program for bison of the Greater Yellowstone ecosystem was started in late 1995 when biologists and managers from the National Park Service met with biologists from the National Biological Service (subsequently the Biological Resources Division [BRD] of the U.S. Geological Survey) to discuss information needs relating to the bison population. Meagher (1973) conducted a study of the Yellowstone bison population from the time Yellowstone National Park was established to the time the "natural regulation" policy in 1968 was implemented and continued to collect data on bison numbers and parkwide distribution. However, additional comprehensive studies of bison ecology, bison movements, and epidemiology and transmission potential of brucellosis in the wild bison population are needed because *B. abortus* is present in a portion of the bison population and bison movements beyond Yellowstone National Park borders have increased.

NPS Natural Resource Preservation Program funding was identified for this research program, but it became apparent that this funding source alone could not support the scope of needed research. NPS and BRD biologists identified important data gaps and information needed for sound, long-term management of the bison population. Potential investigators were identified by BRD scientists and university researchers, and proposal abstracts were prepared and submitted to the director of the Biological Resources Division for funding. A suite of 11 research projects was submitted as a collaborative research initiative, with all projects designed to be carried out simultaneously. Conducting the research projects at the same time would create efficiency in animal capture, marking, sampling, and data collection, as well as enhance the interpretive value of data collected from each project. Once the initiative was funded, investigators prepared full proposals that were subsequently reviewed by an independent review panel comprised of scientists who know the Greater Yellowstone ecosystem, bison ecology, or both. Project proposals were revised as appropriate, and research began in late 1996.

The 11 projects involved in this research initiative include:

1. epidemiology and pathogenesis of brucellosis in Yellowstone National Park bison
2. seasonal habitat selection and movements of bison in Yellowstone National Park
3. development of aerial survey methodology for bison population estimation in Yellowstone National Park
4. determining forage availability and bison use patterns in the Hayden Valley of Yellowstone National Park
5. the effects of groomed roads on the behavior and distribution of bison in Yellowstone National Park
6. population characteristics of Yellowstone National Park bison
7. spatial-ecosystem modelling of Yellowstone bison and their environment
8. development of a PCR-based diagnostic system for B. abortus in bison

9. safety of *B. abortus* vaccines in nontarget species

10. statistical analysis and synthesis of 30 years of Yellowstone National Park bison numbers and distribution data

11. a model-based synthesis of bison and elk habitat use in the Jackson Valley

In addition to these projects that were funded largely by BRD resources, with some contribution from National Park Service Natural Resource Preservation Program funds, several other bison ecology studies have been developed and have been or currently are being conducted in concert with the bison research initiative. These include

assessment of the risk of transmission of *B. abortus* from bison to elk in the Madison-Firehole area of Yellowstone National Park

analysis of snowpack distribution and development of indices of winter severity in Yellowstone and Grand Teton National Parks

assessing impacts of winter recreation on wildlife in Yellowstone National Park, including monitoring the use of groomed roads by bison

conservation genetics relative to the long-term management of bison

Several brucellosis-related research projects are also being conducted, including research into the relationship between seroprevalence and actual *B. abortus* presence in bison blood and tissue. Another study includes efficacy and safety of proposed brucellosis vaccines in bison of varying age and reproductive status. Research on *Brucella* viability and fetal persistence in the Wyoming environment and elk response to RB51 vaccine was recently completed (Cook 1999).

Investigators involved in the bison research initiative meet biannually to present findings, coordinate sampling and data collection efforts, and discuss analysis and interpretation of the growing body of data on bison in the Greater Yellowstone ecosystem. Scientists conducting other bison and brucellosis related studies are encouraged to attend and participate in these meetings, so that the full scope of bison research is available for information and discussion. Preliminary findings from all studies have been made available to managers from the National Park Service and the Grand Teton National Park, as appropriate, for consideration in management planning. For a listing of many completed, ongoing, or proposed research projects and their status, please refer to appendix D.

ALTERNATIVE 1: NO ACTION — CONTINUATION OF THE CURRENT INTERIM BISON MANAGEMENT PLAN

Adopting this alternative would continue current bison management as set forth in the 1996 *Interim Bison Management Plan*. NEPA guiding regulations (40 CFR 1502.14) define the no-action alternative in a plan as "no change from current management direction or level of management intensity," and state that an alternative based on no management at all is often "a useless academic exercise." After the severe winter of 1996–97 when the state and federal agencies removed 1,123 bison due to bison management actions (1,084 bison were shot or sent to slaughter and 39 were used for research purposes), the federal agencies and the state of Montana discussed various adjustments that could be made to the interim plan. The goal of the adjustments was to achieve a generally stable bison population by reducing the number of bison shot or shipped to slaughter should extreme weather conditions cause the movement of bison to or beyond the boundary while preserving Montana's brucellosis class-free status. The National Park Service began implementing the adjustments in 1997 at the onset of winter. Specific adjustments and actions for each boundary area are described below. In general, the adjustments included

Adopting this alternative would continue current bison management as set forth in the 1996 Interim Bison Management Plan.

- increased emphasis of hazing bison back into the park or other appropriate lands
- capturing bison at the Stephens Creek facility and temporarily holding all seronegative bison until winter weather conditions moderate
- allowing low-risk bison in the West Yellowstone area that evade capture to remain on public lands for 30 to 60 days prior to cattle being released on federal grazing allotments (Montana still maintains the jurisdiction to determine when and which bison can be removed. For details of the federal and state decision documents and the federal evaluation of adjustments to the interim plan, please see appendix A).

The interim plan relies on strict border enforcement to keep bison and cattle separate, and has no provision for quarantining bison. Bison are prevented from crossing the northern park boundary at Reese Creek because the adjacent land is private and occupied by cattle throughout the year. Bison are allowed in the Eagle Creek/Bear Creek area.

In the West Yellowstone area, public lands are adjacent to the park. Cattle are more dispersed than at Reese Creek and are not grazed during the winter months. Up to 200 bison in Eagle Creek/Bear Creek, and 50–100 in the

West Yellowstone area have been able to overwinter successfully outside the park without coming in contact with cattle. Bison located outside the park in the west boundary area would be hazed back into the park in the spring, 30 to 60 days before cattle occupy the area. The exact number of days, between 30 and 60, would be at the discretion of the state veterinarian. Those bison that could not be hazed back into the park would be shot. In addition, a handful of bison (usually single bulls) use the Lee Metcalf/Cabin Creek area on the west, or Hellroaring and Slough drainages to the north and east of Eagle Creek/Bear Creek. Those few bison that move beyond the borders of either of these large tracts of forest land would be hazed or shot.

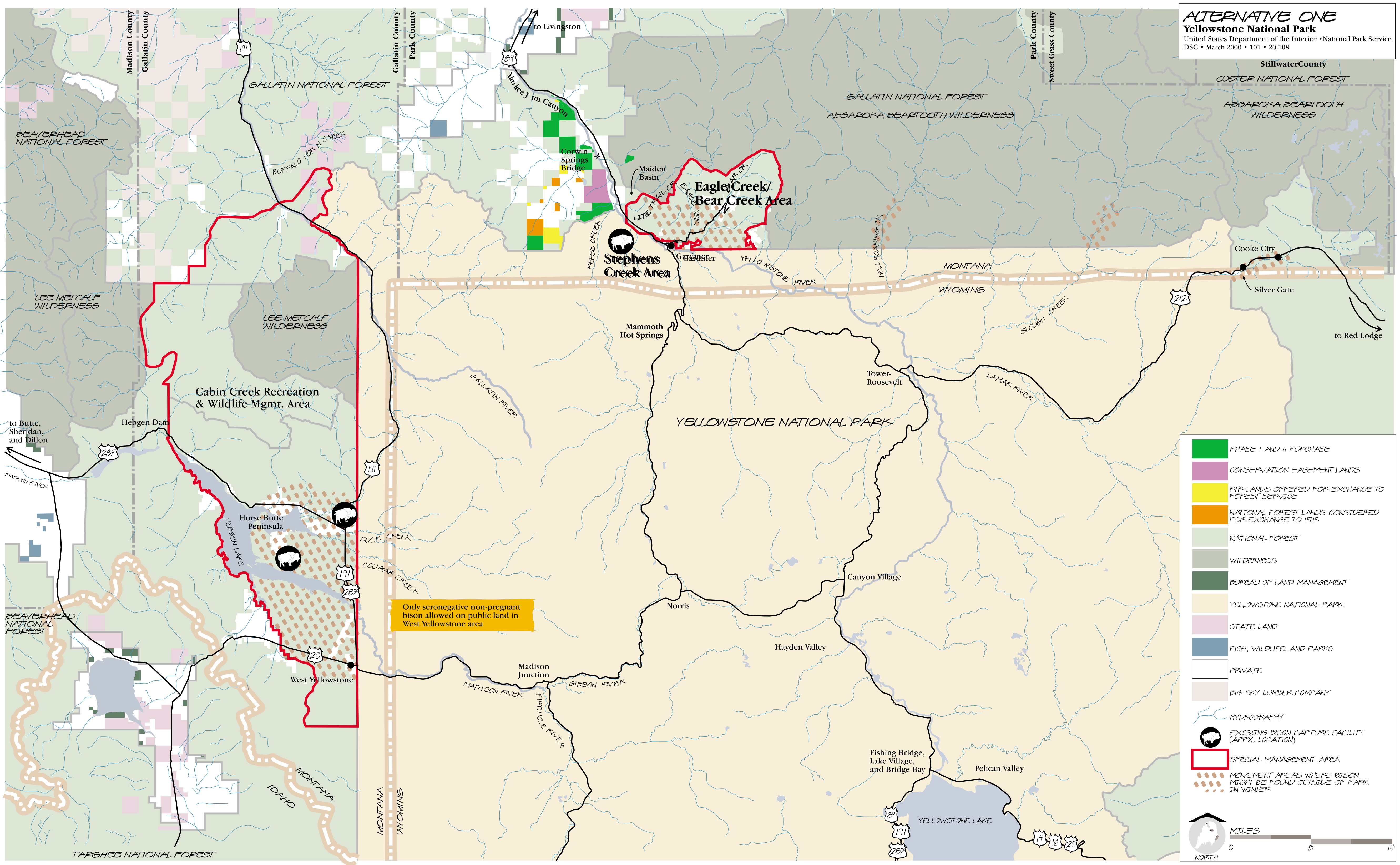
NORTHERN BOUNDARY

Reese Creek

Private property (the Royal Teton Ranch) abuts the Yellowstone National Park boundary at Reese Creek. Through a lease with property owners, approximately 250 cow-calf pairs graze in the Gardiner Valley during the winter from the Corwin Springs bridge for about 8–9 miles to the north end of the property just south of Yankee Jim Canyon (see alternative 1 map). A capture facility inside the park at Stephens Creek is within 2 miles of Reese Creek, and operates from November 1 to April 30. If bison approach the northern boundary at Reese Creek, agency personnel would first attempt to haze bison back into the park to reduce the need for lethal removal. For those bison that could not be hazed, wing fences and agency personnel would guide bison toward the capture facility inside the park for capture and testing. NPS personnel would shoot bison that could not be hazed or captured at the park boundary.

Stephens Creek Capture Facility

The Stephens Creek capture facility (see alternative 1 map) occupies 13 acres, and includes five pens to separate bison, two holding pastures (one large and one small), and chutes to help direct bison. It is adjacent to a park horse corral, receives water and electricity, and is easily accessible by dirt road. All captured bison are divided into groups for safety reasons and blood tested for exposure to brucellosis. Bison testing positive would be held for a few hours (or occasionally for one or two nights) and shipped to slaughter. All seronegative bison (up to a capacity of approximately 125 animals) would be temporarily held in pens at the capture facility until late winter or early spring (i.e., mid to late April) and then released to move back into the park on their own. A few might be used for research purposes.


ALTERNATIVE ONE
Yellowstone National Park
United States Department of the Interior • National Park Service
DSC • March 2000 • 101 • 20,108
Eagle Creek/ Bear Creek Area
Stephens Creek Area
Cabin Creek Recreation & Wildlife Mgmt. Area
Only seronegative non-pregnant bison allowed on public land in West Yellowstone area
YELLOWSTONE NATIONAL PARK
GALLATIN NATIONAL FOREST
ABSAROKA BEARTOOTH WILDERNESS
CUSTER NATIONAL FOREST
BEAVERHEAD NATIONAL FOREST
LEE METCALF WILDERNESS
TARGHEE NATIONAL FOREST
Madison County
Gallatin County
Park County
Sweet Grass County
Stillwater County
to Livingston
Yankee Jim Canyon
Corwin Springs Bridge
Maiden Basin
Gardiner
Mammoth Hot Springs
Tower-Roosevelt
Cooke City
Silver Gate
to Red Lodge
Hebgen Dam
to Butte, Sheridan, and Dillon
Horse Butte Peninsula
West Yellowstone
Madison Junction
Norris
Canyon Village
Hayden Valley
Fishing Bridge, Lake Village, and Bridge Bay
Pelican Valley
YELLOWSTONE LAKE
HEBGEN LAKE
MONTANA
WYOMING
IDAHO
PHASE I AND II PURCHASE
CONSERVATION EASEMENT LANDS
RTR LANDS OFFERED FOR EXCHANGE TO FOREST SERVICE
NATIONAL FOREST LANDS CONSIDERED FOR EXCHANGE TO RTR
NATIONAL FOREST
WILDERNESS
BUREAU OF LAND MANAGEMENT
YELLOWSTONE NATIONAL PARK
STATE LAND
FISH, WILDLIFE, AND PARKS
PRIVATE
BIG SKY LUMBER COMPANY
HYDROGRAPHY
EXISTING BISON CAPTURE FACILITY (APPX. LOCATION)
SPECIAL MANAGEMENT AREA
MOVEMENT AREAS WHERE BISON MIGHT BE FOUND OUTSIDE OF PARK IN WINTER
MILES
0
5
10
NORTH

Eagle Creek/Bear Creek

About 23,000 acres of bison winter habitat are located on the Gallatin National Forest in the Eagle Creek/Bear Creek area bordering Yellowstone National Park to the north and east of Gardiner. Bison are able to occupy portions of these lands during the winter (and summer, although most migrate back into the park in May and June). In this alternative, agency personnel would maintain a boundary at the Little Trail Creek/Maiden Basin divide by hazing or shooting bison that crossed it. In average winters, no bison approach this boundary.

WESTERN BOUNDARY

Bison migrate out of Yellowstone National Park along the Madison River corridor, traveling along groomed roads or bison trails inside the park and feeding at riverbanks and pools warmed by thermal features. Most leave by way of Duck and Cougar Creeks to the north of Madison River and travel west to the national forest in the 24,000-acre Horse Butte area. Some of these lands are forested, but the bison prefer open areas where they can find forage under the snow.

Whenever feasible, the agencies would attempt to haze bison that move out of the park along these routes back into the park.

The public land outside the park on the west side is intermixed with private holdings, and bison might be shot at any time on private land under the conditions described in the "Actions Common to All Alternatives." No cattle are grazed in this area in the winter, and bison are hazed back into park boundaries in May, well before cattle appear in the summer. Under the provisions of this alternative, bison would be hazed back into the park in the spring 30 to 60 days before cattle occupy land in the area west of the park. The exact number of days, between 30 and 60, would be at the discretion of the state veterinarian. Those bison that could not be hazed back into the park would be shot. The scheduled on-date for cattle on Horse Butte is June 15, and for other allotments in the West Yellowstone area is July 15. Cattle can occupy private land at any time; however, they normally are present from about June 1 to November 15.

Two capture facilities smaller than the one at Stephens Creek are also operated by the Department of Livestock from November 1 to April 30 outside the western park boundaries. One is located on private land in the Duck Creek area, about 100 yards from the park boundary. The second is located on Forest Service land in the Horse Butte Area. The Duck Creek facility occupies about 1 acre, and the Horse Butte facility occupies 2 acres. Both rely primarily on "opportunistic" methods of capturing bison (e.g., baiting with hay).

FEIS NOTE: On December 14, 1998 the Gallatin National Forest indicated in an environmental assessment its intent to issue a special use permit to the Montana Department of Livestock. This special use permit allows the establishment and operation of a temporary bison capture and testing facility in the Horse Butte area, which is near West Yellowstone, Montana. The special use permit authorizes the Montana Department of Livestock to construct and operate a bison capture and testing facility approximately two acres in size from November though April. Construction and operation of the facility were done in accordance with the *Interim Bison Management Plan* and "Interim Bison Management Operating Procedures." In January 1999 a "Finding of No Significant Impact" was published and the special use permit for the construction and operation of the facility through December 31, 2008 was subsequently issued in April 1999.

Both facilities have three pens for sorting, as well as a capture pen and hydraulic chutes. Captured bison are blood tested for exposure to *B. abortus*, and all seropositive bison are shipped to slaughter. Seronegative-nonpregnant females and all seronegative males are identified with a metal ear tag and a temporary visual marker, and are shipped to and released on public lands in the West Yellowstone area. Seronegative-pregnant bison are shipped to slaughter. In the event some bison are not captured and tested, certain bison may be allowed on public lands in the West Yellowstone area during winter. During the period November 1 through April 30, the Montana state veterinarian would determine which untested bison represent the greatest potential for brucellosis transmission to domestic livestock. All untested adult female bison and other untested bison that the Montana state veterinarian determines to pose unacceptable risk would be removed as soon as feasible. All untested bison in the proximity of cattle would be removed. At the discretion of the Montana state veterinarian, untested calves and bulls may be tolerated on public lands during the November 1 through April 30 period.

APHIS has provided that certain untested bison, including bulls, yearlings, calves, and postparturient cows that have completely passed placenta, do not have to be shot in the field and can be allowed on certain public lands in the West Yellowstone area during the winter. APHIS has determined that allowing these untested bison to winter on public lands specified in the interim plan in the west boundary area would not jeopardize the brucellosis class-free status of Montana. The state of Montana maintains jurisdiction and discretion for management of bison within Montana and the Montana state veterinarian would determine which untested bison could be allowed to winter on public lands in the west boundary area. Currently, the Montana state veterinarian does not agree with the APHIS definition of low risk bison (see appendix B for more information).

Those evading capture on private lands are shot at the request of or with permission of the landowner. Capture facilities could be relocated to take advantage of changing bison migration routes under this alternative using criteria outlined in the "Actions Common to All Alternatives."

Bison are able to occupy the Cabin Creek Recreation and Wildlife Management Area and Monument Mountain Unit of the Lee Metcalf Wilderness on the west side of Yellowstone National Park without agency management, as these are public lands without livestock allotments. These large tracts are north of the Horse Butte lands (north of Grayling Creek/Fir Ridge), and topography and snow depth usually limit the number of bison that actually use them. Steep, rugged territory prevents bison from exiting these lands to the west except by way of a narrow corridor around Hebgen Lake Dam. Private lands lie to the south and north. Agencies remove bison by hazing or shooting if they attempt to leave this designated management area by any of these three routes.

SPECIAL MANAGEMENT AREAS

Special management areas have not been officially designated in the operation of the interim plan. However, for the purposes of this environmental impact statement, the lands in the Eagle Creek/Bear Creek area up to the Little Trail Creek/Maiden Basin hydrographic divide, Hellroaring and Slough Creek drainages, the portion of West Yellowstone shown on the alternative 1 map, and the Lee Metcalf/Cabin Creek area would function as SMAs — i.e., bison could enter them without endangering Montana's federal brucellosis class-free status (see "Actions Common to All Alternatives: Special Management Areas"). For this reason, these areas are referred to as SMAs through the remainder of the description of this alternative.

Bison are and would continue to be allowed in the Eagle Creek/Bear Creek SMA year-round up to the boundary at Little Trail Creek/Maiden Basin hydrographic divide, although all but a few bulls return to higher elevation inside Yellowstone National Park in the spring. They are also allowed year-round access to and from Hellroaring and Slough Creek drainages, and the Cabin Creek/Lee Metcalf area.

Cattle would be grazed on public lands, primarily on the Horse Butte allotment in the West Yellowstone area in the summer months. Grazing on

Horse Butte would take place from June 15 to September 15. For all other public allotments in the western SMA, the earliest cattle on-date would be June 15, and the latest cattle off-date would be October 15. Grazing on private lands could begin as early as May 1, but usually begins about June 1. Bison would be hazed back into the park in the spring, 30 to 60 days before cattle occupy the area. The exact number of days, between 30 and 60, would be at the discretion of the state veterinarian. Those bison that could not be hazed back into the park would be shot. Seronegative-nonpregnant bison are allowed back into the West Yellowstone area following the departure of livestock (November 1).

RISK MANAGEMENT

The primary means to minimize risk of transmission from cattle and bison in this alternative would be the enforcement of controlled entry at the northern borders described above, and temporal separation at the western border on public lands. At Reese Creek, this would include monitoring, hazing, capture and slaughter, and agency shooting. At Eagle Creek/Bear Creek, monitoring, hazing, and agency shooting would be used to prevent entry via Little Trail Creek/Maiden Basin hydrographic divide into the Gardiner area. On the west end, hazing bison back into the park before summer would prevent them from mingling with cattle. Bison that cannot be hazed or that evaded capture on private lands would be shot at the request of, or with the permission of, the landowner.

Topography, availability of habitat, hazing, and agency shooting would also keep bison from moving beyond SMA boundaries.

In addition to maintaining separation of cattle and bison, other measures would be aimed at reducing the risk of transmission. For example, seronegative-pregnant bison in the western SMA would be slaughtered. This is because bison could test seronegative and be carrying the disease organism. This usually occurs when they have recently become exposed and are in the incubation stage of the disease. In particular, female bison infected *in utero* might show no signs of the disease until the third trimester of their first pregnancy, when hormones trigger the release of the bacteria into the uterus and other reproductive tissues and fluids. Bison fetuses and birth tissues aborted on cattle-use areas in winter and remaining until spring might pose a risk of transmission to cattle that return to the area in summer.

In the event some bison were not captured and tested, risk would be managed by ensuring bison that only pose an acceptable risk by the Montana state veterinarian could remain on public lands in the West Yellowstone area during winter. These might include untested calves and bulls or additional classes of bison that APHIS has indicated do not impose a significant risk, including yearlings and postparturient cows that have completely passed placenta. All untested adult female bison and other untested bison that the Montana state veterinarian determines to pose an unacceptable risk would be removed as soon as feasible. All untested bison in the proximity of cattle would be removed.

Cattle operators in the western SMA or adjacent areas on private lands would be strongly encouraged to vaccinate female calves against brucellosis (see "Actions Common to All Alternatives: Vaccination") with RB51 or other approved vaccine. Cattle herds in these "contact" areas would continue to be surveillance tested, and any herd whose members might have been in contact with bison would be checked for exposure and revaccinated as adults. Livestock owners on private property would continue to be responsible for all costs and materials associated with vaccination.

When a safe and effective vaccine was developed for bison, it would be administered in capture facilities to bison testing negative. It might also be delivered through remote means to bison inside Yellowstone National Park.

POPULATION MANAGEMENT

No actions specifically to control population numbers on either end of the range are built into this alternative. However, it is anticipated that more bison would attempt to migrate outside the park in response to winter severity when numbers were high, and would be captured, slaughtered, or shot. Therefore, this alternative relies on natural forces inside the park and lethal boundary enforcement to keep population numbers from increasing beyond the upper end of the 1,700–3,500 range.

Allowing bison to use the Eagle Creek/Bear Creek area during the winter would sustain between 100 and 200 animals, with good to excellent range condition objectives (*Gallatin National Forest Plan*, p. G-14). The present plan includes a provision that agencies would develop contingencies for ensuring the integrity of the bison herd should numbers drop. However, the interim plan provides no direction for specific contingency measures.

ESTIMATE OF COST

Table 3 indicates the costs that would be incurred by the interagency team for alternative 1.

Table 3: Annual Cost/Income Estimates — Alternative 1

	National Park Service	U.S. Forest Service	State of Montana	APHIS
Capture facilities[1]	$120,000	-	$175,000	$50,000
Test/sample bison	-	-	-	$27,500
Operations (hazing, shooting, monitoring, supplies, equipment)	$198,000	$16,500	$165,000 (1996)[2]– 297,000 (1997)[2]	$110,000
Vaccinate bison	$330,500	-	-	$8,800
Average income from the sale of meat, hides, and heads	-	-	+$38,500 to $203,500	-
Totals	($648,500)	($16,500)	($136,500–$433,500)	($196,300)

1. One time only (costs for existing facilities at Stephens Creek and western SMA have already been incurred).
2. Represents total operations costs spent by Montana in 1996 and 1997, inflated by 10% to reflect possible costs in 2000.

ALTERNATIVE 2: MINIMAL MANAGEMENT

The purpose of this alternative is to restore as near-natural conditions as possible for bison, including a small portion of their historic nomadic migration patterns. The area outside Yellowstone National Park over which bison would be able to range (e.g., the special management areas) without agency management is the largest of all alternatives (see alternative 2 map).

Some features of alternative 2, notably the acquisition, through purchase or easement or changes in cattle operations from willing sellers, of additional winter range for bison, and the vaccination of bison, involve unknowns and/or additional environmental compliance and review. A vaccine the agencies agree is both safe and effective for bison and safe for nontarget species does not currently exist, and the administration of a vaccine requires agreement from the agencies as well as possible environmental compliance, public input, and review. Creation of SMAs to allow bison outside the park would require the approval of the state of Montana as specified by Montana law. This is also true for alternatives 3, 4, 6, 7, and the modified preferred alternative.

The purpose of this alternative is to restore as near-natural conditions as possible for bison, including a small portion of their historic nomadic migration patterns.

This alternative focuses on changes in cattle operations for ranchers in the SMAs as the primary means to minimize the risk of disease transmission. This could only take effect if ranchers were willing to sell land or easements, or receive compensation for changes in their existing cattle operations. Determining which lands were appropriate for such changes, which owners were willing to sell, and negotiating compensation would take time.

Since completion of the *Draft Environmental Impact Statement*, the U.S. Departments of the Interior and Agriculture and the Rocky Mountain Elk Foundation teamed in February and again in August 1999 to purchase some lands and conservation easements north of the Reese Creek boundary of the park. The purchased lands are under the jurisdiction of the Gallatin National Forest. U.S. Forest Service lands are multiple use lands including use by wildlife. The Gallatin National Forest also administers and monitors the terms and provisions of the conservation easement. However, as noted above, Montana approval may be required to establish SMAs to allow bison onto these lands.

It is impossible to know for sure whether or which land would be acquired, when a safe and effective vaccine for bison would be available, or whether an SMA would be approved on land outside the park designated as appropriate for winter range. However, for purposes of analysis, this environmental impact statement assumes certain dates when these events would occur. If these dates were not met, the consequences of this alternative might be slightly different than that disclosed in the "Environmental Consequences" part of this document.

This environmental impact statement assumes a safe and effective vaccine for bison would be available and administered parkwide beginning in the year 2000 (or two years from the date the record of decision is signed). It also assumes any state approvals required to create SMAs would be immediately forthcoming.

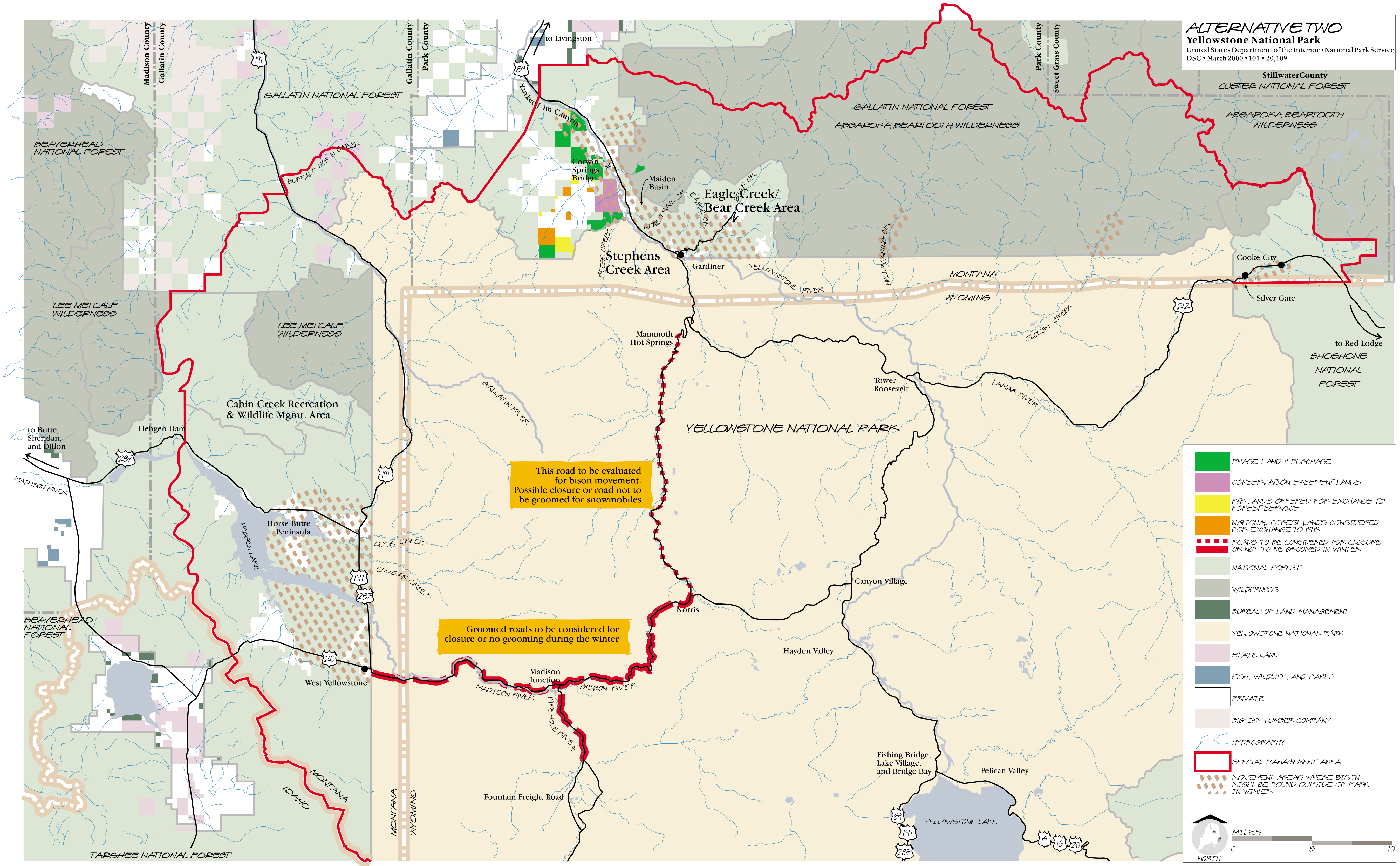
FEIS Note: Recent research indicates a safe and effective vaccine for bison calves, as well as means for remote delivery, would be available by winter 2003/2004.

Because of the complexities inherent in the acquisition of property or easements, or compensation for changes in cattle operations, this environmental impact statement assumes such changes would not be completed until 2003 (or five years from the date the records of decision are signed). For purposes of analysis only, the provisions of the interim plan are assumed to continue until acquisition is completed. This period (when the interim plan is in effect) is referred to as phase 1 of this alternative.

Despite these assumptions for analysis purposes, it is likely that, should some lands be acquired, bison would be allowed on them while others were the subject of continuing negotiations. This would be true of other factors as well. For instance, a safe and effective vaccine would be applied when it was available and compliance was completed, regardless of whether this was earlier or later than the year 2000.

When appropriate acquisition was completed or cattle operation changes were made (referred to as phase 2 of this alternative), lethal control would only be used where human health was in immediate danger, on private property at the request of the landowner, or outside the SMA border. Bison would not be captured or slaughtered by agencies, and all existing capture facilities would be dismantled. A key tool available to help control bison distribution and population size during phase 2 would be the closure of groomed roads the animals now use to traverse and exit the park.

In addition to leaving road segments ungroomed, the agencies would be able to haze bison in some cases, and would maintain boundary lines through hazing and shooting in phases 1 and 2.



ALTERNATIVE TWO
Yellowstone National Park
United States Department of the Interior • National Park Service
DSC • March 2000 • 101 • 20,109
PHASE I AND II PURCHASE
CONSERVATION EASEMENT LANDS
RTK LANDS OFFERED FOR EXCHANGE TO FOREST SERVICE
NATIONAL FOREST LANDS CONSIDERED FOR EXCHANGE TO RTK
ROADS TO BE CONSIDERED FOR CLOSURE OR NOT TO BE GROOMED IN WINTER
NATIONAL FOREST
WILDERNESS
BUREAU OF LAND MANAGEMENT
YELLOWSTONE NATIONAL PARK
STATE LAND
FISH, WILDLIFE, AND PARKS
PRIVATE
BIG SKY LUMBER COMPANY
HYDROGRAPHY
SPECIAL MANAGEMENT AREA
MOVEMENT AREAS WHERE BISON MIGHT BE FOUND OUTSIDE OF PARK IN WINTER
MILES
0
5
10
NORTH
This road to be evaluated for bison movement. Possible closure or road not to be groomed for snowmobiles
Groomed roads to be considered for closure or no grooming during the winter
Madison County
Gallatin County
Gallatin County
Park County
Park County
Sweet Grass County
Stillwater County
to Livingston
GALLATIN NATIONAL FOREST
BEAVERHEAD NATIONAL FOREST
LEE METCALF WILDERNESS
LEE METCALF WILDERNESS
Cabin Creek Recreation & Wildlife Mgmt. Area
Hebgen Dam
to Butte, Sheridan, and Dillon
MADISON RIVER
Horse Butte Peninsula
HEBGEN LAKE
DUCK CREEK
COUGAR CREEK
BEAVERHEAD NATIONAL FOREST
West Yellowstone
MONTANA
IDAHO
TARGHEE NATIONAL FOREST
MONTANA
WYOMING
Corwin Springs Bridge
Maiden Basin
Eagle Creek/ Bear Creek Area
Stephens Creek Area
Gardiner
YELLOWSTONE RIVER
GALLATIN NATIONAL FOREST
ABSAROKA BEARTOOTH WILDERNESS
CUSTER NATIONAL FOREST
ABSAROKA BEARTOOTH WILDERNESS
MONTANA
WYOMING
Cooke City
Silver Gate
to Red Lodge
SHOSHONE NATIONAL FOREST
Mammoth Hot Springs
GALLATIN RIVER
YELLOWSTONE NATIONAL PARK
Tower-Roosevelt
LAMAR RIVER
SLOUGH CREEK
Norris
Canyon Village
Hayden Valley
Madison Junction
MADISON RIVER
GIBBON RIVER
FIREHOLE RIVER
Fountain Freight Road
Fishing Bridge, Lake Village, and Bridge Bay
Pelican Valley
YELLOWSTONE LAKE

NORTHERN BOUNDARY

Reese Creek

While the interim plan is in effect, bison attempting to leave the park via the Reese Creek boundary would be captured and shipped to slaughter or shot on private land as they are now.

When appropriate acquisitions to the north of the park's Reese Creek boundary were completed, the National Park Service would dismantle its capture facility at Stephens Creek and would not maintain any boundary control at the northern border of Yellowstone National Park.

Bison movement would be monitored from November 1 to April 30, but bison would not be hazed. Within the park, selected roads would be closed or not groomed for snowmobile travel during winter.

The Department of Livestock, with help from other agencies, would maintain a boundary at Yankee Jim Canyon (see alternative 2 map), about 12 miles north of the current park border at Reese Creek. Yankee Jim Canyon is a narrow part of the Yellowstone Valley located on national forest land, and agencies would enforce the boundary through hazing and shooting. The majority of land in the valley bottom north of Yankee Jim Canyon is privately owned.

Eagle Creek/Bear Creek

Under the interim plan, bison attempting to cross the Little Trail Creek/Maiden Basin hydrographic divide and travel onto private property in the Gardiner Valley are shot by agencies. This would continue until appropriate acquisitions or changes in cattle operations were made. When they were made, bison would not only be allowed to freely roam in the Eagle Creek/Bear Creek area, but also the Little Trail Creek/Maiden Basin hydrographic divide. Agencies would not maintain any boundary at this entry into the Gardiner area.

WESTERN BOUNDARY

While the interim plan was in effect, bison would be captured and tested in capture facilities in the western SMA. Seronegative-nonpregnant bison would be released onto public lands outside the park for the winter, and hazed back into the park in May to avoid conflicts between bison and cattle that would be entering national forest grazing allotments for the summer.

Agencies would maintain a northernmost boundary in the western SMA in the Cabin Creek Recreation and Wildlife Management Area. When allotments have been changed and/or private cattle operations modified, this boundary would be moved north to Buffalo Horn Creek (see alternative 2 map) on the northwest side of the park. This would add some federal lands north of the Lee Metcalf Wilderness to the western SMA, and establish a boundary to keep bison from occupying private lands to the northeast. Bison movements would be monitored both as they moved toward the park boundary on the west side in the winter and in the SMA. Bison crossing the boundary at Buffalo Horn Creek would be hazed back into the management area or shot. Those leaving to the west along Hebgen Lake Dam would also be hazed or shot. Capture facilities in the western SMA would be dismantled, as this alternative would not include any capture or slaughter by agencies in phase 2.

SPECIAL MANAGEMENT AREAS

During phase 1, while the interim plan was in effect, bison would be allowed to range outside the park in areas described in alternative 1, including the Eagle Creek/Bear Creek area; the

Absaroka-Beartooth Wilderness north of the park, including the Hellroaring and Slough Creek drainages;, and the West Yellowstone area, Cabin Creek Recreation and Wildlife Management Area, and Monument Mountain Unit of the Lee Metcalf Wilderness west of the park. Agencies would maintain boundaries at Reese Creek and the Little Trail Creek/Maiden Basin hydrographic divide, and would capture or shoot bison crossing these boundaries and on private property. Carcasses would be retrieved by the Department of Livestock and distributed as described in the "Actions Common to All Alternatives."

The agencies would attempt to acquire winter range and expand the SMAs to include what are now private lands between Reese Creek and Yankee Jim Canyon on both sides of the Yellowstone River. They might also offer incentives to change livestock operations, acquire winter range from willing sellers, or modify grazing allotments in the western SMA.

FEIS NOTE: See the introduction to this alternative for updated information on attempts to acquire winter range in this area.

Following acquisition through purchase or easement, or appropriate changes in cattle operations, capture facilities would be dismantled and bison allowed to range freely. The northern boundary would move north to Yankee Jim Canyon, and the north edge of the western SMA would shift north to Buffalo Horn Creek.

In the western SMA, bison would no longer be hazed back from the West Yellowstone area into the park in May. Most of these bison return to the park on their own in late spring, and agencies would expect only a few, if any, to stay behind.

If needed, agencies would haze remaining bison from private to public land in the SMA.

RISK MANAGEMENT

The primary means to minimize risk in this alternative would be those used to maintain the separation of cattle and bison. These include the provisions of the interim plan described in alternative 1 for phase 1, and changes in livestock operations and the return to ungroomed conditions of certain key sections of park roads in phase 2 of this alternative.

On private land in the SMAs, which now is used for cattle grazing or other livestock operations, agencies might offer incentives to change operations so susceptible cattle were removed. Nonbreeding cattle, such as steers or spayed heifers, would not transmit the disease if they were infected through contact with bison. Brucellosis is spread primarily through ingestion of reproductive fluids and birth materials from infected cows. Therefore, convincing operators to change management practices to raising nonsusceptible livestock such as steers would eliminate the risk of spreading the disease. Also, procurement of access to winter range by acquiring grazing rights, easements, or outright purchase of property from willing sellers could be used to remove cattle altogether on private property in the designated SMAs. Until these measures were in place, agencies would maintain boundaries as described above (see "Actions Common to All Alternatives: Special Management Areas") and capture and test on the west side. Seronegative nonpregnant bison would be released, and seropositive or pregnant bison would be shipped to slaughter, as they are now.

The agencies would seek agreements with grazing permittees to modify grazing allotments on the national forest where bison might roam. Potential modifications include working with permittees to change class of livestock or operations so that there would be no conflict between cattle and bison, close allotments and move cattle to areas where bison are never present, or other modifications to minimize exposure of susceptible cattle to bison.

The National Park Service would modify its winter road management plan to eliminate winter grooming and snowmobile use of some roads in Yellowstone National Park. Bison have "discovered" these pathways, and routinely use them in the interior of the park to avoid traversing areas of deep snow. It is hypothesized that the energetic cost of traveling these roads is low, and that bison using them are more likely to survive the winter than those who do not use them. In other words, they are made to pay what some believe is "the true cost" of travel. Some bison also could be accessing areas of the park near its borders because of groomed trails and plowed roads. The monitoring of bison movements in the Hayden Valley and Mammoth to Gibbon Falls sections of the park since the *Draft Environmental Impact Statement* was released has indicated that fewer than 12% of bison movements occurred on the groomed road surface (Kurz 1998, 1999b). However, closing groomed roads could affect population size and distribution by shifting patterns to those used before grooming. It is also possible, however, that closing groomed roads would not affect distribution, since bison appear to retain and pass along knowledge through generations, including pathways to better forage. Research on this relationship is continuing.

Bison herd along road in Yellowstone National Park in the winter.

Alternative 2 is the only alternative to propose routine changes in some segments of park roads to control distribution, although other alternatives include research on the use of roads and potential barriers to bison travel (alternative 3), and/or plowing to access capture facilities (alternatives 5 and 6). Some changes in road grooming might occur in phase 1 of this alternative as well to help control distribution (see discussion on bison distribution in "Purpose of and Need for Action: Background").

Roads left ungroomed could include sections from Madison to West Yellowstone, Madison to Norris, and Madison to the Fountain Freight Road (see alternative 2 map), which would isolate herds inside the park from boundary areas, and increase natural winter kill. The agencies would conduct research to determine the effectiveness of those closures in preventing bison from leaving the park during winter, and to evaluate the contribution of other groomed roads to bison movements out of the park. Based on those investigations, additional changes and NEPA compliance to further inhibit bison from leaving the park or to maintain bison population size are possible.

In addition to measures to ensure separation of cattle and bison, state animal health authorities would encourage livestock owners throughout the area whose cattle might come in contact with bison to vaccinate female calves (4–12 months old) against brucellosis with RB51 or other approved vaccine. Operators in boundary areas would be encouraged to annually vaccinate all subadult cattle as well as calves. Cattle herds in contact areas would continue to be surveillance tested periodically, and any herd whose member or members was in contact with bison would be checked for exposure to *B. abortus*. Livestock owners on private property would continue to be responsible for all costs and materials associated with calfhood vaccination.

When a safe and effective vaccine was developed for bison, it would be administered to bison inside Yellowstone National Park through remote means. Depending on the vaccine, calves, yearlings, or possibly adults might be vaccinated as long as the vaccine was safe and effective.

POPULATION MANAGEMENT

No actions specifically to control or maintain population numbers, other than changes in road grooming described above, would be anticipated. It is expected that these changes would ultimately force more bison to experience the full brunt of natural processes, such as harsh winters and ongoing predation and competition, and would maintain the population within the natural range of 1,700 and 3,500 animals. However, it is unknown whether, or the degree to which, changes in road grooming would affect bison distribution. Allowing bison to occupy additional range beyond the park boundaries in the northern and western SMAs would help keep population numbers from falling below 1,700.

ESTIMATE OF COST

Table 4 indicates the costs that would be incurred by the interagency team for alternative 2.

Table 4: Annual Cost/Income Estimates — Alternative 2

	National Park Service	U.S. Forest Service	State of Montana	APHIS	Shared Costs
Test/sample bison	-	-	-	$24,200	-
Monitoring	$27,500	$16,500	-	-	-
Operations	$62,700	-	$165,000	-	-
Acquisition[1]	-	$71,500[2]	-	-	$44.1 million
Easement[1]	-	-	-	-	Unknown[3]
Conversion of livestock operations	-	-	-	-	Unknown[3]
Vaccinate bison	$330,500	-	-	$8,800	-
Increased snowmobile enforcement	-	$55,000	-	-	-
Wildlife/winter use monitoring	-	$27,500	-	-	-
Allotment modification1	-	$16,500	-	-	-
TOTALS	($420,700)	($187,000)	($165,000)	($33,000)	(Up to 44.1 million)

1. One time only.
2. Administrative costs (one time only).
3. Easement and conversion would substitute for acquisition, and costs would be less than 44.1million.

ALTERNATIVE 3: MANAGEMENT WITH EMPHASIS ON PUBLIC HUNTING

Alternative 3 relies on the hunting of bison to regulate population numbers and distribution of bison outside the park and on the separation of bison in time and space to preclude contact with cattle. Where hunting was infeasible or inappropriate, capture and shipment of seropositive bison to slaughter and seronegative bison to quarantine would used to maintain separation and manage the risk of disease transmission. As in other alternatives, bison would be vaccinated when a safe and effective vaccine was developed to further reduce this risk. This alternative has two phases. Phase 2 is a long-term strategy to manage bison through hunting, quarantine, and use of acquired land or easements for additional winter range and bison management options. Because many of these require additional permits, environmental review, or changes not within the complete control of the agencies, alternative 3 also envisions continuing appropriate features of the interim plan (alternative 1) until these features were in place. This is referred to as phase 1.

Alternative 3 relies on the hunting of bison to regulate population numbers and distribution of bison outside the park and on the separation of bison in time and space to preclude contact with cattle.

Alternative 3 includes the use of capture, test and slaughter, creation of SMAs, quarantine of some seronegative bison, hunting, vaccination of bison, acquisition of additional winter range, and creation of an SMA on that range as bison management tools. Vaccination of bison requires a safe and effective vaccine, which does not currently exist. Construction and operation of a quarantine facility would require environmental review and compliance, as well as a funding source and management entity. The acquisition of winter range, whether through purchase or easement or changes in cattle operations, is a time-consuming and uncertain process. In alternative 3 (as well as in alternatives 4 and 7), bison hunting is assumed; yet, this would require approval by the Montana Legislature, which does not convene until 2001. Further, some bison management tools, such as the construction of a quarantine facility, would also likely require additional time for environmental review and compliance.

For purposes of analysis, each of these management tools or regulatory changes was assumed to occur by a certain date. If they occurred earlier or later, the impacts of alternative 3 could be slightly different than reported. Also, the mix of management tools could be slightly different than described herein, as agencies would use whichever tools are approved and available. The necessary changes in regulations to allow bison outside the park were assumed to be made immediately upon the agency decision to select an alternative (documented in both a state and a federal record of decision). Hunting was assumed to be approved by the legislature and to begin in 2000. The quarantine facility was assumed to be built and operating by 1999. A safe and effective vaccine was assumed to be available in the year 2000. Because less land was targeted for acquisition in alternative 3 than alternative 2, acquisition was assumed to be completed by 1999. Phase 1 in this alternative refers to the time prior to 1999.

FEIS NOTE: (Refer to last five sentences in paragraph above.) Although each of these dates has changed in "real time," results of deterministic modelling of the effects of management actions for this and other alternatives remain useful in comparing alternatives. In addition, while actual numbers of bison or seroprevalence in any given year would not equal those reported in "Environmental Consequences: Impacts on Bison Population," the relative increase or decrease from year to year would be correct. For instance, the impact of hunting in 2002 in alternative 3 might not result in 21 bison remaining on public land outside the park in the West Yellowstone area as reported in table 45. However, the impact of hunting two years after it begins would be similar to that reported in table 45 for 2002. In addition, an updated stochastic model was created to address unpredictable events with bison management actions and to assess their effect on the bison population. This newer model assumed more accurate "real time" dates for management actions to begin, including 2002 for hunting. Each of the dates in the paragraph above should be moved back two years for accurate assumptions about when each management action would occur, with the exception of land acquisition. Land acquisition is nearly complete and bison would not be allowed to use the land until an existing cattle lease expires (presumed to end in 2002). Between years and over the life of the plan, relative results would still apply, regardless of the actual year when the management actions took place.

Until land acquisition occurred (phase 2), the separation of cattle and bison on the northern (Reese Creek) boundary would be maintained through capture at Stephens Creek and the shipment of seronegatives to quarantine (or slaughter if the facility was not yet built) and seropositives to slaughter. The National Park Service now holds up to 125 seronegative bison at the Stephens Creek facility over the winter for release into the park in the spring. All seropositive bison and seronegative bison above the 125 limit are sent to slaughter under the provisions of the *Interim Bison Management Plan* (see alternative 1 for an updated description of the *Interim Bison Management Plan*). A quarantine facility would give the National Park Service flexibility in the disposition of seronegative bison it does not now have.

Bison that completed the full quarantine procedure would be shipped live to requesting tribes or organizations, or used to repopulate herds on public lands.

The location, design, and operation of the facility has not been determined, and would require subsequent MEPA/NEPA analysis, including public input, before any decision was made. Until the time a quarantine facility was constructed, bison captured at Stephens Creek would be sent to slaughter.

The Department of Livestock, with help from the agencies, would maintain a boundary at Little Trail Creek/Maiden Basin hydrologic divide similar to alternative 1. Bison on private land moving north of this boundary would be removed by agency personnel with the permission of the landowner.

No capture would occur in the West Yellowstone area in either phase 1 or phase 2, but bison would be hazed back into the park in the spring, 30 to 60 days before cattle occupy the area. The exact number of days, between 30 and 60, would be at the discretion of the state veterinarian. Those bison that could not be hazed back into the park would be shot. As in alternatives 1 and 4, agencies would also maintain a boundary at the northern end of the Cabin Creek Recreation Area/Monument Mountain Unit of the Lee Metcalf Wilderness. Hunting would be used in both the Eagle Creek/Bear Creek and western SMAs to help control population numbers and distribution. Research on the degree to which the winter grooming of park roads contributes to migration out of the park may continue, and changes in road grooming practices made in phase 2 if research showed they were warranted. These changes would be implemented through amendments to the park's winter use plan and appropriate NEPA documentation.

Alternative 3 calls for acquisition of bison winter range through purchase of grazing rights, easements, or property from willing sellers, modifications in cattle allotments, and/or changes in livestock operations to remove susceptible cattle in phase 2. This newly acquired winter range would be designated an SMA (referred to as the Reese Creek SMA throughout the remainder of the description of alternative 3), and would include lands on the west side of the Yellowstone River between Reese Creek and Yankee Jim Canyon. If appropriate, the park's capture facility at Stephens Creek would be dismantled and relocated between the park boundary and Yankee Jim Canyon at a suitable site. The Department of Livestock, with help from the agencies, would maintain a boundary at Yankee Jim Canyon, and hunting in the Reese Creek SMA would be used to control population size and distribution of the bison herd.

FEIS NOTE: (Refer to first sentence in paragraph above.) Some of the property that was designated for acquisition in alternative 3 has been acquired by purchase of land, other lands are covered by conservation easements. Not all lands that would regularly be used by bison have been acquired. Conservation easements do not necessarily provide for the presence of bison in the winter and not all lands are addressed by either purchase or conservation easement that would allow bison presence. Gallatin National Forest has jurisdiction over the purchased lands and administers and monitors the terms and provisions of the conservation easements. Phase 2 would begin when these lands were designated as an SMA and when quarantine and hunting had been approved.

If this alternative was selected, the agencies would request the 2001 Montana Legislature to authorize a fair-chase hunt for bison. Public hunting would then become the primary tool for agencies to maintain population sizes in the new Reese Creek SMA as well as the western SMA.

Modifications in grazing allotments in the West Yellowstone area would be an option in this alternative, which could mean bison would be allowed to occupy public lands year-round. The area over which bison would eventually be able to range (e.g., the SMAs) is shown on the alternative 3 map.

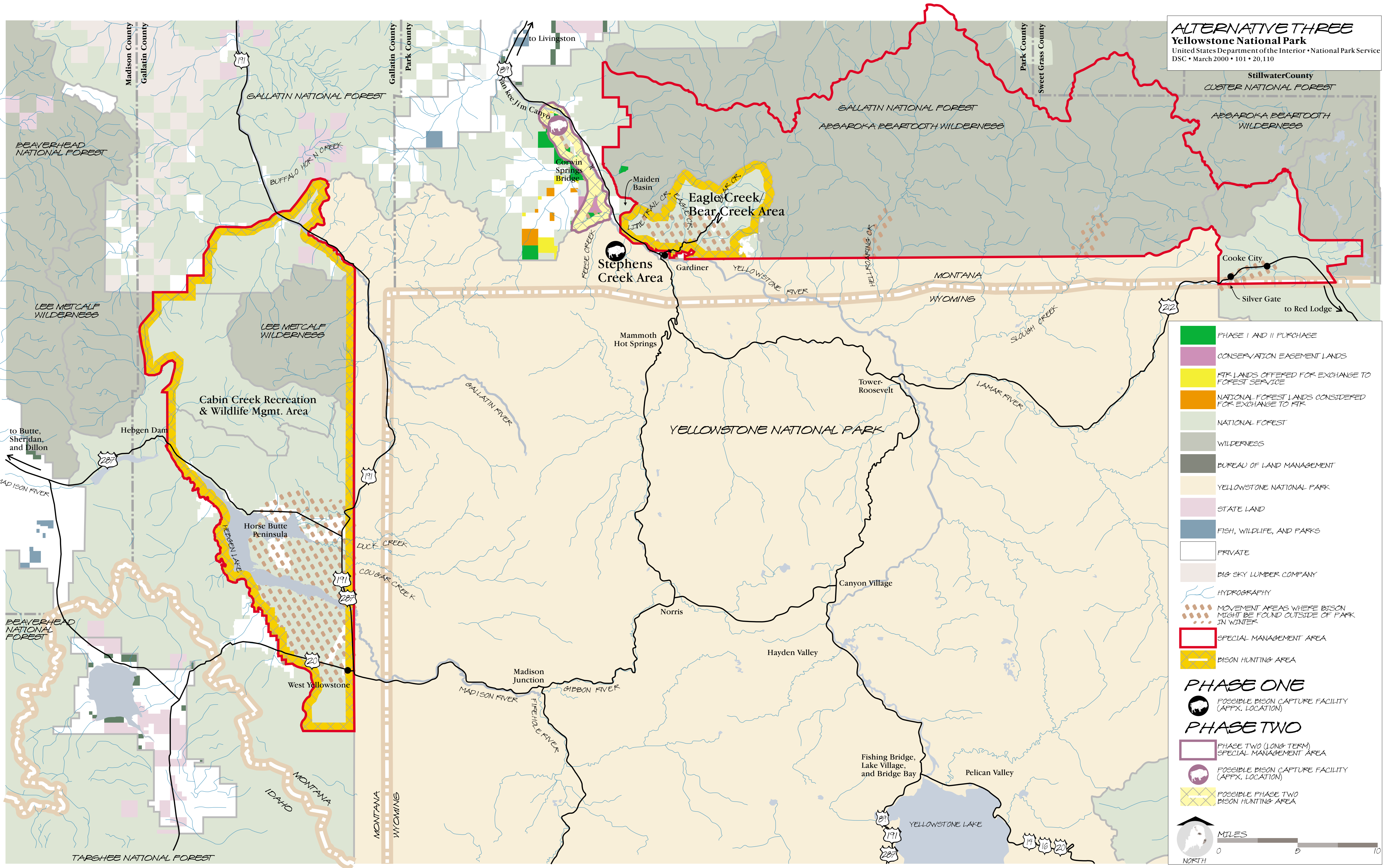
NORTHERN BOUNDARY

Reese Creek

The National Park Service would continue to operate the capture facility at Stephens Creek inside Yellowstone National Park at the Reese Creek boundary in phase 1 of this alternative. Features of the facility are described in alternative 1, and no changes in the Stephens Creek operation except the additional shipping of seronegative bison to quarantine would be anticipated.

Bison evading capture inside the park may be shot by park or other agency personnel with permission from the National Park Service. Those crossing the Reese Creek border and unresponsive to hazing would be shot by the Department of Livestock with help from other agencies, and with permission of the landowner. Currently, efforts would be made to keep all bison from crossing onto private land, and only those unresponsive to hazing and crossing the Reese Creek boundary would be shot. When a quarantine facility was constructed, some or all seronegative bison that would be captured could be quarantined.

Captured bison would be divided into groups for safety reasons, and blood tested for exposure to *B. abortus*. Seropositive bison would be shipped to slaughter at approved slaughter facilities. If a safe and effective vaccine was available, seronegative bison would be vaccinated. If population numbers were high or winter conditions were harsh, seronegative bison would be shipped to


ALTERNATIVE THREE
Yellowstone National Park
United States Department of the Interior • National Park Service
DSC • March 2000 • 101 • 20,110
PHASE I AND II PURCHASE
CONSERVATION EASEMENT LANDS
RTK LANDS OFFERED FOR EXCHANGE TO FOREST SERVICE
NATIONAL FOREST LANDS CONSIDERED FOR EXCHANGE TO RTK
NATIONAL FOREST
WILDERNESS
BUREAU OF LAND MANAGEMENT
YELLOWSTONE NATIONAL PARK
STATE LAND
FISH, WILDLIFE, AND PARKS
PRIVATE
BIG SKY LUMBER COMPANY
HYDROGRAPHY
MOVEMENT AREAS WHERE BISON MIGHT BE FOUND OUTSIDE OF PARK IN WINTER
SPECIAL MANAGEMENT AREA
BISON HUNTING AREA
PHASE ONE
POSSIBLE BISON CAPTURE FACILITY (APPX. LOCATION)
PHASE TWO
PHASE TWO (LONG TERM) SPECIAL MANAGEMENT AREA
POSSIBLE BISON CAPTURE FACILITY (APPX. LOCATION)
POSSIBLE PHASE TWO BISON HUNTING AREA
MILES
0 5 10
NORTH
YELLOWSTONE NATIONAL PARK
GALLATIN NATIONAL FOREST
ABSAROKA BEARTOOTH WILDERNESS
CUSTER NATIONAL FOREST
BEAVERHEAD NATIONAL FOREST
LEE METCALF WILDERNESS
TARGHEE NATIONAL FOREST
Cabin Creek Recreation & Wildlife Mgmt. Area
Eagle Creek/ Bear Creek Area
Stephens Creek Area
Madison County
Gallatin County
Park County
Sweet Grass County
Stillwater County
to Livingston
Yankee Jim Canyon
Corwin Springs Bridge
Maiden Basin
Gardiner
Mammoth Hot Springs
Tower-Roosevelt
Cooke City
Silver Gate
to Red Lodge
to Butte, Sheridan, and Dillon
Hebgen Dam
Horse Butte Peninsula
West Yellowstone
Madison Junction
Norris
Canyon Village
Hayden Valley
Fishing Bridge, Lake Village, and Bridge Bay
Pelican Valley
YELLOWSTONE LAKE
HEBGEN LAKE
MONTANA
WYOMING
IDAHO
YELLOWSTONE RIVER
GALLATIN RIVER
MADISON RIVER
GIBBON RIVER
FIREHOLE RIVER
LAMAR RIVER
SLOUGH CREEK
DUCK CREEK
COUGAR CREEK
BUFFALO HORN CREEK
REESE CREEK

quarantine. If numbers were low, seronegative bison may be held and released when the weather moderated. Under normal circumstances, bison would not remain at the Stephens Creek facility longer than 24 hours. However, if the quarantine facility was not built or room was not available, if population numbers were low, or if winters were harsh, the agencies estimate between 100 and 125 bison could be safely held in the Stephens Creek capture facility.

In phase 2 of this alternative, agencies would dismantle the Stephens Creek capture facility and would not maintain any boundary control at the northern border of Yellowstone National Park. Bison could be hunted in the expanded SMA outside the park. Bison movements would be monitored from November 1 to April 30, but bison would not be hazed unless they approached Yankee Jim Canyon, a narrowing of the valley on national forest land about 12 miles north of Reese Creek. The majority of land north of this point in the valley bottom is privately owned, and agencies would enforce a boundary to keep bison from migrating beyond it. The capture facility would be relocated to a suitable area north of the park and south of Yankee Jim Canyon to provide agencies an option of shooting bison crossing the boundary and to help regulate population numbers.

Eagle Creek/Bear Creek

Agencies would monitor bison movements in the Eagle Creek/Bear Creek area and maintain a boundary at the Little Trail Creek/Maiden Basin hydrographic divide through hunting, hazing, and shooting.

WESTERN BOUNDARY

Agencies would monitor and shoot bison leaving the West Yellowstone area north of Cabin Creek Recreation and Wildlife Management Area/Lee Metcalf Wilderness. Those leaving to the west along Hebgen Lake Dam, or south on private property, would also be hazed or shot (see alternative 3 map). Public hunting would be allowed in the western SMA on appropriate public lands and on private lands if landowners were willing. Existing capture facilities in the Duck Creek and Horse Butte area would be dismantled, as this alternative would not include capture or slaughter in the western SMA.

Bison would be hazed by agencies to move them from private to public land. Bison would also be hazed to remove them from the West Yellowstone area in May so cattle can occupy existing allotments in summer. Longer term modifications in allotments would also be possible in alternative 3, although hunting might reduce bison numbers in West Yellowstone to where they would provide no particular advantage to bison.

SPECIAL MANAGEMENT AREAS

In alternative 3, SMAs in phase 1 would be established in the Eagle Creek/Bear Creek area; the Absaroka-Beartooth Wilderness, including the Hellroaring and Slough Creek drainages; and the western boundary area south of Buffalo Horn Creek, including the Cabin Creek Recreation and Wildlife Management Area/Lee Metcalf Wilderness and West Yellowstone area (see alternative 3 map). Although some acquisitions are complete, modification of cattle operations would presumably not be complete until an existing cattle lease on the property expires in 2002. Acceptance of bison on these lands is subject to further negotiation with the landowner. The usable winter range available to bison without agency management in this alternative would be similar to but less than alternative 2.

Winter hunting would be a primary population management tool in the Eagle Creek/Bear Creek SMA, the newly created Reese Creek SMA, and the western SMA (including Cabin Creek/Lee Metcalf). The hunt would likely be conducted periodically between October 1 and February 28 as bison move into the SMAs. Any capture operations, should they be needed, would occur during the remainder of the winter following the hunt, e.g., from March 1 to April 30.

In the West Yellowstone area cattle would be grazed during the summer months and bison hazed back into the park during May as long as required. Bison would be hazed back into the park in the spring, 30 to 60 days before cattle occupy the area. The exact number of days, between 30 and 60, would be at the discretion of the state veterinarian. Those bison that could not be hazed back into the park would be shot. Hunting would help control population numbers and distribution in this SMA. In phase 2, if modifications in grazing allotments and other acquisitions and incentives allowed it, bison could remain year-round on public lands in the West Yellowstone area, although most would be probably be killed through hunting or would return inside park boundaries during the summer.

RISK MANAGEMENT

Strategies to ensure separation of cattle and bison explained above would be the primary means to manage the risk of transmission. These include temporal separation, capture, test, slaughter, and shooting in phase 1, and changes in existing cattle operations and boundary control measures in phase 2. Hunting in all SMAs would reduce the number of bison and the chances of bison migrating toward the boundaries maintained at Yankee Jim Canyon and

Buffalo Horn Creek, and therefore the risk of transmission through contact with cattle grazed to the north of these areas.

In phase 1 of this alternative, the separation of cattle and bison at the northern border would be maintained by restricting bison at Reese Creek and Little Trail Creek/Maiden Basin hydrographic divide. At Reese Creek, this would include monitoring, hazing, capture and slaughter, and shooting as described above under the "Northern Boundary." At Eagle Creek/Bear Creek, monitoring, hazing and shooting would be used to prevent entry into the Gardiner area. Hunting would reduce the number of bison overall, hence the number migrating toward the Little Trail Creek/Maiden Basin hydrographic divide boundary.

In the western SMA, separation would be maintained through temporal means on public lands in the short term. Bison in the West Yellowstone area would be hazed back into the park in the spring, 30 to 60 days before cattle occupy the area. The exact number of days, between 30 and 60, would be at the discretion of the state veterinarian. Those bison that could not be hazed back into the park would be shot. Bison would not be allowed back into the SMA until cattle have been removed in October. Topography, availability of habitat, hazing, hunting, and shooting would also keep bison from moving beyond SMA boundaries.

In phase 2, the primary means of separation on both the northern, newly created Reese Creek SMA, and the western SMA would shift to modifications in livestock operations or acquisition of property, easements, or other rights of use. On private land in the SMAs, which now is used for cattle grazing or other livestock operations, agencies might offer incentives to change operations so susceptible cattle were removed. Also, acquisition of private grazing rights, easements, or outright purchase of property from willing sellers might be used to remove cattle altogether on private property in the designated SMAs. In the western SMA, hunting would be expected to reduce the number of bison substantially, although modifications in grazing allotments might allow them to remain year-round. Until such changes were made, bison remaining after the winter hunt would be hazed into the park in May to ensure cattle occupying the allotments during the summer did not commingle with bison.

Agencies would continue to maintain boundaries between public and private land at Yankee Jim Canyon on the north, and Buffalo Horn Creek to the west to ensure separation of bison and cattle in phase 2. Also, hunting in all SMAs would reduce the number of bison migrating toward these boundaries.

Vaccination of cattle calves in the western SMA on public lands would reduce risk of transmission. State animal health authorities would encourage livestock owners in the western SMA whose cattle might come in contact with bison to vaccinate female calves (4–12 months old) against brucellosis with RB51 or other approved vaccine. Operators in boundary areas would be encouraged to annually vaccinate all subadult cattle as well as calves. Cattle herds in contact areas would continue to be surveillance tested periodically, and any herd whose member (or members) was in contact with bison would be checked for exposure to *B. abortus.* Livestock owners on private property would continue to be responsible for all costs and materials associated with calfhood vaccination.

When a safe and effective vaccine was developed for bison, it would be administered to bison captured at the northern boundary capture facility, held at the quarantine facility, and/or through remote means to bison inside Yellowstone National Park.

POPULATION MANAGEMENT

Bison population numbers at the northern park boundary would be controlled through capture and quarantine or slaughter in phase 1, and hunting, capture, and quarantine in phase 2. Hunting would also be used to control numbers in phases 1 and 2 in the Eagle Creek/Bear Creek SMA and West Yellowstone area of the western SMA.

Quarantine

A quarantine facility would operate intermittently to give agencies flexibility in handling captured bison that they do not now have (see alternative 3 map). It would also provide a source of live, disease-free bison for tribal governments and requesting organizations that would not be returned to the park. Current regulations do not permit removal of any part of the Yellowstone bison herd for quarantine and eventual release to interstate movement. Accordingly, APHIS, in cooperation with state livestock regulatory authorities, is developing a proposed change to 9 CFR 78 that would allow quarantine and eventual release of seronegative bison completing quarantine for interstate movement (see appendix B). Seronegative bison could be shipped to the quarantine facility and complete an approved quarantine protocol to ensure they were disease free, rather than slaughtered as they are now. Each animal initially assigned to a quarantine facility would have tested seronegative. When the bison have completed the procedure, they would be released live to requesting organizations or agencies.

If bison were migrating out of the park (or Reese Creek SMA in phase 2), and movements were large, making hunting infeasible, they would be captured.

Seropositives would be sent to slaughter, and seronegatives would be quarantined and available for eventual release. If a winter was unusually severe and the herd size was low, some bison might be held through the winter and returned to the park.

At a minimum, all bison must have three consecutive negative serological tests, with at least 12 months between the first and last tests to complete quarantine protocol. To minimize the effect of finding reactors (seropositives), bison would likely be kept in several separated groups rather than one large group. Any bison showing signs of exposure to *B. abortus* during this quarantine period would be slaughtered, and testing of the remaining bison in contact with it begun again. Because of this, bison may need to remain in quarantine for several years to be declared disease-free. Bison successfully completing the full quarantine procedure without contact with any infected animals would be available for release. Concurrent with testing, bison in quarantine could be vaccinated.

Quarantine facilities could be constructed on Gallatin National Forest in the vicinity of Gardiner, other public lands in the vicinity of Yellowstone National Park, lands elsewhere in Montana that would be leased or purchased for this purpose, or on the lands of a cooperating tribe or other organization. Possible designs and costs for a quarantine facility vary widely from a small feedlot-type approach to multiple pasture operation. Because a quarantine facility must ensure potentially diseased animals are not released, they include precautions such as double or triple fencing. Costs range from $500,000 to $800,000 and more to construct such a secure facility. If alternative 3 was selected, the agencies would sign a memorandum of understanding to formalize commitments regarding the quarantine facility.

A quarantine facility can only be operated in a class-free state if (1) APHIS allows the bison to be moved to the facility and (2) the state animal health authorities of that state permit the operation of a quarantine facility and allow the bison to be imported into the state. Also, evaluation of alternative locations and designs could be subject to additional compliance requirements, including criteria described in the "Actions Common to all Alternatives" chapter and NEPA analysis. For purposes of analysis, this environmental impact statement assumed all needed approvals were received and the quarantine facility was sited, built, and available in 1999 or within one year of the decision to select any alternative that included quarantine as a management tool (alternatives 3, 4, 7, and the modified preferred alternative).

Public Hunting

Upon issuance of the records of decision for the environmental impact statements, the agencies would request the 2001 Montana Legislature to authorize Montana to establish regulations for the public hunting of bison. Any public hunting program would be coordinated with the Department of Livestock and the state veterinarian in identifying acceptable animals and areas. In addition to controlling bison numbers, hunting would also help prevent bison on public lands in the Eagle Creek/Bear Creek area, bison on acquired winter range in the Reese Creek area (Reese Creek SMA) and in the western SMA from migrating to private lands, and help maintain bison population numbers and distribution.

This alternative envisions a fair-chase hunt to the extent possible. This would be in contrast to the hunts of the late 1980s, which were widely criticized as unfair to bison and unsporting. Features of a fair-chase hunt would include training or orientation to ensure accurate marksmanship, knowledge of and respect for bison, and emphasizing that all meat, as well as the hide and heads should be used. Hunters would be "on their own" and not accompanied by agency personnel as they were in the 1980s hunts. Hunters would be given no unfair mechanical advantage. Only a few permits would be issued for any given hunting period. Permit numbers would vary, depending on population size and the season format approved by the Montana Fish, Wildlife and Parks Commission. Bison might be hunted in more rugged and remote terrain in the neighboring Gallatin National Forest (Eagle Creek/Bear Creek).

It is not possible to completely describe how the bison season would be administered because Montana statutes do not currently authorize bison hunting. The analysis in this environmental impact statement assumed an application and selection process similar to procedures used to issue permits and licenses for other big game species.

The state's Department of Fish, Wildlife and Parks, in consultation with all cooperating agencies, would prepare recommendations for season length and format, permit quotas, and special regulations for the bison season. The department's recommendations would be developed to be consistent with the purpose of this alternative and in response to current population levels, anticipated migrations, and current bison management issues. The Montana Fish, Wildlife and Parks Commission would approve these recommendations, with or without amendments, as tentative regulations. Upon approval, the commission would provide notice of publication and request public comment on the tentative regulations. Thereafter, the commission could adopt as final, amend, or disapprove the tentative regulations. Upon final approval, the general bison hunting regulations would be in effect for two years, except that permit quotas could change annually.

Each licensed hunter would be authorized to hunt bison only during the time period and only in the area designated on the person's license. The hunting license would not provide the assurance that bison would actually occupy the specified area during the designated hunting period. License fees would not be refunded to licensed hunters who chose not to hunt, nor would fees be refunded because bison were not available during the designated hunting period.

Hunting regulations would be strictly enforced. Hunters would be notified of the health risks and appropriate precautions for handling dead bison. Hunters would be required to attend a bison hunting orientation program prior to hunting. Successful hunters would be required to properly dispose of the offal and to report their kill to a designated official. Blood and tissue samples could be collected from hunter-killed bison. Prior to implementing the bison season, the cooperating agencies would negotiate agreements with affected landowners to provide private land access for bison hunting where possible. Licensed hunters would not be otherwise restricted or assisted by agency personnel. Hunting is assumed to begin in the year 2000. The analysis assumed that initial quotas would provide for a minimum of 10 permits in the Eagle Creek/Bear Creek area and that bulls would likely be harvested in this area. Twenty permits would be offered in the Reese Creek area. Bulls and larger females would likely be harvested in this area. Due to projected increasing bison numbers moving into the Reese Creek area, 25 permits could be offered beginning in 2005. Thirty permits would be offered in the West Yellowstone area, and nearly all bison, except possibly calves, would be harvested. Based on bison population numbers, winter distribution on public and private lands, and other factors, the agencies may hold additional special drawings to harvest additional bison.

FEIS Note: (Refer to dates regarding hunting and hunting permits in paragraph above and to previous notes in alternative 3 description regarding dates). The actions indicated in the paragraph above would begin two years later than shown. Impacts of hunting identified in "Environmental Consequences: Impacts on Bison Population" in the year 2000 or 2005 should be assumed to actually occur in 2002 and 2007.

Research on the degree to which winter road grooming inside the park contributes to migration outside the park (i.e., bison distribution) would be initiated if this alternative was selected. If the research showed bison use these roads, segments could be left ungroomed to keep more bison inside the park boundaries (see description of alternative 2 for more information).

ESTIMATE OF COST

Table 5 indicates the costs that would be incurred by the interagency team for alternative 3.

TABLE 5: ANNUAL COST/INCOME ESTIMATES — ALTERNATIVE 3

	National Park Service	U.S. Forest Service	State of Montana	APHIS	Shared Costs
Test/sample bison	-	-	-	$27,500	-
Capture facility (Stephens Creek)	$120,000	-	-	-	-
Operations(capture, hunting, and bison management)	$173,800	$27,500	$247,500	-	-
Vaccinate bison	$330,500	-	-	$8,800	-
Relocate capture facility[1]	$66,000	-	-	-	-
Quarantine facility[1]	-	-	-	$550,000–$880,000[2]	-
Quarantine operations	$7,500	-	-	$440,000	-
Acquisition[1]	-	-	-	-	$33.1 million
Easement[1]	-	-	-	-	Unknown[3]
Conversion of livestock operations[1]	-	-	-	-	Unknown[3]
Allotment modification[1]	-	$16,500	-	-	-
TOTALS	($697,800)	($44,000)	($247,500)	($1,026,300–$1,356,300)	(Up to $33.1 million)

1. One time only (costs for existing facilities at Stephens Creek and western SMA have already been incurred).
2. Does not include land costs for quarantine facility.
3. Easement and conversion would substitute for acquisition, and costs would be less than $33.1 million.

ALTERNATIVE 4: INTERIM PLAN WITH LIMITED PUBLIC HUNTING AND QUARANTINE

The interim plan (no action, or alternative 1 in this analysis) has served to ensure spatial separation of the bison herd from domestic cattle on the north and west borders of Yellowstone National Park. However, it has given agencies few options when population numbers are high, and/or when harsh winters force more than the average number of bison toward the boundaries of Yellowstone National Park. The capture facility at Stephens Creek on the northern boundary was not designed to hold bison for more than a day or so; yet, because the 1996–97 winter was severe and unprecedented numbers of bison were being removed by management actions, the facility was used to keep more than 100 bison throughout the winter. For this reason, alternative 4 includes a quarantine facility. Under this alternative, seronegative bison captured at Stephens Creek or seronegative pregnant bison captured in either of the capture facilities in the western SMA would be transferred to such a facility until its capacity was reached. Removal of bison to quarantine would also help keep population numbers from growing too large, as bison completing the quarantine protocol would be released to tribes, requesting organizations, or to repopulate herds on public lands. The location of the facility has not been determined, and would require subsequent MEPA/NEPA analysis, including public input, before any decision is made. The details of a quarantine facility are described in alternative 3.

Hunting is also a tool proposed for alternative 4 to help control population sizes and distribution. Except for these differences, alternative 4 is identical to the interim plan, alternative 1.

Vaccination of bison, which is part of all the alternatives, requires a safe and effective vaccine, yet one does not currently exist. Alternative 4 also assumes a quarantine facility would be available and hunting would be approved. A quarantine facility located on public land would require environmental review and compliance, and hunting could not take place unless the 2001 Montana Legislature approves it. This environmental impact statement assumes for purposes of analysis certain dates by which each of these events would occur. Any regulation changes needed to allow bison into SMAs outside the park are assumed to take place immediately upon signing the records of decision to select an alternative. Both the quarantine facility and hunting are assumed to be available by 2000. The provisions of the interim plan would continue until these features were in place. If the dates were not met, analysis in the "Environmental Consequences" part of this document for alternative 4 would be as described in alternative 1, the no-action alternative 1.

Under this alternative, seronegative bison captured at Stephens Creek or seronegative pregnant bison captured in either of the capture facilities in the western SMA would be transferred to such a facility until its capacity was reached.

NORTHERN BOUNDARY

Reese Creek

The National Park Service capture facility located at Stephens Creek inside Yellowstone National Park at the Reese Creek boundary would continue to operate. Features of the facility are described in alternative 1, and no changes in the Stephens Creek operation except the additional shipping of seronegative bison to quarantine would be anticipated. Bison not captured and crossing the property would be hazed back into the park, or shot with permission of the landowners, as they are now. All captured bison would be tested for exposure to *B. abortus.* Bison evading capture inside the park or unresponsive to hazing would be shot on the private land north of the park boundary at Reese Creek. When the quarantine option was available, some bison would be quarantined.

Captured bison would be divided into groups for safety reasons, and blood tested for exposure to *B. abortus.* Seropositive bison would continue to be shipped to slaughter at approved slaughter facilities. All captured seronegative bison for which a safe vaccine is available would be vaccinated. If population numbers were high or winter conditions were harsh, seronegative bison (including pregnant females) would be shipped to quarantine. If numbers were low, seronegative bison could be held until weather moderated and released for return to the park's interior. Under normal circumstances, bison would not remain at the Stephens Creek facility for longer than 24 hours. However, if the quarantine facility was not yet built or room was not available and population numbers were low, it could be used to keep some bison through the winter. The agencies estimate between 100 and 125 bison could be safely held in the Stephens Creek capture facility.

Eagle Creek/Bear Creek

Agencies would continue to monitor bison movements in the Eagle Creek/Bear Creek area and maintain a boundary at the Little Trail Creek/Maiden Basin hydrographic divide from November to April. However, if the Montana Legislature approved it, a fair-chase hunt from approximately October 1 to February 28 would be the primary tool used to control population numbers in this area. Details of the hunt are described in alternative 3. Fewer bison would likely attempt to cross over into the Little Trail Creek/Maiden Basin area if hunting reduced their numbers.

WESTERN BOUNDARY

Entry into the western boundary area would continue to be controlled using capture facilities (now located at Duck Creek and at Horse Butte) from November 1 to April 30. Facilities might be moved to take advantage of changing bison migration routes from year to year. Bison evading capture at these facilities on public lands would be shot. Those evading capture on private lands would be shot at the request or with permission of the landowner. Bison on both private and public land in the area of each of these facilities might respond to baiting or hazing and be captured by agency personnel. Captured bison would be blood tested for exposure to *B. abortus.* All seropositive bison would be shipped to slaughter. Seronegative-nonpregnant females and all seronegative males would be identified with a small metal ear tag and a temporary visual marker, and released on public lands in the West Yellowstone area, where they could remain until May. If necessary, bison might need to be shipped a short distance from the capture facility to public lands. Seronegative-pregnant bison would be shipped to quarantine, where they would follow the quarantine protocol. Following successful completion of the quarantine protocol (see quarantine description in alternative 3), bison would be released to requesting tribes and organizations or used to repopulate herds on public lands. Limited hunting in the western boundary area, primarily as a recreational opportunity rather than as a population management tool, is also a part of this alternative.

SPECIAL MANAGEMENT AREAS

In this alternative, SMAs would be established in the Eagle Creek/Bear Creek area; the Absaroka-Beartooth Wilderness, including the Hellroaring and Slough Creek drainages; and the western boundary area south of Buffalo Horn Creek, including the Cabin Creek Recreation and Wildlife Management Area/Lee Metcalf Wilderness and the West Yellowstone area (see alternative 4 map).

Cattle would continue to be grazed in the West Yellowstone area on Gallatin National Forest lands from about June 15 to October 15. Cattle graze on private land from approximately June 1 to November 15. Bison would be hazed back into the park in the spring, 30 to 60 days before cattle occupy the area. The exact number of days, between 30 and 60, would be at the discretion of the state veterinarian. Those bison that could not be hazed back into the park would be shot. Bison would be allowed back into the West Yellowstone area following the departure of livestock. Bison would be shot by agencies if they occupied private lands in the area (by request or with permission of the landowner), or left the SMAs. Because there is very high elevation country to the west and private lands to the south, bison would only be able to leave the West Yellowstone area on public lands via a narrow corridor around Hebgen Lake Dam. Those that did so would be shot.

Bison would be able to occupy the Cabin Creek Recreation and Wildlife Management Area/Lee Metcalf Wilderness to the north of the West Yellowstone area without interference from the agencies. These are public lands free of cattle, although topography and snow depths limit the number of bison that actually use them. Hunting from October 1 to February 28 would be allowed in both the Eagle Creek/Bear Creek SMA and West Yellowstone area of the western SMA. It would be the primary means of controlling population numbers in the Eagle Creek/Bear Creek area, and be used mostly for recreational purposes in West Yellowstone, although some secondary population control benefits would be expected.

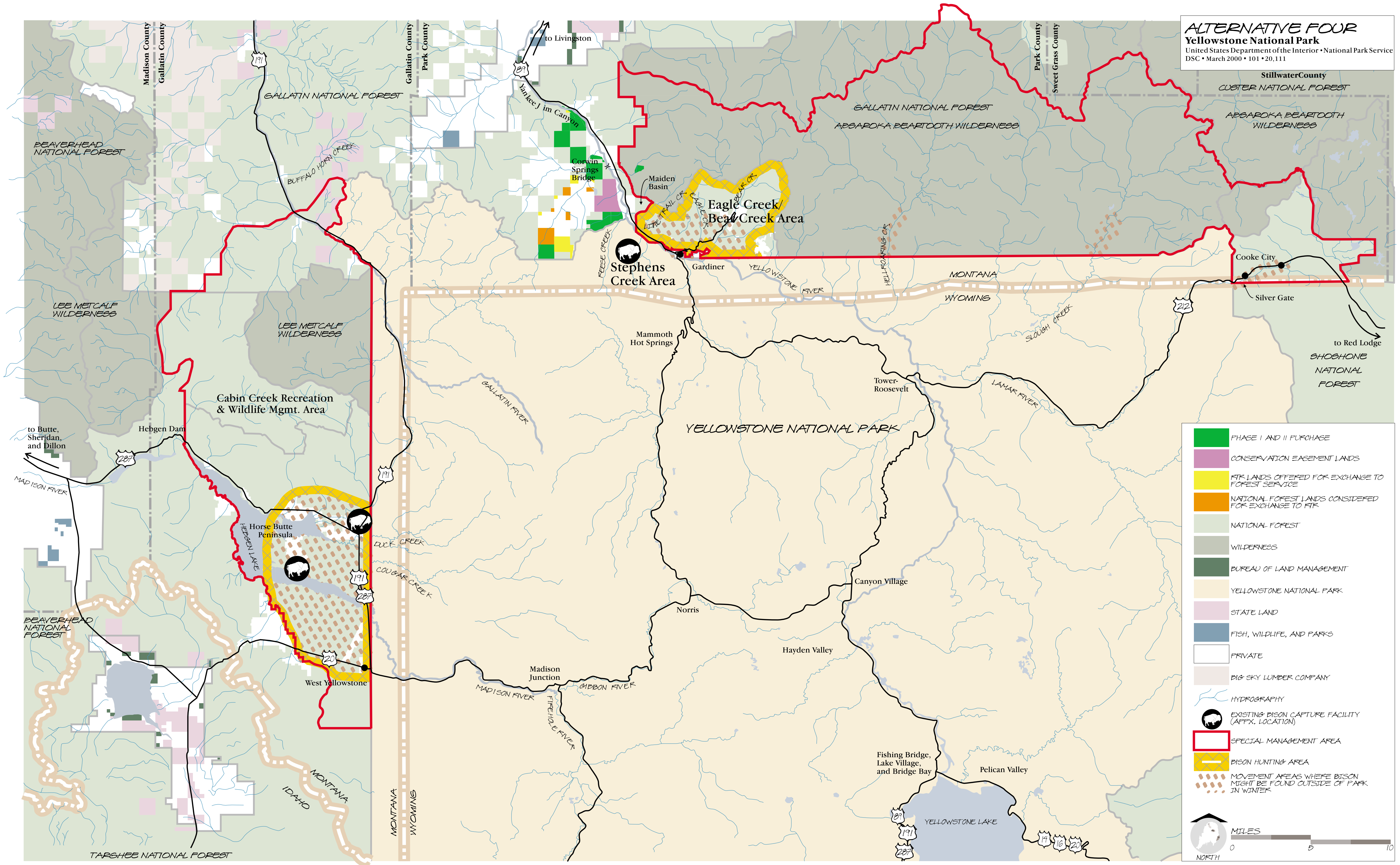
RISK MANAGEMENT

Alternative 4 would rely on separation, capture, and slaughter to minimize the risk of brucellosis transmission.

The primary means to ensure separation of cattle and bison would be the enforcement of controlled entry at the northern border described above, and temporal separation at the western border on public lands. At Reese Creek, this would include monitoring, hazing, capture and slaughter, quarantine, and shooting. At Eagle Creek/Bear Creek, monitoring, hazing, hunting and agency shooting would be used to prevent entry into the Gardiner area.

In the western SMA, bison would be hazed back into the park from the West Yellowstone area to prevent them from mingling with cattle during the time livestock were present. Any remaining bison would be shot. Hunting would reduce the number of bison and slightly reduce pressure of migrating bison on boundary areas. As described above, bison would be hazed back into the park in the spring, 30 to 60 days before cattle occupy the area. The exact number of days, between 30 and 60, would be at the discretion of the state veterinarian. Those bison that could not be hazed back into the park would be shot. Bison would not be allowed into the SMA until cattle have been removed in October. Topography, availability of habitat, hazing, and agency shooting would also keep bison from moving beyond SMA boundaries or onto private land.

In addition to separation, this alternative would reduce risk of transmission through capture and slaughter, and quarantine (see below for more


ALTERNATIVE FOUR
Yellowstone National Park
United States Department of the Interior • National Park Service
DSC • March 2000 • 101 • 20,111
GALLATIN NATIONAL FOREST
ABSAROKA BEARTOOTH WILDERNESS
CUSTER NATIONAL FOREST
BEAVERHEAD NATIONAL FOREST
LEE METCALF WILDERNESS
Cabin Creek Recreation & Wildlife Mgmt. Area
Eagle Creek/ Bear Creek Area
Stephens Creek Area
Horse Butte Peninsula
Hebgen Dam
Hebgen Lake
West Yellowstone
Gardiner
Maiden Basin
Corwin Springs Bridge
Yankee Jim Canyon
to Livingston
Mammoth Hot Springs
Tower-Roosevelt
Cooke City
Silver Gate
to Red Lodge
SHOSHONE NATIONAL FOREST
YELLOWSTONE NATIONAL PARK
Canyon Village
Norris
Madison Junction
Hayden Valley
Fishing Bridge, Lake Village, and Bridge Bay
Pelican Valley
YELLOWSTONE LAKE
YELLOWSTONE RIVER
GALLATIN RIVER
MADISON RIVER
GIBBON RIVER
FIREHOLE RIVER
LAMAR RIVER
SLOUGH CREEK
DUCK CREEK
COUGAR CREEK
BUFFALO HORN CREEK
to Butte, Sheridan, and Dillon
MONTANA
WYOMING
IDAHO
TARGHEE NATIONAL FOREST
Madison County
Gallatin County
Park County
Sweet Grass County
Stillwater County
PHASE I AND II PURCHASE
CONSERVATION EASEMENT LANDS
RTR LANDS OFFERED FOR EXCHANGE TO FOREST SERVICE
NATIONAL FOREST LANDS CONSIDERED FOR EXCHANGE TO RTR
NATIONAL FOREST
WILDERNESS
BUREAU OF LAND MANAGEMENT
YELLOWSTONE NATIONAL PARK
STATE LAND
FISH, WILDLIFE, AND PARKS
PRIVATE
BIG SKY LUMBER COMPANY
HYDROGRAPHY
EXISTING BISON CAPTURE FACILITY (APPX. LOCATION)
SPECIAL MANAGEMENT AREA
BISON HUNTING AREA
MOVEMENT AREAS WHERE BISON MIGHT BE FOUND OUTSIDE OF PARK IN WINTER
MILES
0 5 10
NORTH

information on quarantine). All seronegative bison captured in the Stephens Creek facility and seronegative-pregnant bison in the western SMA would be quarantined, and all seropositives would be slaughtered. This would remove all possible reactors from the vicinity where cattle would eventually be. Removing pregnant bison would ensure their birth materials did not remain onsite when cattle returned to the allotments.

State animal health authorities would encourage livestock owners in the western SMA whose cattle might come in contact with bison to vaccinate female calves (4–12 months old) with RB51. Operators in boundary areas would be encouraged to annually vaccinate all subadult cattle as well as calves. Cattle herds in contact areas would continue to be surveillance tested periodically, and any herd whose member or members might be in contact with bison would be checked for exposure to *B. abortus.* Livestock owners on private property would continue to be responsible for all costs and materials associated with calfhood vaccination.

When a safe and effective vaccine was developed for bison, it would be administered to bison in capture facilities testing negative. It might also be delivered through remote means to bison inside Yellowstone National Park.

POPULATION MANAGEMENT

Bison population numbers at the Reese Creek boundary would be controlled through quarantine or slaughter. In the West Yellowstone area, slaughter, quarantine, and to a lesser extent, hunting would be used to control population numbers. Hunting would be the primary means of controlling numbers in the Eagle Creek/Bear Creek SMA.

Quarantine

A quarantine facility would give agencies flexibility in handling captured bison that they did not have (see alternative 3). It would also provide a source of live, disease-free bison for tribal governments, requesting organizations, or to establish populations on other public lands. Seronegative bison could be shipped to the quarantine facility and complete an approved protocol to ensure they were disease free, rather than slaughtered as they are now. When they have completed the quarantine procedure, they would be released live to requesting organizations or agencies (see appendix B for quarantine protocol). If population numbers in the Yellowstone herd were high and bison were migrating out of the park, more seronegative bison captured on the west side might be quarantined, rather than released into the SMA. If numbers were low and unusually severe weather caused migration out of the park, seronegative bison might be held through the winter at the capture facilities and returned to the park rather than quarantined. Quarantined bison would be available for release to requesting tribes, organizations, or to repopulate herds on public lands, but would not be returned to the park. Any bison showing signs of exposure to *B. abortus* during the quarantine period would be slaughtered, and testing of the remaining bison in contact with it begun again. Because of this, bison might need to remain in quarantine for several years to be declared disease free. Bison successfully completing the full quarantine procedure without contact with any infected animals would be available for release. (See "Quarantine" section in alternative 3 for more information on facility descriptions and procedures.)

Public Hunting

Procedures for administering a bison hunting season would be similar to that described for alternative 3. Upon issuance of the records of decision, the agencies would request the Montana Legislature to authorize Montana to establish regulations for the public hunting of bison. If approved, regulated public hunting seasons would be administered primarily for the purpose of providing recreational hunting; to control bison numbers on public lands in the Eagle Creek/Bear Creek area; and, as a secondary method to control bison numbers in the West Yellowstone areas.

ESTIMATE OF COST

Table 6 reflects costs that would be incurred by the interagency team for alternative 4.

Lone bull.

Table 6: Annual Cost/Income Estimates — Alternative 4

	National Park Service	U.S. Forest Service	State of Montana	APHIS
Test/sample bison	-	-	-	$22,000
Capture facilities[1]	$120,000	-	$175,000	$50,000
Operations (capture, hunting, and bison management)	$173,800	$27,500	$302,500	$110,000
Quarantine facility[1]	-	-	-	$550,000–$880,000[2]
Quarantine operations	$7,500	-	-	$440,000
Vaccinate bison	$330,500	-	-	$8,800
Average income from the sale of meat, hides, and heads	-	-	+$46,200	-
Totals	($631,800)	($27,500)	($431,300)	($1,180,800–$1,510,800)

1. One time only (costs for existing facilities at Stephens Creek and western SMA have already been incurred).
2. Does not include costs for land acquisition.

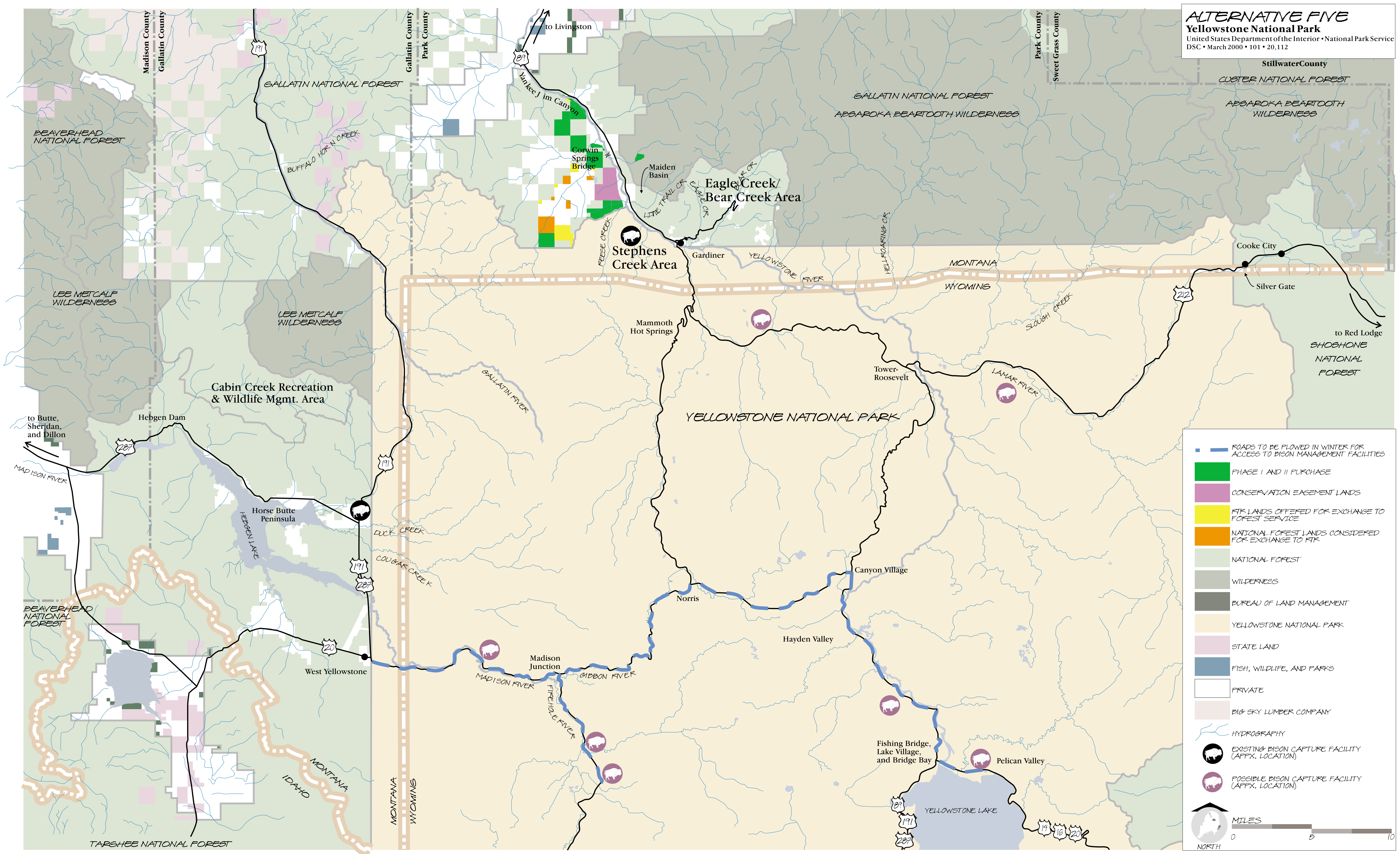
ALTERNATIVE 5: AGGRESSIVE BRUCELLOSIS CONTROL WITHIN YELLOWSTONE NATIONAL PARK THROUGH CAPTURE, TEST, AND REMOVAL

This alternative would implement an aggressive three-year capture and test program for all bison in the park, including those in its interior. Those testing negative would be released in the park, and seropositives would be shipped to slaughter. If a safe and effective vaccine was available, seronegative bison would also be vaccinated. Bison would not be allowed outside the park anywhere in Montana (see alternative 5 map), and agencies would maintain northern and western boundaries. Bison at these boundaries would be hazed back into the park if possible, but shot if they were unresponsive to hazing and leave the park. Capture facilities at Stephens Creek and at the western boundary area would be retained. In addition, an estimated seven temporary capture facilities would be set up in interior areas of the park. All untested bison would be shot in the latter stages of the capture, test, and slaughter program.

This alternative would implement an aggressive three-year capture and test program for all bison in the park, including those in its interior.

After all park bison have been tested or removed, the herd would be monitored for re-appearance of brucellosis. After a number of years, the entire herd would be captured and retested. Some or all of the capture facilities would be retained for this purpose. If seropositive bison were found, they would be sent to slaughter and the herd monitored and retested again after a period of time. If the entire herd tested free of brucellosis (i.e., less than .1% seropositive for five years), the agencies would devise a new long-term bison management plan recognizing the herd as brucellosis free. For this reason, management under alternative 5, should it be selected, might not extend the full 15 years assumed for other alternatives.

Fewer unknowns exist for this alternative than most of the other alternatives. Quarantine, SMAs, or land acquisition are not part of alternative 5. Although a safe and effective vaccine for bison is not yet available, implementation of this alternative does not depend on such a vaccine, but would only use it as a follow-up to parkwide capture and slaughter of seropositive bison. Each of the capture facilities would require environmental clearance to prevent impacts on natural or cultural resources, in particular threatened or endangered species or archeological resources. However, the agencies believe the areas where capture facilities would be needed are broadly defined enough that a suitable location within each (where these resources would not be affected) could be identified.


ALTERNATIVE FIVE
Yellowstone National Park
United States Department of the Interior • National Park Service
DSC • March 2000 • 101 • 20,112
ROADS TO BE PLOWED IN WINTER FOR ACCESS TO BISON MANAGEMENT FACILITIES
PHASE I AND II PURCHASE
CONSERVATION EASEMENT LANDS
RTK LANDS OFFERED FOR EXCHANGE TO FOREST SERVICE
NATIONAL FOREST LANDS CONSIDERED FOR EXCHANGE TO RTK
NATIONAL FOREST
WILDERNESS
BUREAU OF LAND MANAGEMENT
YELLOWSTONE NATIONAL PARK
STATE LAND
FISH, WILDLIFE, AND PARKS
PRIVATE
BIG SKY LUMBER COMPANY
HYDROGRAPHY
EXISTING BISON CAPTURE FACILITY (APPX. LOCATION)
POSSIBLE BISON CAPTURE FACILITY (APPX. LOCATION)
MILES
0
5
10
NORTH
Madison County
Gallatin County
Park County
Sweet Grass County
StillwaterCounty
to Livingston
Yankee Jim Canyon
GALLATIN NATIONAL FOREST
ABSAROKA BEARTOOTH WILDERNESS
CUSTER NATIONAL FOREST
BEAVERHEAD NATIONAL FOREST
LEE METCALF WILDERNESS
Corwin Springs Bridge
Maiden Basin
Eagle Creek/ Bear Creek Area
Stephens Creek Area
Gardiner
Cooke City
Silver Gate
to Red Lodge
SHOSHONE NATIONAL FOREST
YELLOWSTONE RIVER
MONTANA
WYOMING
Mammoth Hot Springs
Tower-Roosevelt
LAMAR RIVER
SLOUGH CREEK
GALLATIN RIVER
Cabin Creek Recreation & Wildlife Mgmt. Area
YELLOWSTONE NATIONAL PARK
to Butte, Sheridan, and Dillon
Hebgen Dam
MADISON RIVER
Horse Butte Peninsula
HEBGEN LAKE
DUCK CREEK
COUGAR CREEK
West Yellowstone
Madison Junction
GIBBON RIVER
FIREHOLE RIVER
Norris
Canyon Village
Hayden Valley
Fishing Bridge, Lake Village, and Bridge Bay
Pelican Valley
YELLOWSTONE LAKE
IDAHO
TARGHEE NATIONAL FOREST

NORTHERN BOUNDARY

Reese Creek

Although the National Park Service capture facility located at Stephens Creek inside Yellowstone National Park at the Reese Creek boundary would continue to operate, boundaries would primarily be controlled through monitoring of bison movements (see "Actions Common to All Alternatives"), hazing to return them to the park, and shooting. The Stephens Creek facility and its operation is described in alternative 1. Agencies would monitor bison prior to and during capture operations to locate bison groups for capture. Monitoring to assist with capture would occur at least twice a month during the period in which capture operations are taking place. During winter as bison approached the northern boundary, agency personnel would record bison locations once per week. When bison approached the Reese Creek area, the northern boundary area east of Gardiner, and the West Yellowstone area, their movements would be monitored daily. Because numerous capture and slaughter operations would be located throughout the park, fewer bison would likely be available to migrate to Reese Creek or other boundary areas. Agency personnel could haze on foot or horseback, in vehicles or aircraft, and might use cracker shells, rubber bullets, or other techniques, or any combination of those methods to move bison back into the park or into the Stephens Creek capture facility. Those bison crossing the Reese Creek border and unresponsive to hazing would be shot on private land by agencies with permission of the landowner.

Eagle Creek/Bear Creek

Agencies would monitor bison movements in the Eagle Creek/Bear Creek area from November to April, and, unlike other alternatives, would shoot any bison in this area. The frequency of monitoring would be the same as in other alternatives, except bison would not usually be able to make it to the Little Trail Creek/Maiden Basin hydrographic divide without being detected and shot. Hazing would not normally be a viable option to return bison to the park, unless bison were near the park boundary.

WESTERN BOUNDARY

Bison would be monitored as they approached the western park boundary. They would be hazed to return them to the park, and shot or captured outside the park if unresponsive to hazing. Two Department of Livestock capture facilities located at Duck Creek and Horse Butte might be retained to aid in the brucellosis eradication effort and help enforce the western boundary.

SPECIAL MANAGEMENT AREAS

No SMAs would be created in this alternative, as bison would not be allowed outside park boundaries.

RISK MANAGEMENT

The primary means of managing the risk of transmission in this alternative would be the confinement of bison to park boundaries and the parkwide capture and slaughter of seropositive bison. The National Park Service would maintain temporary capture facilities and carry out capture and testing operations in some or all of the following locations inside Yellowstone National Park in an attempt to capture every bison inside the park (see alternative 5 map):

Stephens Creek (existing capture facility)

Blacktail Plateau

Lamar/Crystal Bench

Pelican Valley

Hayden Valley

Firehole River/Old Faithful (two facilities)

Madison River

Capture facilities in the western boundary area could also be retained.

The precise locations of these facilities is unknown. However, the criteria listed in the "Actions Common to All Alternatives" chapter would apply in siting the facilities.

Capture operations in the north and west boundary areas (Stephens Creek and West Yellowstone) would take place throughout winter, with interior park capture operations occurring during early to mid winter (November to January) when areas were accessible by wheeled vehicles. Park roads now left unplowed would be plowed to transport seropositive bison to slaughter (see alternative 5 map). National Park Service personnel would shoot untagged bison in remote areas where capture operations would not be feasible during the latter stages when few seropositive bison remain in the herd. Agencies would monitor at least twice a month during the period when capture operations are taking place. If bison approached either the northern or western boundary area, their locations would be recorded weekly. As they approached the park boundary line, their movements would be monitored daily.

Captured bison would be divided into groups for safety reasons, and blood tested for exposure to *B. abortus*. Seropositive bison would continue to be shipped to slaughter at approved slaughter facilities. Therefore, temporary capture facilities would be located adjacent to existing roads. Seronegatives would be identified with a small metal ear tag and a temporary visual marker, and released into Yellowstone National Park. Features of the capture facilities include separating pens, chutes, loading facilities, and areas to hold bison.

In addition to parkwide capture, test, and slaughter, risk would be managed by preventing bison from leaving the park. Because no cattle graze inside the park, cattle and bison would be completely spatially separated. Existing capture facilities at Reese Creek on the north, and at Duck Creek and at Horse Butte on the west, might be retained to provide agencies the option of capture to maintain these boundary controls. However, the primary means of controlling the exit of bison from the park would be shooting and hazing. Drops in population numbers associated with the capture and slaughter of all seropositive bison in the park would also act to reduce the number of bison migrating out of the park.

Operators in boundary areas would be encouraged to annually vaccinate all subadult cattle as well as calves. Cattle herds in contact areas would continue to be surveillance tested periodically, and any herd whose member or members might be in contact with bison would be checked for exposure. Livestock owners on private property would continue to be responsible for all costs and materials associated with calfhood vaccination.

When a safe and effective vaccine was developed for bison, it would be administered to seronegative bison in capture facilities. It might also be delivered through remote means to bison inside Yellowstone National Park.

POPULATION MANAGEMENT

The aggressive capture and slaughter program is likely to lower population numbers quickly, particularly if it was accomplished over a three-year span of time. If the herd approached the minimum viable size (estimated at 580 animals) needed to maintain genetic viability, capture and slaughter operations would be slowed or halted. When it was clear the population was not in danger of falling below this number, operations would begin again.

ESTIMATE OF COST

Table 7 indicates the costs that would be incurred by the interagency team for alternative 5.

FEIS Note: The cost to plow roads was determined using figures from the *Winter Use Plan/Draft Environmental Impact Statement.* This estimate was $22/lane-mile/day. Alternative 5 proposes to plow 77 miles of two-lane road for a 170-day winter season.

Table 7: Annual Cost/Income Estimates — Alternative 5

	National Park Service	U.S. Forest Service	State of Montana	APHIS
Test/sample bison	-	-	-	$49,500
Vaccinate bison during capture	$27,500	-	-	$6,600
Vaccinate bison during phase 2	$330,500	-	-	-
Capture facility (Stephens Creek)[1]	$120,000	-	-	-
Capture operations (continuing)	$226,600	$16,500	-	-
Other capture facilities[2]	$1,056,000	-	-	-
Operations of other capture facilities (3 years) during test and slaughter	$720,500	-	-	-
Equipment/repair/replacement	$220,000	-	-	-
Road plowing (3 years)	$575,960	-	-	-
Average income during parkwide capture from the sale of meat, hides, and heads	+$473,770	-	-	-
Totals	($2,803,290)	($16,500)	-	($56,100)

1. One time only (costs for facilities at Stephens Creek have already been incurred).
2. Does not include costs of impact mitigation at capture facility sites proposed to be located in the park. Estimates for a facility at Seven-Mile Bridge, for example, range from $1 million to $10 million to mitigate impacts on cultural resources.

ALTERNATIVE 6: AGGRESSIVE BRUCELLOSIS CONTROL WITHIN YELLOWSTONE NATIONAL PARK THROUGH VACCINATION

This alternative, like alternative 5, pursues the aggressive reduction of brucellosis from the Yellowstone bison herd. However, the entire bison herd would first be vaccinated primarily through remote means (when a safe and effective vaccine was available) and tested as they attempted to exit at park boundary locations. When tests showed the incidence of exposure to *B. abortus* ceased to decline as a result of vaccination, the herd-wide capture, test, and slaughter outlined in alternative 5 would begin. The vaccination stage of this alternative is referred to as phase 1; the capture, test, and slaughter as phase 2.

Unlike alternative 5, bison would be allowed in the Eagle Creek/Bear Creek and western SMAs (see alternative 6 map), although the majority of bison in the western SMA would be tested and seronegatives released. The National Park Service would construct and operate a capture facility at Seven-Mile Bridge inside the park on the west side. Nearly all bison migrating toward the West Yellowstone area cross through this narrow area, giving agencies a better chance for capturing 100% of the bison than if existing Department of Livestock facilities at Duck Creek and Horse Butte were used. These facilities (at Duck Creek and Horse Butte) would be dismantled, although a small, backup capture facility near Horse Butte might be maintained.

Under this alternative, the entire bison herd would first be vaccinated primarily through remote means (when a safe and effective vaccine was available) and tested as they attempted to exit at park boundary locations.

Like alternatives 2, 3, 4, and 7, alternative 6 would include the creation of SMAs to allow bison outside the park. It also depends heavily on a safe and effective vaccine for bison for implementation. Both of these management tools involve some unknowns. For the purposes of this environmental impact statement, the agencies have assumed that any approvals needed to allow bison outside the park would be made immediately upon signing the records of decision to select an alternative, and that a vaccine that was safe and effective for bison, and safe for nontarget species, would be available by winter 2003/2004. The deterministic modelling of impacts on seroprevalence from vaccination assumes such vaccination would begin in 2000 or year 3 of the model (modelling began in 1997). If the record of decision for this plan is signed in 2000, year 3 of the plan would be 2003. Results from deterministic modelling are therefore applicable, and nearly transferable, by simply assuming seroprevalence reported in "Environmental Consequences: Impacts on Bison Population" for any given year would actually occur 3 years later, or 3 years from the time a record of decision is signed. In addition, results from an updated and refined stochastic model are included, which include more recent assumptions on when vaccination and other management techniques would likely begin.

NORTHERN BOUNDARY

Reese Creek

The National Park Service would continue to operate the capture facility at Stephens Creek inside Yellowstone National Park to maintain boundary control at Reese Creek. Features of the facility are described in alternative 1, and no changes in the Stephens Creek operation would be anticipated under this alternative. Bison crossing the boundary would be hazed back into the park or shot. All captured bison would be tested for exposure to *B. abortus*. Bison evading capture inside the park might be shot. Those crossing the Reese Creek boundary and unresponsive to hazing would be shot on private land by agencies with permission of the landowner.

Captured bison would be divided into groups for safety reasons. All bison, whether seropositive or seronegative, would be shipped to slaughter at approved slaughter facilities. Under normal circumstances, bison would not remain at the Stephens Creek facility for longer than 24 hours.

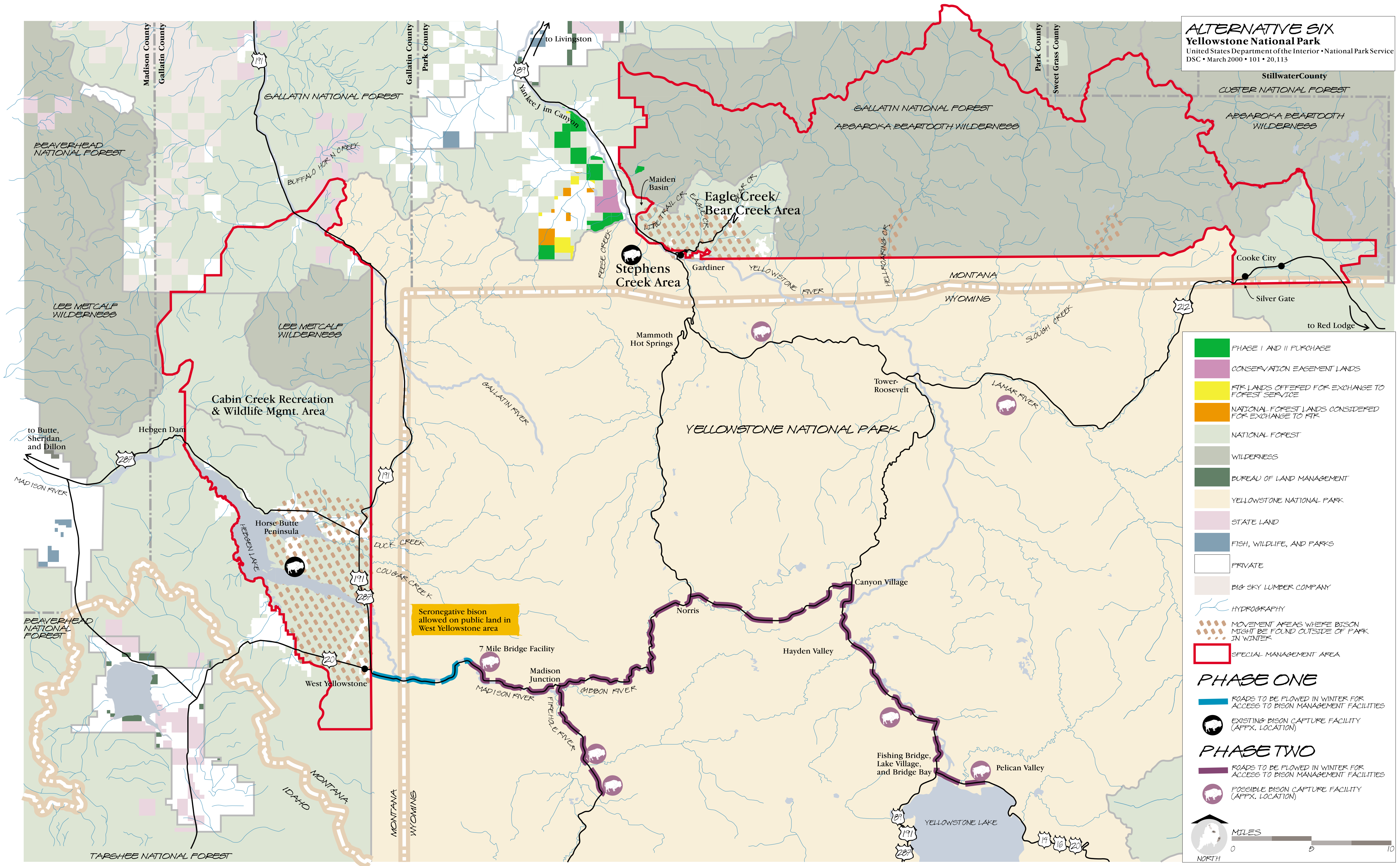
When the aggressive capture and slaughter phase of this alternative began following the stabilization of seroprevalence in the population (assumed by the deterministic model to occur after 10 years of vaccination; and predicted by the refined stochastic model to occur 18 years after implementation), the Stephens Creek facility would become one of several capture facilities in the park, although boundary control at Reese Creek would likely be less problematic as population numbers would drop quickly. Monitoring, hazing, and shooting would remain as border control measures at Reese Creek.

Eagle Creek/Bear Creek

Agencies would monitor bison movements in the Eagle Creek/Bear Creek area and maintain a boundary at the Little Trail Creek/Maiden Basin hydrographic divide from November to April as described in alternatives 1, 3, and 4.

WESTERN BOUNDARY

During phase 1 and as needed during phase 2, entry into the western boundary area from November 1 to April 30 would be controlled with a new National Park Service capture facility located at Seven-Mile Bridge inside the western end of Yellowstone National Park, 7 miles from the western border of



ALTERNATIVE SIX
Yellowstone National Park
United States Department of the Interior • National Park Service
DSC • March 2000 • 101 • 20,113
Madison County
Gallatin County
Gallatin County
Park County
Park County
Sweet Grass County
StillwaterCounty
to Livingston
GALLATIN NATIONAL FOREST
ABSAROKA BEARTOOTH WILDERNESS
CUSTER NATIONAL FOREST
BEAVERHEAD NATIONAL FOREST
LEE METCALF WILDERNESS
Cabin Creek Recreation & Wildlife Mgmt. Area
Maiden Basin
Eagle Creek/ Bear Creek Area
Stephens Creek Area
Gardiner
Mammoth Hot Springs
Cooke City
Silver Gate
to Red Lodge
MONTANA
WYOMING
YELLOWSTONE RIVER
Tower-Roosevelt
LAMAR RIVER
SLOUGH CREEK
GALLATIN RIVER
YELLOWSTONE NATIONAL PARK
to Butte, Sheridan, and Dillon
Hebgen Dam
MADISON RIVER
Horse Butte Peninsula
HEBGEN LAKE
DUCK CREEK
COUGAR CREEK
Seronegative bison allowed on public land in West Yellowstone area
West Yellowstone
7 Mile Bridge Facility
Madison Junction
GIBBON RIVER
FIREHOLE RIVER
Norris
Canyon Village
Hayden Valley
Fishing Bridge, Lake Village, and Bridge Bay
Pelican Valley
YELLOWSTONE LAKE
IDAHO
MONTANA
TARGHEE NATIONAL FOREST
PHASE I AND II PURCHASE
CONSERVATION EASEMENT LANDS
RTR LANDS OFFERED FOR EXCHANGE TO FOREST SERVICE
NATIONAL FOREST LANDS CONSIDERED FOR EXCHANGE TO RTR
NATIONAL FOREST
WILDERNESS
BUREAU OF LAND MANAGEMENT
YELLOWSTONE NATIONAL PARK
STATE LAND
FISH, WILDLIFE, AND PARKS
PRIVATE
BIG SKY LUMBER COMPANY
HYDROGRAPHY
MOVEMENT AREAS WHERE BISON MIGHT BE FOUND OUTSIDE OF PARK IN WINTER
SPECIAL MANAGEMENT AREA
PHASE ONE
ROADS TO BE PLOWED IN WINTER FOR ACCESS TO BISON MANAGEMENT FACILITIES
EXISTING BISON CAPTURE FACILITY (APPX. LOCATION)
PHASE TWO
ROADS TO BE PLOWED IN WINTER FOR ACCESS TO BISON MANAGEMENT FACILITIES
POSSIBLE BISON CAPTURE FACILITY (APPX. LOCATION)
MILES
0
5
10
NORTH

the park. Bison evading capture at this facility and exiting the park would be shot. Agencies would use hazing (as described above for the Stephens Creek facility), wing fences, and/or bait to move bison into the facility. Bison would be separated and blood tested for exposure to *B. abortus*. All seropositive bison would be shipped to slaughter. The facility would occupy approximately 13 acres, with corrals for holding bison, and four pens to separate them. Two pastures would be available to hold bison for 24 to 36 hours until testing was completed. Water would be provided from the nearby Madison River. Electricity, if needed, would be provided by diesel generators. The facility would be located adjacent to a road, so seropositive bison could be shipped to slaughter. It would also be located so as to meet all additional criteria described in "Actions Common to All Alternatives." The 7 miles of park road between the facility and West Yellowstone would be plowed to facilitate transport of seropositives to slaughter. When a safe and effective vaccine was available, seronegative bison captured at this facility would be vaccinated.

Seronegative animals would be identified with a small metal ear tag and a temporary visual marker, and released onsite. They might continue their migration to the West Yellowstone area and occupy public lands outside the park in the West Yellowstone area (see alternative 6 map), or remain inside the park. They can remain on public lands in the western SMA until May, when agencies would haze them back inside park boundaries. Bison would be shot by agencies if they occupied private lands in (by request or with permission of the landowner) or attempted to leave the SMA.

The Seven-Mile Bridge facility would continue to operate following the stabilization of seroprevalence rates and progression to the aggressive capture and slaughter phase of this alternative. As population numbers dropped in the interior of the park, fewer bison would be likely to migrate toward the west end of the park and be captured in the Seven-Mile Bridge facility.

SPECIAL MANAGEMENT AREAS

In this alternative, SMAs would include the Eagle Creek/Bear Creek area, the Hellroaring and Slough Creek drainages, Cabin Creek Recreation and Wildlife Management Area/Lee Metcalf Wilderness, and the portion of West Yellowstone shown on the alternative 6 map. Cattle would be grazed on Gallatin National Forest lands in the West Yellowstone area from about June 15 to October 15. During phase 1 and as needed during phase 2 of this alternative, bison in the West Yellowstone area would be hazed back into the park in the spring, 30–60 days before cattle occupy the area. The exact number of days, between 30 and 60, would be at the discretion of the state veterinarian. Bison that could not be hazed back into the park would be shot. They would be allowed back into the western SMA following the departure of livestock.

Bison could occupy the Eagle Creek/Bear Creek area year-round. They would also be allowed to occupy the Cabin Creek area, Lee Metcalf Wilderness, and Hellroaring and Slough Creek drainages without agency intervention.

RISK MANAGEMENT

Phase 1 of this alternative relies on vaccination of bison and spatial and temporal separation measures to minimize risk until seroprevalence rates stabilized. When they did (assumed by the deterministic model to occur 10 years after whole-herd vaccination begins), a phase 2 parkwide capture, test, and slaughter program would be implemented to reduce risk to near zero. Throughout both phases, spatial separation would be assured through the enforcement of controlled entry at the northern and western borders described above, as well as temporal separation at the western border on public lands. At Reese Creek, this would include monitoring, hazing, capture and slaughter, and shooting. At Eagle Creek/Bear Creek, monitoring, hazing, and shooting would be used to prevent entry into the Gardiner area. On the western end, the Seven-Mile Bridge capture facility would catch most bison migrating toward the West Yellowstone area, and monitoring, hazing, capture and slaughter, and shooting would be used to maintain this boundary and ensure separation of bison and cattle. Topography and availability of habitat also keep bison from straying beyond SMA boundaries.

In the West Yellowstone area of the western SMA, cattle and bison would also be separated in time. During phase 1 and as needed during phase 2 of this alternative, bison would be hazed back into the park in the spring, 30 to 60 days before cattle occupy the area. The exact number of days, between 30 and 60, would be at the discretion of the state veterinarian. Those bison that could not be hazed back into the park would be shot. Bison would not be allowed into the SMA until cattle have been removed in October.

The capture facilities and boundary control measures would continue in phase 2 of this alternative, when aggressive capture and slaughter of all seropositive bison in the herd begins. However, since population numbers would drop quickly, fewer bison would migrate out of the park toward lands occupied by cattle.

In addition to the means described above to ensure boundary control and bison and cattle separation, this alternative would include aggressive vaccination of the entire park herd on an annual basis, and the capture and slaughter of all remaining seropositive bison. Vaccination with a safe and effective vaccine of captured seronegative bison would occur through hand injection during phase 2, as well as remote vaccination through means such as bio-bullets. Remote vaccination would occur yearly. While the vaccination effort is ongoing, the risk of transmission would be controlled by restricting bison to areas where cattle were not present (described above), or through temporal separation. Risks would be further reduced by slaughtering all captured seropositive bison.

When seroprevalence rates did not decrease for a period of two years, they would assume to have stabilized and phase 2 would begin. The National Park Service would then construct seven additional capture facilities across the park as described in alternative 5. Bison throughout the park would be captured, tested, and seropositives slaughtered. Roads inside the park indicated on the alternative 6 map would be plowed as needed to allow transport of seropositive bison to slaughter. Agencies would attempt to capture every bison in the park, and would shoot those not marked as seronegative in inaccessible areas. Capture operations inside the park would occur primarily during late fall and early winter.

Agencies would haze on foot, on horseback, or by helicopter to move bison toward capture facilities, using wing fences, bait, loud noise, or other methods. The combination of vaccination and capture and slaughter would eventually result in a very low rate of seroprevalence in the bison population, and reduce the risk of transmission to cattle to near zero. Vaccination of bison would continue following the capture and slaughter of seropositive bison to help ensure the lowest possible infection rate. The length of time vaccination of the herd continues would depend on the original efficacy of the vaccine, and the success of ongoing efforts to control brucellosis in the Wyoming elk population.

State animal health authorities would encourage livestock owners in the western SMA whose cattle may come in contact with bison to vaccinate female calves (4–12 months old) against brucellosis with RB51 or other approved vaccine. Operators in boundary areas would be encouraged to annually vaccinate all subadult cattle as well as calves. Cattle herds in contact areas would continue to be surveillance tested periodically, and any herd whose member or members may be in contact with bison would be checked for exposure. Livestock owners on private property would continue to be responsible for all costs and materials associated with calfhood vaccination.

POPULATION MANAGEMENT

The effect of capture and slaughter operations at Stephens Creek and Seven-Mile Bridge and other boundary control measures would be to reduce population numbers, particularly during harsh winters when many bison might attempt to move toward park boundaries. During phase 2 of this alternative when capture facilities were set up throughout the park, population numbers would be expected to move toward the lower, rather than higher, end of the range. If numbers moved toward the lower end of the range during phase 1 of this alternative, both capture facilities could be converted to temporary holding facilities to keep bison during harsh winters. If population numbers fell too quickly during the second parkwide capture and slaughter phase of this alternative, operations would be slowed or halted until the population numbers showed stabilization or recovery.

ESTIMATE OF COST

Table 8 indicates the costs that would be incurred by the interagency team for alternative 6.

FEIS Note: The estimated costs were determined using figures from the *Winter Use Plan/Draft Environmental Impact Statement* of $22/lane-mile/day for 170 days of winter. In phase 1, 7 miles of two-lane road would be plowed for 10 years. In phase 2, 77 miles of road would be plowed for 3 years.

Table 8: Annual Cost/Income Estimates — Alternative 6

	National Park Service	U.S. Forest Service	State of Montana	APHIS
Test/sample bison - phase 1	$11,000	-	-	$22,000
Test/sample bison - phase 2	$44,000	-	-	$27,500
Capture facilities at Stephens Creek and Seven-Mile Bridge - phase 1[1]	$297,000	-	-	-
Operations - phase 1	$323,000	$16,500	-	-
Road Plowing - phase 1 (10 years)	$52,360	-	-	-
Vaccinate bison	$330,500	-	-	$2,200
Capture facilities - phase 2 (6)[1]	$792,000	-	-	-
Operations - phase 2	$940,500	-	-	-
Road plowing - phase 2	$575,960	-	-	-
Operations	-	-	$192,500	-
Average income from the sale of meat, hides, and heads	+$305,800 - phase 2	-	+$36,300 - phase 1	-
Totals	($1,013,860 - phase 1 $2,377,160 - phase 2)	($16,500)	($156,700 - phase 1 $192,500 - phase 2)	($24,200 - phase 1) ($29,700 - phase 2)

1. One time only (costs for Stephens Creek have already been incurred). Does not include the costs of impact mitigation for capture facilities proposed for inside the park. Estimates range from $1 million to $10 million, for example, to mitigate the cultural resource impacts at the proposed Seven-Mile Bridge facility site.

ALTERNATIVE 7: MANAGE FOR SPECIFIC BISON POPULATION RANGE

This alternative, like others evaluated in this environmental impact statement, involves many unknowns and assumptions about future conditions and available tools to manage the bison population. These assumptions represent what the agencies believe are most reasonable time frames for these tools to become available. Should one or more be available earlier or later than assumed for the purposes of analysis in this environmental impact statement, the impacts on several resources could be slightly different than indicated in "Environmental Consequences." It is also possible that while one management option is approved in the time frame assumed, another might not. The agencies would use whichever tools were approved when they became available. Again, this might mean slightly different impacts than those described for alternative 7.

This alternative, like others evaluated in this environmental impact statement, involves many unknowns and assumptions about future conditions and available tools to manage the bison population.

Alternative 7 includes the use of capture, test, and slaughter, the creation of special management areas (SMAs) in the Eagle Creek/Bear Creek area and west of the park, hazing and shooting bison outside the SMAs and on private lands within the SMAs, quarantine of some seronegative bison, hunting for recreational purposes and to help control bison distribution, vaccination of bison, the potential acquisition of additional winter range and the proposed creation of an SMA on that range as management tools.

As in all alternatives except alternative 5, alternative 7 would allow bison outside park boundaries. This, or agency actions to manage bison on these lands, would require the creation of SMAs to protect Montana's class-free status, and the approval of the state of Montana as specified by Montana law to establish SMAs.

Use of quarantine as a management tool would provide the agencies flexibility in handling captured bison they do not now have. However, such a quarantine facility does not yet exist, and environmental compliance and public review would be required to examine alternative designs and locations before it could be built or operated on public land.

For purposes of analysis, the environmental impact statement assumes any required approvals to create SMAs would occur immediately upon signing the records of decision to implement the selected alternative and that the quarantine facility would be built and operating by the year 2001. If this proved not to be the case, the agencies would continue to rely on the capture, slaughter, hazing, and/or shooting of all bison attempting to exit the park at Reese Creek as described in the *Interim Bison Management Plan* under which the agencies now operate. When the facility was built, seronegative bison captured at the Stephens Creek facility would normally be transferred to quarantine, although at very low or very high population numbers this might not be the case (see "Population Management" section below). Seronegative-pregnant bison captured at facilities inside the western SMA would also be quarantined and available for release following the successful completion of quarantine protocol.

Hunting is an additional management tool this alternative assumes would be available to help maintain a prescribed population size and distribution. The agencies would request the 1999 Montana Legislature to authorize a fair-chase hunt for bison. If authorized, the agencies would recommend Montana establish regulations for the public hunting of bison in a timely manner in accordance with applicable state laws. This analysis has assumed hunting would be available as a management tool in the year 2000. However, both authorization and appropriate state environmental compliance and public review would be completed before implementation of a bison hunt could begin.

FEIS Note: (Refer to agency actions in paragraph above.) The agencies would request the 2001 Montana Legislature to authorize a fair-chase hunt for bison and have assumed hunting would be available in 2002 as a bison management tool. Please see notes in other alternatives (3 and 4) to understand how to use the information in "Environmental Consequences: Impacts on Bison Population."

This alternative, like all others, also assumes the use of a safe and effective vaccine on bison throughout the park, as well as the use of a safe vaccine on captured or quarantined bison. As the section on "Vaccination" in "Actions Common to All Alternatives" indicates, a vaccine known to be safe and effective for bison, and safe for nontarget species does not currently exist, and the administration of a vaccine would require agreement from the agencies as well as possible environmental compliance and review. The decision on when a vaccine is safe and effective "enough" is complex and depends on a variety of factors. It is unknown when such a vaccine would be available, although the agencies believed it was reasonable to assume that vaccination would begin in the year 2000.

FEIS Note: (Refer to last sentence in paragraph above.) Please see notes on other alternatives to understand how to use existing impact information on the effect of vaccination on reducing seroprevalence. A safe and effective vaccine for remote delivery to bison calves is not expected until 2003/2004; however, this is 3 years following the signing of a record of decision on the bison management plan, and this is the assumption made in the deterministic model of seropravelance.

For purposes of analysis, this alternative also anticipates acquisition through purchase or easement of private property to the north of the park. This could only occur if the current owners of the property were willing to sell or grant easements on part or all of the property the agencies believed was useful for plan implementation, money was available for such a purchase, an organization or public entity agreed to manage the land, and all necessary environmental review and compliance was completed. Any or all of these conditions might or might not be met. The agencies are currently discussing the possible acquisition of land north of Yellowstone National Park, and have assumed for the purposes of analysis that the conditions would be met and purchase or easement would occur in the year 2000.

FEIS NOTE: (Refer to last sentence in paragraph above.) As indicated in the description of other alternatives (see alternative 3, for example), the acquisition of property and easements identified in alternative 7 has already taken place. However, use of the property for bison winter range is not likely to occur until expiration of a cattle lease in 2002.

The terms of the possible acquisition or easement at this time are unknown. In part because of these unknowns, this environmental impact statement analyzes the effect of alternative 7 on bison distribution with and without the purchase or easement. This same information for impacts on other resources is available by comparing the environmental consequences sections for alternative 4, where acquisition was not anticipated.

Alternative 7 departs from all other alternatives in that a range of bison population numbers is analyzed that differs from the other alternatives. This range is from 1,700 to 2,500 bison. Agency-implemented lethal controls would decrease as the population approached 1,700 bison and would cease at 1,700 bison in certain areas as described in management sections for each area. In general, hazing bison from areas where they were not permitted such as outside SMAs or on private land would be attempted before they were shot. Untested bison in the western SMA that posed a lower possibility of transmission of brucellosis and animals testing negative and previously released, would be allowed on public land during periods of the year that cattle were not present. Bison that posed a greater possibility of disease transmission would be removed. The state of Montana reserves the right to identify bison with a lower possibility of transmission according to such criteria as the state veterinarian and the Board of Livestock deem necessary to prevent brucellosis transmission from bison to cattle and to prevent import sanctions on Montana cattle by other states. The determination of animals in the western SMA that pose a lower possibility of transmission would be within the discretion of the Montana state veterinarian. The Montana state veterinarian would consult with APHIS and other state animal health authorities and use the best available science when making this determination (see appendixes A and G). Measures to remove increasing numbers of bison would be implemented as the population approached 2,500. However, the agencies might not be able to limit the herd to 2,500 because all lethal measures would occur at or outside the park boundary and in response to bison migrations.

In phase 2, it is assumed the agencies would acquire access to additional lands in the Gardiner Valley on the west side of the Yellowstone River for uses including winter range, siting the capture facility, and other bison management activities provided willing sellers were identified and funding was available.

See Note below.

These lands would be evaluated along with other alternative sites for a quarantine facility. This might mean purchase of grazing rights, easements, or property from all willing sellers. Assuming land or easements were acquired and placed under state or federal management, this area could be used for winter range, siting the capture facility, and other bison management activities. Physical barriers such as heavy jack-leg fencing might be placed at the north end next to the Yellowstone River to block bison movement. Protective fencing around small private inholdings could be constructed with landowner concurrence. Allowing bison outside the park in this area, should it be acquired, would require the creation of an SMA. For the remainder of this description, this SMA is referred to as the Reese Creek SMA. The capture facility now located at Stephens Creek could be dismantled and relocated to a suitable location north of the park boundary and south of Yankee Jim Canyon in this SMA.

FEIS Note: As indicated in alternative 1, the acquisition of these lands and conservation easements has occurred. The U.S. Forest Service has jurisdiction over the purchased lands and will administer and monitor the terms and conditions of the conservation easement lands.

Although alternative 7 is distinct, it has elements similar to other alternatives. Capture and slaughter of seropositives is the primary means of managing risk, as it is in alternatives 1, 4, and 5. As many seronegative bison as possible would be shipped to a quarantine facility, as they would be in alternative 4.

Also like alternative 4, low levels of hunting would be allowed in one or more of the SMAs outside the park. As in alternative 3, alternative 7 allows the Stephens Creek facility to be moved to a suitable location north of the park boundary and south of Yankee Jim Canyon if the land was acquired under public ownership. However, as described above (and in the "Population Management" section below), this alternative is much more specific in defining a narrower population range and management actions to keep it within that range.

NORTHERN BOUNDARY

Reese Creek

If acquisition of land from willing sellers north of the park occurred, it would be evaluated as an alternate site for the Stephens Creek capture facility managed by the park. However, if lands were not acquired, the park would continue to operate the facility throughout the life of this plan. Features of the capture facility are described in alternative 1, and no changes in operation except the additional shipment of as many seronegative bison as possible to quarantine would be anticipated. Criteria listed in "Actions Common to All Alternatives" for the location of a capture facility would apply to siting such a facility if it were moved.

FEIS NOTE: Acquisition of the lands described in the paragraph above has occurred. Use of the land for an SMA or relocation of a capture facility would not occur until a cattle lease on acquired land has expired in 2002 and the state of Montana has approved an SMA on the property.

Management actions at the capture facility would vary, depending on the population size. Bison evading capture at the Stephens Creek facility (or at the new capture facility on acquired property, should this occur) might be shot or hazed on private land. If population numbers approached 1,700, agencies would haze bison in the park or capture facility if possible rather than shoot them. If population numbers approached 2,500, agency personnel would likely shoot bison when they occupied private land, rather than trying to haze them back into the park or capture facility.

Captured bison would be divided into groups for safety reasons and blood tested for exposure to *B. abortus*. Seropositive bison would be shipped to slaughter at approved slaughter facilities. Until a quarantine facility was approved, sited, and built, seronegative captured bison at Stephens Creek would also be shipped to slaughter, unless population numbers were approaching 1,700. If population numbers were low (approaching 1,700), seronegative bison might be held until weather moderated and released back into the park. Should such environmental conditions recur at low population numbers, the Stephens Creek capture facility might again be used to temporarily hold overwintering bison. The agencies estimate between 100 and 125 bison could be safely held in the Stephens Creek facility.

If bison numbers were approaching 2,500 and bison left the park, seronegative bison would be sent to quarantine for release following completion of protocol described in appendix B. Bison completing the full quarantine protocol would be made available to establish bison populations on tribal lands, other appropriate public lands, or provided to other appropriate public institutions or other qualified recipients. When a safe vaccine was available, seronegative bison would also be vaccinated at the capture or quarantine facility. If the quarantine facility was full (and population numbers at or above 2,500), captured seronegative bison would be sent to slaughter.

In phase 2, these same functions could be relocated to a new capture facility on acquired lands north of the park boundary and south of Yankee Jim Canyon. This is dependent on the acquisition from willing sellers of private lands, easements, or grazing rights to property north of the park border to Yankee Jim Canyon (see alternative 7 map). Changes to allotments on the north side of the park would be possible in phase 2.

FEIS Note: Please see notes regarding acquisition.

Eagle Creek/Bear Creek

Agencies would monitor bison movements in the Eagle Creek/Bear Creek area and maintain a boundary at the Little Trail Creek/Maiden Basin hydrographic divide through limited hunting (if approved by the Montana Legislature), hazing, and agency shooting. Hunting would also keep population numbers lower and decrease the number of bison approaching the boundary at the Little Trail Creek/Maiden Basin hydrographic divide.

WESTERN BOUNDARY

Agencies would monitor and haze or shoot bison leaving the northern boundary (to the south of Buffalo Horn Creek) of the West Yellowstone area of the western SMA (see alternative 7 map). Those leaving to the west along Hebgen Lake Dam would also be hazed or shot. Although hunting in the West Yellowstone area is not a part of alternative 7 in phase 1, the agencies could include hunting as a population management tool in phase 2.

The state of Montana would continue to operate capture facilities on private land at Duck Creek and on U.S. Forest Service land in the Horse Butte area. Either of these capture facilities could be relocated in future winters if bison migration paths changed.

Bison would be moved into the facilities using bait, hazing, wing fences, or other appropriate methods. They would be tested for exposure to *B. abortus*, and all seropositive bison shipped to slaughter at an approved slaughterhouse. Seronegative-pregnant bison would be sent to quarantine. Normally (e.g., when population size is in the mid-range), seronegative-nonpregnant bison would be identified with a metal ear tag and a temporary visual marker and released onto public lands in the West Yellowstone area. The treatment of seronegative bison captured on the west side would change if populations levels approached the low (1,700) end or the high (2,500) end (see "Population Management" section below).

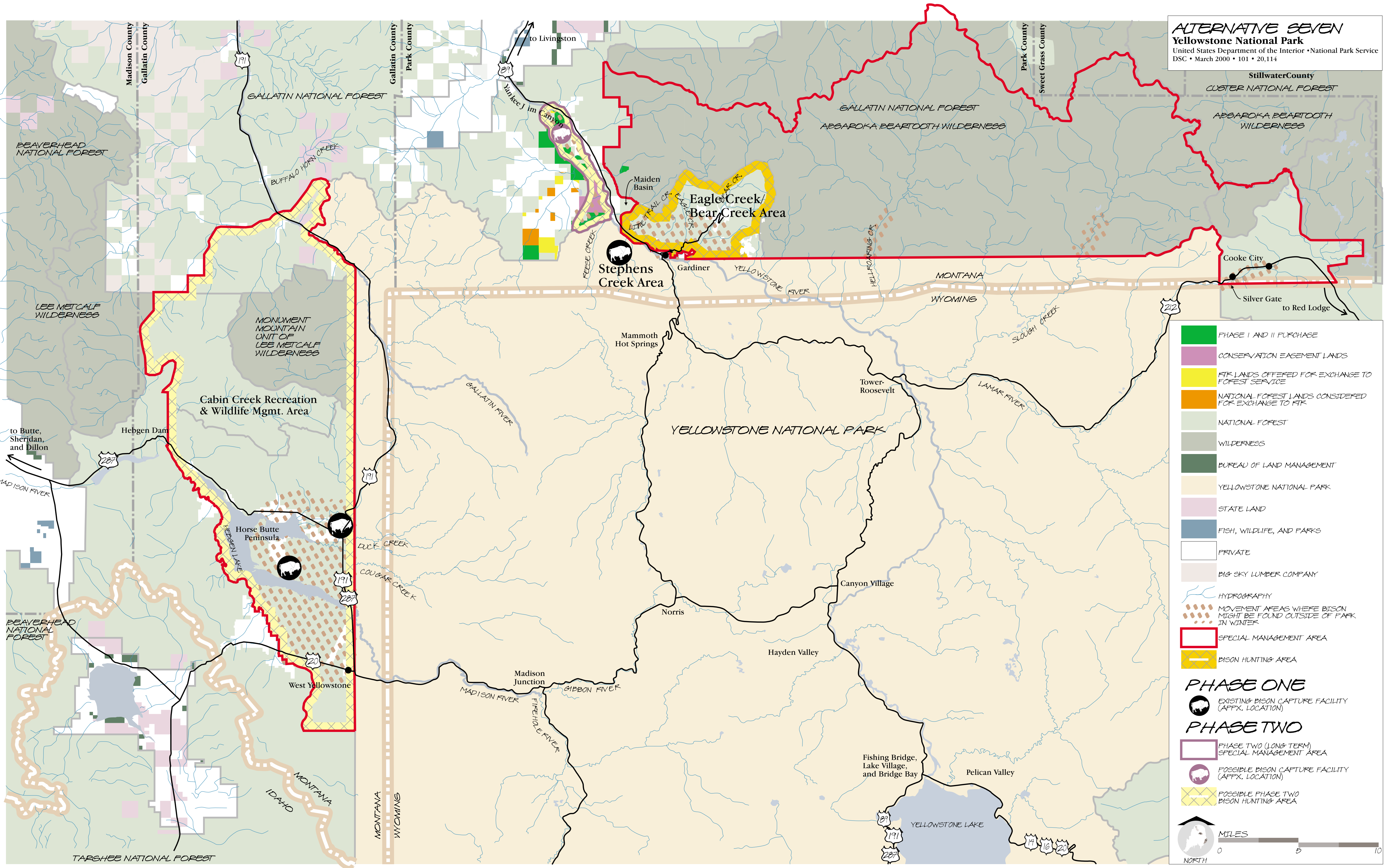
No changes in allotments or grazing rights on the west side of the analysis area would be anticipated in either phase 1 or phase 2.

SPECIAL MANAGEMENT AREAS

In this alternative, SMAs would be established in the Eagle Creek/Bear Creek area, the Hellroaring and Slough Creek drainages, and the West Yellowstone area south of Buffalo Horn Creek, including the Cabin Creek Recreation and Wildlife Management Area/Lee Metcalf Wilderness (see alternative 7 map). Lands acquired north of the park border at Reese Creek may also become an SMA. Any SMA requires the approval of the state of Montana as specified by Montana law.

Agencies would use the management tools described in the "Northern Boundary" and "Western Boundary" sections of this alternative. Although hunting in the Reese Creek SMA is not part of the alternative in phase 1, it might become a part later if agencies felt it was appropriate and the legislature approved it. If so, the number of hunting permits would be increased when the population level approached 2,500, and decreased when it approached 1,700. The details of the hunt and how it would be conducted would be similar to those described in alternative 3, although the number of permits would likely be more limited.

A limited public hunt in the Eagle Creek/Bear Creek SMA would be used to help control population numbers and distribution and to provide recreation. The hunt would likely run between October 1 and February 28 (see the description in "Population Management" section below).


ALTERNATIVE SEVEN
Yellowstone National Park
United States Department of the Interior •National Park Service
DSC • March 2000 • 101 • 20,114
PHASE I AND II PURCHASE
CONSERVATION EASEMENT LANDS
RTR LANDS OFFERED FOR EXCHANGE TO FOREST SERVICE
NATIONAL FOREST LANDS CONSIDERED FOR EXCHANGE TO RTR
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BISON HUNTING AREA
PHASE ONE
EXISTING BISON CAPTURE FACILITY (APPX. LOCATION)
PHASE TWO
PHASE TWO (LONG TERM) SPECIAL MANAGEMENT AREA
POSSIBLE BISON CAPTURE FACILITY (APPX. LOCATION)
POSSIBLE PHASE TWO BISON HUNTING AREA
MILES
0
5
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NORTH
Madison County
Gallatin County
Gallatin County
Park County
Park County
Sweet Grass County
StillwaterCounty
to Livingston
GALLATIN NATIONAL FOREST
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Maiden Basin
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YELLOWSTONE RIVER
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LEE METCALF WILDERNESS
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Madison Junction
MADISON RIVER
GIBBON RIVER
FIREHOLE RIVER
MONTANA
IDAHO
MONTANA
WYOMING
Fishing Bridge, Lake Village, and Bridge Bay
Pelican Valley
YELLOWSTONE LAKE
TARGHEE NATIONAL FOREST

Cattle would continue to be grazed on Gallatin National Forest lands in the West Yellowstone area from about June 15 to October 30. Cattle graze on private land from approximately June 1 to November 15. Bison would be hazed back into the park in the spring, 30 to 60 days before cattle occupy the area. The exact number of days, between 30 and 60, would be at the discretion of the state veterinarian. Those bison that could not be hazed back into the park would be shot. Seronegative-nonpregnant bison released from capture facilities on the west side would be allowed back into the SMA following the departure of livestock if populations were in the low or mid range. If the bison herd was approaching 2,500, a larger proportion of captured seronegatives would be shipped to quarantine rather than released.

If population numbers were high, bison would be shot by agencies (by request or with permission of the landowner) if they occupied private lands in or attempted to leave the SMA. If numbers were low, it would be the preference of the agencies to use hazing as a primary tool to keep bison off private land or from crossing out of the western SMA. If hazing was unsuccessful or the private landowner would not allow hazing, the agencies would shoot bison identified for removal. Very high elevation country to the west would help keep bison confined to the SMA.

Bison would be able to occupy the Cabin Creek Recreation and Wildlife Management Area and Monument Mountain Unit of the Lee Metcalf Wilderness to the north of the West Yellowstone area without agency management. These lands are without livestock allotments, although topography and snow depths limit the number of bison that actually use them.

Hunting bison in the western SMA might be considered as an adjunct to capture operations. If so, it would be used to help manage population size and distribution. The number of hunting permits issued would increase when the population approached 2,500, and decrease as it approached 1,700.

As described above, both the Duck Creek and Horse Butte capture facilities would continue to operate in their present locations in the western SMA.

RISK MANAGEMENT

Alternative 7 would rely on separation, capture, slaughter of seropositives, and vaccination of bison to reduce the risk of brucellosis transmission.

The primary means to ensure separation of cattle and bison would be the enforcement of controlled entry at the northern border and in the western SMA as described above, and temporal separation in the western SMA. On the north end, agencies would use monitoring, hazing, capture, slaughter of seropositives, and agency shooting to maintain separation at Reese Creek. At Eagle Creek/Bear Creek, monitoring, hazing, hunting, and agency shooting would prevent entry into the Gardiner area. If a Reese Creek SMA was established on lands acquired north of the park, hunting could be used in the SMA to help control population numbers and distribution.

In the West Yellowstone area, temporal separation would be maintained by allowing seronegative-nonpregnant bison in the area in the winter months and cattle in the summer. To prevent commingling of bison and cattle, bison would hazed back into the park in the spring, 30 to 60 days before cattle occupy the area. The exact number of days, between 30 and 60, would be at the discretion of the state veterinarian. Those bison that could not be hazed back into the park would be shot. Bison would not be allowed in the SMA until cattle have been removed in October/November. Hunting, if it was approved, would help control population numbers and distribution. Topography, availability of habitat, hazing, hunting, and agency shooting would keep bison from moving beyond SMA boundaries or onto private land.

In addition to separation, this alternative would reduce risk of transmission to cattle in the West Yellowstone area of the western SMA through capture and slaughter of seropositives in two the capture facilities described above.

Seronegative-pregnant females and bison that posed a greater possibility of disease transmission, including pregnant, untested females or females with newborn calves who have not passed all birth membranes would be captured and quarantined or removed. Removing pregnant bison would ensure no birth materials are left behind when cattle reoccupy the area in the summer. Removal could be through shooting, or if logistically feasible, through immobilization via dart. If the bison has a newborn calf, the calf would be captured by hand or darted. The immobilized animals would be transported back into the park, to quarantine, or to an approved research facility. (Experience to date indicates the chance of a female with a newborn calf who has not passed all birth membranes appearing in the western boundary area is very low. None was observed in any of the past bison control operations.)

Operators in the West Yellowstone area of the western SMA on public lands would be encouraged to vaccinate female cattle calves against brucellosis. Operators in all other boundary areas would be encouraged to annually vaccinate all subadult cattle as well as calves. Cattle herds in contact areas would continue to be surveillance tested periodically, and any herd whose member or members might have come in contact with bison would be checked for exposure. Livestock owners on private property would continue to be responsible for all costs and materials associated with calfhood vaccination.

When a vaccine was developed that was determined safe for bison and nontarget animals, it would be administered to captured bison and bison placed in quarantine. When a safe and effective vaccine was developed, it would be administered through remote means to free-ranging bison.

POPULATION MANAGEMENT

Bison population numbers at the northern park boundary would be controlled through the increasing or decreasing use of lethal methods to manage bison. At low population numbers, if bison crossed the Reese Creek boundary onto private land, the agencies would attempt to haze the bison back into the park. If hazing was unsuccessful or the private landowner would not allow hazing, the agencies would shoot those bison on private land. If winter conditions were very severe, some bison could be held and fed at the capture facility throughout the remainder of the winter. If a Reese Creek SMA was established on acquired lands north of the park and west of the Yellowstone River, bison would be hazed off private land within the SMA if population numbers remained low. If hazing was unsuccessful or the private landowner would not allow hazing, the agencies would shoot those bison on private land within the SMA. Also, if hunting was approved in the SMA, few or no permits would be issued if the herd size was approaching 1,700.

If the bison population approached 2,500 and bison approached the SMA boundary, captured seronegative bison would be sent to quarantine. If the quarantine facility was full, seronegative bison would be sent to slaughter. Bison released from quarantine would be made available to establish bison populations on tribal lands, other appropriate public lands, or provided to other appropriate public institutions or other qualified recipients. In phase 1, bison crossing the park boundary at Reese Creek would be shot on private land. In phase 2, bison going beyond the SMA boundary would be shot by agencies. If the Reese Creek SMA was created, bison on private land within its boundary would be shot upon landowner request. If hunting was approved in the new SMA, increasing numbers of permits would probably be issued as population numbers approached 2,500.

Hunting permits for the Eagle Creek/Bear Creek area would also increase or decrease, depending on the size of the herd. Agencies would attempt to haze bison back into the Eagle Creek/Bear Creek SMA if possible at low population levels and would rely more on shooting to maintain the boundary at Little Trail Creek/Maiden Basin hydrographic divide at higher population levels.

The agencies would use the same types of methods in the western SMA to control population size. When population numbers were low, bison would be hazed off private land, rather than shot. Those attempting to leave the SMA would be hazed if possible, and shot only as a last resort.

Bison would continue to be captured on the west side as the population approaches the low end (1,700 animals). All bison posing a lower risk of transmission and animals testing negative and previously released would be allowed on public lands in the SMA.

All bison in the SMA would be hazed back into the park in May to facilitate reoccupation of the area by cattle in the summer. If hunting was approved in this SMA, no permits would be issued until the population grew beyond 1,700.

If the population was in the mid range, seronegative-nonpregnant bison captured at the two existing capture facilities on the west side would be released onto public lands. Seronegative-pregnant bison would be sent to quarantine.

When the population numbers approached 2,500, agencies would shoot bison on private land or those bison attempting to leave the SMA. All seronegative bison captured in the two facilities operating in the western SMA would be shipped to quarantine provided facility space was available and those bison would be released upon completion of quarantine protocol to establish bison populations on tribal lands, other appropriate public lands, or provided to other appropriate public institutions or qualified recipients.

Quarantine

A quarantine facility would be proposed (e.g., when population levels were not approaching 1,700 and bison were migrating out of the park) to give agencies flexibility in handling captured bison that they do not now have (see alternative 3). It would also provide a source of live, disease-free bison for tribal governments, requesting organizations, or to establish populations on other public lands. Seronegative bison could be shipped to the quarantine facility and complete an approved protocol to ensure they were disease free. When they have completed the quarantine protocol described in appendix B, they could be released to establish bison populations on tribal lands, other appropriate public lands, or provided to other appropriate public institutions and qualified recipients. Any bison showing signs of exposure to *B. abortus* during the quarantine period would be slaughtered, and testing of the remaining bison in contact with it begun again. Because of this, bison might need to remain in quarantine for several years to be declared disease free. Bison successfully completing the full quarantine procedure without contact with any infected animals would be available for release (see "Quarantine" section in alternative 3 for more information on facility description and procedures). The agencies would sign a memorandum of understanding to formalize commitments regarding a quarantine facility should alternative 7 or another alternative including quarantine be selected. Details of the design, location, and other factors would be decided following appropriate environmental review and compliance.

Public Hunting

Upon issuance of the records of decision, the agencies would request the Montana Legislature authorize Montana to establish regulations for the public hunting of bison. If approved, regulated public hunting seasons would be administered to help control bison numbers and provide recreation on public lands in the Eagle Creek/Bear Creek area. In addition to controlling bison numbers, hunting would also help prevent bison on public lands in the Eagle Creek/Bear Creek area from migrating to private lands. Hunting might also be allowed in the West Yellowstone and other SMAs. If so, it would be used to help remove bison from private lands in both areas, and in maintaining bison population and distribution.

Regulations likely would authorize a season that would begin no earlier than October 1 and end no later than February 28, with several designated hunting periods within the season. Individual licensed hunters would be authorized to hunt during one designated hunting period. The regulations would specify a quota on the number of licenses to be issued for each area during each hunting season. Each licensed hunter could legally take one bison of any age and of either sex.

Each hunter interested in participating in the bison season would submit an application for a license, similar to an application for other special hunting licenses. Applicants would submit the fees for the license and a processing fee with the application.

Hunting would begin in the year 2002 at the earliest. Based on bison population numbers, winter distribution on public and private lands, and other factors, the agencies might conduct additional special drawings to harvest additional bison (see additional details of the hunt in the description of alternative 3).

ESTIMATE OF COST

Table 9 indicates the costs that would be incurred by the interagency team for alternative 7.

Table 9: Annual Income/Cost Estimates — Alternative 7

	National Park Service	U.S. Forest Service	State of Montana	APHIS	Shared Costs
Test/sample bison	-	-	-	$27,500	-
Capture facility (Stephens Creek)[1]	$120,000	-	-	-	-
Capture facility (west area)[1]	-	-	$175,000	$50,000	-
Operations at capture facilities	$463,100	$16,500	$247,500	$110,000	-
Hunting operations	-	$11,000	$55,000	-	-
Equipment, repair, replacement	$72,600	-	-	-	-
Vaccinate bison	$330,500	-	-	$8,800	-
Relocate Stephens Creek capture facility[1]	$66,000	-	-	-	-
Quarantine facility[1]	-	-	-	$550,000–$880,000[2]	-
Quarantine operations	$7,500	-	-	$440,000	-
Acquisition[1]	-	-	-	-	29.1 million
Easement[1]	-	-	-	-	Unknown[3]
Conversion of livestock operations[1]	-	-	-	-	Unknown[3]
Wildlife/winter use monitoring	-	$5,500	-	-	-
Average income from the sale or meat, hides, and heads	-	-	+$51,480	-	-
TOTALS	($1,059,700)	($33,000)	($426,020)	($1,193,800–$1,523,800)	(Up to 29.1 million)

1. One time only capital costs.
2. Does not include land costs for quarantine facility.
3. Easement and conversion would substitute for acquisition, and costs would be less than $29.1 million.

MODIFIED PREFERRED ALTERNATIVE

The federal agencies acknowledge that the state of Montana may accept or reject participation on any aspect of the management prescriptions set forth in the preferred alternative. However, as with all the alternatives analyzed in this environmental impact statement, the preferred alternative assumes that the federal and state agencies would implement the proposed actions. As explained in "Purpose of and Need for Action: Introduction," the federal agencies acknowledge that the state of Montana would decide the long-term management for bison located on lands outside Yellowstone National Park in Montana.

The modified preferred alternative employs an adaptive management approach that allows the agencies to gain experience and knowledge before proceeding to the next management step, particularly with regard to managing bison on winter range outside Yellowstone National Park. The alternative uses many tools to address the risk of transmission, but primarily relies on the spatial and temporal separation of potentially infectious bison or their birth products and susceptible cattle. Bison are not allowed to intermingle with cattle, and are hazed back into the park, captured, or shot if they cannot be hazed.

This alternative employs an adaptive management approach that allows the agencies to gain experience and knowledge before proceeding to the next management step, particularly with regard to managing bison on winter range outside the park.

The purpose of such actions is to ensure that sufficient time (approximately 45 days) is allowed to kill *B. abortus* bacteria before cattle return to graze in the summer. *B. abortus* bacteria are highly unlikely to survive after an approximate 45-day period due to heat and ultraviolet light.

Telemetry would be used to monitor seronegative pregnant bison outside the park in some steps to determine the risks associated with their presence and to develop appropriate mitigative measures if needed. While data are being collected, telemetry would also be used to provide an added measure of security in the event that any of these bison seroconvert and either abort or give birth outside the park. An overall herd size, as well as manageable limits to the number of bison outside the park, would be enforced.

As with other alternatives, vaccination of vaccine-eligible bison, including remote vaccination of those inside the park, is anticipated. For the most part (see discussions of Eagle Creek/Bear Creek and Cabin Creek, Lee Metcalf below for exceptions), when bison are allowed to exit the park to access winter range, they are managed in zones, where management becomes increasingly intense as bison approach the edge of the boundary area. Cattle may be more intensively monitored under this alternative than under some other alternatives, with regular testing, calfhood vaccination, and possible adult vaccination conducted by the agencies.

Perceived risk of state sanctions is also addressed through the commitment of APHIS to consult with states threatening sanctions to convince such states that sanctions are unwarranted. With owner consent, APHIS would also certify as brucellosis-free particular cattle herds that might occupy the impact area in the winter and that meet the certification requirements.

As with most other alternatives analyzed in the *Draft Environmental Impact Statement*, untested bison would be allowed to occupy the following areas year-round without agency interference:

Eagle Creek/Bear Creek area

Cabin Creek Recreation and Wildlife Management Area

Monument Mountain Unit of the Lee Metcalf Wilderness

The alternative has three adaptive management steps each for the north and west boundary areas. In the north boundary area, the first step would continue the provisions of the interim plan at the Reese Creek boundary of the park. Some of the lands north of this boundary were purchased and easements acquired by the U.S. Departments of the Interior and Agriculture and the Rocky Mountain Elk Foundation in 1999 and 2000. Purchased lands are now under the jurisdiction of the Gallatin National Forest. When an existing cattle lease on the property expires in 2002, step 2 would begin. In the western boundary area, step 1 would be similar to the interim plan except that all seronegative bison (including pregnant females, which would be instrumented with telemetry devices) up to a tolerance level of 100 would be released, rather than sent to slaughter as they are now. Captured calves and yearlings would be vaccinated with a safe vaccine, and all bison in the West Yellowstone area would be managed in zones, with progressively more intense management the farther bison are from the park.

Bison that could not be captured, but are tolerated, would be permitted outside the park until approximately 45 days before cattle return to graze for the summer. Those bison not tolerated outside the park that cannot be hazed or captured would be shot. Under the provisions of the current *Interim Bison Management Plan* (see description of alternative 1 in this environmental impact statement), bison are not vaccinated, 50–100 seronegative, nonpregnant bison are tolerated in the West Yellowstone area, and zone management is not in place.

During step 1, APHIS, as lead agency along with other federal agencies, would also begin a NEPA process to determine the design, location, and operation parameters of a quarantine facility.

One unknown in step 1 is the date when the safety verification of RB51 (or another vaccine) for use in bison calves and yearlings would occur. Research on a safe vaccine is not yet complete, but is expected to be finished by late 2000.

Impacts of step 1 are similar to those described in alternative 1 (the No-action alternative, or continuation of the interim plan), except that seronegative, pregnant bison would be released and closely monitored in the west boundary area, rather than shipped to slaughter as they are now.

Step 2 in the north boundary area begins in 2002 when an existing cattle lease on recently acquired lands adjacent to the Reese Creek boundary of the park expires. Because cattle would presumably be absent on these lands all year, seronegative bison would be allowed to occupy these lands during the winter under certain conditions. These conditions include

- the overall bison late winter/early spring population is at 3,000
- only seronegative bison are allowed out of the park
- no more than 100 bison occupy the area
- all bison not returning on their own would be hazed back into the park in the spring

Step 2 in the west boundary area would be identical to step 1, except that the agencies anticipate a safe and effective system would be available to deliver a safe vaccine for bison calves and yearlings. Any untested calves, yearlings, or other vaccine-eligible bison that could not be captured in the west boundary area would be remotely vaccinated using this system if a safe vaccine is available. Other bison that could not be captured and are not tolerated would be shot.

When the quarantine facility becomes available, it would be used to hold seronegative bison captured when the tolerance level of the boundary areas is reached, when the overall late winter bison population is greater than 3,000 animals, or when hazing bison back into the park to enforce the approximately 45-day separation period is ineffective.

Unknowns in implementing step 2 include the availability of a safe and effective remote delivery system for the vaccine; the location, design, operation, and holding capacity of a quarantine facility; and the date when such a facility would become available for use by the agencies.

The third step of the alternative begins when the agencies have collected adequate data and experience in managing bison outside the park in each boundary area, a minimum of two years following the initial release of seronegative bison. In the West Yellowstone area, this date is presumed to be winter 2003/2004. In the Reese Creek area, it is winter 2004/2005. Because the data and experience collected during the first two steps would provide agencies the tools and knowledge to manage bison outside the park, step 3 would allow bison to leave the park and enter management zones without first being tested. Untested bison up to a tolerance level of 100 would therefore be allowed to freely range in both the western and northern boundary areas, and would be managed in zones as described above.

In the spring, the bison would be hazed back into the park. Capture facilities in Stephens Creek and the West Yellowstone area, and a quarantine facility would be used to maintain the bison population at 3,000, to enforce tolerance levels of 100 bison in either the Reese Creek and West Yellowstone boundary areas, and to ensure no bison remain outside the park during the approximately 45-day period before cattle return. Parkwide vaccination of vaccine-eligible bison (assumed at this time to be calves and yearlings only) with a safe and effective vaccine using a safe and effective remote delivery system would begin in winter 2003/2004. The agencies have agreed that vaccination of all vaccination-eligible bison would also be used when a safe and effective vaccine for all ages and pregnancy status is available, and a safe and effective delivery system is available.

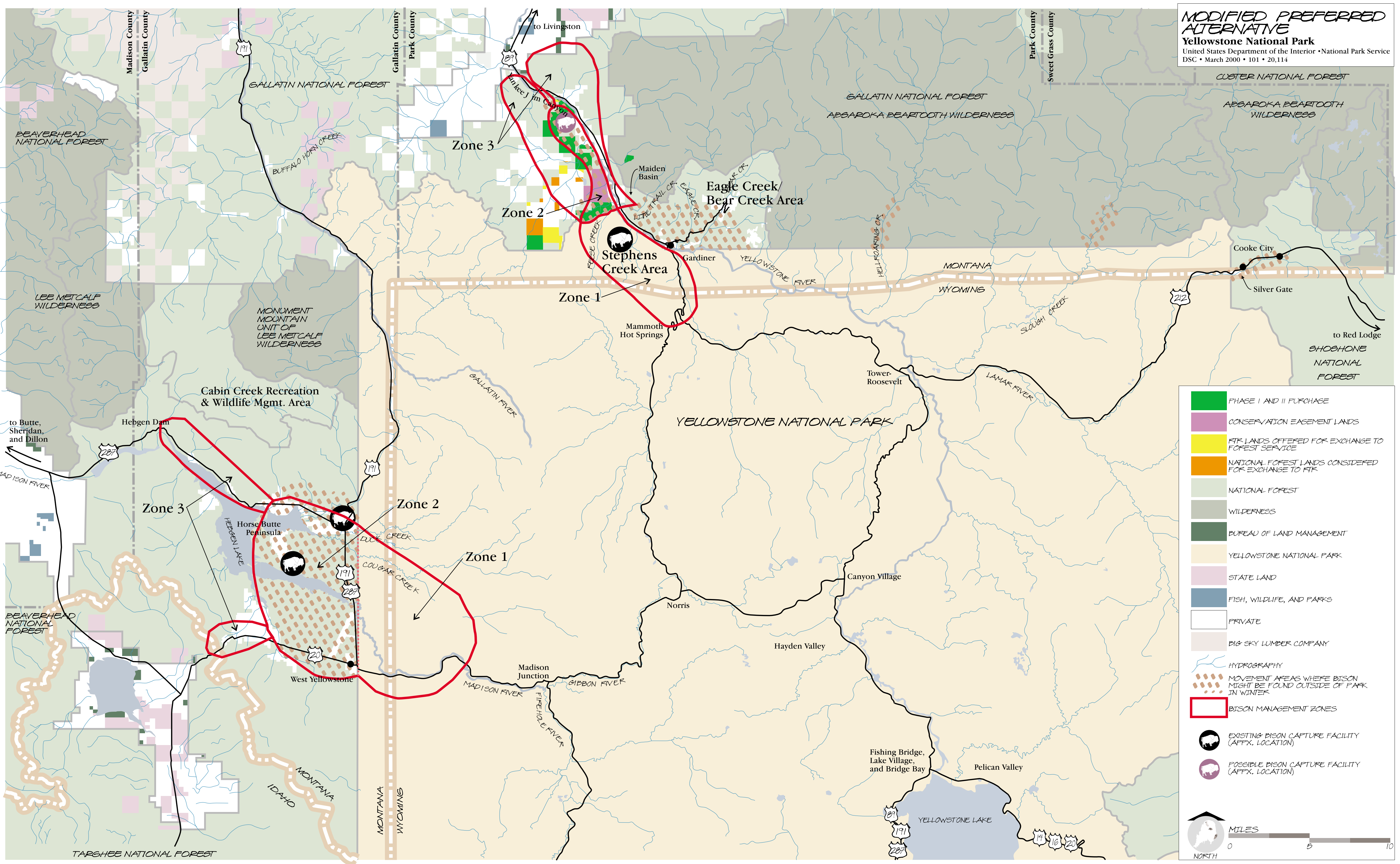
Unknowns for this phase of the alternative include the date when a safe and effective vaccine and delivery system become available for bison calves and yearlings, and the outcome of NEPA processes for the use of a parkwide vaccine.

MAINTAINING THE NORTHERN BOUNDARY

Reese Creek

The Reese Creek region of the northern boundary area is shown on the modified preferred alternative map. It lies to the west of the Yellowstone River, north of the park boundary at Reese Creek and south of Yankee Jim Canyon.

During the first adaptive management step, while a private grazing lease on this land is in effect, the National Park Service would continue monitoring during the approximate period between November 1 and April 30 and use hazing to prevent bison movement north of the park boundary onto public and private lands in the Reese Creek area. If hazing becomes infeasible, the National Park Service would operate the Stephens Capture facility, test all captured bison, send seropositives to slaughter, and temporarily hold all seronegatives up to its capacity of 125 for release back into Yellowstone National Park in the early spring. Calves and yearlings that are captured would


MODIFIED PREFERRED ALTERNATIVE
Yellowstone National Park
United States Department of the Interior • National Park Service
DSC • March 2000 • 101 • 20,114
GALLATIN NATIONAL FOREST
ABSAROKA BEARTOOTH WILDERNESS
CUSTER NATIONAL FOREST
BEAVERHEAD NATIONAL FOREST
LEE METCALF WILDERNESS
MONUMENT MOUNTAIN UNIT OF LEE METCALF WILDERNESS
Cabin Creek Recreation & Wildlife Mgmt. Area
to Livingston
Zone 3
Zone 2
Zone 1
Maiden Basin
Eagle Creek/ Bear Creek Area
Stephens Creek Area
Gardiner
Mammoth Hot Springs
YELLOWSTONE RIVER
MONTANA
WYOMING
Cooke City
Silver Gate
to Red Lodge
SHOSHONE NATIONAL FOREST
Tower-Roosevelt
LAMAR RIVER
SLOUGH CREEK
YELLOWSTONE NATIONAL PARK
GALLATIN RIVER
to Butte, Sheridan, and Dillon
Hebgen Dam
MADISON RIVER
Horse Butte Peninsula
HEBGEN LAKE
DUCK CREEK
COUGAR CREEK
West Yellowstone
Madison Junction
GIBBON RIVER
FIREHOLE RIVER
Norris
Canyon Village
Hayden Valley
Fishing Bridge, Lake Village, and Bridge Bay
Pelican Valley
YELLOWSTONE LAKE
IDAHO
TARGHEE NATIONAL FOREST
Madison County
Gallatin County
Park County
Sweet Grass County
BUFFALO HORN CREEK
PHASE I AND II PURCHASE
CONSERVATION EASEMENT LANDS
RTK LANDS OFFERED FOR EXCHANGE TO FOREST SERVICE
NATIONAL FOREST LANDS CONSIDERED FOR EXCHANGE TO RTK
NATIONAL FOREST
WILDERNESS
BUREAU OF LAND MANAGEMENT
YELLOWSTONE NATIONAL PARK
STATE LAND
FISH, WILDLIFE, AND PARKS
PRIVATE
BIG SKY LUMBER COMPANY
HYDROGRAPHY
MOVEMENT AREAS WHERE BISON MIGHT BE FOUND OUTSIDE OF PARK IN WINTER
BISON MANAGEMENT ZONES
EXISTING BISON CAPTURE FACILITY (APPX. LOCATION)
POSSIBLE BISON CAPTURE FACILITY (APPX. LOCATION)
MILES
0
5
10
NORTH

be vaccinated with a safe vaccine. Bison that cannot be hazed and evade capture would be shot.

After the cattle grazing lease expires in 2002, the agencies would initiate step 2. As in step 1, the National Park Service would again monitor bison and attempt to prevent movement north of the park. If hazing were ineffective, the bison would be captured and tested, with seropositives sent to slaughter and all seronegatives up to a pre-defined tolerance level (presumed to be 100 bison) released. Captured calves and yearlings would be vaccinated with a safe vaccine before their release. Seronegative pregnant female bison would receive a radiotelemetry collar and vaginal radiotelemetry implant during handling at capture facilities to allow agencies to monitor bison locations and recapture if needed. Telemetry would also allow the agencies to locate and monitor any birth or abortion sites that may occur in the Reese Creek area.

After two years, when the agencies have collected enough information on bison movements and behavior, as well as on the agencies' ability to monitor and manage bison in the Reese Creek area, step 3, allowing untested bison outside the park into this area, would begin. This step is expected to begin in winter 2004/2005.

The agencies would limit bison movement at Yankee Jim Canyon in steps 2 and 3, and would use topography and progressively more intense management to ensure no contact with cattle. If needed to control bison movements, a second capture facility may be constructed between Reese Creek and Yankee Jim Canyon.

Eagle Creek/Bear Creek

In all steps of this alternative, agencies would allow untested bison to roam freely into the Eagle Creek/Bear Creek region of the northern boundary area. As with all other alternatives, bison in the Eagle Creek/Bear Creek area would be monitored twice per week during the winter. If they approach the Little Trail Creek/Maiden Basin hydrographic divide, they would be monitored daily. Unless private property or easements were purchased from willing sellers, or agreements with property owners in the Gardiner Valley adjacent to this area were made, the agencies would maintain a boundary at the Little Trail Creek/Maiden Basin hydrographic divide by hazing or shooting bison attempting to cross it.

Absaroka Beartooth Wilderness

Untested bison would be allowed to roam freely into the Absaroka Beartooth Wilderness north of the park, including the Hellroaring and Slough creek drainages. This is a large area with no cattle, and bison would not be monitored or managed in any way. Because of the high elevation and rugged topography, no more than a few (usually solitary male) bison are expected to occupy these areas.

MAINTAINING THE WESTERN BOUNDARY

West Yellowstone

The West Yellowstone region of the western boundary area is shown as the stippled area on the modified preferred alternative map. It includes lands to the north of West Yellowstone west to Hebgen Lake Dam and north to the area near Highway 287.

In step 1, the agencies would haze back into the park those bison attempting to exit into the West Yellowstone area. When hazing is ineffective, bison would be captured and tested, seropositives sent to slaughter, and all seronegatives up to a specified tolerance level released. Seronegative pregnant females would be instrumented and monitored as in the northern boundary area. Seronegative calves and yearlings that are captured would be vaccinated with a safe vaccine. Bison that could not be captured but are tolerated would be permitted outside the park until approximately 45 days before cattle return. Those bison that could not be captured and are not tolerated and cannot be hazed would be shot.

Management practices conducted in step 1 would continue in step 2, when a safe and effective remote delivery mechanism is available (expected winter 2002/2003). In addition for step 2, any untested vaccination-eligible bison that are tolerated in the West Yellowstone area would be remotely vaccinated.

When the agencies have collected enough information on bison movements and behavior, as well as the agencies' ability to monitor and manage bison in the West Yellowstone area, step 3, allowing untested bison outside the park, would begin. Because the agencies would already have more than two winters of data, this step is expected to start in 2003/2004, a year earlier on the west side than at Reese Creek.

In all three steps, bison in the West Yellowstone area would be managed in zones, using topography and progressively more intense management to ensure no contact is made between bison and susceptible cattle outside the boundary area. Bison would also always be hazed back into the park in the spring, and captured or shot to ensure none remain in the West Yellowstone area during the approximately 45-day period before cattle return.

Cabin Creek/Lee Metcalf

Few, if any, bison are expected to move to the Cabin Creek Recreation & Wildlife Management Area, and the Monument Mountain Unit of the Lee Metcalf Wilderness during winter. Bison movement would be periodically monitored, and those crossing outside these areas or onto private lands would be hazed or shot. If bison attempt to winter in these areas, they would likely return to the park in the spring. If not, agency personnel would haze them back, if feasible.

MANAGEMENT IN BOUNDARY AREAS

Northern Boundary Area

As described above, bison are allowed to roam freely in the Eagle Creek/Bear Creek and Absaroka Wilderness regions of the northern boundary area. The agencies would maintain a border through hazing and shooting at the Little Trail Creek/Maiden Basin hydrographic divide.

Topography and natural features would help restrict bison to public lands or lands where no cattle graze in the Reese Creek portion of the northern boundary area. Yankee Jim Canyon (the northern extension of the Reese Creek boundary area) is a narrow, natural constriction point for bison movement that would permit the agencies to halt bison movement north. The steep rocky terrain that impinges immediately on the Yellowstone River at this point provides a pincer point for bison movement. Flatter terrain south of Yankee Jim Canyon would allow hazing of bison, if necessary. The Yellowstone River, steep terrain, snow depth, and other features would also help restrict bison movement east or west.

Bison would be managed differently in different zones of the Reese Creek boundary area, depending on their relative proximity to Yankee Jim Canyon. The zones and management actions in each are described below, and are pictured on the modified preferred alternative map.

- Zone 1 — Yellowstone National Park winter habitat where bison would be subject to hazing in the spring as bison in zone 2 are returned to the park to maintain the approximately 45-day separation period in the spring. Capture and testing of bison may occur in zone 1 on the north boundary to manage for bison tolerance limits (presumed to be 100 bison), population limits (a total herd size of 3,000), and to enforce the approximately 45-day separation period for those bison that cannot be hazed back into the park in the spring.

- Zone 2 — U.S. Forest Service winter habitat with some conservation easement land where bison would be managed for

  approximate 45-day temporal separation period

  lethal removal for private property concerns

  bison tolerance limits (presumed to be 100)

- Zone 3 — the area where bison that leave zone 2 would be intercepted and killed.

To execute continual monitoring of bison and to coordinate bison control operations in zone 2, Yellowstone National Park would commit to assigning staff for this purpose as a primary duty. A staff of three is required to provide two people at the north boundary and provide coverage seven days a week with the responsibility for monitoring, limited hazing, local coordination, and assistance on larger bison management actions. These personnel would likely be on duty from mid-November through mid-May.

With experience and knowledge gained from adaptive management steps and tolerance limits, zone boundaries and management actions within the zones may be modified.

In addition to the spatial separation the zone management approach would provide, the agencies would ensure temporal separation in the Reese Creek area in all phases where it is needed. Beginning in 2002, cattle will be absent year-round from the conservation and easement lands purchased by the federal agencies. This begins step 2 for the northern boundary area. However, small private cattle operations are present in the Gardiner Valley east of the Yellowstone River. Although bison are not expected to cross the river or present a risk to these operations, they would nonetheless be hazed back into the park on or near April 15 to eliminate any risk. Adjustments to the haze-back date could be made through an annual meeting of the agencies. The agencies could consider factors like weather to determine the feasibility of hazing bison into the park by April 15. Any bison that cannot be hazed back into the park would be captured and tested. If a quarantine facility were available, seronegatives would be sent to quarantine and seropositives to slaughter. If not, all captured bison would be sent to slaughter. Any bison that could not be hazed into the park or captured would be shot.

Western Boundary Area

In the western boundary area, although topography is not as restrictive to movement north or south, bison moving toward and beyond the proposed zone management areas are highly visible. Steep terrain and heavy snow depth to the west would help keep bison from crossing onto private lands west of Hebgen Dam.

Four zones would be established in the West Yellowstone region of the western boundary area. Because there are private lands outside the boundaries that may have cattle present year-round, the fourth zone is an extra buffer between the bison herd and cattle beyond zone 3, as any bison found in zone 3 would be intercepted, shot, or captured and slaughtered.

The zones and actions in each are described below:

- Zone 1 — Yellowstone National Park habitat where bison would be subject to hazing in the spring as bison in zone 2 are returned to the park to maintain the approximate 45-day separation period in the spring.
- Zone 2 — U.S. Forest Service winter habitat with some private property where bison would be managed for

    approximate 45-day temporal separation period

    lethal removal for private property concerns

    bison tolerance limits (presumed to be 100)

    bison population size (3,000)

- Zone 3 — the area where bison that leave zone 2 would be intercepted and killed.

To execute continual monitoring and coordination, Yellowstone National Park would commit to assigning staff for this purpose as a primary duty. A staff of three is required to provide two people at the west boundary and provide coverage seven days a week with the responsibility for monitoring, limited hazing, local coordination, and assistance on larger bison management actions. These personnel would likely be on duty from mid-November through mid-May. Should Montana require additional assurance to monitor and detect overnight movement in areas such as the road corridor leading down the Madison Canyon, additional staff would be needed to provide 24-hour monitoring and patrol.

With experience and knowledge gained from adaptive management steps, bison management, boundary areas, and bison tolerance limits may be modified.

In addition to the spatial separation the zone management approach would provide, the agencies would ensure temporal separation in the West Yellowstone area in all phases where it is needed. A similar approach to that described above for Reese Creek would be used in the West Yellowstone area, where cattle would occupy the same lands in the summer as bison use in the winter. Bison would be hazed back into the park by the agencies on or near May 15. The exact date would be set annually by the agencies and would be based on weather, the feasibility of returning bison to the park through hazing, and other factors such as population size.

To ensure temporal separation, bison in the West Yellowstone boundary area that cannot be hazed back into the park would be captured and tested. Seropositives would be sent to slaughter, and seronegatives sent to quarantine (if it is available) or slaughter (if quarantine is not available). Bison that cannot be captured would be shot.

RISK MANAGEMENT

Strategies described above to ensure separation of cattle and potentially infectious bison or their birth products would be the primary means to manage the risk of transmission. These strategies include capture, test and slaughter of seropositive bison at both the Reese Creek and West Yellowstone areas in step 1, and the use of hazing, capture, test and slaughter operations or quarantine of all bison that might remain outside the park in these areas after specified haze-back dates.

Risk of transmission to cattle outside the boundary areas would be controlled by limiting the number of bison in the boundary areas, through intensive monitoring, and zone management where lethal means are increasingly used as bison move toward the edges of the prescribed boundary areas.

Capture facilities would be used to prevent bison from leaving the boundary areas, enforce zone management, and ensure all bison are removed from the Reese Creek and West Yellowstone areas outside the park well before cattle are in the vicinity in the summer. Vaccination of bison and cattle would be used to reduce risk even further, and to show a commitment to the eventual elimination of brucellosis in bison.

In step 1, the separation of cattle and bison at the Reese Creek border would be maintained through monitoring and hazing, or if needed, through capture and slaughter, or shooting to prevent contact with wintering cattle immediately to the north. East of the Yellowstone River on public lands north of the park, a boundary at Little Trail Creek/Maiden Basin hydrographic divide would be maintained through hazing, or if needed, shooting.

In the western boundary area, spatial separation is assured because cattle do not winter on these lands. Risk would be additionally managed through capture, test, and slaughter of seropositive bison in step 1, and temporal separation through the hazing back of seronegative bison in spring. Bison that could not be captured but are tolerated would be permitted outside the park until approximately 45 days before cattle return. Those uncaptured bison not tolerated outside the park would be shot.

As an additional means of identifying and managing risks in step 1, pregnant seronegative bison occupying these lands would be fitted with transmitters to locate these bison and to indicate if, when, and where a birth or abortion event occurs. The agencies would monitor any such site to ensure all *B. abortus* bacteria are gone by the time cattle return to the area in late spring/early summer. Research indicates (see volume 2, "Bison: Brucellosis Risk Management — Risk of Transmission" section for more information) that the *B. abortus* bacteria do not live in temperatures typical of a Wyoming May or June for more than 17 days. Assuming similar climatic conditions in Montana, setting a temporal separation window of approximately 45 days in the spring between the time bison leave and cattle return would be adequate to ensure *B. abortus* bacteria in the environment would not survive. It should be noted, however, that differences in weather, snow cover, ambient temperature and vegetation cover may alter the persistence of *Brucella abortus* in the West Yellowstone environment compared with that in the Wyoming study.

In step 2, expiration of the cattle-grazing lease in the Reese Creek area in 2002 would remove the threat of transmission from direct contact between bison and cattle. However, as an extra precaution, bison approaching Reese Creek would continue to be hazed back into the park in an attempt to keep them inside park boundaries during the winter, even in the absence of cattle. Those resisting hazing would be captured, and only seronegative bison released. Seronegative pregnant females would be fitted with radiocollars and vaginal transmitters to monitor location and to indicate whether or when a birth or abortion event occurs as described above for step 1 in the West Yellowstone boundary area. Temporal separation would be enforced through hazing bison back into the park from the Reese Creek area.

Bison and cattle would remain spatially separate in the West Yellowstone boundary area because cattle do not winter on these lands. Bison and cattle would continue to be temporally separated through the use of an approximate 45-day window before cattle return to public lands in the boundary area in late spring/early summer.

The experience gained from managing bison in both boundary areas would be used to determine the appropriate number of bison the agencies could manage in each area. The agencies would use this knowledge to implement step 3.

In step 3, untested bison would be allowed into both boundary areas up to the tolerance limit (see "Population Management" below) of each if data from steps 1 and 2 indicate that doing so is safe or that risks can be mitigated. A second capture facility in the Reese Creek boundary area may be built to manage bison distribution. A significantly higher level of staff commitment to monitoring and managing bison outside the park, and the zone management system described above (see "Management in Boundary Areas") would keep untested bison from approaching the edges of both the Reese Creek and West Yellowstone boundary areas. Temporal separation would be maintained through hazing bison back into the park well before cattle return to ensure all bison are absent and *B. abortus* bacteria that may be shed in the environment are no longer viable.

In addition to spatial and temporal separation, the agencies would employ vaccination to initiate a reduction in bison intraherd transmission and to reduce the risk of transmission to cattle. In steps 1 and 2, the agencies would use a safe vaccine on captured calves and yearlings. In step 2, the agencies would remotely vaccinate any untested calves and yearlings allowed outside the park in the western boundary area using a safe and effective delivery system. In step 3, they would begin parkwide remote vaccination of calves and yearlings using a safe and effective vaccine and delivery system. Criteria for safety and efficacy of a vaccine for these bison are established by the GYIBC (see the "Actions Common to All Alternatives: Vaccination" chapter for more information). The criteria for a safe vaccine state, in part, that it must not significantly reduce survivability or reproductive success of the bison and must not cause deleterious effects on the short-term survivability of nontarget species. The agencies would know whether these criteria are met after completion of current ongoing research regarding the safety of RB51, expected by September 2000. Additional studies that assess the risk of the vaccine to nontarget species including mule deer, bighorn sheep, moose, elk, and ravens have been completed, and studies of the risk of the vaccine to pronghorn, coyotes, ground squirrels, and voles will be completed by August 2000. The agencies have agreed that vaccination of all vaccination-eligible bison would also be used when a safe and effective vaccine for all ages and pregnancy status, and a safe and effective delivery system are available.

Among other considerations, an effective and safe vaccine delivery system for free-ranging bison must

account for the tolerance of bison for multiple doses

determine whether marking of bison is required to avoid multiple doses

determine the effective range of delivery (i.e., how close must the personnel using the delivery system be to the bison)

determine bison's tendency to avoid personnel

determine seasonal timing for vaccine delivery based on the desired age for vaccination

evaluate feasibility of vaccinating at particular times of year

Efficacy and safety tests for a delivery system are ongoing in current studies, and development and field-testing are planned to start in late 2000. Development and testing of a safe and effective vaccine delivery mechanism should be completed, and the mechanism available for use, during winter 2002/2003.

The completed studies on the effectiveness of RB51 on calfhood vaccination of bison and the information and experience gained through remote vaccination of bison in the West Yellowstone area will be available to begin parkwide vaccination of bison in winter 2003/2004.

In addition to bison vaccination, the state of Montana would encourage voluntary vaccination of test-eligible cattle that may graze in areas outside the park that bison may occupy during the winter. If by the fall of 2000, 100% voluntary vaccination of test-eligible cattle in areas outside the park that may be occupied by bison was not achieved, the State would make such vaccination mandatory. The federal government would reimburse the direct cost of the vaccination.

Beyond these steps, APHIS and the state of Montana would conduct additional monitoring of cattle herds that graze in areas that bison may occupy during the winter, including regular testing of test-eligible cattle and possible adult vaccination of these cattle herds. APHIS would also do the following:

Work to convince any state threatening sanctions against the state of Montana for executing the elements of the bison management plan that such sanctions are unwarranted.

Make funding available to certify as brucellosis-free individual cattle herds that graze in areas that bison may occupy in winter.

Pay the direct costs of additional testing of any cattle that might commingle with bison.

POPULATION MANAGEMENT

The population target for the whole herd is 3,000 bison. This is the number above which the National Academy of Sciences report (NAS 1998) indicates bison are most likely to respond to heavy snow or ice by attempting to migrate to lower elevation winter range outside Yellowstone National Park (e.g., the Reese Creek or West Yellowstone areas). An in-depth study of overall carrying capacity of the park for bison is ongoing, and this number may be adjusted pursuant to its findings. The study is expected to be completed by late 2002 or early 2003.

In addition, both the Reese Creek and West Yellowstone boundary areas have "tolerance limits" for bison, which have been tentatively set at 100 bison in each. Tolerance limits are not the same as carrying capacity (sometimes called ecological or biological carrying capacity). Carrying capacity implies that a population of animals in a given area is based on ecological factors such as climate and forage production (Strickland et al. 1996). In the case of the bison management plan, tolerance limits are defined upper limits for bison in a particular area outside the park. These limits are based, not on forage or weather, but on initial estimates of the ability of the agencies to monitor, manage, and limit bison movements within a specific geographic area. Factors used by the agencies to estimate tolerance limits include

interspersion of public and private lands

public and private landowner tolerance for bison in an area

geological or hydrological features limiting bison movement within a particular area

previous experience and observations of animal use on public lands in an area

previous tolerance for wildlife on or adjacent to private lands

The agencies would use capture facilities to maintain the bison tolerance limits for lands outside the park in step 1 (in the West Yellowstone area) and step 2 (for both the Reese Creek and West Yellowstone areas). Up to 100 seronegative bison would be released and tolerated in the defined management areas outside the park. If during the winter, the 100-bison tolerance limits were met, any additional seronegative bison captured would be sent to quarantine or slaughter if quarantine were not available.

If the 100-bison tolerance levels were exceeded in step 3, the agencies would capture and test those bison on lands outside the park, send seropositives to slaughter, and re-release seronegative bison to freely range outside the park in the Reese Creek and West Yellowstone management areas. To avoid further handling of previously captured seronegative bison, the agencies would capture any additional bison attempting to move to lands outside the park and send seropositives to slaughter. The agencies would release additional seronegative bison up to the 100 tolerance limit or send them to quarantine or slaughter if the 100 tolerance limit is exceeded.

If the late-winter/early-spring bison population were above the 3,000 target, specific management actions may be taken to reduce its size. For example, instead of hazing bison remaining in boundary areas back into the park in the spring, they may be removed to quarantine or slaughter. This is true even in step 3, where routine operation of capture facilities is not anticipated.

If the population is below the 3,000 target, contingency measures may be put into effect in the Reese Creek area to keep the population size stabilized. In step 1, if population levels are 3,000 or less, seronegative bison attempting to leave the park at Reese Creek would be captured and temporarily held in the Stephens Creek capture facility up to its capacity (about 125 bison) to be released back into the park in the spring. If still more seronegative bison attempt to leave the park via Reese Creek during step 1, they would be sent to quarantine or slaughter if quarantine was unavailable.

The agencies may selectively hold certain ages or classes of seronegative bison in the Stephens Creek facility over the winter to ensure maximum reproductive success in the spring. Seropositive bison would always be sent to slaughter in step 1. Holding seronegative bison in the Stephens Creek facility would be used as a contingency measure to help stabilize population numbers in steps 2 and 3 as well. In either step, if overall population numbers were under 3,000, 100 seronegative bison were already occupying the Reese Creek boundary area and additional bison attempted to move into the area, the agencies would capture, test, and temporarily hold seronegative bison in the Stephens Creek capture facility, up to its capacity, and release them in spring.

No specific contingency measures beyond the use of a quarantine facility for excess migrating seronegative bison are proposed for the West Yellowstone boundary area.

Quarantine

As noted above, the quarantine facility would give the agencies flexibility they do not now have in managing and distributing seronegative bison.

Seronegative bison would be sent to a quarantine facility under the following circumstances:

- when bison tolerance levels in the north and West Yellowstone areas (presumptively 100 bison each) are exceeded
- when the overall bison population is greater than 3,000 animals
- when capture and testing of bison at the north and western boundary is used to enforce the approximate 45-day separation period between bison and cattle use of public lands in the north and West Yellowstone areas

The federal agencies would initiate a separate NEPA analysis to determine the location, design, and operation of a such a facility, although some details and possible designs are described in this environmental impact statement (see pp. 109-110 of the *Draft Environmental Impact Statement,* and volume 2, "Bison: Quarantine" in the final environmental impact statement).

APHIS would serve as the lead agency in the design and would provide oversight of the operation of the quarantine facility. Any quarantine facility would follow an APHIS approved quarantine protocol similar to or as shown in appendix B of the *Draft Environmental Impact Statement*. Any approved quarantine operator would be required to sign an agreement ensuring that APHIS would have the ability to monitor the facility and enforce the terms of the quarantine protocol. Bison that pass through the quarantine protocol may be transferred to Indian reservations or other appropriate public lands.

ESTIMATE OF COST

Table 10 reflects the costs incurred by the interagency team for the modified preferred alternative.

Table 10: Annual Cost/Income Estimates — Modified Preferred Alternative

	National Park Service	U.S. Forest Service	State of Montana	APHIS	Shared Costs
Test/sample/vaccinate cattle	-	-	-	$53,800	-
Capture facility (Stephens Creek)[1]	$120,000	-	-	-	-
Capture facility (west area)[1]	-	-	$175,000	$50,000	-
Operations at capture facilities	$463,100	$16,500	$247,500	$110,000	-
Equipment/repair/ replacement	$72,600	-	-	-	-
Vaccination of bison	$330,500	-	-	-	-
Relocate Stephens Creek capture facility[1]	$66,000	-	-	-	-
Quarantine facility[1]	-	-	-	$550,000–$880,000[2]	-
Quarantine operations	$7,500	-	-	$440,000	-
Acquisition[1]	-	-	-	-	$29.1 million
Easement[1]	-	-	-	-	Unknown[3]
Conversion of livestock operations[1]	-	-	-	-	Unknown[3]
Wildlife/winter use monitoring	-	$5,500	-	-	-
Average income from the sale of meat, hides, and heads	-	-	+$51,480	-	-
Totals	($1,059,700)	($22,000)	($371,020)	($1,203,800 to $1,533,800)	(Up to $29,100,000)

1. One-time costs for existing facilities at Stephens Creek and Western SMA have already been incurred. A one-time cost of approximately $150,000 might be incurred to construct an additional capture facility between Reese Creek and Yankee Jim Canyon.
2. Does not include land costs for quarantine facility.
3. Land acquisition in the Reese Creek area has already occurred. Easement and conversion would substitute for acquisition, and costs would be less than $29.1 million.

ADDITIONAL ALTERNATIVES PROPOSED AND EVALUATED

During and subsequent to the comment period on the *Draft Environmental Impact Statement,* several alternatives were suggested and carefully considered by the agencies. These alternatives consisted of fully developed approaches submitted by public and private organizations. Two other alternatives were developed by the agencies themselves in response to public comments and other issues: 1) the state of Montana submitted its alternative on October 24, 1999, for discussion with the federal agencies; and 2) the federal agencies provided another scenario that examined implementation of the federal modified preferred alternative inside Yellowstone National Park, assuming that the state would continue its actions under the *Interim Bison Management Plan* outside of park boundaries. This scenario is a combination of the federal modified preferred alternative defined in "The Alternatives" part of this final environmental impact statement and alternative 1, also defined in that part.

During and subsequent to the comment period on the Draft Environmental Impact Statement, several alternatives were suggested and carefully considered by the agencies.

The agencies compared each of these alternatives submitted by the private and public organizations, the state's October 24, 1999, alternative, and the scenario described in item number two above with the objectives in the "Purpose of and Need for Action" part in this final environmental impact statement. The objectives help determine whether a proposed alternative is reasonable and accomplishes what the agencies established as goals for the bison management plan. The agencies then compared the features of these alternatives to the *Draft Environmental Impact Statement* to see if any had major differences in effect or outcome that had not been previously analyzed. The agencies concluded that some of these alternatives did not fully meet the objectives and none of the alternatives had major differences in environmental effects as defined by the National Environmental Policy Act.

A summary of the agencies' analyses is provided in the narrative that follows and in tables 11, 12, 13, 14, and 15. Other options and scenarios were suggested during the public comment period but were found to be incomplete or repetitive of alternatives already analyzed. These options and scenarios are addressed in volume 2, "New Alternatives Similar to Others" of this final environmental impact statement.

OCTOBER 24, 1999, ALTERNATIVE SUBMITTED BY MONTANA

The following alternative was proposed by the state of Montana on October 24, 1999. The language in quotes is identical to that written by Montana officials, with slight copy editing changes. In reviewing this alternative to determine whether it was significantly different from others already analyzed, the federal agencies made certain assumptions where language was unclear. These assumptions are stated following the applicable sentence or paragraph of Montana's alternative. The federal agencies also compared Montana's alternative, point by point, to others analyzed in the final environmental impact statement and have explained these comparisons below to help readers locate the impact analysis of these points. Assumptions, comparisons, or other notes by the federal agencies are in bold. Overall, impacts to bison population, seroprevalence, distribution, and other resources of Montana's alternative were nearly always the same as alternative 1, with the exception of bison distribution in quarantine (alternative 1 does not include quarantine), which paralleled the analysis in alternative 4.

INTRODUCTION

"This alternative, like others evaluated in the environmental impact statement, involves many unknowns and assumptions about future conditions and available tools to manage bison. The alternative contains two phases and time lines. Within these phases, the analysis in this environmental impact statement, including the impacts on several resources could be slightly different than indicated in the "Environmental Consequences" part based on research results, tests and other developments and ultimate implementation of the phases. These assumptions represent what the agencies believe are the most reasonable time frames for certain tools to become available. The analysis includes dates for the implementation of specific actions within both Phase 1 and Phase 2 however again, this might mean slightly different impacts than those described for this alternative."

The following alternative was proposed by the state of Montana on October 24, 1999.

"The preferred alternative is based on spatial and temporal separation of bison and cattle; the vaccination of cattle that occupy lands during the summer that may be occupied by bison during the winter; and the vaccination of bison."

NOTE: The use of the term "preferred alternative" is assumed to indicate Montana's preference of this as its favored approach as of October 24, 1999.

"In addition to providing the agencies with methods to manage the risk of transmission, the alternative demonstrates the agencies' commitment to eradicating brucellosis from the bison herd and demonstrates the desire for free-roaming bison. Unlike other alternatives, both eradication of the disease and a free-roaming herd are identified as objectives of this alternative."

"The implementation of a vaccination program for the bison is a key component to any effort to eradicate brucellosis in the bison herd. Therefore, the alternative emphasizes beginning vaccination of bison that are captured outside of the park as soon as winter 2000/2001 and beginning the vaccination of bison within the park as soon as the winter of 2002/2003. As previously mentioned, these are current time frames the agencies assume would be met. The alternative establishes criteria to be met before the agencies implement both phases of vaccination. The criteria to be met includes: vaccine used at the capture facility is safe for bison and nontarget species; the vaccine is effective for use within the park; and the delivery mechanism is available for use within the park."

Assumption: The criteria specified are so similar to the ones used by the federal agencies that they are assumed to be the same.

Comparison: The dates the federal agencies used to calculate the effect of vaccination are explained in the modified preferred alternative discussion. Calves would be vaccinated with a safe vaccine in the capture facility as soon as winter 2000/2001. Wholeherd vaccination of calves would begin when a safe and effective vaccine and safe and effective delivery system was available, expected in winter 2003/2004.

"The alternative demonstrates the agencies' commitment to a free-roaming bison herd by establishing zones outside the park for free-roaming bison. Within Special Management Areas, zones would be identified by the agencies for free-roaming bison and management actions."

"As mentioned earlier, the alternative is a phased approach.

Phase 1. The first phase of the alternative includes existing management practices outlined in alternative 1 with the following additional management actions.

When a vaccination is determined to be safe for both bison and nontarget species, the first phase includes the vaccination of bison at all capture facilities both inside and outside the park. The vaccination of bison that are handled in the capture facilities would be conducted pursuant to criteria identified later, which includes criteria established by the GYIBC for the safety of the vaccination (Appendix). The agencies believe that the necessary studies will be completed by September 2000. The initial results from the safety studies for RB51 in capture facilities should be obtained by winter 2000/2001."

"Also, during Phase 1, formalizing the vaccination of cattle in the area is included. The agencies understand that livestock producers, as a general practice, already vaccinate calfhood, test-eligible cattle that occupy lands in the areas surrounding Yellowstone that may be occupied by bison during winter months. As a part of Phase 1, the alternative contains means to formalize this practice by having the Montana Department of Livestock certify that this vaccination is occurring. If 100% compliance is not met by May 2001, the Department will mandate the use of vaccination. If this is necessary, reimbursement of direct costs to the producers would be allocated by the federal agencies."

Comparison: 100% compliance was assumed in all alternatives.

"Use of a quarantine or holding facility, as a management tool, would provide the agencies flexibility in handling captured bison. However, such a facility does not yet exist, and environmental compliance and public review would be required to examine alternative designs and locations before it could be built or operated on public lands."

Comparison: Quarantine was assumed to be part of alternative 4. Please see "Environmental Consequences: Impacts on Bison Population" (results of stochastic model) for information on how quarantine would affect bison distribution. Also, it is unknown whether the quarantine facility would be located on public lands.

"The agencies are considering the construction of a holding facility for bison calves. This facility would allow the agencies to hold calves that migrate out of the park, and cannot survive by themselves, for research purposes or for return of the bison-calves into Yellowstone National Park at the conclusion of winter. This facility would be jointly run by ((the agencies)) in close proximity to the park. (MOU for operation as Appendix F to environmental impact statement)."

Assumption: The Stephens Creek capture facility would serve as the calf holding area.

Comparison: Many alternatives include the holding of bison at the Stephens Creek capture facility over the winter for return to the park in spring. Alternatives 1 and 4 (as well as others) include overwinter holding of captured bison.

"*Phase 2.* Phase 2 includes the establishments of zones within SMAs. These are zones where bison are allowed to roam freely into Montana and areas where management actions, like hazing would take place. Phase 2 would be implemented only after a vaccination (and effectiveness verification) program for all bison, inside and outside the park, has started."

Assumption: Vaccination of all bison, including adult pregnant females in particular, is not expected for many years, as current vaccines under study cause females to abort. For this reason, the federal agencies believe the most realistic assumption is that phase 2 of the Montana alternative would not begin in the 15-year life of the bison management plan, and phase 1 would be in affect throughout this period of time.

"The SMAs would be managed according to very specific information regarding boundaries and management zones. SMAs would include actions at the outer boundaries. In addition, management would be flexible regarding temporal separation. Within a management framework that clearly specifies the circumstances under which bison would be otherwise removed, the State Veterinarian, in consultation with APHIS, United States Forest Service and other states' animal health officials, should have the flexibility and discretion to determine the separation period for bison and cattle.

These decisions would be based on an established decision making framework and criteria. The criteria include, but are not limited to: snow conditions, temperature and weather conditions, size of the bison herd, how bison are distributed vis-à-vis where cattle would be located, prevalence rate of the disease, type of bison (sex, age, tested, vaccinated, pregnancy status, etc.), documented bison birthing sites and known bison abortion, and biological and disease status of the bison. The management plan for each zone would establish holding-capacity objectives for each SMA."

Comparison: Discretion by the state veterinarian to determine when, within a 30 to 60 day framework, bison must be hazed back into the park to allow the return of cattle in late spring or early summer, is a part of all alternatives analyzed in the environmental impact statement. Holding capacity objectives were also assumed for alternatives where bison are allowed outside the park, including alternatives 1 and 4 (see "Environmental Consequences: Impacts on Bison Population"). The winter management objective for the West Yellowstone area is 50 to 100 bison in both alternatives 1 and 4; it is 100 to 200 for the Eagle Creek/Bear Creek area. The criteria identified above, which the state veterinarian would use to determine when to begin hazing bison back into the park, require continued capture and testing throughout phase 2;

this makes later descriptions of phase 2, including the phrase "bison would be allowed to roam freely" outside the park in certain areas (see below) unclear.

"In addition to having a safe and effective vaccine, before vaccination of bison inside the park can occur and Phase 2 is implemented, an effective and safe delivery-system for free-roaming bison must be developed and tested. Such a delivery system must account for the tolerance of bison for multiple doses of vaccination, whether marking of bison is required to avoid multiple doses, effective range of delivery and other pertinent factors. Also, the vaccination of cattle and bison outlined in Phase 1 would continue in Phase 2."

"The vaccination program in Phase 2 would also include components to monitor the overall effectiveness of vaccination."

"Before bison are vaccinated, it is possible additional National Environmental Policy Act, Montana Environmental Policy Act and federal Endangered Species Act compliance may be necessary. These reviews could change the time lines outlined in this document. It is unknown when such a vaccine for a free-roaming herd would be available, although the agencies believed it was reasonable to assume that vaccination under Phase 2 would begin when vaccination efforts begin within the park in 2002."

Assumption: The agencies have agreed that vaccination of vaccination eligible bison would be used when safety and efficacy of the vaccine is demonstrated for various ages and pregnancy status, and a delivery system is available. It is unknown when vaccination of adult female bison would occur but for purposes of analysis, it was assumed that adult female bison would not be vaccinated during the life of the state's proposed plan.

"Last, the agencies recognize that other states' animal health authorities can restrict the movement of Montana livestock due to the presence of brucellosis-exposed animals. As a part of Phase 2, APHIS and the U.S. Department of Justice would maintain support of Montana's commodities in the event of any boycotts or restrictions initiated by other states."

NORTH BOUNDARY

Reese Creek

"*Phase 1.* The park would continue to operate the Reese Creek/Stephens Creek facility throughout the life of this plan. Features of the capture facility are described in alternative 1. The operation would remain the same with the following exception: the use of vaccination through injection would be implemented when criteria are met. Also, shipment of as many seronegative bison as possible to quarantine or holding facility would be anticipated. Criteria listed in "Actions Common to All Alternatives" for the location of a capture facility would apply to siting such a facility. An additional capture facility may be necessary in the northern boundary area to maintain separation of bison."

Comparison: Bison are assumed to be vaccinated in capture facilities when a safe vaccine for their age/sex/pregnancy status is available (see "Actions Common to All Alternatives: Vaccination"). A quarantine facility is planned for alternative 4, and its effect on bison distribution and population is analyzed in "Impacts on Bison Population." Also, as noted above, a holding facility at Stephens Creek is assumed for many alternatives, including alternatives 1 and 4.

"Within the facility captured bison would be divided into groups for safety reasons and blood tested for exposure to *Brucella abortus*. Seropositive bison would be shipped to slaughter at approved slaughter facilities. Until a quarantine facility was approved, sited, and built, seronegative captured bison at Stephens Creek would also be shipped to slaughter."

"Bison completing the full quarantine protocol would be made available to establish bison populations on tribal lands, other appropriate public lands, or provided to other appropriate public institutions or other qualified recipients."

"*Phase 2.* There is no change in operation of the Stephens Creek facility. When current cattle leases end on the Royal Teton Ranch the agencies would experiment with test negative, vaccinated bison to assess the "holding capacity" management needs. This would be done through creation of zones. (Note criteria listed under Special Management Areas, Phase 2.) When adequate controls and an agreed upon number is reached, vaccinated bison would be allowed onto the property until the holding capacity is reached. If this occurs then all bison would be tested and seropositive removed. (See alternative XX map.)"

Comparison: As noted above, phase 2 is assumed to begin only after the initiation of whole-herd vaccination, which is not expected to occur during the life of the state's plan. Given this assumption, phase 1, whose impacts fall between alternative 1 and 4, would remain in effect. However, should a safe and effective vaccine for adult bison (and particularly pregnant bison) become available and take effect, the

agencies have assumed phase 2 of Montana's alternative would be very similar to phase 2 of alternative 7 (assuming a mid population range).

Eagle Creek

"*Phase 1.* Agencies would monitor bison movements in the Eagle Creek area and maintain a boundary at the Little Trail Creek/Maiden Basin hydrographic divide through hazing and agency removals.

Phase 2. There is no change from Phase 1 to Phase 2."

WESTERN BOUNDARY

"*Phase 1.* Agencies would monitor and haze or remove bison leaving the northwest boundary area (to the south of Buffalo Horn Creek) of the western SMA (see alternative XX map). (Note: No map was provided by the state.)

The state of Montana would continue to operate a capture facility on private land at Duck Creek in the western SMA and a second facility, located on public land along the Maiden River or at the Horse Butte."

Assumption: "Maiden River" is actually Madison River. The second facility has already been located, and is at Horse Butte (as described in the next section).

"This second capture facility is located south of the Yellowstone Park near the Horse Butte village and west of the Forest Service cattle guard as provided by the current permit. It would be sited using criteria outlined in "Actions Common to All Alternatives" and operated jointly by APHIS and National Park Service. Either of these capture facilities could be relocated in future winters if bison migrating paths changed."

"In the western boundary area, bison would be subject to the management actions above and would not be allowed outside of the area defined as the Horse Butte peninsula."

Assumption: The agencies assumed bison would not be kept from Cabin Creek or Lee Metcalf cattle-free areas as described below, despite this restriction. Restricting bison to the Horse Butte peninsula removes about 90% of the area used by bison in the West Yellowstone portion of the western SMA. Bison distribution in the western SMA would therefore be significantly affected. Bison population size would continue to be similar to that predicted in alternative 1, as most bison in the West Yellowstone area do overwinter on the Horse Butte Peninsula.

"*Phase 2.* Bison would be allowed to roam freely within the specified zone and within the agreed time frames. Bison would be managed in accordance to the prescriptions in zones XX and YY. Once the holding capacity of the SMA was reached, bison would be tested and seropositive bison removed. (See map.)" (Note: No map was provided by the state.)

Comparison: As noted above, phase 2 does not begin until parkwide, whole-herd vaccination has been initiated. This means untested bison would likely never be allowed outside the park into the western SMA, and impacts to the bison herd would be the same as those in alternative 1. However, if a safe and effective vaccine for all bison was available during the life of the plan, bison would "be allowed to roam freely." This could mean untested bison would be allowed out, but other sections indicate capture and testing would continue (e.g., that untested bison are not allowed outside the park). Again, this is similar to alternative 1 in the western SMA. If bison continue to be tested, and only those the state of Montana believes pose less threat of transmission were allowed outside the park, impacts would be indistinguishable from phase 1 on the western SMA, which in turn is indistinguishable from alternative 1 in the environmental impact statement.

SPECIAL MANAGEMENT AREAS

"*Phase 1.* In this alternative, SMAs would be established in the Eagle Creek/Bear Creek area, the Hellroaring and Slough Creek drainages, and the northwest entrance area south of Buffalo Horn Creek. Including the Cabin Creek Recreation and Wildlife Management Area/Lee Metcalf Wilderness (see alternative XX map)."

"Cattle would continue to be grazed on Gallatin National Forest lands in the West Yellowstone area from approximately June 15 to October 30. Cattle graze on private land from approximately May 15 to November 30. Bison would be hazed back into the park in the spring before cattle occupy the area. The exact number of days of temporal and spatial separation would be at the discretion of the State Veterinarian and APHIS. The bison that could not be hazed back into the park would be removed."

"Bison would be able to occupy the Cabin Creek Recreation and Wildlife Management Area and Monument Mountain Unit of the Lee Metcalf Wilderness to the north of the West Yellowstone area without agency management. These lands are without livestock allotments."

Assumption: See note on Horse Butte peninsula above. As noted in the environmental impact statement, because of terrain and winter snow depths, few, if any, bison are expected to occur in these areas.

"*Phase 2.* Bison would be allowed to roam freely within the specified zones and within the agreed time frames. Map XX and Map YY delineate the Special Management Area, and zones within the area, for the north boundary and the west boundary respectively."

NOTE: See previous note on assumptions regarding "roam freely" and when phase 2 would begin.

"Zone 1 areas are where….

Zone 2 areas are where….

Zone 3 areas are where…."

NOTE: Montana did not identify the location of or provide specific management strategies in these zones.

"Montana, U.S. Forest Service and APHIS would consider stochastic weather, prevalence rates, biological and population factors to determine a satisfactory period of temporal and spatial separation. In addition, the agencies would include and consider when management actions such as hazing, capture and testing and removal of seropositive and/or pregnant animals or other removal actions would be precluded due to environmental conditions. These agencies would attempt to develop a consensus concerning proper temporal and spatial separation of bison and cattle on public land until brucellosis is eradicated in the Greater Yellowstone Area. If consensus cannot be reached, then Montana would perform management actions necessary to prevent sanctions against the movement of Montana livestock and to protect the health and well being of the public and the livestock industry of Montana."

Assumption: Although this is unclear, the federal agencies assumed Montana's actions would be restricted to hazing bison back into the park closer to 60 days than 30 days before cattle return.

Comparison: This action could result in a larger percentage of the 50 to 100 bison allowed to winter in the western SMA removed from the population than alternative 1 would indicate, but fewer than if alternative 4 were implemented (because of hunting). Impacts from this management action would therefore be between these two alternatives.

"The management plan for each zone would establish holding-capacity objectives for each SMA. If the holding capacity of the SMA is reached, bison would be tested and seropositive removed."

RISK MANAGEMENT

"This alternative relies on separation, capture, slaughter of seropositives, and vaccination of bison and cattle to reduce the risk of brucellosis transmission in varying ways between both Phase 1 and Phase 2."

"*Phase 1.* The primary means to ensure separation of cattle and bison would be the enforcement at the northern border of the park and controlled entry in the western SMA and temporal and spatial separation in the western SMA as described within the Northern and Western Boundary sections."

"On the north end, agencies would use monitoring, hazing, capture and testing, slaughter of seropositives, vaccination, and agency removals to maintain separation at Reese Creek. At Eagle Creek/Bear Creek, monitoring, hazing, and agency removals would prevent entry into the Gardiner area."

"In the West Yellowstone area, temporal and spatial separation on lands that would be occupied by cattle would be maintained by allowing seronegative-nonpregnant bison in the area in winter months and cattle in the summer. To prevent commingling of bison and cattle, bison would be hazed back into the park in the spring before cattle occupy the area. The exact number of days would be at the discretion of the State Veterinarian. Those bison that could not be hazed back into the park would be shot. Bison would not be allowed in the SMA until cattle have been removed in November."

Comparison: These management steps are identical to those in alternative 1.

"In addition to separation, this alternative would reduce the risk of transmission to cattle in the West Yellowstone area of the western SMA through capture and slaughter of seropositives in the capture facilities described above."

"Seronegative-pregnant females and bison that posed a greater possibility of disease transmission, including pregnant, untested females or females with newborn calves would be captured and quarantined or removed."

Assumption/Comparison: Despite the use of the words "pregnant, untested females," the federal agencies assume female bison must be captured and tested to determine pregnancy status. Also, Montana has consistently refused to implement the APHIS definition of low-risk bison (e.g.,

untested bison that can occupy public lands when no cattle are present without posing risk to returning cattle). These classes include bulls, yearlings, calves, and females with newborn calves. Note appendix G in the environmental impact statement where Montana indicates its difficulty in assuming any of these classes are low risk. In the modified preferred alternative (and others, including 2 and 3 in the environmental impact statement), all classes of untested bison are allowed outside the park when cattle are absent. Risk is managed primarily through temporal and spatial separation of bison and their potentially infectious birth products from susceptible cattle. Other tools, such as vaginal transmitters in pregnant bison, restrictions on the number of bison tolerated outside the park to ensure manageability, increasingly aggressive control of bison outside the park as they approach defined zone boundaries, and a significant commitment of NPS staff and resources to bison management in these zones, are also used in the modified preferred alternative.

"Removing pregnant bison would ensure no birth materials are left behind when cattle reoccupy the area in the summer. Removal could be through capture or shooting, or if logistically feasible, through immobilization via dart if possible. If the bison has a newborn calf, the calf would be captured by hand or darted. The immobilized animals would be transported back into the park, to quarantine, or to an approved research or holding facility."

Comparison: Although alternative 1 does not include a quarantine facility, the effect of Montana's management strategy for pregnant females or females with newborn calves would result in impacts to the bison population that are the same as those described for alternative 1. This is because removals to quarantine are the same as removals by capture and slaughter in terms of impacts to the population. Numbers of female bison sent to quarantine are the same in this alternative as those described in alternative 4, phase 2. However, total number of bison predicted to winter in the western SMA are the same as alternative 1, as alternative 4 removals include hunting (see table 30 in the *Draft Environmental Impact Statement*, for example).

"Also, operators in the West Yellowstone area of the western SMA would vaccinate cattle against brucellosis. The agencies understand that, as a general practice, ranchers already calfhood vaccinate test-eligible cattle in the area. The agencies would formalize this practice by the Montana Department of Livestock certifying that this vaccination is occurring. If 100% compliance is not met by May 2001, the Department will mandate the use of vaccination.

If this is necessary, reimbursement of direct costs to the producers would be allocated by the federal agencies."

Comparison: The impact of this measure on the costs of the alternative and the costs to livestock operators is explained in the cost chart and in "Environmental Consequences: Impacts on Livestock Operations — Modified Preferred Alternative."

"In addition, when a vaccination is determined to be safe for both bison and nontarget species, Phase 1 includes the vaccination of bison at the capture facilities and bison outside the park. The vaccination of bison would be conducted pursuant to criteria identified later, which includes criteria established by the GYIBC for the safety of the vaccination (Appendix). The agencies believe the necessary studies will be complete by September of 2000. The initial results from the safety studies for RB51 in capture facilities should be obtained by the winter of 2000/2001."

Comparison: For purposes of analysis of all alternatives in the environmental impact statement (see results of stochastic modelling in "Environmental Consequences: Impacts on Bison Population"), vaccination of calves already in the capture facility with a safe vaccine was assumed to begin in winter 2000/2001. Parkwide remote application of a safe and effective vaccine for calves was assumed to begin in winter 2003/2004. The impact of vaccination on reducing seroprevalence in the Montana alternative is the same as alternative 1.

"*Phase 2.* For Phase 2, risk management is addressed through vaccination accomplished by remote delivery of vaccine to all bison inside and outside the park. Before vaccination within the park begins, ongoing studies must show that the vaccine is effective. Vaccination efforts inside the park would be in addition to vaccination efforts included within Phase 1."

"In addition to having a safe and effective vaccine, before vaccination of bison inside the park can occur, a delivery system for free-roaming bison must be developed and tested. Such a delivery system must account for the tolerance of bison for multiple doses, whether marking of bison is required to avoid multiple doses, effective range of delivery and other factors. Also, before bison are vaccinated, additional National Environmental Policy Act and Montana Environmental Policy Act and federal Endangered Species Act compliance may be necessary."

"In addition to the other tools outlined in this phase, managing the risk of transmission of brucellosis from bison to cattle would include ensuring a temporal and spatial separation between bison and cattle. Zones would be designed within the SMAs. Zones are designated areas where bison would be allowed to freely roam or where management practices would take place. (See map.)" (Note: No map was provided by the state of Montana.)

"Factors to be considered in managing bison are as follows:

the presence of bison on public lands

date and length of time when present on public land; biological status (e.g., serologic, pregnancy and vaccination status, age, sex, etc.) of bison and cattle on public land

prevalence rates

weather conditions

environmental conditions

ability to perform management actions in determining proper temporal and spatial separation of bison and cattle on public lands in the counties bordering Yellowstone National Park — these factors are not exclusive and other factors may be considered during the process."

"Management actions to ensure temporal and spatial separation of bison and cattle on public lands would include hazing, capture and testing and removal of seropositive bison and pregnant bison, and other removal actions. Yellowstone National Park, U.S. Forest Service, APHIS, and Montana would cooperate in management actions to prevent emigration from Yellowstone National Park of seropositive bison and pregnant bison or bison of unknown biological or brucellosis disease status."

Assumption/Comparison: The statements in the paragraph above, such as "include hazing, capture and testing and removal of seropositive and pregnant bison" make the phrase "allowed to roam freely" with regard to phase 2 unclear. As noted above, phase 2 cannot begin until initiation of whole-herd vaccination, which may not happen for several years of the plan because a safe and effective vaccine for adult, female, pregnant bison may not be available. In this case, impacts of phase 2 are the same as phase 1, or between those analyzed for alternatives 1 and 4 in this environmental impact statement. If a vaccine does become available, and Montana continues capture and testing to "prevent emigration from Yellowstone National Park of seropositive bison and pregnant bison or bison of unknown biological or brucellosis disease status," impacts would be similar to those in alternative 1 on the west side, and alternative 7, phase 2 on the north side (assuming a mid-range

population size). If "allowed to roam freely" means untested bison are allowed out on both the north and west ends of the park, impacts would be similar to those described for step 3 of the modified preferred alternative. As noted throughout, the federal agencies have assumed phase 2 does not begin for several years of this plan, because of the contingency that a whole-herd vaccination, including all adults, must be initiated first.

"Bison would not be allowed on private lands without the agreement of the landowners. If bison are on private lands, the agencies would take management actions necessary to maintain temporal and spatial separation of bison and cattle to prevent transmission of brucellosis to cattle on public or other private lands."

"Bison would not be allowed to move beyond certain areas outside Yellowstone National Park. In the northern boundary area, bison that move or attempt to move out of Yellowstone National Park in the Reese Creek area would have been vaccinated against brucellosis, if eligible, and the criteria (section 1) for brucellosis vaccination of bison will have been met, brucellosis tested, and females would have been pregnancy tested. Bison that move or attempt to move out of the Eagle Creek/Bear Creek area would be subject to the management actions mentioned above."

NOTE: Please note other comments regarding initiation of phase 2 and whether untested bison would ever be allowed outside the park.

POPULATION MANAGEMENT

"This alternative does not include any actions to control population numbers on either end of the range. However, it is anticipated that more bison would attempt to migrate outside the park in response to winter severity when bison numbers were high, and would be removed according to this plan. Therefore, this alternative relies on natural forces inside the park and boundary enforcement to keep population numbers from increasing beyond the upper end of 1,700 to 3,000."

Comparison: Although both deterministic and stochastic modelling indicate alternatives without specified upper limits tend to allow population numbers to increase beyond 3,000, the modified preferred alternative uses the 3,000 figure, and impacts to bison population with this assumption are analyzed for this alternative.

"As referenced in the Special Management Area section, under Phase 2, the management plan for each zone would establish hold-capacity objectives for each SMA. If the holding capacity of the SMA is reached, bison would be tested and seropositives removed."

Assumption/Comparison: This suggests untested bison would be allowed into SMAs and only tested if the holding capacity is reached to make room for additional seronegative bison by removing seropositive ones — see earlier discussions of this factor. The impact of testing all bison outside the park and removing seropositive bison if additional bison beyond a defined limit are already in place is analyzed as part of step 3 of the modified preferred alternative.

"Agency-implemented lethal controls would decrease as the population approached 1,700 bison and would cease at 1,700 in certain areas as described in the management sections for each area. In general, hazing bison from areas where they were not permitted such as outside SMAs or on private land would be attempted before they were shot. Untested bison in the western SMA that posed a lower possibility of transmission of brucellosis and animals testing negative and previously released would be allowed on public land during periods of the year that cattle were not present. Bison that posed a greater possibility of disease transmission would be removed."

Assumption: This phrase suggests some untested bison would be allowed outside the park, although serological testing and pregnancy testing (implying capture) appear to continue. Again, it is unclear which management strategies would be in place in phase 2. However, the federal agencies assume phase 2 would not be implemented in the time this plan is in place for reasons described above.

"The plan includes a provision that agencies would develop contingencies for ensuring the integrity of the bison herd should numbers drop."

ESTIMATE OF COST

"Table *** indicates the costs that would be incurred by the interagency team for this alternative.

((divide costs among agencies))"

NOTE: Costs were not provided by Montana.

CONTINUATION OF THE CURRENT INTERIM BISON MANAGEMENT PLAN OUTSIDE PARK, MODIFIED FEDERAL PREFERRED INSIDE PARK

The state of Montana and federal agencies have agreed to actions described in alternative 1, as updated, to manage bison on an interim basis. The bulk of this management is of bison emigrating from Yellowstone National Park, although actions to control emigration do occur at the Stephens Creek capture facility, which is located just inside the northern boundary of the park. Should Montana continue to manage bison according to the provisions of the interim plan, and the federal agencies implement the modified preferred alternative (see description above), the following text explains which management actions would take place. It assumes all actions outside the park would continue as is under the interim plan, and actions inside the park would be governed by the modified preferred alternative.

The interim plan relies on strict border enforcement to keep bison and cattle separate. Bison are prevented from crossing the northern park boundary at Reese Creek, but are allowed in the Eagle Creek/Bear Creek area.

It assumes all actions outside the park would continue as is under the interim plan, and actions inside the park would be governed by the modified preferred alternative.

In the West Yellowstone area, 50 to 100 tested, seronegative nonpregnant bison would continue to overwinter, primarily in the Horse Butte area. Bison located outside the park in the west boundary area would be hazed back into the park in the spring, 30 to 60 days before cattle occupy the area. The exact number of days, between 30 and 60, would be at the discretion of the State Veterinarian. Those bison that could not be hazed back into the park would be shot. In addition, a handful of bison (usually single bulls) use the Lee Metcalf/Cabin Creek area on the west, or Hellroaring and Slough drainages to the north and east of Eagle Creek/Bear Creek. Those few bison that move beyond the borders of either of these large tracts of forest land would be hazed or shot.

NORTHERN BOUNDARY

Reese Creek

The National Park Service capture facility located at Stephens Creek would continue to operate in step 1 (see the "Modified Preferred Alternative" chapter). Captured bison would be divided into groups for safety reasons, and blood tested for exposure to *Brucella abortus*. Seropositive bison would be shipped to slaughter. Captured bison calves would be vaccinated with a safe vaccine initially. Captured adults would also be vaccinated with a safe vaccine, when one becomes available. If population numbers were above 3,000, seronegative bison would be sent to quarantine when it becomes available, and to slaughter if unavailable. If population numbers were 3,000 or below, up to 125 captured seronegative bison would be held at the Stephens Creek facility and released back into the park in the spring. Because all bison attempting to leave the park via the Reese Creek boundary would be removed, the impact of this alternative would be similar to or identical to alternative 1. The number of bison sent to quarantine would be similar to or identical to alternative 4.

When an existing cattle lease on private land adjacent to the park's Reese Creek boundary expires in 2002, step 2 of the modified preferred alternative would begin on the northern boundary. Normally, the National Park Service would capture and test all bison attempting to migrate outside the park and release up to 100 seronegative bison into the newly acquired federal lands between Reese Creek and Yankee Jim Canyon. This step would continue for two years if the modified preferred alternative were selected. However, in this alternative, it is assumed that the Montana Department of Livestock would not tolerate any bison outside the park at Reese Creek. If the National Park Service knows this is the case, it would be unlikely to attempt capture and testing, but would instead use the Stephens Creek facility only to hold 125 captured seronegative bison for return to the park in the spring if needed (e.g., if population numbers were 3,000 or below). Otherwise, capture and testing operations at Stephens Creek would cease.

In step 3 of the modified preferred alternative, up to 100 untested bison are allowed to occupy the acquired lands between Reese Creek and Yankee Jim Canyon under certain population conditions (see description of the modified preferred alternative). However, under this alternative, it is assumed the state would manage all bison outside the park as they are managed now under the interim plan. This means no bison would be tolerated, and all would either be hazed back into the park or shot. As described above for step 2, the Stephens Creek facility would therefore be used only to hold 125 seronegative bison for return to the park in the spring if population numbers were at or below 3,000.

Eagle Creek/Bear Creek

Agencies would continue to monitor bison movements in the Eagle Creek/Bear Creek area and maintain a boundary at the Little Trail Creek/Maiden Basin hydrographic divide from November to April.

WESTERN BOUNDARY

Entry into the western boundary area would continue to be controlled using capture facilities (now located at Duck Creek and Horse Butte) from

November 1 to April 30. Facilities might be moved to take advantage of changing bison migration routes from year to year. Bison evading capture at these facilities on public lands would be shot. Those evading capture on private lands would be shot at the request or with permission of the landowner.

Bison on both private and public land in the area of each of these facilities might respond to baiting or hazing and be captured by Montana personnel. Captured bison would be blood tested for exposure to *Brucella abortus.* All seropositive bison would be shipped to slaughter. Seronegative nonpregnant females and all seronegative males would be identified with a small metal ear tag and a temporary visual marker, and released on public lands in the West Yellowstone area, where they could remain until May. If necessary, bison might need to be shipped a short distance from the capture facility to public lands. The state of Montana will determine the distribution of seronegative pregnant bison as follows:

ship to quarantine if facility is available

ship to slaughter

The impacts of both options have been analyzed in this environmental impact statement. Impacts of slaughter are analyzed under alternative 1, and impacts of quarantine are analyzed under alternative 4.

SPECIAL MANAGEMENT AREAS

Under this alternative, SMAs would be established in the Eagle Creek/Bear Creek area; the Absaroka-Beartooth Wilderness, including the Hellroaring and Slough Creek drainages; and the western boundary area south of Buffalo Horn Creek, including the Cabin Creek Recreation and Wildlife Management Area/Lee Metcalf Wilderness and the West Yellowstone area (see alternative 1 map).

Cattle would continue to be grazed in the West Yellowstone area on Gallatin National Forest lands from about June 15 to October 15. Cattle graze on private land from approximately June 1 to November 15. Bison would be hazed back into the park in the spring, 30 to 60 days before cattle occupy the area. The exact number of days, between 30 and 60, would be at the discretion of the State Veterinarian. Those bison that could not be hazed back into the park would be shot. Bison would be allowed back into the West Yellowstone area following the departure of livestock. Bison would be shot by agencies if they occupied private lands in the area (by request or with permission of the landowner), or left the SMAs. Because there is very high-elevation country to the west and private lands to the south, bison would be able to leave the West Yellowstone area only on public lands via a narrow corridor around Hebgen Lake Dam. Those that did so would be shot.

Bison would be able to occupy the Cabin Creek Recreation and Wildlife Management Area/Lee Metcalf Wilderness to the north of the West Yellowstone area without interference from the agencies. These are public lands free of cattle, although topography and snow depths limit the number of bison that actually use them.

RISK MANAGEMENT

This alternative would rely on separation, capture, and slaughter to minimize the risk of brucellosis transmission.

The primary means to ensure separation of cattle and bison would be the enforcement of controlled entry at the northern border described above, and temporal separation at the western border on public lands. At Reese Creek, this would include monitoring, hazing, capture and slaughter, quarantine, and shooting. At Eagle Creek/Bear Creek, monitoring, hazing, and agency shooting would be used to prevent entry into the Gardiner area.

In the western SMA, bison would be hazed back into the park from the West Yellowstone area to prevent them from mingling with cattle during the time livestock were present. Any remaining bison would be shot. As described above, bison would be hazed back into the park in the spring, 30 to 60 days before cattle occupy the area. The exact number of days, between 30 and 60, would be at the discretion of the State Veterinarian. Those bison that could not be hazed back into the park would be shot. Bison would not be allowed into the SMA until cattle have been removed in October. Topography, availability of habitat, hazing, and agency shooting would also keep bison from moving beyond SMA boundaries or onto private land.

In addition to separation, this alternative would reduce risk of transmission through capture and slaughter. All seropositive bison would be sent to slaughter. A quarantine facility would be pursued by either the state or federal agencies, or both. Those bison captured in the Western SMA that are seronegative pregnant or that the Montana Department of Livestock believes pose unacceptable risks would be sent either to slaughter or to this quarantine facility. Some bison escaping capture may be allowed to remain in the western SMA on public lands. While APHIS has determined that untested bulls, yearlings, calves, and postparturient cows (i.e., cows that have given birth) that have passed placenta do not pose a risk to returning cattle, ultimate discretion about which untested bison remain outside the park in the western SMA would belong to the Montana state veterinarian. For purposes of analysis, readers should assume the impacts on bison population and other resources of risk management actions on the north and west side would be similar to or exactly the same as in alternative 1.

State animal health authorities would encourage livestock owners in the western SMA whose cattle might come in contact with bison to vaccinate female calves (4–12 months old) with RB51. Operators in boundary areas would be encouraged to annually vaccinate all subadult cattle as well as calves. Cattle herds in contact areas would continue to be surveillance tested periodically, and any herd whose member or members might be in contact with bison would be checked for exposure to *B. abortus.* Livestock owners on private property would continue to be responsible for all costs and materials associated with calfhood vaccination.

All captured bison would be vaccinated if a safe vaccine for their particular age, sex, biological or pregnancy status exists. Current research and testing would likely result in a safe vaccine for bison calves in late 2000. It is unknown when a safe vaccine for adults might become available. For the purposes of analysis, such a vaccine was not assumed to become available during the life of the state's plan, although in practice such a vaccine may be available sooner. When a safe and effective vaccine for bison calves, and a safe and effective remote delivery system are available, in-park vaccination of calves would begin. This is expected to start in winter 2003/2004. The relative effectiveness on reducing seroprevalence of this system of vaccination, capture, test and removal to quarantine or slaughter, is similar to or exactly the same as that predicted for alternative 1.

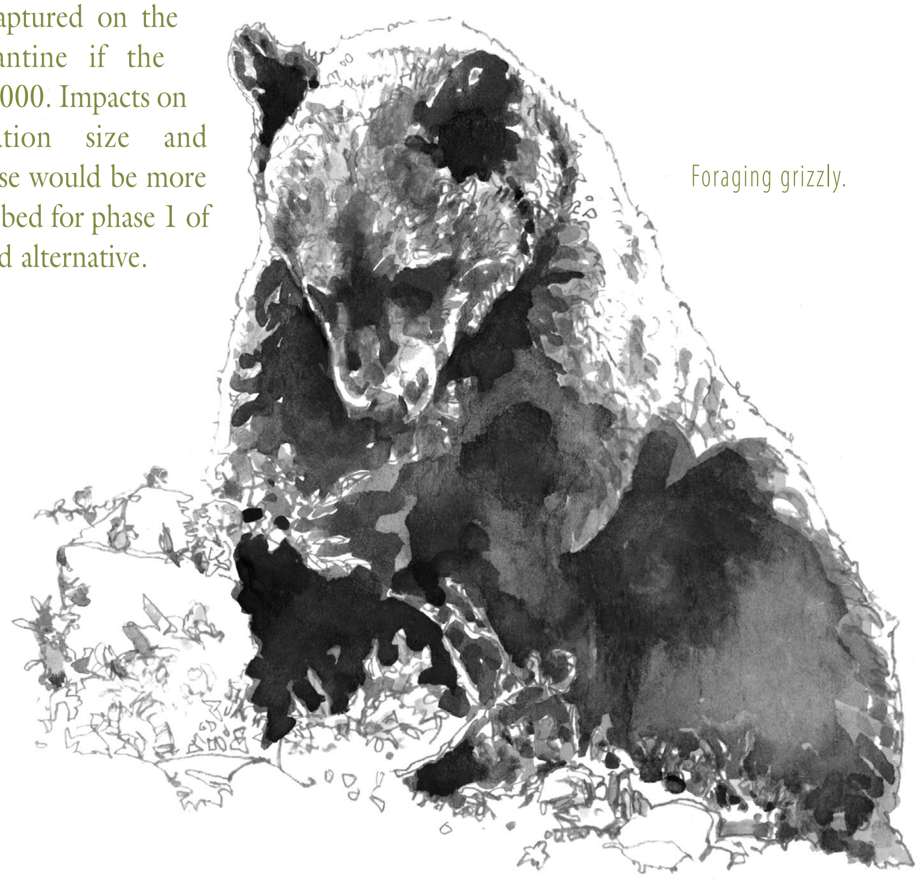
POPULATION MANAGEMENT

Implementing the modified preferred alternative inside Yellowstone National Park means the overall bison population would be managed, to the extent possible, to maintain it at 3,000 animals. The National Park Service would use the Stephens Creek facility to capture bison attempting to emigrate, and remove all bison to quarantine or slaughter until the herd reaches 3,000. Because the National Park Service would not operate capture facilities on the west side of the park, it is assumed the Montana Department of Livestock would continue to capture, test, and remove all seropositive or pregnant bison, and release all remaining seronegative bison (up to 50 to 100) in the West Yellowstone area, regardless of whole herd population size. These practices would not impact the bison population, seroprevalence, or other resources differently than alternative 1. However, bison captured at Stephens Creek (and possibly at Duck Creek or Horse Butte outside the park in the western SMA) may be sent to quarantine instead of to slaughter. Readers should consult

"Environmental Consequences: Impacts on Bison Population," alternative 4 and the modified preferred alternative, to obtain an estimate of the number of bison that may be sent to quarantine under this scenario.

Quarantine

The function and administration of a quarantine facility is described in alternatives 3, 4, 7, and the modified preferred alternative. As noted above, seronegative bison captured at Stephens Creek would be sent to quarantine if the bison population exceeds 3,000. The state may also choose to send captured bison to quarantine, particularly pregnant animals. Impacts of this scenario would be the same as those identified for alternative 1. The state of Montana may also elect to send all seronegative bison captured on the west side to quarantine if the population exceeds 3,000. Impacts on the bison population size and distribution in this case would be more similar to those described for phase 1 of the modified preferred alternative.



Foraging grizzly.

ALTERNATIVES CONSIDERED BUT REJECTED

A segment of the public asked that agencies develop alternatives that used no lethal controls and that allowed bison to exist with no restrictions on their distribution or population size. This alternative would not resolve need or meet the purpose of the plan (see the "Purpose of and Need for Action" part), and was therefore eliminated from full-scale analysis and consideration, although it was considered thoughtfully before doing so. Information and conclusions from the preliminary analysis of this alternative is presented below to show a "no management" baseline.

A segment of the public asked that agencies develop alternatives that used no lethal controls and that allowed bison to exist with no restrictions on their distribution or population size.

If bison were allowed to freely leave Yellowstone National Park, they would move north into the Gardiner, Paradise, and Yellowstone River valleys and west along the Madison River, Duck Creek, and Cougar Creek into the Madison River valley. The continental divide lies to the west of these areas, but bison could travel north, south, and east, and potentially reinhabit adjacent river valleys.

As bison travel onto private lands, or onto public lands where cattle are grazed, the chances of contact and of the transmission of brucellosis would increase, jeopardizing the state's class-free status. If the disease were to spread undetected, it could quickly move to other states since Montana exports breeding cattle. As bison move into populated areas, the risk of human injury and private property damage would increase. Areas to the north and west of the park have experienced significant increases in human occupation and development over the past few years, and this trend is not expected to change. Additional traffic accidents involving bison would likely occur as well. The corresponding social and economic consequences would be substantial.

Additional alternatives were considered but rejected for reasons outlined in the "Purpose of and Need for Action: Scoping Process and Public Participation" chapter.

Table 11: Methods each alternative uses to ensure each agreed-upon objective is met

Objective	Alternative 1: No Action - Continuation of the Current *Interim Bison Management Plan*	Alternative 2: Minimal Management	Alternative 3: Management with Emphasis on Public Hunting	Alternative 4: Interim Plan with Limited Public Hunting and Quarantine	Alternative 5: Aggressive Brucellosis Control within Yellowstone National Park through, Capture, Test, and Removal	Alternative 6: Aggressive Brucellosis Control within Yellowstone National Park through Vaccination	Alternative 7: Manage for Specific Bison Population Range	Modified Preferred Alternative	State of Montana October 24, 1999 Preferred Alternative	Implementation of Interim Plan outside Park, Modified Preferred inside Park
1. Address bison population size and distribution; have specific commitments relating to size of bison herd	Overall size not specified in *Interim Bison Management Plan*; distribution (winter numbers): Eagle Creek/Bear Creek - 100–200, Reese Creek - 0; West Yellowstone - 50–100; no commingling of bison/cattle per landowner discretion; capture/slaughter and agency shooting controls distribution	Overall size: 1,700 to whatever environmental conditions dictate; road closure controls distribution; limited by landowner tolerance; acquire additional winter range; allow bison on all public land inside line; distribution (winter numbers): Eagle Creek/Bear Creek - 100–200, Gardiner Valley area - 200; West Yellowstone - 50–100	Overall size: 1,700–3,500; West Yellowstone and Eagle Creek/Bear Creek: hunting program to regulate numbers/ distribution; Reese Creek: capture/ slaughter - run capture facility until additional winter range acquired; quarantine seronegatives: Eagle Creek/Bear Creek - 100–200, Reese Creek SMA - 50–100; W. Yellowstone - 50–100	Overall size: 1,700–3,500; distribution (winter numbers): Eagle Creek/Bear Creek - 100–200; Reese Creek - 0; West Yellowstone - 50–100; capture, test, slaughter, or quarantine, shooting to control distribution; hunting in Eagle Creek/Bear Creek and West Yellowstone; remove seronegatives captured at Reese Creek to control numbers	Distribution limited to Yellowstone National Park; agencies capture/test/ slaughter seropositives parkwide; shoot strays; population size dictated by disease control success	Overall size: 1,700–3,500; distribution (winter numbers): Eagle Creek/Bear Creek - 100–200; Reese Creek - 0; West Yellowstone - 50–100; capture, test, slaughter, shooting; capture at Seven-Mile Bridge; incidental hunting at Eagle Creek/Bear Creek and West Yellowstone may help control numbers; capture and slaughter control distribution	Overall size: 1,700–2,500: Eagle Creek/Bear Creek - 100–200; Reese Creek SMA - 50–100; West Yellowstone - 50–100; capture, test, slaughter and quarantine, shooting, limited hunting in Eagle Creek/Bear Creek and West Yellowstone control numbers and distribution; specific measures at specific population ranges	Overall size: maximum of 3,000; Eagle Creek/Bear Creek – 100 to 200; Reese Creek area- up to 100; West Yellowstone - up to 100; distribution con-trolled by zone manage-ment; numbers controlled by capture, test, and removal to quarantine or slaughter when population over 3,000, and by holding up to 125 seronegative bison over winter when population less than 3,000; purchase or otherwise acquire additional winter range for bison in northern range	Same as alternative 1	Same as alternative 1; except in step 1, park would use capture, test, and removal to enforce whole herd maximum of 3,000; in steps 2 and 3, Montana may continue this
2. Clearly define a boundary line beyond which bison will not be tolerated	Maiden/Little Trail, Reese Creek, on north; West Yellowstone/Horse Butte/north boundary of Cabin Creek; Hebgen Lake on west side	Yankee Jim Canyon on north; Buffalo Horn Creek; Hebgen Lake on west side	Yankee Jim Canyon, west side of Yellowstone River and Gardiner; Little Creek/ Maiden Basin on east side of river; Cabin Creek, Hebgen Lake on west side	Same as alternative 1	All bison restricted to Yellowstone National Park	Inside Yellowstone National Park; Eagle Creek/Bear Creek; West Yellowstone, Horse Butte	Same as alternative 3	Same as alternative 3, steps 2 and 3; same as alternative 1, step 1	Same as alternative 1	Same as alternative 1
3. Address the risk to public safety and private property damage by bison	Removal at landowner request or by Department of Livestock	Same as alternative 1	Removal at landowner request or by Department of Livestock; West Yellowstone - hunting on private lands with agreement by landowners	Removal at landowner request or by Department of Livestock; special hunt on private land	Same as alternative 1	Same as alternative 1	Same as alternative 4	Remove through hazing at landowner request; shoot only if hazing ineffective	Same as alternative 1	Maximize use of hazing; otherwise same as alternative 1
4. Commit to the eventual elimination of brucellosis in bison	Vaccinate bison when safe and effective vaccine developed; capture/ slaughter seropositives in West Yellowstone; slaughter all at Reese Creek	Vaccinate bison when safe and effective vaccine developed	Vaccinate bison when safe and effective vaccine developed; slaughter seropositives; remove seronegatives captured at Reese Creek	Vaccinate bison when safe and effective vaccine developed; capture/ slaughter seropositives; remove seronegatives captured at Reese Creek	Parkwide capture and slaughter of seropositives; vaccinate when safe and effective vaccine developed	Capture/slaughter seropositives at Reese Creek/Seven-Mile Bridge; parkwide vaccination until seropositive rate plateaus; then parkwide capture and slaughter of seropositives	Vaccinate bison when safe and effective vaccine developed; slaughter seropositives; quarantine seronegatives captured at Reese Creek	Vaccinate all captured bison with vaccine safe for that age/sex/ pregnancy status; when safe and effective vaccine and safe and effective remote delivery system available, begin parkwide vaccination of all bison for whom the vaccine has proven safe and effective	Same as alternative 1; in addition, vaccinate captured bison with safe vaccine; whole herd with safe and effective vaccine and safe and effective remote delivery	Same as alternative 1; in addition, vaccinate captured bison with safe vaccine; whole herd with safe and effective vaccine and safe and effective remote delivery

Table 11: Methods each alternative uses to ensure each agreed-upon objective is met *(continued)*

Objective	Alternative 1: No Action - Continuation of the Current *Interim Bison Management Plan*	Alternative 2: Minimal Management	Alternative 3: Management with Emphasis on Public Hunting	Alternative 4: Interim Plan with Limited Public Hunting and Quarantine	Alternative 5: Aggressive Brucellosis Control within Yellowstone National Park through, Capture, Test, and Removal	Alternative 6: Aggressive Brucellosis Control within Yellowstone National Park through Vaccination	Alternative 7: Manage for Specific Bison Population Range	Modified Preferred Alternative	State of Montana October 24, 1999 Preferred Alternative	Implementation of Interim Plan outside Park, Modified Preferred inside Park
5. Protect livestock from the risk of brucellosis	Monitor movement; test/slaughter all seropositives (and some seronegatives); vaccinate bison/cattle; enforced boundary; remove on private land; surveillance testing; test/vaccinate adult contact cattle; shoot on private land or crossing out of SMAs	Monitor movement; modify livestock use where bison present; public acquisition of private land; easements; modify cattle allotments and operations in SMAs; hazing; shoot on private land or crossing out of SMAs; boundary control; vaccinate cattle in SMA; surveillance testing; test/vaccinate adult contact cattle; vaccinate bison calves	Monitor movement; capture/slaughter seropositives (phase 1); hunting; temporal separation in West Yellowstone with possible changes in allotments in phase 2; public acquisition of winter range, easements, or modifications in cattle operations; surveillance testing; test/vaccinate adult contact cattle; vaccinate bison calves; haze or shoot on private land or crossing out of SMAs	Monitor movement; test/slaughter seropositives; vaccinate bison/cattle; enforced boundary; hunting to remove at West Yellowstone; remove on private land; surveillance testing; test/vaccinate adult contact cattle; shooting on private land or crossing out of SMAs	Restrict to park; capture/test/vaccinate/slaughter inside Yellowstone National park; monitor movement; vaccinate cattle; surveillance testing; shoot on private land	Vaccinate bison; capture/test/slaughter; vaccinate cattle; monitor movement; surveillance testing; shoot on private land or crossing out of SMAs	Monitor movement; test/slaughter seropositives; vaccinate bison/cattle; enforced boundary; remove bison on private land; surveillance testing; test/vaccinate adult contact cattle; public acquisition of winter range; haze or shooting on private land or crossing out of SMAs	Monitor movement; ensure spatial and temporal separation of bison and birth products from susceptible cattle; haze bison into park well before cattle arrive; monitor pregnant bison outside park; cattle vaccination, bison vaccination; wait until cattle lease expires before bison occupy newly acquired lands; haze or shoot bison on private land or crossing out of zones in boundary areas; adaptive management to phase tolerance of untested bison outside park; additional monitoring of cattle; possible adult vaccination of cattle	Same as alternative 1	Same as alternative 1 in step 1; vaccinate bison as above
6. Protect the state of Montana from risk of reduction in its brucellosis status	Designate SMAs; adopt above measures to protect livestock from risk of brucellosis	Designate SMAs; adopt above measures to protect livestock from risk of brucellosis	Designate SMAs; adopt above measures to protect livestock from risk of brucellosis	Designate SMAs; adopt above measures to protect livestock from risk of brucellosis	Adopt above measures to protect livestock from risk of brucellosis	Designate SMAs; adopt above measures to protect livestock from risk of brucellosis	Designate SMAs; adopt above measures to protect livestock from risk of brucellosis	Designate management zones; adopt above measures to protect livestock from risk of brucellosis; make funds available to certify individual cattle herds as brucellosis free	Same as alternative 1	Same as alternative 1; vaccinate bison as above
7. At a minimum, maintain a viable population of wild bison in park, as defined in biological, genetic, and ecological terms	Discussion process to develop contingency measures	Increase available winter habitat through modifications in cattle allotments, private cattle operations, etc.	Increase available winter habitat through modifications in cattle allotments, private cattle operations, etc.; reduce number of hunting permits issued; use capture facilities to hold bison for park release	Reduce number of hunting permits issued; release live, rather than quarantine and remove	Slow down pace of bison eradication	Same as alternative 5, plus reduce number of hunting permits issued	Haze instead of shoot bison on private land or crossing SMA boundary; release rather than quarantine seronegatives, use capture facilities to overwinter bison in severe winters	Haze instead of shoot bison on private land or crossing management zone boundary; release rather than remove seronegatives; use capture facilities to hold bison if population below 3,000; direct funds to complete research on carrying capacity	Same as alternative 1; use Stephens Creek to hold calves	Same as alternative 1; use Stephens Creek to hold overwintering seronegative bison when population numbers drop below 3,000

Table 11: Methods each alternative uses to ensure each agreed-upon objective is met *(continued)*

Objective	Alternative 1: No Action - Continuation of the Current *Interim Bison Management Plan*	Alternative 2: Minimal Management	Alternative 3: Management with Emphasis on Public Hunting	Alternative 4: Interim Plan with Limited Public Hunting and Quarantine	Alternative 5: Aggressive Brucellosis Control within Yellowstone National Park through, Capture, Test, and Removal	Alternative 6: Aggressive Brucellosis Control within Yellowstone National Park through Vaccination	Alternative 7: Manage for Specific Bison Population Range	Modified Preferred Alternative	State of Montana October 24, 1999 Preferred Alternative	Implementation of Interim Plan outside Park, Modified Preferred inside Park
8. Be based on factual information, with the recognition that the scientific database is changing	Ongoing research to develop safe, effective vaccine; better blood test; understand intra- and inter-species transmission; estimates of minimum population; brucellosis pathology and epidemiology in bison	Same as alternative 1 except add research effects of road grooming on bison migration	Same as alternative 2	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 2	Assume carrying capacity is 3,000 based on research in NAS (1998) report; assume risk of transmission is nonexistent if bison are removed 45 days before cattle return, based on research on viability of the brucella organism; incorporate vaccination research findings into management strategy; continue research on epidemiology and pathology of brucellosis in bison	Same as alternative 1	Same as alternative 1; focus on GYIBC to provide information on safe and effective vaccine criteria
9. Recognize the need for coordination in the management of natural and cultural resource values that are the responsibility of signatory agencies	Apply laws, constraints for siting facilities, consultation/coordination; specify cooperative responsibilities	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1

Table 12: Summary Comparison of Alternative Actions

Action	Alternative 1: No Action – Continuation of the Current *Interim Bison Management Plan*	Alternative 2: Minimal Management	Alternative 3: Management, with Emphasis on Public Hunting	Alternative 4: Interim Plan with Limited Public Hunting and Quarantine	Alternative 5: Aggressive Brucellosis Control within Yellowstone National Park through Capture, Test, and Removal	Alternative 6: Aggressive Brucellosis Control within Yellowstone National Park through Vaccination	Alternative 7: Manage for Specific Bison Population Range	Modified Preferred Alternative	State of Montana October 24, 1999 Preferred Alternative	Implement Interim Plan outside Yellowstone National Park, Modified Preferred Alternative inside Yellowstone National Park
Bison population range	No range specified in existing interim plan	Allow natural forces to determine herd size	Manage herd within range of natural variation: 1,700–3,500	Same as alternative 3	Manage herd size to prevent loss of genetic integrity and ensure success of disease control	Same as alternative 5	Manage herd within range of 1,700 to 2,500	Manage for overall population limit of 3,000 bison	Same as alternative 1; assume management would maintain herd within 1,700–3,000	Same as alternative 1; assume management would maintain herd within 1,700–3,000
Capture, test, and slaughter operations	Reese Creek: capture all bison at Stephens Creek facility inside park and ship seropositives to slaughter, temporarily hold seronegative bison; West Yellowstone: capture, test, and ship seropositive males and females and all pregnant females to slaughter; test and release seronegative male and nonpregnant females on public land; capture facilities on national forest and/or private land used during winter months	Phase 1 same as alternative 1; phase 2 no capture, test, and slaughter operations	Reese Creek: in phase 1, ship all seropositives to slaughter, seronegatives to quarantine; in phase 2, capture facility between Yankee Jim Canyon and Reese Creek as backup to hunting; West Yellowstone: no capture facilities	Capture facilities same as alternative 1, except ship seronegatives from Reese Creek to quarantine	Temporary capture facilities throughout park; test; ship all seropositives to slaughter and release all seronegatives within park; Stephens Creek facility remains	Reese Creek: ship all captured bison to slaughter; West Yellowstone capture facility at Seven-Mile Bridge area inside park; test and ship seropositives to slaughter; test, vaccinate, and release all seronegatives onsite; phase 2 capture facilities same as alternative 5	Reese Creek: in phase 1, ship all seropositives to slaughter, seronegatives to quarantine; in phase 2, capture facility between Yankee Jim Canyon and Reese Creek; West Yellowstone: same as alternative 1, except quarantine all seronegatives at high population levels and all seronegative-pregnant bison at population mid range; capture facility at Horse Butte	Step 1- Reese Creek: same as alternative 1; West Yellowstone: capture bison, ship seropositives to slaughter, release all seronegatives on public land up to 100 tolerance; Step 2 - Reese Creek: capture bison, ship seropositives to slaughter, release seronegatives on public and conservation easement lands up to 100 tolerance; West Yellowstone: same as Step 1; Step 3 - Reese Creek: allow untested bison on public and conservation easement lands up to 100 tolerance, capture and release seronegatives when >100, <45 day separation, >3,000 bison; West Yellowstone: allow untested bison up to 100 tolerance, capture and release seronegatives when >100, <45 day separation, >3,000 bison	Capture facilities same as revised alternative 1 except hold calves instead of all seronegatives at Stephens Creek facility; possibly ship seronegatives to quarantine in phase 1 and phase 2 same as alternative 4; West Yellowstone: same as alternative 1	Capture facilities same as either revised alternative 1 or 4 in step 1 (depending on whether quarantine is available); in steps 2 and 3, Stephens Creek facility would only be used to hold up to 125 overwintering seronegative bison if total population numbers were 3,000 or below. West Yellowstone - assumed to be same as alternative 4 in all steps.
Contingency Plan	None specifically identified. Actions common to all alternatives identifies that when the population approaches 1,700, agencies would more aggressively employ	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1 but bison population could go below 1,700	Same as alternative 1	Same as alternative 1	Detailed plan to reduce the number of bison that are killed as part of bison management actions and to provide for a generally stable bison population should large numbers of bison attempt to move outside the park in	"Agency implemented lethal controls would decrease as population approaches 1,700 and cease at 1,700 in certain areas."- same as or similar to alternative 1	Same as alternative 1 and hold up to 125 seronegative bison over the winter if population levels at 3,000 or below.

Table 12: Summary Comparison of Alternative Actions *(continued)*

Action	Alternative 1: No Action – Continuation of the Current *Interim Bison Management Plan*	Alternative 2: Minimal Management	Alternative 3: Management, with Emphasis on Public Hunting	Alternative 4: Interim Plan with Limited Public Hunting and Quarantine	Alternative 5: Aggressive Brucellosis Control within Yellowstone National Park through Capture, Test, and Removal	Alternative 6: Aggressive Brucellosis Control within Yellowstone National Park through Vaccination	Alternative 7: Manage for Specific Bison Population Range	Modified Preferred Alternative	State of Montana October 24, 1999 Preferred Alternative	Implement Interim Plan outside Yellowstone National Park, Modified Preferred Alternative inside Yellowstone National Park
Contingency Plan (Continued)	nonlethal methods to encourage bison to remain within management boundaries; lethal control would still occur for bison posing greatest risk of transmission							response to severe winter weather; actions emphasize hazing, capture, and release of seronegative bison to tolerance level, and holding seronegative bison for spring release; if hazing ineffective and tolerance levels exceeded, additional bison sent to quarantine, to slaughter, or shot.		
Agency Shooting	Agency personnel would shoot bison that could not be hazed, evaded capture, or were deemed unsafe to handle (usually large adult males)	Agency personnel would shoot bison that could not be hazed and attempted to move beyond SMA boundaries, threatened human safety, or were identified for removal from private property	Same as alternative 1	Same as alternative 1	Bison would be shot if they attempted to move beyond the park boundary and were unresponsive to hazing	Same as alternative 1	Same as alternative 1	Same as alternative 1	Not specifically addressed, but assumed to be the same as alternative 1	Same as alternative 1 in step 1; in steps 2 and 3, Montana might choose to continue to shoot bison to enforce boundaries or facilitate capture
Quarantine operations	No quarantine operations	No quarantine operations	Quarantine operations - take seronegatives from Stephens Creek in phase 1; relocate capture facility in phase 2	Quarantine operations - Reese Creek: quarantine all seronegatives; West Yellowstone: quarantine seronegative-pregnant females	No quarantine operations	No quarantine operations	Quarantine operations – take seronegatives from Stephens Creek in phase 1; West Yellowstone: quarantine seronegative-pregnant females; if population high, quarantine all seronegatives	Quarantine operations, if available; take seronegative bison from Reese Creek and West Yellowstone under the following circumstances: 1) when bison tolerance levels of 100 were exceeded, 2) when overall population >3,000, 3) to enforce 45-day separation period	Quarantine operations Reese Creek quarantine all seronegatives until whole-herd (including adult) vaccination initiated; West Yellowstone: quarantine seronegative pregnant females. Same as alternative 4	Quarantine operations used in step 1, if available; Montana may continue to use quarantine for captured seronegative, nonpregnant bison in steps 2 and 3
Monitoring of bison	Aerial and ground reconnaissance of bison in and adjacent to park	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1 and monitor bison to facilitate capture inside park	Phase 1, same as alternative 1; phase 2, same as alternative 5	Same as alternative 1	Aerial and ground reconnaissance of bison in and adjacent to Yellowstone National Park; telemetry of pregnant bison; additional staff to enforce zone management boundaries	Not specifically addressed; assumed to be similar to alternative 1	Same as alternative 1

Table 12: Summary Comparison of Alternative Actions *(continued)*

Action	Alternative 1: No Action – Continuation of the Current *Interim Bison Management Plan*	Alternative 2: Minimal Management	Alternative 3: Management, with Emphasis on Public Hunting	Alternative 4: Interim Plan with Limited Public Hunting and Quarantine	Alternative 5: Aggressive Brucellosis Control within Yellowstone National Park through Capture, Test, and Removal	Alternative 6: Aggressive Brucellosis Control within Yellowstone National Park through Vaccination	Alternative 7: Manage for Specific Bison Population Range	Modified Preferred Alternative	State of Montana October 24, 1999 Preferred Alternative	Implement Interim Plan outside Yellowstone National Park, Modified Preferred Alternative inside Yellowstone National Park
Bison hunting	No hunt	No hunt	If legislature approves, state of Montana institutes fair-chase hunt on public and private land in all SMAs; public hunt during winter (Oct.–Feb.) primary method to control population numbers and distribution	If legislature approves, state of Montana institutes fair-chase hunt on public lands; public recreational hunt during winter (Oct.–Feb.)	No hunt	No hunt	If legislature approves, state of Montana institutes fair-chase hunt on public lands at Eagle Creek/Bear Creek; in phase 2, hunting could be allowed on public lands in all SMAs	No hunt	No hunt	No hunt
Bison management on public lands adjacent to Yellowstone National Park	Allow bison on public lands in Eagle Creek/Bear Creek except north of Little Trail Creek/Maiden Basin hydrographic divide; do not allow bison north of Reese Creek; do not allow bison in West Yellowstone area beyond May and until November 1	Allow bison on public lands in Eagle Creek/Bear Creek; in Gardiner Valley south of Yankee Jim Canyon; and south of Buffalo Horn Creek and east of Hebgen Lake in western area	Allow bison on public lands in Eagle Creek/Bear Creek except north of Little Trail Creek/Maiden Basin hydrographic divide; do not allow bison in West Yellowstone area beyond May and until November 1; in phase 1, bison not allowed north of Reese Creek; phase 2, bison allowed between Reese Creek and Yankee Jim Canyon	Same as alternative 1	Do not allow bison outside park; haze to return bison to interior of park	Same as alternative 1	Allow bison on public lands in Eagle Creek/Bear Creek except north of Little Trail Creek/Maiden Basin hydrographic divide; do not allow bison in West Yellowstone area beyond May and until November 1; in phase 1, bison not allowed north of Reese Creek; in phase 2, bison allowed between Reese Creek and Yankee Jim Canyon	Allow bison on public lands in Eagle Creek/Bear Creek area except north of Little Trail Creek/Maiden Basin hydrographic divide; Reese Creek: step 1 - do not allow bison north of Reese Creek; step 2 - allow seronegative bison on public and conservation easement lands up to 100; then after 2 years (step 3) allow untested bison up to 100; for steps 2 and 3, do not allow bison beyond zone management boundaries at Yankee Jim Canyon. Haze to return to park in spring; West Yellowstone: step 1, 2 - release all seronegative bison on public land in Horse Butte area during winter up to 100: step 3 - allow untested bison on public land during winter, up to 100; do not allow bison in West Yellowstone area past mid-May to enforce 45-day separation;	Same as alternative 1 except state veterinarian would consult with agencies, use weather and other criteria to determine haze back date within 30–60 day window (e.g., the date may vary between April 1 and May 1).	Same as alternative 1

TABLE 12: SUMMARY COMPARISON OF ALTERNATIVE ACTIONS *(CONTINUED)*

Action	Alternative 1: No Action – Continuation of the Current *Interim Bison Management Plan*	Alternative 2: Minimal Management	Alternative 3: Management, with Emphasis on Public Hunting	Alternative 4: Interim Plan with Limited Public Hunting and Quarantine	Alternative 5: Aggressive Brucellosis Control within Yellowstone National Park through Capture, Test, and Removal	Alternative 6: Aggressive Brucellosis Control within Yellowstone National Park through Vaccination	Alternative 7: Manage for Specific Bison Population Range	Modified Preferred Alternative	State of Montana October 24, 1999 Preferred Alternative	Implement Interim Plan outside Yellowstone National Park, Modified Preferred Alternative inside Yellowstone National Park
Bison management on public lands adjacent to Yellowstone National Park (Continued)								beginning approximately November 1, do not allow bison beyond management zone boundaries during winter		
Bison management on private lands adjacent to Yellowstone National Park	Remove bison at landowner request	Same as alternative 1	Bison hunted with landowner permission; remove at landowner request	Remove bison at landowner request; possible bison hunt under special and limited circumstances	Same as alternative 1	Same as alternative 1	Same as alternative 3	Remove, preferentially by hazing, at landowner request	Same as alternative 1	Same as alternative 1
Surveillance testing of cattle	No change in existing cattle surveillance requirements	Require testing of susceptible cattle in SMA	Require testing of cattle in contact with bison	Same as alternative 3	Same as alternative 1	Require testing of cattle in high-risk areas in West Yellowstone	Whole herd surveillance protocols for cattle within SMAs recommended by APHIS	APHIS would cooperate with Montana to conduct additional testing and vaccination of cattle that graze in areas that bison might occupy in the winter; APHIS would offer livestock operators option of having cattle certified as brucellosis free; federal agencies would provide funds for direct costs of additional testing in unlikely event bison commingle with cattle	Not specifically addressed; assumed to be same as alternative 1	Same as alternative 1
Vaccination of cattle with RB51	Encourage calfhood vaccination of cattle adjacent to park	Encourage vaccination of all susceptible female cattle calves within SMA, adjacent to park or within 20-mile radius of either	Same as alternative 2	Same as alternative 2	Same as alternative 1	Same as alternative 2	Same as alternative 2	Montana would encourage vaccination of cattle that may graze in areas that bison might occupy in winter; if voluntary compliance was not 100%, Montana would make it mandatory; federal government would reimburse direct cost of vaccination	Mandatory vaccination if 100% compliance not met by May 2001; cost reimbursed by federal government	Mandatory vaccination if 100% compliance not met by May 2001; cost reimbursed by federal government

Table 12: Summary Comparison of Alternative Actions *(continued)*

Action	Alternative 1: No Action – Continuation of the Current *Interim Bison Management Plan*	Alternative 2: Minimal Management	Alternative 3: Management, with Emphasis on Public Hunting	Alternative 4: Interim Plan with Limited Public Hunting and Quarantine	Alternative 5: Aggressive Brucellosis Control within Yellowstone National Park through Capture, Test, and Removal	Alternative 6: Aggressive Brucellosis Control within Yellowstone National Park through Vaccination	Alternative 7: Manage for Specific Bison Population Range	Modified Preferred Alternative	State of Montana October 24, 1999 Preferred Alternative	Implement Interim Plan outside Yellowstone National Park, Modified Preferred Alternative inside Yellowstone National Park
Vaccination of bison	Vaccinate bison calves after vaccine is developed that is safe and effective for bison using capture facilities and remote means	Same as alternative 1, using remote means only	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1	Vaccinate all captured vaccination-eligible bison (initially calves and yearlings) with safe vaccine; possible remote vaccination with safe vaccine, safe/effective delivery system on untested bison tolerated at West Yellowstone; when safe and effective vaccine and safe and effective delivery available, conduct remote parkwide vaccination on eligible bison	Vaccinate captured bison with safe vaccine for that age/class of bison in phases 1 and 2; vaccinate whole herd with safe and effective vaccine for all bison with a safe and effective remote delivery system in phase 2	Vaccinate all captured vaccination-eligible bison (initially calves and yearlings) with safe vaccine; possible remote vaccination with safe vaccine, safe/ effective delivery system on untested bison tolerated at West Yellowstone; when safe and effective vaccine and safe and effective delivery available, conduct remote parkwide vaccination on eligible bison - same as modified preferred alternative
Modify national forest grazing allotments	No modification of national forest grazing allotments	Modification of national forest grazing allotments may occur	No modification of national forest grazing allotments expected in phase 1, but may occur in phase 2	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 3	If needed, modify public land-grazing start date to ensure 45-day temporal separation between bison use of public lands in winter and cattle grazing on public lands in summer and fall	Same as alternative 1	Same as alternative 1
Change in land use, easement, or acquisition of additional wildlife habitat.	No change in existing land use/ownership FEIS Note: Land north of Reese Creek designated as wildlife habitat has been acquired; a cattle lease on this land remains in effect until 2002	Easement or acquisition of additional winter wildlife habitat; or change from breeder cattle (susceptible cattle) to steers/spayed heifers within SMA	Similar to alternative 2, with reduced acquisition	Same as alternative 1	Same as alternative 1	Same as alternative 1	Phase 1, no change; phase 2, acquire additional winter range north of Reese Creek; no changes in cattle operations	Same as revised alternative 1	Same as revised alternative 1	Same as revised alternative 1

TABLE 12: SUMMARY COMPARISON OF ALTERNATIVE ACTIONS *(CONTINUED)*

Action	Alternative 1: No Action – Continuation of the Current *Interim Bison Management Plan*	Alternative 2: Minimal Management	Alternative 3: Management, with Emphasis on Public Hunting	Alternative 4: Interim Plan with Limited Public Hunting and Quarantine	Alternative 5: Aggressive Brucellosis Control within Yellowstone National Park through Capture, Test, and Removal	Alternative 6: Aggressive Brucellosis Control within Yellowstone National Park through Vaccination	Alternative 7: Manage for Specific Bison Population Range	Modified Preferred Alternative	State of Montana October 24, 1999 Preferred Alternative	Implement Interim Plan outside Yellowstone National Park, Modified Preferred Alternative inside Yellowstone National Park
Winter road grooming	No change in existing winter road management FEIS NOTE: (Changes in winter road management made as a result of separate planning efforts would be implemented	Eliminate winter grooming and snowmobile use of some trails; research effects of closures on population numbers and on ability to keep bison within park boundaries	Research effects of road closures on bison	Same as alternative 1	Plow roads in winter for access to bison capture facilities	Phase 1 - plow road to Seven-Mile Bridge capture facility; phase 2 - plow roads same as in alternative 5	Same as alternative 1	No changes in winter road management proposed	Same as revised alternative 1	Same as revised alternative 1
Total annual cost of alternative (includes one-time only costs such as quarantine, capture facilities, and land acquisition)	• NPS – $660,500 • USFS – $16,500 • State of MT – $154,000-$451,000 • APHIS – $201,300	• NPS – $420,700 • USFS – $187,000 • State of MT – $165,000 • APHIS – $36,300 • Shared costs (up to $44.1 million)	• NPS – $709,800 • USFS – $44,000 • State of MT – $247,500 • APHIS – $1,026,300–$1,356,300 • Shared costs (up to $33.1 million)	• NPS – $643,800 • USFS – $27,500 • State of MT – $448,800 • APHIS – $1,185,800–$1,515,800	• NPS – $2,815,290 • USFS – $16,500 • State of MT – 0 • APHIS – $56,100	(phase 2) $1,1013,860 – phase 1; $2,377,160 – phase 2 • USFS – $16,500 • State of MT – $156,700–phase 1; $192,500–phase 2 • APHIS – $24,700–phase 1; $29,700–phase 2	• NPS – $1,071,700 • USFS – $33,000 • State of MT – $443,020 • APHIS – $1,216,300–$1,546,300 • Shared costs (up to $29.1 million)	• NPS – $1,071,700 • USFS – $22,00 • State of MT – $388,020 • APHIS – $1,538,800 • Shared costs (up to $29.1 million)	Costs not included. Assumed to be similar to alternative 4	In step 1 - same as alternative 1; in steps 2 and 3 - NPS costs would be reduced; Montana's may be increased

Table 13: Summary Comparison of Actions in Alternatives Submitted by Organizations After Release of the *Draft Environmental Impact Statement*

Action	Bison Alternative	Plan B	Fort Belknap Tribe	Citizens' Plan	USAHA Plan
Sponsors	The Fund for Animals; other organizations, including the Humane Society, Earth Island Institute and over 1,600 individuals	Written and submitted by an independent wildlife biologist; endorsed by organizations including the Ecology Center, Montana Ecosystems Defense Council, and Taxpayers for Common Sense	Fort Belknap Native American Community of Montana	Greater Yellowstone Coalition, Defenders of Wildlife, Inter Tribal Bison Cooperative, National Parks and Conservation Association, National Wildlife Federation, other organizations, and more than 47,500 individuals	U.S. Animal Health Association
Summary of plan's overall management approach	Allow bison to roam freely and be regulated naturally; modify winter use management to restore natural regulation as the primary mechanism for controlling population and distribution; alter cattle operations on private and public lands and require vaccination of cattle to reduce the risk of bacterial transmission	Adopt a cost-effective approach to disease management by addressing the underlying factors that cause brucellosis to be problematic; reduce the prevalence of brucellosis in bison by nonintrusive, remote vaccination; vaccinate and annually test the few cattle in areas used by bison, remove cattle from public lands used by bison, and compensate ranchers who switch to no-risk operations; maintain bison populations at ecological carrying capacities through active management The approach is similar to phase 2 of alternative 3	Allow bison to range freely and retain their status as wildlife; give bison priority over livestock in the use of all public lands outside the park; make the acquisition of land for winter range and migration routes a priority; this approach appears to be similar to phase 2 of alternative 2	Manage herd size to the ecological carrying capacity of land both inside the park and within special management areas; minimize disease transmission through separation, including changes in cattle operations on public lands and the acquisition of land or easements; regulate herd sizes through public harvest or live removal to quarantine for later disposition to tribal or other public lands Similar in approach to modified preferred alternative; carrying capacity outside park identified and analyzed in phase 2 of alternative 2	Aim to totally eradicate brucellosis from the Yellowstone bison; under phase 1, reduce the number of bison testing positive through vaccination; maintain population at 1,800; in five years begin phase 2, capture and test every bison within the park, slaughter those testing positive, and quarantine those testing negative; do not allow bison outside the park except into the Eagle Creek/Bear Creek SMA Approach same as alternative 6
Bison population range	No set limit, naturally regulated Same as alternative 2, phase 2	Actively manage to achieve ecological carrying capacity	Establish population goals for the herd based on habitat available in park, SMAs, acquired land Alternative 2, phase 2 assumes bison will use available winter habitat up to its ecological carrying capacity	Establish ecological carrying capacities for the park and special management areas outside the park; if additional lands became available, increase size of herd; review annually by cooperative wildlife team Alternative 2, phase 2 assumes bison would use available winter habitat in the park and in SMAs similar to those suggested in the Citizens' Plan up to their ecological carrying capacity (see results of new stochastic modelling in "Environmental Consequences: Impacts on Bison Population")	1,800 bison until non-National Park Service range experts say Yellowstone National Park can accommodate more than this. Never more than 2,200 Impacts on bison population indicated for years 1–10 (1997–2006) for alternative 5 (table 47) would occur in years 6–15 in this alternative; unclear impacts for phase 1, population at 1,800; assume removals at Stephens Creek and Seven-Mile Bridge facility is 100% of migrating bison, e.g., that all bison indicated in table 42 as remaining outside Yellowstone National Park at West Yellowstone would also be removed to slaughter or quarantine for years 1–5 (1997 to 2001 in table 42)
Capture, test, and slaughter operations	None Same as alternative 2, phase 2	None Same as alternative 2, phase 2	Within 18 months, construct facilities in appropriate locations to capture bison Unclear purpose, location of facilities	Immediately relocate Stephens Creek facility to outside park; use to trap and test for quarantine to maintain population numbers; retain one capture facility on west side in SMA. Use facility to maintain population size, keep number of bison outside park to carrying capacity; hold seropositive bison for use in research or for use by tribes. Similar approach to modified preferred alternative, although capture facility remains at Stephens Creek; relocation analyzed in phase 2 of alternative 3	Two permanent capture facilities - at Stephens Creek and Seven-Mile Bridge in both phases; in phase 1 assume capture, test, and removal to slaughter of seropositive bison in these facilities; remove seronegative bison to slaughter or quarantine at Reese Creek, release into western part of park from Seven-Mile Bridge; shoot or capture and return to park, quarantine if bison migrate to western park boundary; in phase 2, add 7 temporary facilities in the park, begin parkwide capture, test, and slaughter as described in alternatives 5 and 6

Table 13: Summary Comparison of Actions in Alternatives Submitted by Organizations After Release of the *Draft Environmental Impact Statement* (*continued*)

Action	Bison Alternative	Plan B	Fort Belknap Tribe	Citizens' Plan	USAHA Plan
Quarantine operations	None Same as alternative 2 and others	None Same as alternative 2 and others	Unclear; possible use of capture facilities to complete quarantine protocol; live removal for tribes in cooperation with Inter Tribal Bison Cooperative The description of quarantine and associated impacts would likely be similar to that described in the environmental impact statement for alternatives 3, 4, 7, and the modified preferred alternative; the distribution of live bison completing quarantine in the Ft. Belknap Tribe alternative would be coordinated with tribal governments and/or Inter Tribal Bison Cooperative	Locate away from park; use different, less severe protocol and pasture-type facility; use to maintain population size and number of bison in SMAs at carrying capacity Impacts of quarantine are not part of this final environmental impact statement; proposed location and type would be decided in a future NEPA process; different protocol is considered unreasonable by APHIS (see "Volume 2: Responses to Comments" for more information)	Build immediately; locate in area far removed from cattle; suggestions include in park, adjacent to Stephens Creek, or build new capture facility at Seven-Mile Bridge or in Lamar Valley or Madison River areas near west boundary of park; use to hold bison tested and released from Seven-Mile Bridge facility and migrating westward out of the park Impacts of a quarantine facility would be decided in a future NEPA process. In the environmental impact statement, quarantine is assumed to become available one year following the signing of a record of decision in alternatives 3, 4, 7 and the modified preferred alternative
Monitoring of bison	Continue agencies' existing monitoring of bison within and adjacent to the park Same as all alternatives	Done by Montana Department of Fish, Wildlife and Parks for bison as they do for other species No change to impacts from other alternative	Not addressed	Continue agencies' existing monitoring	Aerial and ground monitoring within and adjacent to the park No anticipated differences in impacts between this and monitoring as described for alternatives analyzed in the environmental impact statement
Bison hunting	None Same as alternative 2	Not addressed. But "active management" by state wildlife agencies referenced; this usually includes hunting Most similar to alternative 4, although numbers of bison killed through hunting and hunting area much larger	If hunting is used, tribal hunting only; no public hunt Impacts of tribal hunting would be indistinguishable from public hunting (see alternatives 3 and 4)	Regulate public harvest to help maintain population limits Impacts of hunting analyzed in alternatives 3 and 4	Allow in the Eagle Creek/Bear Creek SMA if approved Impacts of hunting only in Eagle Creek/Bear Creek area analyzed in alternative 7
Bison management on public lands adjacent to Yellowstone National Park	Allow bison to roam freely in all areas outside the park Same as alternative 2, phase 2	Allow bison to roam freely in all areas outside the park Same strategy as alternative 2, phase 2 and alternative 3, phase 2, but area where this would need to occur is much larger	Allow bison to roam freely within Greater Yellowstone Ecosystem; offer incentives to modify livestock operations; use Inter Tribal Bison Cooperative to manage bison on newly acquired lands Same strategy as phase 2 of alternatives 2 and 3, but area larger	Allow bison to roam freely in SMAs located north and west of the park, but keep boundaries flexible, especially on west side; focus on changes in cattle management rather than bison management; boundaries roughly the same as alternative 2, phase 2 Same as phase 2 of alternative 2	Bison allowed to occupy Eagle Creek/Bear Creek except north of Little Trail Creek/Maiden Basin hydrographic divide; do not allow bison north of Reese Creek; do not allow bison in West Yellowstone area Impacts on bison distribution would be intermediate between those alternatives in 5 and 6
Bison management on private lands adjacent to Yellowstone National Park	Avoid hazing unless it can be done humanely from private lands where not tolerated; construct fencing and require vaccination and testing for cattle. Same effect as alternative 2, phase 2, but area requiring action much larger	Use volunteers to haze bison from private land upon request Possibly unreasonable as Montana Department of Livestock required to remove bison from private land for disease control or if landowner requests it; impacts similar to phase 2 of alternatives 2 or 3, area much larger	Haze bison where they are not permitted. Use Inter Tribal Bison Cooperative to manage bison on newly acquired lands; offer incentives to modify livestock operations Approach similar to phase 2 of alternatives 2 and 3, but area larger	Haze bison from private land to avoid conflicts with human safety or property; compensate owner for any property damage Same approach as alternatives 2, 3, 7 or Modified Preferred	Bison not allowed outside park except into Eagle Creek/Bear Creek area (public lands); if bison do evade capture, haze or shoot at landowners request or with landowner permission Same as all alternatives (see "The Alternatives: Actions Common to All Alternatives")

Table 13: Summary Comparison of Actions in Alternatives Submitted by Organizations After Release of the *Draft Environmental Impact Statement* (*continued*)

Action	Bison Alternative	Plan B	Fort Belknap Tribe	Citizens' Plan	USAHA Plan
Surveillance testing of cattle	Federal and state agencies will use testing in conjunction with fencing for separation and vaccination Most similar to modified preferred alternative	Not addressed	Not addressed	Not addressed	Require testing of cattle in areas near West Yellowstone Same as alternative 6
Vaccination of cattle	Mandatory Same effect as all alternatives, but costs higher because area larger	Mandatory if contact with bison possible Same as alternative 3, phase 2	Vaccinate at federal expense Costs would be higher than in environmental impact statement because of additional area; would be borne by federal government, not livestock operators	Require vaccination within and adjacent to the SMAs Impacts of this approach similar to assumptions made in analysis (all cattle in impact area vaccinated) of all alternatives	Encourage vaccination of female calves that may come in contact with bison Same approach as alternative 1
Vaccination of bison	None Seroprevalence would continue at existing levels or increase	Vaccinate when safe and effective vaccine available Remote vaccination of bison calves part of all alternatives	Not addressed	Vaccinate when safe and effective vaccine available and can be administered when sure that elk will not reinfect bison Same approach as alternatives 1, 2, 3, 4, 7, and the modified preferred alternative; seroprevalence would not drop low enough that elk reinfection was a concern in these alternatives	Immediately vaccinate calf and yearlings with RB51; use empirical data from domestic bison herds to implement adult vaccination with reduced dose of RB51, especially for seronegative adult females. When seroprevalence stabilizes (no statistically significant reductions occurring), begin parkwide capture and test program; slaughter seropositives, vaccinate, and release seronegative bison into park or quarantine.
Modify national forest grazing allotments	Prohibit cattle grazing on affected public lands; U.S. Forest Service would provide alternative public lands if available Same as alternative 2, phase 2	Give bison preference over cattle on public lands; remove cattle if there are conflicts; limit grazing permits to steer only or other low-risk operations Type of impacts same as phase 2 of alternatives 2 or 3 with larger extents	Give bison preference over cattle; modify permits to reduce or eliminate contact between bison and livestock Same approach as alternative 2, phase 2	Change the type, timing, and location of cattle operations to accommodate bison on public lands Similar to or same as phase 2 of alternatives 2 and 3, and steps 2 and 3 of modified preferred alternative	None Modifications would not be necessary as no bison exit the park into areas where allotments occur; same as alternative 5
Change in land use, easement or acquisition of additional wildlife habitat	Acquire private grazing lands, if available, as additional winter range Assume same as alternatives 2, 3, and 7, phase 2, or unreasonable due to costs (to acquire additional land wherever bison range)	None	Make acquisition of additional land from willing sellers for winter range and migration routes a priority Assume same as alternatives 2, 3, and 7, phase 2, or unreasonable due to costs (to acquire additional land in entire Greater Yellowstone ecosystem)	Acquire key winter range north and west of the park by purchasing land or easements from willing sellers Similar to phase 2 of alternative 2 (given SMA boundaries identified in Citizens' Plan)	None proposed Same as alternatives 1, 4, 5, and 6
Winter road grooming	Change policy to end all grooming and snowmobile use in park Unknown impact, assume similar to phase 2, alternative 2	Not addressed	Not addressed	Study impact of groomed roads on bison migration; take action to close them if warranted Same as alternative 3	Plow roads as required to transport bison from capture facilities, quarantine Same as alternatives 5 and 6

TABLE 13: SUMMARY COMPARISON OF ACTIONS IN ALTERNATIVES SUBMITTED BY ORGANIZATIONS AFTER RELEASE OF THE *DRAFT ENVIRONMENTAL IMPACT STATEMENT* (*CONTINUED*)

Action	Bison Alternative	Plan B	Fort Belknap Tribe	Citizens' Plan	USAHA Plan
To a large degree, does proposed alternative meet objectives 1–9 and purpose of bison management plan as stated in the environmental impact statement	No; violates several objectives (1, 2, 3, 4, 6, and 9) outright; does not "protect economic interest and viability of livestock industry in Montana" (purpose) or achieve objective 5 to a large degree	No; violates objectives 1 and 2. The agencies believe it would not be possible to achieve objectives 4, 5, and 6 or protect the Montana livestock industry from threat of brucellosis transmission from bison with an ever increasing range occupied by bison	Unclear; appears to violate objectives 1, 2, 4, 5, and 6; no stated boundary, population size, vaccination of bison (commitment to eventual elimination of brucellosis); unclear purpose of capture facilities, quarantine, timing of cattle changes or land acquisition may mean objectives 5 and 6 cannot be achieved	Yes	No; bison would not remain wild and free ranging, as they would be extensively handled throughout phase 2, and confined to the park and Eagle Creek/Bear Creek for the entire 15-year life of the plan; also, the use of a bison vaccine before it is clearly safe, particularly for adults, violated objectives 7, 8, and 9
NEPA status	Rejected as unreasonable for violating stated purpose and objectives; geographic scope much larger - since no boundaries, may include all former range of bison in U.S.; within the geographic boundaries defined by the agencies, this approach is similar to alternative 2, phase 2	Scope of analysis much larger than in environmental impact statement; since no boundary set, geographic scope may include all former range of bison in U.S.; rejected as outside the scope of this environmental impact statement and unreasonable for violating stated purpose and objectives; within the geographic boundaries defined by the agencies, this approach is similar to alternative 3, phase 2	Scope of analysis much larger than in environmental impact statement and appears to violate several objectives; rejected as outside the scope of this environmental impact statement, and unreasonable for violating stated objectives	Viable alternative; however, the impacts of each management tool identified are similar or identical to those already analyzed for one or more alternatives in the environmental impact statement; the alternative is not rejected, but is considered already analyzed in the environmental impact statement and no further analysis is needed	Rejected as unreasonable for the following reasons: violates purpose of taking action by not preserving a wild and free-ranging population and violates objectives of taking action

Table 14: Comparison of Features of Each Alternative

Action	Alternative 1: No Action - Continuation of the Current *Interim Bison Management Plan*	Alternative 2: Minimal Management	Alternative 3: Management with Emphasis on Public Hunting	Alternative 4: Interim Plan with Limited Public Hunting and Quarantine	Alternative 5: Aggressive Brucellosis Control within Yellowstone National Park through, Capture, Test, and Removal	Alternative 6: Aggressive Brucellosis Control within Yellowstone National Park through Vaccination	Alternative 7: Manage for Specific Bison Population Range	Modified Preferred Alternative	State of Montana October 24, 1999 Preferred Alternative	Implementation of Interim Plan outside Park, Modified Preferred inside Park
Agency-enforced boundary control at Reese Creek	✓	✓ (phase 1)	✓	✓	✓	✓	✓	✓ (steps 1, 2)	✓	✓ (step 1)
Agency enforced boundary control at Little Trail Creek/ Maiden Basin divide	✓	✓ (phase 1)	✓	✓		✓	✓	✓	✓	✓
Bison shot inside Eagle Creek/Bear Creek area			✓ (hunt)	✓ (hunt)	✓ (agency)					
Agency-enforced boundary at Yankee Jim Canyon (northern boundary beyond Reese Creek)		✓	✓ (phase 2)				✓ (phase 2)	✓ (steps 2, 3)		
Agency-enforced boundary at Cabin Creek area boundary on western side	✓		✓	✓		✓	✓	✓	✓	✓
Agency-enforced boundary at Buffalo Horn Creek on western side		✓								
Capture facility at Stephens Creek (northern, Reese Creek boundary inside park)	✓	✓ (phase 1)	✓ (phase 1)	✓	✓	✓	✓ (phase 1)	✓	✓	✓ (step 1)
Capture facilities at Duck Creek and Madison River (western boundary)	✓	✓ (phase 1)		✓	✓					
Capture facilities at several locations inside park					✓	✓ (phase 2)				
Capture facilities at Duck Creek and Horse Butte (western boundary)							✓	✓	✓	✓
Capture facilities at Seven-Mile Bridge (western boundary inside park)						✓				

Table 14: Comparison of Features of Each Alternative *(continued)*

Action	Alternative 1: No Action - Continuation of the Current *Interim Bison Management Plan*	Alternative 2: Minimal Management	Alternative 3: Management with Emphasis on Public Hunting	Alternative 4: Interim Plan with Limited Public Hunting and Quarantine	Alternative 5: Aggressive Brucellosis Control within Yellowstone National Park through, Capture, Test, and Removal	Alternative 6: Aggressive Brucellosis Control within Yellowstone National Park through Vaccination	Alternative 7: Manage for Specific Bison Population Range	Modified Preferred Alternative	State of Montana October 24, 1999 Preferred Alternative	Implementation of Interim Plan outside Park, Modified Preferred inside Park
Seronegative bison from Stephens Creek slaughtered	✓	✓ (phase 1)			✓	✓		✓ (step 1; steps 2 and 3 under certain conditions, quarantine full)	✓ (phase 1)	✓ (step 1)
Seronegative bison from Stephens Creek quarantined			✓	✓			✓	✓ (step 1; steps 2 and 3 under certain conditions)	✓	✓ (step 1)
Seronegative-nonpregnant bison from West Yellowstone capture facilities released onsite	✓	✓ (phase 1)		✓		✓	✓	✓	✓	✓
Seronegative-pregnant bison from West Yellowstone slaughtered	✓	✓ (phase 1)							✓	✓
Seronegative-pregnant bison from West Yellowstone quarantined				✓			✓ (at high population levels)		✓	✓
Seronegative-pregnant bison from West Yellowstone released onsite						✓		✓		
Quarantine facilities			✓	✓			✓	✓	✓	✓
Bison hazed into capture facilities, away from borders	✓	✓ (phase 1)	✓	✓	✓	✓	✓	✓	✓	✓
Bison crossing boundaries shot	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SMA in Eagle Creek/Bear Creek	✓	✓	✓	✓		✓	✓	✓	✓	✓
SMA between Reese Creek and Yankee Jim Canyon on west side of Yellowstone River only			✓				✓	✓		
SMA between Reese Creek and Yankee Jim Canyon on east and west side of Yellowstone River		✓								
Western SMA including Horse Butte area	✓	✓	✓	✓		✓	✓	✓	✓	✓

Table 14: Comparison of Features of Each Alternative *(continued)*

Action	Alternative 1: No Action - Continuation of the Current *Interim Bison Management Plan*	Alternative 2: Minimal Management	Alternative 3: Management with Emphasis on Public Hunting	Alternative 4: Interim Plan with Limited Public Hunting and Quarantine	Alternative 5: Aggressive Brucellosis Control within Yellowstone National Park through, Capture, Test, and Removal	Alternative 6: Aggressive Brucellosis Control within Yellowstone National Park through Vaccination	Alternative 7: Manage for Specific Bison Population Range	Modified Preferred Alternative	State of Montana October 24, 1999 Preferred Alternative	Implementation of Interim Plan outside Park, Modified Preferred inside Park
Western SMA includes Cabin Creek/Lee Metcalf area	✓	✓	✓	✓		✓	✓	✓	✓	✓
Western SMA includes all land south of Buffalo Horn Creek		✓								
Bison hazed back into park from West Yellowstone in May	✓	✓ (phase 1)	✓ (phase 1)	✓		✓	✓	✓	✓	✓
Bison hazed back into park from Reese Creek in April								✓ (steps 2, 3)		
Bison hunted in West Yellowstone area			✓	✓ (limited)			✓ (possible)			
Untested bison outside park at Reese Creek								✓ (step 3)		✓ (step 2, 3)
Seronegative bison released at Reese Creek								✓ (step 2)		✓ (step 2)
Untested bison allowed into western SMA, including West Yellowstone area								✓ (step 3, possible in step 2)		
Capture facility at Stephens Creek used only to hold 125 bison overwinter, if late winter population greater than 3,000, or if more than 100 bison occupy Reese Creek management area outside park.								✓ (step 3)		
Capture facility at Horse Butte used only if late winter population greater than 3,000, or if more than 100 bison occupy West Yellowstone management area outside park								✓ (step 3)		

Table 15: Summary Comparison of Impacts of Alternatives

The following terms are used in this impact summary chart and throughout the environmental impact statement. In some cases, the terms are defined quantitatively. However, when they are not, the following definitions apply:

- Negligible – at lower levels of detection
- Minor – detectable, but slight
- Moderate – readily apparent environmental effects with the potential to become major
- Major – severe adverse or exceptional beneficial effects

Topic	Alternative 1: No Action	Alternative 2:	Alternative 3:	Alternative 4:	Alternative 5:	Alternative 6:	Alternative 7:	Modified Preferred Alternative	State of Montana October 24, 1999 Preferred Alternative	Implementation of Interim Plan outside Park, Modified Preferred inside Park
Impacts on Bison Population										
Estimated population size (# bison) in 2006 or later	3,100 in 2006 from DEIS deterministic model; the stochastic model predicts a mean population of 3,700	3,500 in 2006; moderate increase from DEIS deterministic model; the stochastic model predicts a mean population of 5,200, a major increase compared to alternative 1	3,500 in 2006; moderate increase from DEIS deterministic model; the stochastic model predicts a mean population of 3,700; similar to alternative 1	2,800 in 2006; minor decrease from DEIS deterministic model; the stochastic model predicts a mean population of 3,700; similar to alternative 1	Deterministic model predicts 2,150 in 1997 to 1,250 in 1999; up to 2,000 by 2006; major decrease; the stochastic model predicts a mean population of 2,900 in 2000 to 2,080 in 2001; major decrease, 2,494 in 2004; major decrease compared to alternative 1, 3,600 in 2014	Deterministic model predicts 3,500 in 2010; 2,500–2,900 in 2011; moderate to major decrease; the stochastic model predicts that phase 2 could not be implemented during life of the plan; required at least 20 years to fully implement alternative; a mean population of 3,700 at 15 years	Deterministic model predicts 2,700 in both 2006 and 2011; moderate to major decrease; the stochastic model predicts that the population objective is never achieved; the stochastic model predicts a mean population of 3,600; similar to alternative 1	Deterministic model predicts 3,245 in 2006; similar to alternative 1; major increase compared to alternative 7; the stochastic model predicts a mean population of about 3,700; similar to alternative 1	Same as alternative 1	Same as alternative 1
Estimated distribution in West Yellowstone	Deterministic model predicts 18–52 bison; the stochastic model predicts an average of 61–66 seronegative nonpregnant bison would remain	Deterministic model predicts 20–60 bison; the stochastic model predicts an average of 366–1,128 bison could winter in the western SMA; a major increase	Deterministic model predicts 16–120 bison; the stochastic model predicts an average of 62-68 bison, similar to alternative 1	Deterministic model predicts 1–52 bison; the stochastic model predicts an average of 56-60 bison; a minor decrease	Both deterministic and stochastic models predict 0 bison; a major decrease	Deterministic model predicts 22–60 bison; the stochastic model predicts an average of 58 – 80 seronegative bison might winter in the area; a minor to major increase	Deterministic model predicts 13–51 bison; the stochastic model predicts no bison would winter in the area in an attempt to meet population objectives; a major decrease	The deterministic model predicts 22–60; minor to moderate increase compared to alternative 1; the stochastic model predicts 10 bison up to 100 tolerance limit might winter in the area; similar to alternative 1 but more management flexibility and less hazing, capture and handling when tolerance limit is not exceeded	Same as alternative 1	Same as alternative 1
Estimated distribution in Reese Creek	0 bison	Deterministic model predicts 0–120 bison; the stochastic model predicts an average of 462–530 bison could winter north of the park; a major increase	Deterministic model predicts 60-80 bison; the stochastic model predicts an average of 68–80 bison could winter north of the park; a major increase	Deterministic model and stochastic model predict 0 bison; same as alternative 1	Deterministic model and stochastic model predict 0 bison; same as alternative 1	Deterministic model and stochastic model predict 0 bison; same as alternative 1	Deterministic model predicts 0–100 bison; the stochastic model predicts no bison would winter in the area in an attempt to meet population objectives; major decrease	Deterministic model predicts 65–82; major increase compared to alternative 1; the stochastic model predicts 10–20 up to 100 tolerance limit might winter in the area; major increase compared to alternative 1	Same as alternative 1	Same as alternative 1

Table 15: Summary Comparison of Impacts of Alternatives *(continued)*

Topic	Alternative 1: No Action	Alternative 2:	Alternative 3:	Alternative 4:	Alternative 5:	Alternative 6:	Alternative 7:	Modified Preferred Alternative	State of Montana October 24, 1999 Preferred Alternative	Implementation of Interim Plan outside Park, Modified Preferred inside Park
Impacts on Bison Population *(continued)*										
Estimated seroprevalence rate in 2011 using the deterministic model and in 2013 for the stochastic model; (for all alternatives except alternative 6, these dates represent 11 years after vaccination of bison begins)	Deterministic model predicts seroprevalence would decline to 24%; stochastic model predicts decline to about 11%	Deterministic model predicts seroprevalence would decline to 26%; minor adverse impact; stochastic model predicts decline to about 13%	Deterministic model predicts seroprevalence would decline to 28%; minor to moderate adverse impact; stochastic model predicts decline to about 15%	Deterministic model predicts seroprevalence would decline to 26%; minor adverse impact; stochastic model predicts decline to about 13%	Both deterministic and stochastic models predict seroprevalence would fall to near 0%; a major beneficial impact	Deterministic model predicts seroprevalence would decline to 0% by 2013; major beneficial impact; stochastic model predicts decline to about 9% in 2014; similar to alternative 1, and that this alternative would require at least 20 years to fully implement	Deterministic model predicts seroprevalence would decline to 23%; negligible to minor beneficial impact; stochastic model predicts decline to about 14%	Deterministic model predicts seroprevalence would decline to 25%; negligible to minor beneficial impact; stochastic model predicts decline to about 13%	Same as alternative 1	Same as alternative 1
Impacts on Recreation										
Visitor experience related to capture facilities and operations	Minor adverse impacts related to capture operations and restricted access or closures because of them	No impact to visitors because capture facilities removed; relative benefit	Negligible adverse impact on visitor use as capture facilities rarely used; relative benefit	Similar to alternative 1	Moderate to major adverse impact from capture operations parkwide; moderate to major adverse impact from additional facilities and year-round operations	Similar impact from operations in phase 2 to those in alternative 5; major adverse impact to visitor experience from capture facility in Seven-Mile Bridge area	Similar to alternatives 1 and 4, although possible adverse impact from increased use of capture facilities to maintain population size	Similar to alternative 7, but less adverse as the target population level is higher than alternative 7	Same as alternative 1	Same as alternative 1
Wildlife viewing opportunities – percent change by 2006 and distribution	42% increase is bison population over 1997; relative benefit compared to existing conditions	14% increase over alternative 1; and wider distribution; minor to moderate benefit compared to alternative 1 to those seeking to view bison	14% increase over alternative 1; minor to moderate benefit compared to alternative 1	8% decrease over alternative 1; minor adverse impact compared to alternative 1	35% decrease over alternative 1; minor to moderate adverse impact compared to alternative 1	1% higher, i.e., same as alternative 1 through the year 2009. Similar to alternative 5 after 2010	12% decrease by 2006; 23% by 2011; minor to moderate adverse impact compared to alternative 1	6% higher than alternative 1 by 2006; 7% lower by 2011; negligible to minor impact compared to alternative 1	Same as alternative 1	Same as alternative 1
Winter recreation; snowmobiling	No impact	Displacement of well over 50% of oversnow park visitors; major impact on individual in-park users; minor to moderate adverse impact overall	Possible minor to major impact if research indicates road closures needed	No impact	Major impact on some individual in-park snowmobile users; minor to moderate impact overall	Similar to alternative 2 for first 10 years; then similar to alternative 5 for 2–3 years	No impact	No impact	Same as alternative 1	Same as alternative 1
Hunting	No impact	No impact	75–85 bison hunting permits; minor to moderate benefit	35 bison hunting permits; minor benefit	No impact	No impact	15–25 bison hunting permits; minor benefit	No impact	Same as alternative 1	Same as alternative 1

TABLE 15: SUMMARY COMPARISON OF IMPACTS OF ALTERNATIVES (CONTINUED)

Topic	Alternative 1: No Action	Alternative 2:	Alternative 3:	Alternative 4:	Alternative 5:	Alternative 6:	Alternative 7:	Modified Preferred Alternative	State of Montana October 24, 1999 Preferred Alternative	Implementation of Interim Plan outside Park, Modified Preferred inside Park
Impacts on Livestock Operations										
Cost of vaccination and testing	2% of yearly production costs; minor impact in the long term, but more apparent in years of low cattle prices	With removal of test-eligible cattle, no testing or vaccinating in SMAs; possibly continued testing and vaccinating in areas near SMAs	Similar to alternative 2 in the long term, but smaller SMAs and possible continued presence of test-eligible herds in western SMA	Same as alternative 1	Possibly less vaccination and testing; minor beneficial impact	First 12 years, same as alternative 1; final 3 years, same as alternative 5	Same as alternative 3 north of Yellowstone National Park; same as alternative 1 west of park	Vaccination costs borne by APHIS resulting in a negligible to minor benefit to producers	Same as alternative 1	Same as alternative 1
Operational changes to non-breeding cattle–individual ranchers	No impact	Possible conversion of cow-calf operations; moderate to major impact on a few individual ranchers	Fewer possible conversions than in alternative 2; moderate to major impact on a few individual ranchers	No impact	No impact	No impact	No impact	No impact	Same as alternative 1	Same as alternative 1
Modification of grazing on national forest allotments	No impact	Possible allotment modifications; moderate to major impact on a few ranchers using allotments now	Fewer possible modifications than in alternative 2; moderate to major impact on a few ranchers using allotments now	No impact	No impact	No impact	Short term, no impact; long-term, a few allotments on the north end may be modified; moderate to major impact on those users	Allotment on/off dates modified; minor impact on local scale Negligible impact on a regional scale	Same as alternative 1	Same as alternative 1
Private land acquisition or easements	No impact	Possible buyouts or easements; major impact on public funds	Fewer possible buyouts or easements than in alternative 2; major impact on public funds	No impact	No impact	No impact	Same as alternative 3, but no acquisitions in West Yellowstone	Acquisitions complete; no new impact on public funds or on landowners expected; one cattle operator on acquired land may experience minor to major adverse effects from relocation	Same as alternative 1	Same as alternative 1
Property damage by bison	Minor impact overall, but could be moderate to major for individuals affected	Short term, same as alternative 1; long term, reduced adverse impact	Short term, same as alternative 1; long-term, reduced adverse impact	Same as alternative 1	Minor impact overall, but could be a moderate to major benefit for individuals who might otherwise experience damage under alternative 1	Same as alternative 1	Short term, same as alternative 1; long term, reduced adverse impact	Negligible to minor overall, but moderate to major for individuals affected	Same as alternative 1	Same as alternative 1
Perception of risk	Risk exists; minor impact	Risk exists; moderate adverse impact	Until changes in operations or acquisitions occur, same as alternative 1; thereafter reduced risk	Same as alternative 1	Reduced risk, moderate beneficial impact	Slightly less, but similar to alternative 5; minor to moderate benefit	West Yellowstone, same as alternative 1; Reese Creek, reduced risk in long term	The same or slightly more beneficial than alternative 1 from additional risk mitigation features	Same as alternative 1	Same as alternative 1

Table 15: Summary Comparison of Impacts of Alternatives (continued)

Topic	Alternative 1: No Action	Alternative 2:	Alternative 3:	Alternative 4:	Alternative 5:	Alternative 6:	Alternative 7:	Modified Preferred Alternative	State of Montana October 24, 1999 Preferred Alternative	Implementation of Interim Plan outside Park, Modified Preferred inside Park
Impacts on Socioeconomics — Regional Economy										
Impacts on regional economy from wildlife viewing	40–45% of regional economy ($500 million) dependent on tourism	Possible beneficial impact; magnitude unknown	Similar to alternative 2	Similar to alternative 1 with hunting an additional source of local income	Possible adverse impact; magnitude unknown	Similar to alternative 1 until phase 2; then similar to alternative 5	Similar to alternative 1	Similar to alternative 1	Similar to alternative 1	Same as alternative 1
Impacts on regional economy from snowmobiling	No change in existing conditions; $30 million per winter	Loss of an estimated $13.75 million in spending in the Greater Yellowstone Area, likely most heavily impacting communities nearest the park	Same as alternative 1	Same as alternative 1	Similar to alternative 2	Similar to alternative 2	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1
Impacts on regional economy from hunting	Bison hunting not allowed	Same as alternative 1	$33,000 annual expenditures	$15,380 annual expenditures	Same as alternative 1	Same as alternative 1	$10,890 per year increase from fees, expenditures	Same as alternative 1	Same as alternative 1	Same as alternative 1
Impacts on regional economy from livestock sector	Livestock cash receipts for Gallatin and Park counties comprise 5% of livestock cash receipts statewide	A few livestock operators may relocate their private and/or federal grazing operations to other locations; adverse impact offset by increased wildlife viewing related tourism	Same as alternative 2, but fewer livestock operators potentially displaced	Same as alternative 1	Aggressive brucellosis control may increase livestock use of area; negligible benefit	Similar to alternative 5, but less beneficial to livestock operators as brucellosis eliminated more slowly	Same as alternative 3, but without the possibility of displacements in the West Yellowstone area	Similar to alternative 7	Same as alternative 1; no impact	Same as alternative 1; no impact
Impacts on Socioeconomics — Regional Economy Minority and Low-Income Populations										
Minority and low-income populations	$19,500 of bison meat donated on average per year; minor beneficial impact	Negligible adverse impact from loss of bison meat	Negligible adverse impact from loss of bison meat to hunters; negligible benefit from availability of live bison; possible $826,000 in live bison value to tribes	$23,000 per year of bison meat received; value would be higher if some bison are donated live; minor benefit; possible $1.17 million in live bison value to tribes	$61,000 in meat available for 3–4 years; otherwise similar to alternative 1; minor beneficial impact	$19,000 per year donated during phase 1; Similar to alternative 5 during phase 2; minor beneficial impact	$26,000 per year of bison meat received; value would be higher if some bison are donated live; minor benefit; possible $1.06 million in live bison donations to tribes	$26,300 per year of bison meat donated; a possible $1.8 million in live bison value over 15 years of the plan	Potentially more bison slaughtered therefore more meat available to tribes; Unknown number of bison could be sent to quarantine	Same as alternative 1
Impacts on Socioeconomics — Social Values										
Social values	Minor to moderate impacts to those with humanitarian/moralistic values; negligible impact to ranching values	Minor impact on traditional ranching lifestyles; relative positive impact on moral and humanitarian attitudes; possible major impacts on individual ranchers, tribes, those with moral/humanitarian values; possible major impact on winter visitors who support mechanized access	Minor to moderate impacts on those opposed to hunting; negligible impacts on those with humanitarian/moral values; minor impact on ranching values	Overall minor to moderate; impacts on tribes minor; ranching similar to alternative 1	Those with humanitarian/moral values, tribes, some visitors experience major impact; ranchers negligible to minor benefits from eradication of brucellosis in bison	Similar to alternative 5 during phase 2 (parkwide capture, test, and slaughter), to alternative 1 during first 12 years	Minor to moderate adverse impact on humanitarian/moral values; minor to major impact on tribes; minor impact on traditional ranching lifestyle	Similar to alternative 1, except tribes receiving more benefits from potential quarantine	Same as alternative 1	Same as alternative 1

Table 15: Summary Comparison of Impacts of Alternatives *(continued)*

Topic	Alternative 1: No Action	Alternative 2:	Alternative 3:	Alternative 4:	Alternative 5:	Alternative 6:	Alternative 7:	Modified Preferred Alternative	State of Montana October 24, 1999 Preferred Alternative	Implementation of Interim Plan outside Park, Modified Preferred inside Park
Impacts on Socioeconomics — Nonmarket Values										
Annual nonmarket values attributed to well-being of bison population	No impact	Estimated present value of winter range of $4.43 million	Similar to or slightly less than alternative 2	No impact	Estimated present value of capture, test and slaughter (seropositive) or vaccinate (seronegative) program of $3.57 million	Same as alternative 1 until parkwide capture and slaughter, then same as alternative 5	Similar to alternative 3	Similar to alternative 3	Similar to alternative 1	Similar to alternative 1
Nonmarket values attributed to wildlife viewing	No impact	Possible benefit; magnitude unknown	No impact	No impact	Possible adverse impact; magnitude unknown	No impact	No impact	No impact	No impact	No impact
Nonmarket values attributed to recreation or hunting	No impact	Estimated loss of $3.69 million annually	$24,000 gain from hunting	$11,000 gain from hunting	Similar to alternative 2 during capture period	Similar to alternative 2 during first 10 years, then similar to alternative 5 during capture and slaughter	Similar to alternatives 1 and 4 ($8,000 gain from hunting)	No impact	Same as alternative 1	Same as alternative 1
Impacts on Threatened, Endangered, and Sensitive Species										
Bald eagle	Potential human disturbance impacts reduced to negligible through avoidance mitigation	No impact	No impact	Same as alternative 1	Potential direct effect on wintering eagles from capture facility in Madison River area; major impact possible	Potential major adverse impact on one pair of nesting bald eagles from construction of a capture facility at Seven-Mile Bridge	Same as alternative 1	Negligible effects on the bald eagle with required mitigating measures; minor positive effect on bald eagles on Horse Butte as a result of the potential for less hazing, capture and handling of bison	Same as alternative 1	Same as alternative 1
Analysis area grizzly bear – carrion supply	Slower than natural increase to maximum bison population level would have negligible impact	Quicker growth of bison population, largest range; moderate benefit compared to alternative 1 to bears by increasing carrion foraging	Minor benefit to bears compared to alternative 1 from increased growth rate, range of bison population	Same as alternative 1	Rapid decrease in bison numbers, reduction in carrion foraging opportunities for bears from range of bison population; moderate to major adverse impact	Same as alternative 1	Bison numbers less than alternative 1, but not biologically different for grizzly bears; negligible impact	Similar to alternative 7 but less adverse because of higher target bison population	Same as alternative 1	Same as alternative 1
Park interior grizzly bear – carrion supply	Groomed roads now allow bison to leave park during severe winter; negligible impact on bear carrion supply	Closing groomed roads to snowmobiles may keep bison in interior; minor to moderate beneficial impact on bear carrion supply by increased winterkill	Same as alternative 1	Same as alternative 1	Rapid decrease in bison numbers, reduction in carrion foraging opportunities for bears from range of bison population; moderate to major adverse impact	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1

Table 15: Summary Comparison of Impacts of Alternatives *(continued)*

Topic	Alternative 1: No Action	Alternative 2:	Alternative 3:	Alternative 4:	Alternative 5:	Alternative 6:	Alternative 7:	Modified Preferred Alternative	State of Montana October 24, 1999 Preferred Alternative	Implementation of Interim Plan outside Park, Modified Preferred inside Park
Impacts on Threatened, Endangered, and Sensitive Species *(continued)*										
Grizzly bear — human confrontations	Possibility of human/ bear encounter and bear being shot increased by bison management actions; currently mitigated by removal of bison viscera, body parts after shooting	Fewer bison likely shot because of larger SMAs, more dispersed shooting; beneficial impact compared to alternative 1	Possibility of human/ bear encounter and bears being shot increased by bison hunting; impact reduced to negligible through hunter education	Same as alternative 3	Same as alternative 1	Same as alternative 1	Same as alternative 3	Same as alternative 1	Same as alternative 1	Same as alternative 1
Grizzly bear — bison management activities	Potential disturbance and displacement caused by hazing and shooting of bison; negligible impact; no or negligible impact from capture facilities, as bears are denning	Potential temporary disturbance and displacement caused by hazing and shooting of bison; negligible impact, as most occurs during denning period	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1
Gray wolves — human confrontation	No impact	No impact	Possibility of a human/ wolf encounter and wolf being shot increased by bison hunting; impact reduced to negligible through hunter education	Same as alternative 3	No impact	No impact	Same as alternative 3	No impact	Same as alternative 1	Same as alternative 1
Gray wolves — bison management activities	Disturbance and displacement caused by hazing and shooting; short-term, negligible impact; no or negligible impact from capture facilities	Potential displacement of wolves that may inhabit the area in the future caused by shooting bison; negligible impact	Same as alternative 2	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1	Similar to alternative 1 but less adverse as a result of the potential for less hazing, capture and handling of bison	Same as alternative 1	Same as alternative 1
Gray wolves — bison as prey and carrion	Negligible impact	Moderate benefit for wolves by increasing their opportunities to forage on carrion due to quickest growth of bison population and largest range	Similar to alternative 2, but negligible as range and growth rate of bison population would be less	Same as alternative 1	Smaller range and rapid decrease in bison population would reduce wolf foraging opportunities; moderate to major adverse impact	Same as alternative 1	Reduced size of bison herd over the long term would have a negligible impact on wolf foraging opportunities	Negligible to minor benefit for wolves due to tolerance of bison beyond park boundaries during winter months	Same as alternative 1	Same as alternative 1
Wolverine and lynx — changes in snowmobile grooming	Negligible impact	Potential shift in use to national forest caused by stopping road grooming for snowmobiles at west entrance; potential increase in packed snow routes, allowing predators to access prey now used by lynx; negligible adverse impact	Negligible impact	Negligible impact	Negligible impact	Negligible impact	Negligible impact	Negligible impact	Same as alternative 1	Same as alternative 1

Table 15: Summary Comparison of Impacts of Alternatives *(continued)*

Topic	Alternative 1: No Action	Alternative 2:	Alternative 3:	Alternative 4:	Alternative 5:	Alternative 6:	Alternative 7:	Modified Preferred Alternative	State of Montana October 24, 1999 Preferred Alternative	Implementation of Interim Plan outside Park, Modified Preferred inside Park
Impacts on Threatened, Endangered, and Sensitive Species *(continued)*										
Trumpeter swan — nesting pair	No impact	No impact	No impact	No impact	No impact	Major adverse impact from Seven-Mile Bridge facility	No impact	No impact	No impact	No impact
Impacts on Other Wildlife Species										
Pronghorn antelope — habitat removal	Removal of >13 acres of critical winter habitat due to Stephens Creek facility; moderate to major adverse impact	Same as alternative 1 during phase 1, then moderate to major benefit from removal of facility at Reese Creek	Same as alternative 1 unless land acquired and capture facility moved north; if so, possible major benefit	Same as alternative 1	Removal of critical winter habitat caused by Stephens Creek and other facilities; moderate to major adverse impact	Same as alternative 5	Same as alternative 3	Same as alternative 1	Same as alternative 1	Same as alternative 1
Elk, antelope, and other ungulates — capture operations	Disturbance and displacement caused by hazing, fences, and shooting; minor impact	Same as alternative 1 during phase 1, then minor benefit from removal of facility	Short term, same as alternative 1; long term, minor benefit from removal of Stephens Creek facility	Same as alternative 1	Minor impact caused by additional capture facilities	Same as alternative 5	Same as alternative 3	Moderate to major benefit to pronghorn and minor benefit to other wildlife species due to decreased use of capture facilities	Same as alternative 1	Same as alternative 1
Elk, antelope, and other ungulates — acquisition of land	No impact	Moderate to major beneficial impact on pronghorn; minor benefit to other ungulates	Moderate to major beneficial impact on pronghorn; minor benefit to other ungulates	Same as alternative 1	No impact	No impact	Same as alternative 3	Same as alternative 3	Same as alternative 3	Same as alternative 3
Predators and scavengers	Potential minor impact caused by hazing; negligible impact on carrion supply from removal of bison	No impact	Potential minor impact caused by hazing; no impact associated with changes in bison population relative to alternative 1	Same as alternative 1	Major decrease in prey/carrion; moderate adverse impact	Slight to moderate decrease in prey/carrion; minor adverse impact	Minor adverse impact from maintaining smaller bison population size over long term	Same as alternative 1 during step 1; minor benefit during steps 2 and 3	Same as alternative 1	Same as alternative 1
Impacts associated with snowmobiling	Displacement, noise, habitat modification; degree of impact unknown, likely minor	Minor to moderate impact from snowmobile use displaced to national forest	Same as alternative 1	Same as alternative 1	Moderate adverse impacts during parkwide capture and slaughter from displacement due to road closures	Same as alternative 2 for first 12 years, then additive with alternative 5; moderate impacts likely	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1
Impacts on Human Safety										
Risk of bison management personnel or hunters contracting undulant fever	Negligible to minor impact	Negligible impact	Negligible to minor impact	Minor impact	Moderate impact (phase 1); negligible impact (phase 2)	Negligible to minor impact for first 12 years; moderate impact last 3 years	With mitigation, negligible to minor	Same as alternative 1 but less adverse during step 3 when bison handling is expected to decrease	Same as alternative 1	Same as alternative 1

Table 15: Summary Comparison of Impacts of Alternatives (continued)

Topic	Alternative 1: No Action	Alternative 2:	Alternative 3:	Alternative 4:	Alternative 5:	Alternative 6:	Alternative 7:	Modified Preferred Alternative	State of Montana October 24, 1999 Preferred Alternative	Implementation of Interim Plan outside Park, Modified Preferred inside Park
Impacts on Cultural Resources										
Archeological resources	No additional impact	Potential disturbance from removal of capture facilities; negligible or minor impact with required mitigation	Potential disturbance from grading for capture or quarantine facilities; negligible or minor impact with required mitigation	Same as alternative 3	Potential disturbance from grading for nine capture facilities has potential for major adverse impacts; could be mitigated to negligible or minor impacts; costs could be high	Capture facility in Seven-Mile Bridge area would have major adverse impacts to archeological resources; could be mitigated at minimum estimated cost of $1 million; impacts, with mitigation, would be minor	Same as alternative 3	Potential disturbance from grading for capture or quarantine facilities; with mitigation, negligible to minor impact	Same as alternative 1	Same as alternative 1
Cultural significance of bison herd to tribes	Status quo may be considered major adverse impact to tribes viewing bison herd as culturally significant	Free ranging bison herd protected, herd size increased; minor to major positive impact compared to alternative 1	Similar to alternative 2	Similar to alternative 1	Restrictions on distribution and decreased size of herd would have major adverse impact	Similar to alternative 1 in phase 1; similar to alternative 5 in phase 2	Similar to alternative 1 and 4	Increased tolerance of bison outside park would be major benefit	Similar to alternative 1 but less bison expected to occupy public lands outside of park	Same as alternative 1
Historic landscape	Capture facilities visually intrusive on landscape; negligible impact	Dismantling capture facilities, additional bison restores scene; beneficial impact	Dismantling capture facilities inside park, some increase in bison restores scene	Similar to alternative 1	Additional capture facilities not part of historic scene inside park; major short-term adverse impact	Similar to alternative 5	Similar to alternative 3	Same as alternative 1 unless additional capture facility located north of the park; then possible adverse impact	Similar to alternative 1 but less bison expected to occupy public lands outside of park	Same as alternative 1
Impacts on Visual Resources										
Presence of capture/quarantine facilities	Minor to moderate impact on natural vista	Beneficial compared with alternative 1	Minor impact from relocated facility on north side; minor impact from quarantine, beneficial to west side	Minor to moderate impact on natural vista; quarantine minor impact	Major impact on natural vista from capture facilities parkwide.	Major impact on natural vista; major adverse impact from Seven-Mile Bridge facility	Similar to alternative 3; except on west side	Same as alternative 4	Same as alternative 4 if quarantine included	Same as alternative 1
Bison viewing	Potential increase in viewing opportunities from increase in bison population over time; minor benefit	Minor to moderate benefit for those seeking bison due to moderate increase in bison population, compared to alternative 1 and increased distribution	Similar to alternative 2	Same as alternative 1		Minor to moderate adverse impact on viewing opportunities for those seeking bison due to decrease in bison population, compared to alternative 1	Same as alternative 1 in phase 1, alternative 5 in phase 2	Minor benefit to those seeking to view bison from increased distribution of bison outside park and negligible changes in population level	Same as alternative 1	Same as alternative 1
Bison management activities	Potential major visual impact caused by hazing, shooting and gutting	No impact	Potential major visual impact caused by hunting	Similar to alternatives 1 and 3	Moderate to major visual impact from capture operations	Same as alternative 5	Similar to alternative 4	Similar to alternative 1 but less adverse due to potential reduction in management activities during step 3	Same as alternative 1	Same as alternative 1
Winter scene	Current effect on scene from snowmobiles and other winter recreationists	Minor to major benefits for the park visual scene from displaced snowmobiles, minor to major adverse impacts on the scene on adjacent U.S. Forest Service lands	Same as alternative 1, unless research indicates road closures; if so, similar to alternative 2	Same as alternative 1	Same as alternative 2, except visitors able to access park would experience moderate to major impact from capture operations on winter scene	Same as alternative 2, except visitors able to access park would experience moderate to major impact from capture operations on winter scene	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1

Affected

environment

PROJECT SETTING

The project, or analysis area, is a part of what is often described as the Greater Yellowstone Area, the largest and most nearly intact ecosystem in the contiguous United States (Greater Yellowstone Coordinating Committee 1991); see the Greater Yellowstone Area map). The portion of the Greater Yellowstone Area specifically subject to analysis includes those areas in Yellowstone National Park habitually occupied by bison (approximately 1.75 million acres), as well as adjacent federal, state, and private lands outside the park in southwestern Montana (parts of Park and Gallatin Counties) that have been periodically occupied by Yellowstone bison during the past 12 years (see the Study Area map).

The portion of the analysis area outside the park includes approximately 568,994 acres, of which about 97% is managed by Gallatin National Forest, 1% by state or local government, and 2% by private owners.

In all alternatives except alternative 5, the following would be designated special management areas (SMAs) on the Gallatin National Forest:

- Cabin Creek Recreation and Wildlife Management Area outside the park's western boundary
- Monument Mountain Unit of the Lee Metcalf Wilderness outside and adjacent to the park's northwestern boundary
- Horse Butte area near West Yellowstone
- Portions of the Absaroka-Beartooth Wilderness adjacent to the park's northern boundary, including the Hellroaring and Slough Creek drainages
- Gallatin National Forest land in the vicinity of the Eagle Creek/Bear Creek drainage adjacent to the northwestern portion of the park.

The Cabin Creek Recreation and Wildlife Management Area, Monument Mountain Unit of the Lee Metcalf Wilderness, and Horse Butte area lands are referred to collectively as the western SMA throughout this document, and are depicted on all alternative maps except alternative 5. In alternative 2, the boundary of the western SMA continues south from Hebgen Dam, and then follows the Montana-Idaho state line to the border of Yellowstone National Park.

Since completion of the *Draft Environmental Impact Statement*, the federal Departments of the Interior and Agriculture and the Rocky Mountain Elk Foundation teamed in February and again in August 1999 to purchase lands and conservation easements north of the Reese Creek boundary of the park.

The project, or analysis area, is a part of what is often described as the Greater Yellowstone Area, the largest and most nearly intact ecosystem in the contiguous United States ...

The purchased lands total about 6,000 acres and are under the jurisdiction of the Gallatin National Forest and, like all U.S. Forest Service lands, are multiple use lands including for use by wildlife. The Gallatin National Forest also administers and monitors the terms and provisions of the conservation easement. However, Montana approval may be required to establish SMAs to allow bison onto these lands.

In alternatives 2, 3, and 7, land in the Gardiner Valley, from the park's northern boundary to Yankee Jim Canyon, is either partially or wholly included in an SMA. In alternatives 3 and 7, land to the west of the Yellowstone River in this valley is referred to as the Reese Creek SMA in this document. In alternative 2, land on both sides of the river becomes part of an SMA.

As noted above, the property designated for acquisition in alternatives 3 and 7 has been acquired by purchase of land and conservation easements. Phase 2 of these alternatives would begin when these lands are designated as a SMA.

For the modified preferred alternative, the purchased and conservation easement lands north of the Reese Creek boundary are identified as zone 2. Topography and natural features would help restrict bison to public lands or lands where no cattle graze in the Reese Creek portion of the northern boundary area. Yankee Jim Canyon (the northern extension of the Reese Creek boundary area) is a narrow, natural constriction point for bison movement that would permit the agencies to halt bison movement north. The steep rocky terrain that impinges immediately on the Yellowstone River at this point provides a pincer point for bison movement. The Yellowstone River, steep terrain, snow depth, and other features would also help restrict bison movement east or west.

The portion of the Cabin Creek Recreation and Wildlife Management area available to bison is approximately 37,000 acres in size, and is accessed by U.S. Highway 191 and U.S. Highway 287. It is primarily high elevation (8,200 feet to 10,600 feet) mixed forest and open meadow. The Cabin Creek area is managed for grizzly bear and big game, and allows recreation consistent with animal presence. Semiprimitive and nonmotorized recreation is allowed. The area is rarely used by bison, but may be occupied by a few bulls.

The Monument Mountain Unit of the Lee Metcalf Wilderness is 31,000 acres in size, and is also accessed by U.S. Highway 191 and U.S. Highway 287. It ranges in elevation from 7,400 feet to about 10,100 feet, and is mixed conifer forest and mountain meadows. Bison are most likely to use the lower elevations of the wilderness, and enter the area from the east on Bacon Rind Creek or from either of the roads leading into it. In most alternatives, bison leaving the Taylor

Fork drainage and heading north past Buffalo Horn in the Gallatin Canyon would be shot by agencies (several cattle ranches lie to the north).

The Horse Butte area is approximately 24,000 acres in size and lies generally north of Highway 20 leading west from the town of West Yellowstone. It is also east of the south fork of the Madison River and Hebgen Lake. Lands north of Hebgen Lake up to and adjacent to the southern boundary of the Cabin Creek Recreation and Wildlife Management Area are part of the area described as the West Yellowstone or Horse Butte area in this environmental impact statement. Much of this area is open meadow mixed with conifer forest, and is lower in elevation than the Cabin Creek or Lee Metcalf portions of the western SMA.

The Absaroka-Beartooth Wilderness is high elevation land, and is more heavily forested than the Cabin Creek or Lee Metcalf areas. Bison typically enter this area from the south along the Slough Creek and Hellroaring Creek drainages. The hydrographic divide is the northern boundary of this SMA. Between 10 and 20 bison may use this area, primarily in the summer. The portion available to bison is about 270,000 acres.

The Eagle Creek/Bear Creek area, identified as an SMA for all alternatives except number 5, is approximately 23,000 acres in size and is located on the Gallatin National Forest, primarily on the benches about a half mile north and east of Gardiner, Montana. A network of roads and trails crisscross the area, but the major access is via Park County Road 15 (known locally as the Jardine Road), which goes to the town of Jardine.

There are significant elevational differences found across the breadth of the Eagle Creek/Bear Creek SMA, as well as the presence of several drainages. The elevation is 5,200 feet at the valley floor and 10,500 feet at the crest of the hydrographic divide. The SMA is bordered on the southwest by the Yellowstone River, and the northwest by the Little Trail Creek/Maiden Basin hydrographic divide. It is traversed by Bear Creek and Eagle Creek and their respective tributaries.

LANDSCAPE OF THE AREA

The landscape of the analysis area is characterized by steep, mountain ranges, most of which trend north and south. The Gallatin and Absaroka mountain ranges dominate the north-central portion of the area on the west and east sides of the Yellowstone River valley, respectively. West of Yellowstone Park, the Madison Range parallels the Gallatin Range.

The Continental Divide crosses Yellowstone National Park diagonally, from a few miles south of West Yellowstone, Montana, to the southeast corner of the park near the Thorofare region. North and east of the divide, numerous streams flow from the park area into the Missouri River drainage. Preeminent among these is the Yellowstone River, which heads just southeast of the park, then flows north and northwest through the park, then north into Montana and northeast across Montana to the North Dakota border, where it joins the Missouri River.

The Madison River, formed by the geothermally influenced waters of the Gibbon and Firehole rivers, flows west from the park, then north to Three Forks, Montana, where it meets the Jefferson, coming in from the west, and the Gallatin, which rises in the Gallatin Mountain Range in northwestern Yellowstone National Park. The three form the Missouri River.

Bison in Yellowstone National Park.

The climate of the study area features long, cold winters, and short, cool summers. Mean monthly temperatures average 32.3 F. Weather conditions at Gardiner, Montana, are generally the mildest in the area. Between 75% and 85% of precipitation in the mountainous regions of Yellowstone National Park falls as snow. In the interior plateau regions of Yellowstone National Park, 35% to 55% of precipitation falls as rain (Despain 1987).

VEGETATION

The region in and around Yellowstone has great variations in elevation, soils, and climate, and is something of a botanical crossroads, with at least seven "distinct floras" present, ranging from desert to alpine (Despain 1990; Glick et al. 1991). About 1,700 species of plants have been identified in the region, but most of the landscape is dominated by only a few species.

Approximately 60% of the federal lands in Greater Yellowstone is covered by forest, and the majority of that area, especially in the elevations between 7,500 feet and 9,000 feet, is dominated by lodgepole pine. Between 6,000 feet and 7,000 feet depending on conditions, grasslands and shrub steppes are the native vegetation communities in river valleys, floodplains, and terraces, though many plants' distributions have been changed by cultivation.

Distinctive vegetative communities also occur on private land and lower elevations in riparian areas bordering both moving and still waters.

Lodgepole pine, in various stages of succession, is the primary tree species inside the park, covering about 1.4 million acres of park land. Englemann spruce and subalpine fir are most often found in moist areas, and form the "climax" forest in areas underlain by the richer and site soils. Whitebark pine is usually the dominant tree species at elevations above 8,400 feet. Douglas-fir and aspen occur at elevations ranging from 6,000 to 7,600 feet. These communities are chiefly associated with the Yellowstone, Lamar, and Madison River drainages. A few other species, such as cottonwood, found along stream corridors, and limber pine and Rocky Mountain juniper, found at lower elevations primarily in the northern end of the park, are intermittent species comprising a very small portion of the Yellowstone landscape.

Nonforested areas consist of shrublands, grasslands, subalpine or other wet meadows, and alpine tundra. Several species of sagebrush, rabbitbrush, yarrow, sulphur buckwheat, Idaho fescue, bluebunch wheatgrass, and junegrass are among the species that dominate shrubland communities. Grasslands are typically represented by bluebunch wheatgrass, Sandberg's bluegrass, bearded wheatgrass, Hood's phlox, rosy pussy-toes, and others. In subalpine or other wet meadows, willows, cinquefoil, American bistort, tufted hairgrass, alpine timothy, and various sedges are common. A wide variety of low-growing grasses and forbs are found in alpine tundra.

The Stephens Creek area is located in the Yellowstone River valley at the lowest elevations within park boundaries, ranging from 5,000 to 6,000 feet. Annual precipitation averages from 8 to 12 inches. Vegetation is best described as bunchgrass steppe or shrub steppe communities. Grasses in these areas include Idaho fescue, junegrass, and occasionally bluebunch wheatgrass. About 570 acres of abandoned agricultural fields, added to the park in 1932, are present in this area. Prominent vegetation on these lands is crested wheatgrass.

In Eagle Creek/Bear Creek, precipitation is about 10 to 12 inches a year, and the vegetation is a mosaic of dry sagebrush shrublands and dry grasslands such as bluebunch wheatgrass and Idaho fescue. As the elevation increases, the average annual precipitation increases as well. The additional moisture allows for the presence of forests.

Most of the West Yellowstone area of the western SMA is found on a 7,000-foot plateau, which includes the obsidian flats, found in the area in the east and central portion of the SMA. This part of the SMA supports primarily lodgepole pine. At one point a rhyolite monolith (Horse Butte) rises about

300 feet in elevation from the center of the SMA. The monolith supports an *Abies lasiocarpa/Calamagrostis rubesens* habitat type on northerly exposures, grasses such as Idaho fescue and Ross's sedge on southern exposures, and distinctive aspen groves on the small area of flat terrain.

There is a wide variety of vegetation within the Cabin Creek Recreation and Wildlife Management Area and the adjoining Monument Mountain Unit of the Lee Metcalf Wilderness. This variety is associated with elevations that range from 7,200 to 10,600 feet (Sage Peak) and numerous soil types. The vegetation present within the Cabin Creek Area and adjoining Monument Mountain Unit is associated with either forested, mountain meadow, alpine meadow, or rock rubble habitats.

Approximately 65% of the land area is forested. These forested areas are dominated by mixed conifer stands of lodgepole pine, Englemann spruce, and subalpine fir. Whitebark pine is generally the dominant tree species above 8,400 feet. Aspen is not a significant component of the forested habitats. Douglas-fir exists at the lower elevations on southern aspects. The grass/forb associations within the forested areas consist of pine grass, sedge, trisetum, huckleberry, and arnica.

Mountain meadows are interspersed throughout the area and comprise about 20% of the area. Some of these meadows are up to 600 acres and contain clumps or isolated patches of subalpine fir/spruce and/or clumps of whitebark pine, subalpine fir/spruce. The grass component consists of grasses such as meadow barley, sedge, tufted hair-grass, alpine timothy, while forb components consist of plants such as meadowrue, carrotleaf, paintbrush, aster, potentilla, mountain dandelion, and geranium. The wetter mountain meadows have shrub components consisting of willow, and some of the drier meadows have a sagebrush component.

Set apart from the mountain meadows by elevation are the alpine meadows. These non-forested areas comprise 10% of the area and are generally above 9,400 feet where harsh climate limits growth. Trees such as alpine fir, spruce, and whitebark pine are stunted, deformed, and isolated. Grass plants include Idaho fescue, tufted hairgrass, and sedge. Forbs include mountain dandelion, lupine, and clover. Shrubs include purple mountain heath.

Rock rubble or rubble land make up approximately 5% of the unit. Moss and lichen are found in these high elevation areas, but there are also isolated areas of stunted whitebark pine. Purple mountain heath is also found in some of the rock crevices.

The portion of the Absaroka-Beartooth Wilderness bordering Yellowstone National Park to the north is characterized by a series of deep, parallel drainages. Hellroaring, Buffalo Fork, and Slough Creek are the major drainages. They begin at the Boulder Divide 10 to 15 miles north of the park boundary and flow in a north-south direction. The area was heavily impacted by fires in 1988. The upper reaches that did not burn are densely forested. Several large willow communities and wet meadows are present at wider parts of the valleys. After the creeks flow into Yellowstone Park, sage/grasslands are prevalent. High ridges with whitebark pine forests, exposed bedrock, and alpine meadows separate the drainages. Snow conditions preclude access to most ungulates during most of the year. Bison are found in this Absaroka-Beartooth Wilderness rather infrequently, but there is suitable summer and fall habitat for this species.

WETLANDS

Only general mapping of wetland resources has occurred in the affected area of Yellowstone National Park and the Gallatin National Forest. According to these maps, wet forest habitat dominated by subalpine fir and Englemann spruce covers about 8% of the park. The forest floor is dominated by a variety of wet-site species including horsetails, bluejoint reedgrass, trapper's tea, twisted stalk, arrowleaf groundsel, and a variety of mosses.

Shrubby riparian habitats are usually dominated by willows and sedges. They are most often distributed along streams and near seeps. Grassland riparian habitats are most often sedge marshes or bogs. Their distribution is usually associated with standing water throughout the growing season.

Prior to placement of capture or quarantine facilities (if they are part of the selected alternative), sites would be surveyed for wetland resources and facilities modified or moved to avoid them.

ACCESS

The region is served by a wide variety of federal, state, and local road systems. Two Montana travel corridors approach Yellowstone National Park: U.S. Highway 89 from the north and U.S. Highway 191 on the west. An all-season gravel-surfaced county road parallels about 7 miles of U.S. Highway 89 north and west of Gardiner. About 4.5 miles of this road are in the park. The only paved roads in Yellowstone National Park open to conventional vehicles year-round are from the north entrance at Gardiner, Montana, to Cooke City, Montana, outside the northeast entrance, and U.S. Highway 191 along the northwest boundary of the park. Except for this road, winter travel in

Yellowstone National Park is limited to oversnow vehicles (on groomed roads only) and nonmotorized modes of transportation.

A number of county and U.S. Forest Service roads provide access to public and private land both north and west of the park. Winter travel on most of the U.S. Forest Service roads is limited to oversnow vehicles.

HUMAN POPULATION

In 1990 the combined population of Park and Gallatin Counties, Montana, bordering Yellowstone National Park to the north and west, respectively, was 65,000 people. Less than 5% of that population, perhaps 2,500 people, reside within the analysis area.

Other residents in the study area are employees in Yellowstone National Park. At the height of the summer season in the park, there are approximately 3,930 employees; 3,200 are concession employees, and 730 work for the National Park Service. During the winter months there are 700 employees; 450 are concession employees, and 250 are NPS employees.

Gallatin and Park Counties include 38% and 48% federal land, respectively. In the study area, more than 90% of the land is federal.

In 1996, 5.8 million recreational visits were recorded in the area (3.0 million in Yellowstone National Park and 2.8 million in Gallatin National Forest). Recreational visits are expected to increase between 16% and 38% by the year 2003.

Cattle operations on public and private lands are located north and northwest of the towns of West Yellowstone and Gardiner. Near West Yellowstone, there are five cattle allotments on public land and a few private holdings in the Hebgen Lake area (see Bison Winter Movements map). Northwest of Gardiner, several operators run livestock on public allotments on the Gallatin National Forest, and at least one large operator (and several smaller) on private lands (see "Livestock Operations" chapter). In some alternatives, the boundary on the west side extends as far north as Buffalo Horn Creek. Extensive private land holdings lie north of this boundary and out of the analysis area. Cattle operations in the West Yellowstone area and most of those in the Gardiner area are predominantly summer only. Cattle are maintained on a year-round basis on the privately owned Royal Teton Ranch adjacent to the park's Reese Creek border.

BISON POPULATION

The terms "bison" and "buffalo" are both acceptable names for the animal scientifically classified as *Bison bison*. The genus *Bison* crossed the Bering Strait from Eurasia sometime during the late Pleistocene Era. Studies of the paleontology and history of the area indicate bison have inhabited the Greater Yellowstone Area since prehistoric times (NPS, Meagher 1973; Schullery and Whittlesey 1992).

BEHAVIOR AND SOCIAL INTERACTIONS

Bison are driven by instincts for survival and mating. Distinct behaviors may vary with age and sex. Behaviors are also influenced by habitat and environmental conditions, which affect the availability and access to forage. Land management decisions by agencies may affect behavior.

Bull bison fighting.

Much of bison behavior is based on the differential groupings of animals. Cow-calf herds, for example, are most pronounced in the spring, during calving. This herding instinct may be motivated primarily to protect calves against predators because adult bison have few natural predators. The social bonds formed by cow-calf herds are strong and usually are broken only by severe environmental conditions.

Young bulls (up to 6 years of age) or older bulls (more than 10 years of age) exhibit different social behaviors. Young bulls often separate from the cow-calf herds after the rut to form small fraternal groups. They will generally coexist peacefully with each other for most of the year, but as the rut approaches, increased competition and fights for dominance occur. Older bulls are often found as scattered individuals that may move long distances. These bulls are often the least tolerant of any other animals, including humans.

Bison are quite sociable, as long as the habitat allows them to aggregate. Large herds of bison of mixed sex and age classes may congregate on range with suitable forage, especially during the rut. In Yellowstone, Hayden Valley, Pelican Valley, and Lamar Valley are suitable habitats for seasonally large bison herds. The National Park Service is currently initiating research to study the ecological carrying capacity in the park. However, herds of any size will seldom spend much time in any one place. Because individual bison tend to live on large quantities of forage, bison herds are constantly on the move, feeding from one site to the next. They will seek out higher-quality forage, but those sources are generally available only on a short-term, seasonal basis.

Despite their size and seemingly slow-moving habits, bison are surprisingly agile and quick. They have great stamina to travel long distances. Bison will usually choose the most energy-efficient travel route, over flat, open terrain, although they may sometimes select courses that are exceptionally steep, rough, or otherwise inhospitable. In deep snow, they commonly travel in single file, with alternating leaders, to reduce energy expenditures. Currently, a number of routes in the park are groomed for snowmobiling, and the road from Mammoth to Cooke City is plowed. Bison use plowed roads and compacted or groomed trails in the winter, and this may reduce their energy expenditure (Aune 1981; Aune, pers. comm.). Monitoring bison movements in the Hayden Valley and Mammoth to Gibbon Falls sections of the park since the *Draft Environmental Impact Statement* was released has indicated that fewer than 12% of bison movements occurred on the groomed road surface (Kurz 1998, 1999b). Closing groomed roads could affect population size and distribution by shifting patterns to those used before grooming. It is also possible, however, that closing groomed roads would not affect distribution, since bison appear to retain and pass along knowledge through generations, including pathways to better forage. Research on this relationship is continuing.

In the winter, Yellowstone National Park is the most severe North American habitat supporting a viable population of free-ranging bison (Meagher 1971). Canada may have colder temperatures, but the accumulation of snow on the Yellowstone Plateau makes it more stressful for bison and affects their behavior. Bison, however, are well adapted to this environment. Using their massive heads, supported by powerful neck and shoulder muscles, bison have the ability to displace snow to access forage in areas unavailable to other ungulates.

When conditions such as very deep or heavily crusted snow limit availability or access to forage, a breakdown in social bonds may occur. Smaller groups of bison split from the large herds and search for isolated habitats, such as Yellowstone's numerous geyser basins and scattered meadows, which individually support only limited numbers of bison.

Regression analyses of the relationship between winter severity and the overall estimated bison population size on the number of bison moving out of Yellowstone National Park were recently described by the National Academy of Sciences (NAS 1998). These results suggest that for an overall population greater than 3,000, the number of bison moving out of the park increases rapidly with increasing winter severity. While on average, large numbers of bison move out of the park when snow conditions (e.g., depth, ice crusting) are severe, this average fails to capture the fact that, historically, some winters have passed without bison movement outside the park, despite population sizes larger than 3,000, and during other winters, bison movement outside the park occurred when the population was well below 1,000.

While earlier reports suggested that bison may have used groomed roads or trails for travel (Meagher 1989a), results of another study indicated 17% of bison travel occurred on roads during the grooming season and 83% of travel occurred on off-road, off-trail, and on established trails in the Madison-Gibbon-Firehole study area. Road use declined from a peak in the fall to a low level, when roads are groomed, and peaked again in April, coinciding with snowmelt and increased availability of forage (Bjornlie 2000). Bison use of groomed roads seems to be an activity neither sought out or avoided (Bjornlie 2000).

HABITAT AND FORAGE

Bison are most often seen grazing in open meadows and along river valleys (NPS, Meagher 1973). Suitable bison habitat outside Yellowstone National Park would likely include lower elevation winter range along major drainages, and much of it is currently under private ownership. Willow thickets and sage steppe, the habitat occupied by white-tailed deer or pronghorn, are not preferred by the bison. Thermal areas are important winter feeding grounds due to the easy accessibility of plants growing on the warmer soil. The heat from warm ground and thermal features also reduces the amount of energy bison must expend to keep warm in winter.

Sedges, and to a lesser extent grasses, constitute the preferred diet of Yellowstone bison. In winter, 99% of their diet is grasses and sedges, with browse being the remaining 1%. In summer they consume slightly more forbs (NPS, Meagher 1973).

BREEDING, CALVING, AND SEX-AND-AGE CLASSES

The rut (breeding activity) season occurs from about mid-July to mid-August. Female bison rarely breed as $1\frac{1}{2}$-year olds. Approximately one-quarter of the $2\frac{1}{2}$-year-olds breed (NPS, Meagher 1973). The majority of females attain sexual maturity by $3\frac{1}{2}$ years of age. Males are sexually mature the same time as females, but more dominant older bulls usually will not allow younger bulls to become part of the active breeding population until they are at least six years of age.

Typically, bison are born in the spring. Calving begins by mid-April, but most births occur during May. There are always a few out-of-season births. Single births are the rule; reports of twins are extremely rare. The pregnancy rate, determined by necropsy of animals killed during management actions involving northern range bison during the 1930s and 1940s averaged 80% (range 65% to 95%, N=5) and from 1964 to 1966 was 52% for the entire adult female population (NPS, Meagher 1973). At low bison population numbers, low calfhood mortality was found, although subadult mortality (from calf to $2\frac{1}{2}$ years old) was estimated at 50% (NPS, Meagher 1973). From 1990 to 1992, researchers found 52.6% of mature females produced calves on the northern range compared with 42.6% for the Mary Mountain area, yielding a 47.6% calving rate for the entire adult female population (Kirkpatrick et al. 1996). They also found pregnancy rates, estimated by urinary or fecal analysis, of 51.6% for the northern range and 39.8% for the Mary Mountain area, comprising an overall pregnancy rate of 45.7%. Comparing the pregnancy rates with the observed calving rates suggests that neonatal loss was not significant for bison in Yellowstone National Park. The pregnancy rate, determined by necropsy of 131 adult female bison ($2\frac{1}{2}$ years or older) killed during management actions in the winter of 1996–1997, was 72.9% for the northern portion of the park and 54.3% for the west. The overall pregnancy rate was 66.4% (Gogan et al., unpubl. data).

Sex ratios of bison in Yellowstone have historically favored males over females (NPS, Meagher 1973; Pac and Frey 1991; Meyer and Meagher 1995). At low bison population numbers, a sex ratio of 56% males to 44% females was reported (NPS, Meagher 1973). Data from bison harvested in the winter of 1988-1989 showed a ratio of 57% males to 43% females, however, fetal sex ratios favored females (58%) over males (42%) (Pac and Frey 1991). Data obtained from the nonselective removal of bison during management actions in the winter of 1996–97 showed a sex ratio of 50% female to 50% male, while fetal sex ratios obtained by necropsy of known-age females favored females (55%) over males (45%) (Gogan et al., unpubl. data). Data from bison captured outside the park during management actions in the winter of 1998–1999 showed a sex ratio of 49% females to 51% males (Gogan et al. unpubl. data).

There are a number of different sources of data regarding the age structure of the Yellowstone bison population (table 16). Meagher (1973) indicated that bison captured during the winter of 1964–1965 exhibited an age structure of 16% calves, 11% yearlings, and 73% adults. Pac and Frey (1991) sampled bison harvested in the winter of 1988–1989 and estimated the age structure to be 14% calves, 14% yearlings and 72% adults. Data from aerial surveys conducted in June and July from 1995–1999 show an average age structure of 15.8% calves and

84.2% yearlings and adults (NPS flight reports, unpubl. data). Data from a sample of known-age bison harvested during management actions in the winter of 1996–1997 also show an age structure similar to those presented previously: 15% calves, 14% yearlings, and 71% adults (Gogan et al., unpubl. data). Bison captured during management actions in 1998–1999 were also similar, with 13.6% calves and 86.4% yearlings and adults (Gogan et al., unpubl. data). Field classification of the Yellowstone bison herd by NPS biologists in August of 1998 and 1999 show a substantial difference in the proportion of the population comprised by yearlings. Biologists noted that due to the difficulty in distinguishing yearlings at the time of the surveys, it is likely that some yearlings may have been classified as adults (NPS files, unpubl. data).

Table 16: Age Structure of the Yellowstone Bison Population as Estimated by Various Sources

Date	% Calves	% Yearlings	% Adults	Total Number	Data Source
1964–1965	16	11	73	480	Meagher 1973
1988–1989	14	14	72	382	Pac and Frey 1991
7/28/1995	15.6	*	84.4	3928	NPS aerial survey
6/30/1996	15	*	85	3584	NPS aerial survey
7/30/1997	11.4	*	88.6	2169	NPS aerial survey
7/07/1998	18.7	*	81.3	1946	NPS aerial survey
7/10/1999	18.3	*	81.7	2189	NPS aerial survey
1996–1997	15	14	71	374	Gogan et al.
August 1998	21.8	7.5	70.6	821	NPS bison classification
August 1999	20.6	6.6	72.4	827	NPS bison classification
1998-1999	13.6	*	86.4	132	Gogan et al.

* data made no distinction between yearling- and adult-age classes.

MORTALITY

Except for human management removals, winterkill is the primary cause of mortality for bison in Yellowstone. Winterkill results from the combined effects of climatic stress, low forage availability, and declining physiological condition of individual animals. Bison expend most of their body fat in early to mid winter. As winter progresses, some bison cannot acquire enough of the nutrients needed to survive the remainder of the season. The old, sick, and young generally are the first to die of winterkill. As winter severity increases, bison winterkill mortalities tend to increase (Podruzny and Gunther 1999).

In the harsh Yellowstone climate, relatively few members of the population reach "old age," which probably begins at 12 to 15 years of age (Fuller 1959). Very rarely will a wild Yellowstone bison reach the age of 20.

Although predation is not a significant cause of death among bison in Yellowstone, it does occur. Wolves have preyed on bison in other areas of North America, and preliminary studies in Yellowstone indicate that wolves are preying on bison (Smith et al. 1999 in press). Boyce and Gaillard (1992) predicted that in Yellowstone, wolf predation of bison would decrease the bison population by no more than 15%. Observed wolf predation on bison has increased from 2 predations in 1997 and 3 predations in 1998 to 15 predations in 1999 (NPS, Smith et al. 1999, in press; NPS, unpubl. data). This has been less than 1% of the total bison population and is considered negligible. Smith and others suggest that for some wolves, Yellowstone bison may become a regular prey item, particularly during late winter and spring.

HISTORY OF BISON IN YELLOWSTONE NATIONAL PARK

In 1901, 25 bison were counted in the native Yellowstone herd. Due to subsequent protection from poaching, the number of wild bison steadily increased. At the close of the 1901 session, congress appropriated $15,000 dollars to establish a new herd of bison in Yellowstone National Park. In 1902, 18 cows were received from the Allard herd in Montana and 3 bulls from the Goodnight herd in Texas. These new bison were first held in enclosures at Mammoth and then moved to the Lamar Buffalo Ranch in 1907. For a short period the herd was fenced in and managed like domestic stock. Beginning in 1910 the captive herd was allowed to graze on the open range in summer, while during winter they were fed hay produced near the Buffalo Ranch (Skinner and Alcorn 1942–1951).

During this time, the wild native herd primarily used the Mirror Plateau and upper Lamar River area in summer and primarily wintered in the Pelican Valley. As early as 1903, calves from the native herd were introduced into the captive herd. (Skinner and Alcorn 1942–1951). Between 1915 and 1920, intermingling between the introduced and wild herds increased, and after the early 1920s, little or no effort was made to keep the two populations separate.

Disease in the bison population was soon recognized as a possible management concern (Skinner and Alcorn 1942–1951). In 1911, hermorrhagic septicemia killed 22 animals, or 15%, of the introduced herd. This disease was also diagnosed in 1919 and 1922, each outbreak taking approximately 9% of the herd (Skinner and Alcorn 1942–1951). Brucellosis was first diagnosed in the Yellowstone bison in 1917 (Mohler 1917, Tunnicliff and Marsh 1935), although subsequent reports (Tunnicliff and Marsh 1935; Quortrup 1945) indicated that it seemed to have little adverse effect on the bison population.

By 1922, Yellowstone National Park Superintendent Albright's Annual Report suggested that a law be passed authorizing the sale or disposition of surplus bison (Albright 1922, Skinner and Alcorn 1942–1951). Authority for this was granted in the Appropriation Act of 1923 (Skinner and Alcorn 1942–1951). By the 1930s, the total number of bison wintering in the Lamar area had increased to more than 1,000 (see table 17), and the National Park Service had begun reduction of this herd (NPS, Meagher 1973). Some of these bison were used to establish herds in the Hayden Valley and Firehole River areas. Other bison (usually animals in prime condition) were shipped to public parks, zoos, and private estates for exhibition and herd expansion (YNP 1928). Still other animals were selected for slaughter at the Lamar Buffalo Ranch, including old bulls, dry cows, steers, and individuals that were crippled, deformed, or diseased (LaNoue 1936).

Based on information derived from studying range conditions and carrying capacity at that time, along with management recommendations made by Rush (1932), the park decided to maintain the Lamar Herd at a maximum of 1,000 head (Meagher 1973). Subsequent park management decisions lowered the maximum herd numbers until by 1952 the bison in Lamar had been reduced to 143 individuals (see table 17). A January 1954 fixed-wing aerial survey of all primary wintering valleys indicated the bison population in the park was 1,477.

By the mid-1960s the stated primary purpose of reducing bison populations was to limit perceived damage to the Yellowstone range, even though management prescriptions appeared to place equal emphasis on brucellosis control (Yellowstone National Park Bison Management Plan 1964).By this time, park bison management plans called for the live trapping of as many bison as possible for brucellosis testing through the use of helicopter drives (Yellowstone National Park Bison Management Plan 1964). All bison testing positive or suspected of brucellosis infection were to be killed at the trap site or shipped to a slaughterhouse, while all calves were to be vaccinated, ear-tagged, and released. The remaining bison were to be ear-tagged prior to release. All entrails of bison testing positive or suspected of brucellosis (referred to as "infected") were to be removed (Yellowstone National Park Bison Management Plan 1964). Continued reduction of the bison population by the National Park Service on the herds of the northern range (Lamar), Mary Mountain, Madison and Firehole Rivers, Hayden Valley, and Pelican Valley lowered the total population of bison in the park to 397 individuals by 1967 (Meagher 1973). Beginning in 1967, bison management ceased in the park, increasing the bison population to about 2,100 in the 1984–85 winter (see table 17).

FEIS NOTE: Table 17 has been updated to include 1998-2000 data.

Management actions from 1902 through 1968 removed an average of 94 bison each year (bison removals ranged between 0 and 407 animals over the 66 year period) from the Yellowstone population (see table 17). Those removals occurred primarily within the park. During the period from 1968 through 1996, management actions removed an average of 72 bison per year (removals ranged between 0 and 569 animals). Almost all of these removals occurred after 1984, and with the exception of one adult cow, all of these removals occurred outside of the park. Despite natural mortality and management removals during 1984 to 1996, bison numbers increased an average of 5.1% per year, peaking at approximately 4,000 bison in 1994 and declining to approximately 3,500 in the early 1996-97 winter.

In 1996–97, severe winter conditions and other factors, such as large herd numbers, resulted in a major movement of bison outside the national park, and management removals totaled 1,084 (32% of the early winter population). Also, between 300 and 400 bison died as a result of severe weather-induced winterkill. A January 2000 fixed-wing aerial survey of the total bison population indicated approximately 2,400–2500 bison occupied traditional Yellowstone winter ranges (NPS, unpubl. data).

ECOLOGICAL ROLE OF BISON

Bison play an important role in Yellowstone's ecosystem. They are the largest ungulate in the park, and consume huge quantities of grasses and sedges. Bison do not play the same ecological role in the park today that they did prior to settlement. That role may be different than prior to settlement because the park herd has been isolated.

There is some indication that grazing by both bison and elk can increase the productivity and stability of grassland systems, and enhance the nutrient content of grazed plants (Frank and McNaughton 1993; Singer 1995; Wallace 1996). Bison may contribute to new plant growth by distributing seeds, breaking up soil surfaces with their hooves and wallows, and fertilizing by recycling nutrients through their waste products.

Large numbers of bison can physically alter environments. Bison rub trees and saplings, debarking and sometimes killing them (NPS, Meagher 1973). This

Table 17: Historic Bison Population Counts and Removals from the Winters 1901–02 to 1999–2000

Winter of Year	Total Bison Counted	Total Bison Removed	Winter of Year	Total Bison Counted	Total Bison Removed	Winter of Year	Total Bison Counted	Total Bison Removed
1901–02	44	0	1936–37	674	17	1969–70	592	0
1902–03	47	1	1937–38	755	25	1970–71	565	0
1903–04	51	7	1938–39	811	67	1971–72	713	0
1904–05	74	0	1939–40	868	3	1972–73	837	0
1905–06	nc	nc	1940–41	809	213	1973–74	873	0
1906–07	84	2	1941–42	869	202	1974–75	1,068	0
1907–08	95	1	1942–43	964	11	1975–76	1,125	8
1908–09	118	5	1943–44	747	407	1976–77	1,252	nc[2]
1909–10	149	3	1944–45	932	nc	1977–78	1,626	nc[2]
1910–11	168	2	1945–46	791	238	1978–79	1,727	nc[2]
1911–12	192	28	1946–47	nc	nc	1979–80	1,803	nc[2]
1912–13	215	8	1947–48	960	237	1980–81	2,396	nc[2]
1913–14	nc	nc	1948–49	1,126	nc	1981–82	2,239	0
1914–15	270	4	1949–50	1,094	228	1982–83	2,160	0
1915–16	348	18	1950–51	nc	nc	1983–84	2,229	0
1916-17	397	11	1951–52	976	250	1984–85	2,114	88
1917–18	nc	nc	1952–53	nc	nc	1985–86	2,291	57
1918–19	504	46	1953–54	1,477	139	1986–87	2,433	6
1919–20	501	17	1954–55	1,350[1]	288	1987–88	2,644	35
1920–21	602	7	1955–56	1,258	373	1988–89	3,159	569
1921–22	647	56	1956–57	543	273	1989–90	2,606	4
1922–23	748	14	1957–58	nc	12	1990–91	3,178	14
1923–24	nc	nc	1958–59	800[1]	44	1991–92	3,426	271
1924–25	830	109	1959–60	800[1]	nc	1992–93	3,304	79
1925–26	931	23	1960–61	869	nc	1993–94	3,551	5
1926–27	1,008	41	1961–62	975[1]	148	1994–95	3,956	427
1927–28	1,057	58	1962–63	819[1]	370	1995–96	3,398	433
1928–29	1,109	106	1963–64	821[1]	6	1996–97	3,436	1,084
1929–30	1,124	132	1964-65	388	392[3]	1997–98	2,105	11
1931–32	nc	nc	1965–66	226	54	1998–99	2,239	94
1932–33	nc	nc	1966–67	397	3	1999–2000	2,444	0[4]
1934–35	nc	nc	1967–68	418	4			
1935–36	847	109	1968–69	556	0			

SOURCE: NPS, Meagher 1973; Meagher, unpubl. data; Montana Department of Fish, Wildlife and Parks, Montana Department of Livestock, and National Park Service, unpubl. data).

NOTE: Sources of removals include culling from the semidomestic Lamar Ranch, hunting and agency shooting, and capture and slaughter.

nc = not counted or information unavailable

1. Estimates, rather than actual counts.

2. During 1976–81 a few bulls were removed.

3. Includes 38 from natural mortality.

4. As of November 1999.

activity, over time and in some places, may benefit some insects and bird species (such as woodpeckers and cavity-nesting birds). Other species (such as Steller's jay) could be affected by loss of mature trees. It has been suggested that tree rubbing and debarking by bison may impede or even prevent forest invasion of open grasslands (NPS, Meagher 1973; J. Shaw, pers. comm.).

Grazing may also maintain open grassland communities by preventing accumulation of dead grass litter that would otherwise suppress growth of grasses (T. Baumeister, pers. comm.). These physical impacts, in combination with the previously mentioned stimulation of productivity in grazed areas, are likely to help maintain open grasslands that are important to many other species.

Historically, prairie dog distribution in the U.S. overlapped completely with bison distribution (J. Shaw, pers. comm.). It is likely that burrowing rodents benefit from disturbances created by bison trampling and wallowing. Trampled areas and wallows, however, may also provide opportunities for invasion by nonnative and exotic vegetation, and may contribute to soil and streambank erosion.

Bison are not a significant prey for predatory animals. However, their carcasses are scavenged by many species of mammals, birds, insects, and other agents of decomposition.

GENETICS

Genetic variability allows populations to evolve under different selection pressures. If a population is not genetically variable, it may not be able to survive changing environmental conditions. Populations that have decreased levels of genetic variation may also suffer from inbreeding effects. It has been suggested that the estimated size of a minimum viable population should not allow greater than 1% loss of the genetic variation per generation if the population is to avoid inbreeding effects over a long period of time (Frankel and Soulé 1981). However, not all populations with low genetic diversity are suffering inbreeding effects. For instance, there is no evidence of inbreeding effects in black-tailed prairie dogs or black bears, despite low levels of genetic variation in some populations (Hoogland 1992; Paetkau and Strobeck 1994).

Since the absolute ranking of bison populations by genetic variation depends upon the analysis system used, the examination of more than one genetic system would add credence to any survey of genetic variation. As a species, bison show levels of variation that are relatively low, but higher than other species that have recently undergone population bottlenecks (Bonnell and Selander 1974; Roy et al. 1994). With most of the genetic systems surveyed, YNP bison display average levels of genetic variation when compared with other bison populations (Polziehn et al. 1996; Ward et al. 1999; Stormont 1993). Therefore, there is no reason to think that this population would be any more susceptible to inbreeding effects than any other bison population.

What the above studies suggest is that for large-bodied polygynous mammals that have experienced fairly recent bottlenecks, a large proportion of genetic variability may already have been lost (Berger and Cunningham 1994). When the bison were driven to near extinction in the late 19th century, bison had experienced an extremely large bottleneck (Roe 1970). This should have lowered the species' genetic variability, but without knowing levels of genetic variation before this bottleneck, it is difficult to determine if genetic variability was lost. In fact, other large mammal species in northern temperate regions that have not gone through a large human-induced bottleneck also have low heterozygosity values (Sage and Wolff 1986).

Genetic drift is the change in genetic frequencies over generations due to the random sampling of the genetic material in the population. As with any random sampling, gene frequencies will fluctuate more in smaller samples than larger samples. As such, genetic variation will be lost faster from smaller populations (Frankham 1996). Eventually, genetic drift can result in a depression on genetic diversity.

It has been suggested that at least one migrant per generation should be inserted into a closed population, but as many as ten might be more appropriate to avoid the effects of genetic drift. However, great care should be taken before importing new bison into any closed park bison population for the purpose of decreasing inbreeding. Cattle mitochondrial DNA has been discovered in a number of bison populations as a result of earlier private-sector crossbreeding trials. Polziehn et al. (1995) found cattle mitochondrial DNA in almost one third of the bison from Custer State Park, and Ward et al. (1999) found cattle mitochondrial DNA in other private, state, and federal herds. Cattle mitochondrial DNA was not found in bison from Yellowstone National Park. If bison-cattle hybrids are added to a bison population, the population can no longer be considered pure, and some of the bison genetic material contained in that population will be lost.

An additional genetic issue concerning YNP bison is the extent to which the gene, known as the natural resistance associated macrophage protein1 (NRAMP1) gene, is prevalent in the bison herd. This gene has been shown to have a major impact on controlling a natural resistance to brucellosis in bovines. DNA genetic analyses have shown that the existing variation of this gene between bison and cattle is consistent with the 1 to 1.5 million years of separation between these species. It also appears that the DNA sequence of NRAMP1 associated with natural resistance to brucellosis has been partially conserved in native bison. Although the extent to which this genetic trait is expressed in YNP bison is not fully understood, conserving this trait would seem to be an important consideration for long-term brucellosis management.

To estimate a minimum viable population for bison so that a population remains at a constant level of genetic variation (assuming loss due to genetic drift is the same as gains due to mutation to new alleles) requires accounting for the selective pressures on the population. Selective pressures include the influences of sex ratio on breeding adults, the reproductive success of males and females, the fluctuations in population size, and the role that random chance can play on the population. Minimum viable population is not merely affected by genetic factors alone, but also by demographic and environmental randomness and catastrophes. The effect these factors have on different taxa depends on their respective ecology and life-history traits, and hence no universal estimate of minimum viable population exists. However, management prescriptions that result in nonrandom selective removal of bison from the population through lethal and nonlethal mechanisms (e.g., selective removal of pregnant females, females that carry the NRAMP1 trait, or prime breeding-age bulls) can negatively influence the resultant genetic integrity and viability of a population.

BRUCELLA ABORTUS *IN YELLOWSTONE BISON*

In cattle and bison with field strain *B. abortus* infection, the correlation between serology and the ability to culture the organism is well below 100% due to a number of factors such as individual animal variation and culture technique. Harrington and Brown (1976) found *Brucella* isolates from 46% of 355 cattle from 38 states that were seropositive on one or more tests. Huber and Nicoletti (1986) isolated *Brucella* from 49.2% of 2,570 cattle that were classified as seroreactors.

The precise relationship between serological tests and the presence of *B. abortus* bacteria in bison is unknown. Even the precise relationship between serological tests and the ability to culture the organism from bison is not well understood at this time. However, isolation of *B. abortus* on bacterial cultures correlates well with high serologic responses; that is, bison infected with large numbers of bacteria typically have high serologic titers. A serologic result can be a good, but not infallible, indicator that an animal is infected. A number of studies have reported isolation rates from seropositive bison. These rates vary considerably. Tessaro (1987) was able to isolate the bacteria from 15%–28% of seropositive bison from Wood Buffalo National Park but suggested that the true prevalence of infection may have been underestimated due to poor sample quantity and quality.

A recent study using a rigorous experimental sampling protocol found a higher percentage of positive cultures: 46% of 26 seropositive female Yellowstone bison (Roffe et al. 1999), a result similar to the findings for cattle (Huber and Nicoletti 1986). A limited study of bison from the Jackson Herd in northern Wyoming found two culture positive females among four that were seropositive (Williams et al. 1993). Selected specimens from 144 bison that were either shot or sent to slaughter from 1997 to 1999 were cultured for *B. abortus*. Of the 97 seroreactors in this group of 144, 13 (25%) of 52 seropositive females and 13 (29%) of 45 seropositive males were culture positive (USDA, unpubl. data). The breakdown by serological classification nd sex for all 144 bison is shown in table 18.

Table 18: Numbers of Culture Positive and Culture Negative Yellowstone Bison Shot or Sent to Slaughter from January 1997 through April 1999, by Serological Classification and Sex, Based on Culture of Selected Tissues

Serological Classification	Sex	Number Culture +	Number Culture -	Total Number
Reactors	F	13	39	52
	M	13	32	45
Suspects	F	0	6	6
	M	0	7	7
Negative	F	0	24	24
	M	0	10	10

It is clear there is considerable variability in percent seropositive that were also culture positive among these reports. When considering the serology-culture relationship, the limitations and differences among these studies must be remembered. For example, the discrepancy between the culture positive percentages in the USDA data (unpublished) and that of Roffe et al. (1999) was likely due to the fact that a limited number of samples was collected from the 144 bison. Individual animal variation (e.g., the animal's age, sex, and reproductive stage); sampling protocol; and sampling, handling, and processing of the tissues will all affect whether *B. abortus* can be isolated. A positive culture indicates the presence of *B. abortus*, but a negative culture does not prove the absence of the organism. In addition, it is possible that a seropositive animal may not truly be infected.

The card test is a very sensitive test that is amenable for use in the field. This test is often positive earlier in the course of infection than when a positive culture can be obtained. Therefore, there will not be as high a correlation between the card test and culture isolation as there would be between less sensitive, but more specific, blood tests and culture isolation. For management purposes, the card test alone, or in combination with selected other serological tests, is used under field conditions, e.g., to make decisions on the disposition of bison in capture facilities.

BRUCELLA ABORTUS *VIABILITY IN THE ENVIRONMENT*

Research on the survival of *Brucella* has been ongoing since the early 1900s. McFadyean and Stockman (1909) found that under controlled conditions, *B. abortus* in bovine vaginal exudates survived for a period of seven months. In a more in-depth study, Cameron (1932) found that the bacteria survived 4½ hours in direct sunlight, less than 4 days in soil that dried quickly, 66 days in soil that was kept moist in an unheated cellar, and 120 days in bovine feces that were placed in an unheated cellar. Subsequent studies also yielded similar results (Gilman 1951; Hussel 1963). However, Cameron states that his research did not duplicate natural conditions and that the survival of the bacteria would likely decrease when subjected to natural conditions.

Whether subject to natural conditions or under controlled conditions, the persistence of the bacteria in different media varied greatly. *B. abortus* in feces survived over 100 days in laboratory situations; however, the bacteria was not found after 48 hours in manure heaps with temperatures of 170°F (King 1957). In slurry from cattle operations, the bacteria have been shown to survive for periods from as short as 8 days up to 3 to 8 months (Hussel 1963; Rankin and Taylor 1969; Burrows and Rankin 1970; Plommett 1972). Although the bacteria survived for several months in raw sewage (Knoll 1961), Wray (1975) cites Koser (1954) as suggesting that on sewage-irrigated pastures, an interval of 12 days between spreading the sewage and allowing cattle to graze was sufficient to eliminate the risk of infection from *B. abortus*. In samples of bovine urine, the organism has been found to survive from 4 to 30 days (Gilman 1951; Hussel 1963). However, Kuzdas and Morse (1954) found that when kept at room temperature, *B. abortus* did not survive in urine for more than 24 hours and survival times increased in samples stored at lower temperatures. Several studies also focused efforts on determining survival of the bacteria in water, with survival periods ranging from 5 to 150 days (Gilman 1951; Hussel 1963; Kuzdas and Morse 1954).

Although the survival of the organism in these media is interesting, Wray (1975) states that the greatest risk of animal infection arises from fetal products of abortion; environmental contamination from other sources are not considered to be important pathways of infection. Wray also cites Stableforth's (1959) conclusion that the greatest risk of *Brucella abortus* infection was from contact with fetal material. Nicoletti (1986) stated that the primary route of transmission in animals is through ingestion of contaminated fetuses, placentas, and associated fluids. The NAS report (1998) states that the risk of *B. abortus* transmission is largely determined by the presence and survival of the bacteria in placental exudates.

Research efforts to determine the presence and survival of the bacteria within the Greater Yellowstone Area are ongoing. Samples taken in April 1996, May 1997, and May 1998 from 30 known birth or abortion sites in Yellowstone National Park resulted in *Brucella abortus* being isolated at only two of those sites and lasting a maximum of 18 days after the birth or abortion event (K. Coffin, pers. comm.). Cook (1999) found that *Brucella abortus* strain RB51 survived on samples taken from the exposed surface of bovine fetuses from 17.1 days in February to 0.3 days in June. Samples taken from the underside of the fetuses showed bacteria surviving from 60.5 days in February to 4.7 days in June (Figure 1).

Although the bacteria could be isolated for up to several weeks, Cook (1999), in a separate study, placed fetuses in various habitats within the Greater Yellowstone Area during February and March of 1996–1998 and found that 90% were scavenged, primarily by carnivores, and disappeared within 4 days. By consuming the products of birth and abortion, carnivores remove the bulk of infectious materials from the site and expose remaining *B. abortus* on the soil and vegetation to light and desiccation, to which they are vulnerable (Mitscherlich and Marth 1984). NAS (1998) also concluded "predation and scavenging by carnivores likely biologically decontaminates the environment of infectious *B. abortus* with an efficiency unachievable in any other way."

The data presented by Cook (1999) show that the viability of the organism drops off rapidly during April and May and that separation of bison and cattle on public grazing allotments by as little as 4.7 days in mid-June could be sufficient to eliminate the risk of cattle being exposed to viable *Brucella* bacteria.

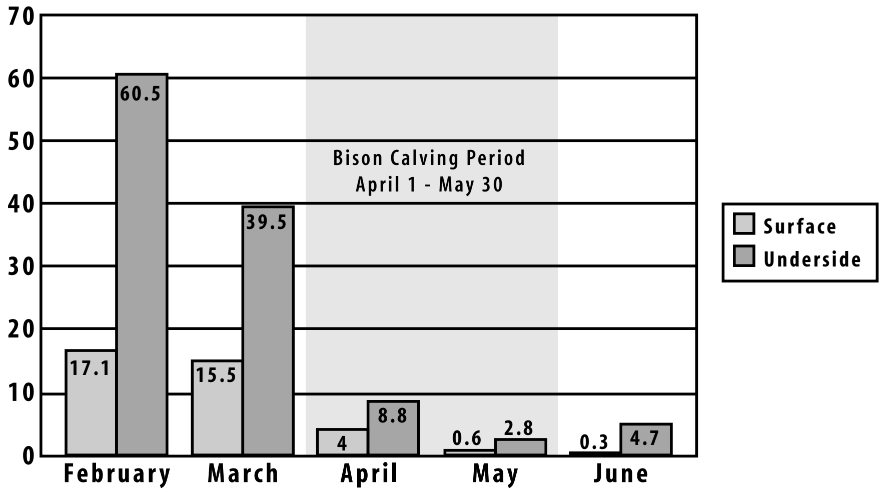


Figure 1.

Average Number of Days for Survival of *B. Abortus* Strain RB51 on Bovine Fetuses Exposed to the Environment in Laramie, Wyoming

Source: Data from Cook 1999

FEIS NOTE: Additional information on the status of bison vaccination research has been added to "The Alternatives: Actions Common to All Alternatives — Vaccination" section.

RECREATION

OVERALL VISITOR USE AND EXPERIENCE

United States citizens and people from all over the world spend more than 9 million visitor days of recreation in developed sites of the Yellowstone area each year. Though the draw of people worldwide to Yellowstone National Park is obvious, the less visible national forests and state-managed lands and resources near the park also offer an abundance and diversity of recreational opportunities. In the national parks, more than 95% of all recreation takes place at developed sites. In national forests, developed sites account for only about 25% of recreational use, and the rest is dispersed. Federal, state, and county public recreation sites number about 460, including campgrounds, picnic areas, trailheads, interpretive sites, and boat-launching facilities (Greater Yellowstone Coordinating Committee 1987).

Yellowstone National Park

Recreational visitation to Yellowstone National Park has grown by more than 25% in the last 14 years, from 2,404,862 in 1982 to 3,012,171 in 1996. As is common in most other western national parks, visitor use in Yellowstone is concentrated in the summer months, with 66% of the visitation in June, July, and August. The potential future recreational use of Yellowstone has been estimated, based on recreational use during the last 10 years. By the year 2003, estimated visitation is expected to range from 3.6 million to 4.3 million visitors per year (NPS 1994).

United States citizens and people from all over the world spend more than 9 million visitor days of recreation in developed sites of the Yellowstone area each year.

In the park, visitor use patterns are an image of entrance traffic. The west entrance to the park accounts for 34% of the vehicles entering in 1992, with the north and northeast entrances accounting for 14% and 6%, respectively, of the traffic (BRW 1994). Peak season average daily traffic on the west entrance road is 6,060 vehicles, while on the northeast entrance road, peak average daily traffic is 3040 vehicles (using 1992 figures). On the north entrance road between Gardiner and Mammoth, the peak average daily traffic number is 3,160 (BRW 1994). In 1993 the National Park Service began counting traffic through the park on U.S. Highway 191 as nonrecreational visitors (in prior years, these visitors were uncounted). In that year, 893,000 nonrecreational visitors were counted on U.S. Highway 191.

Visitor use in the park is concentrated in the major developed areas, such as Old Faithful, Canyon, Lake, and Mammoth Hot Springs. In 1990, 57% of summer visitors reported visiting the Mammoth Hot Springs area during their visit to the park (Littlejohn, Dolson, and Machlis 1990). Old Faithful is the most popular developed area in the park; 84% of 1990 visitors stopped at the Old Faithful area.

Visitor accommodations are also concentrated in the developed areas. In the parts of the park that would be affected most by bison management alternatives, the Mammoth Hot Springs area has 223 hotel rooms and cabins available for visitors, and 85 campsites in the National Park Service-managed campground, while the Tower-Roosevelt area has 80 cabins and a 32-site campground (out of a total of 2,181 motel rooms and cabins and 2,211 campsites, parkwide).

The nearby states of Wyoming, Montana, Utah, and Idaho accounted for 25% of all Yellowstone visitors in 1990. These four states have a combined population of nearly 4 million, or just 1.5% of the United States population. Nearly one-half of the visitors are making their first trip to Yellowstone, and one-third are making a second, third, or fourth trip. Seven percent of the park's visitors were from outside the United States (primarily Canada and Germany).

Backcountry use accounts for about 5% of park visitation. Day use of backcountry areas is not recorded, but 44,000 visitor use nights by backcountry users were counted in 1993 (NPS 1994). In the northern and western portions of the park backcountry campsite use varied from an average of 25 person-use nights to 199 person-use nights for the 1986 through 1992 period. The most used campsite had an average of 756 person-use nights.

Stephens Creek Area. The Stephens Creek area (which is now used for a capture facility) of the park has few visitor-related facilities, and no statistics are kept for use of the area. The abandoned railroad bed has been designated as a mountain bicycling trail, and the county road provides access for visitors wishing to view wildlife (such as pronghorn) on the Stephens Creek flats. Some cross-country walking and horseback riding also occurs in the area. Recreational rafting, canoeing, and kayaking of the Yellowstone River downstream of Gardiner, which parallels the Stephens Creek area, is popular during the summer months, as is fishing on this segment of river. Trails from the county road lead to the river for fishing access.

Gallatin National Forest

Gallatin National Forest provided a total of 2,798,000 recreation visitor days in 1992 or nearly 4 million recreation visits. In 1992 recreational use in developed sites accounted for 27% of the total recreation visitor days in the national forest. Hunting accounted for 7% of the recreation days and nonconsumptive wildlife use was 1% of the recreation days. The remaining use is dispersed/wilderness use (U.S. Forest Service 1992).

Horse Butte Area. During the spring, summer, and fall, all of the Horse Butte area included in the SMA is designated as a day-use area. Overnight camping is restricted to the two developed campgrounds, at Baker's Hole and Rainbow Point. Camping at these two sites begins in late May and lasts through mid-September. Rainbow Point has 85 units, with only hard-sided campers allowed, while Baker's Hole has 72 units.

During the fall months, October and November, waterfowl hunters use the Madison River, Madison Arm, Horse Butte Peninsula, and southern shorelines of the Grayling Arm. Big-game hunting for elk, moose, and deer occurs throughout the SMA in September, October, and November (see discussion on hunting below).

Along the south shore of the Madison Arm are 40 private recreational residences. In addition, two recreational residences are on Rainbow Point, and three are at Baker's Hole. These residences are occupied throughout the summer season with some incidental use on weekends and holidays in the fall and winter.

Located midway along the south shore of the Madison Arm is the private Madison Arm Resort, which offers camping and a marina. The resort is open from Memorial Day through the end of September.

Bear Creek/Eagle Creek Area. The Bear Creek/Eagle Creek area serves as a major wintering area for big-game and is important both to horn hunters in the spring and to big-game hunters in the fall and winter. The hunting season runs from mid-October to mid-February in the area.

Fall hunters heavily use the campgrounds in the Bear Creek/Eagle Creek region, as well as the dispersed camping opportunities available throughout the area. The trailhead at Little Trail Creek also receives heavy use during both the fall and winter hunts. The Bear Creek and Palmer Mountain trailheads are located in this district, and they too receive a significant amount of use, especially by outfitters and others during the backcountry hunting season (September 15–November). This area is especially popular and well known for elk hunting.

Summer activities include hiking, mountain biking, hang gliding, and camping at the Eagle Creek, Timber Camp, and Bear Creek campgrounds. Eagle Creek campground has 16 units, and Bear Creek and Timber Camp are dispersed camping. Eagle Creek is open year-round, while Timber Camp and Bear Creek campgrounds are open June 15 through October 31. Fees began to be charged as of 1997 at the Eagle Creek campground, so reliable records of use are not available.

WILDLIFE AND BISON VIEWING

When Yellowstone National Park was set aside in 1872 as the world's first national park, the "wonders of the Yellowstone" were the primary motivation — spectacular geysers, colorful hot pools, and the Grand Canyon of the Yellowstone (Meagher 1974). However, it is clear that in modern times, wildlife viewing is the primary activity for many visitors who come to Yellowstone National Park. In 1989 visitors who stayed in the park more than one day reported that their activities included viewing wildlife (93%), seeing thermal features (85%), photography (83%), walking for pleasure (75%), and visiting visitor centers (73%) (Littlejohn, Dolson, and Machlis 1990). Similarly surveys of park visitors during August–September 1990 and June 1991 found that wildlife observation was the single-most important activity for Yellowstone National Park visitors with 94% of respondents participating (Duffield 1992). This exceeds participation for geyser viewing (87%), bird watching (48%), hiking (29%), camping (19%), fishing (13%), and boating (3%). The relative importance of wildlife viewing is further revealed by the surprisingly high share of respondents reporting wildlife photography as an activity (73%).

These findings are further supported by a survey of YNP visitors during May through July of 1999, which found that wildlife observation was the most important activity for visitors, with 95% of respondents indicating this activity (Duffield et al. 2000a). This exceeds participation for geyser viewing (87%), bird watching (27%), hiking (39%), camping (27%), and fishing (13%).

The summer 1999 survey also asked participants to list the top 3 mammals and birds they hoped to see on their trip from a list of 16 animals (see table 19). Bison were the eighth most frequently cited species in this list, with a ranking between eagles and elk. Bison herds are commonly seen along three of the park's road segments: in the Lower Geyser Basin between Madison Junction and Old Faithful; in Hayden Valley between Lake and Canyon; and in the Lamar Valley between Tower Junction and the northeast entrance. Individuals and small groups can often be seen along all road segments. Because 75% of Yellowstone visitors enter the park through one gate and exit via another, most visitors pass through one of these areas. The major, observable effect of bison on existing visitor travel is traffic jams created when visitors slow or stop to watch herds of bison cross park roads. Traffic jams several miles long and up to several hours in duration have been observed in mid-summer in Hayden Valley.

Table 19: Order of Viewing Preference of Wildlife Animals in Yellowstone National Park

Rank	Species	Percent	Rank	Species	Percent
1	Grizzly	58	9	Elk	14
2	Wolf	36	10	Wolverine	6
3	Moose	35	11	Swan	4
4	Mountain lion	31	12	Fox	2
5	Black bear	29	13	Coyote	2
6	Bighorn sheep	23	15	Deer	2
7	Eagle	21	16	Canada Goose	1
8	Bison	19	-	-	-

SOURCE: Duffield et al. (2000a).

NOTE: Based on percent of respondents ranking the top three animals the would like to see (visitors sampled in May–July 1999).

Wildlife viewing is a primary activity in Yellowstone National Park and the adjacent national forests, and significant changes in wildlife populations can be expected to affect park visitation levels and total visitor spending in the regional economy. For example, visitor surveys conducted for the environmental impact statement concerning recovery of wolves in Yellowstone National Park (USFWS 1994) indicated that, other things equal, the opportunity to see or hear wolves in Yellowstone National Park could lead to an approximate 5% increase in visitation for nonresident visitors. This would amount to about $20 million per year in increased tourism spending. Similarly, a 1989 survey showed that the opportunity to see elk had a measurable impact on the visitor experience in terms of the value of a current trip to the park (Duffield 1991). Although wildlife viewing is the single most common activity engaged in by summer visitors to Yellowstone National Park, it is unclear whether the bison population changes described in the *Draft Environmental Impact* Statement would lead to measurable changes in how visitors to the park value their visits. Responses to a 1999 summer survey of park visitors did not show any systematic relationship between the number of bison seen by visitors on their trips and the value they ascribed to their trip. The lack of such a statistical relationship is likely due to the fact that nearly all (97%) summer visitors responding to the survey had seen bison on their trips. Additionally, most visitors had seen a relatively large number of bison.

While marginal changes in the number of bison in the park may not impact visitor trip values, a significant number of respondents indicated that seeing bison was one of their reasons for visiting the Greater Yellowstone Area. Among park visitors in both the summer and winter surveys, about 50% said seeing bison was a reason for their trip (48.9% of resident summer visitors, 52% of nonresident summer visitors, and 53.9% of winter visitors). Furthermore, a portion of these respondents said they would not have made their trip to the park if bison had not been present (5% of resident summer visitors, 3.6% of nonresident summer visitors, and 6.6% of winter visitors).

WINTER RECREATION

Winter use has been growing at an accelerating rate, nearly doubling in the decade between 1984 and 1994, to 140,000 in the 1994–95 winter season. Little overnight backcountry use occurs in the winter. During the winter, 25% of the visitors stopped at Mammoth, while 10% visited Tower Junction. Old Faithful is the single-most common destination, with 60% of winter visitors stopping at that location. Forty-six percent of winter visitors liked viewing the scenery most, and 17% specifically identified wildlife viewing as what they liked most about the park in the winter (NPS 1990).

In areas surrounding the park winter recreation is also growing. The town of West Yellowstone, Montana, is located at the west entrance to the park and has been touted as "the snowmobile capital of the world." Total entrances to the park through the west entrance for the months of December through March rose 31% from the 1989–90 winter season to the 1994–95 winter season. A 1994 report from the Bureau of Business and Economic Research at the University of Montana suggests that three-quarters of all nonresidents snowmobiling in Montana spent time in or near West Yellowstone (Sylvester and Nesary 1994).

During the 1997–98 winter season, 53% of park visitors entered through the west entrance, 23% through the north, 23% through the south, and 2% through the east.

Paralleling the increase in winter visitation to the park has been winter recreational use of U.S. Forest Service lands adjacent to the park. Table 20 shows historical winter use levels for Yellowstone National Park and adjacent Gallatin National Forest. It shows that both aggregate recreational use in the park, and all listed types of use in the national forest have been trending upward over the decade 1984–94.

Table 20: Winter Use Levels by Years for Yellowstone National Park and Gallatin National Forest

		Gallatin National Forest		
	Yellowstone National Park Winter Recreational	Hebgen Lake District Wide	Cooke City	Hebgen Lake Rendezvous Trail
Year	Use Level	Snowmobiles	Snowmobiles	Skiers
1984–85	77,679	47,552	-	4,125
1985–86	93,971	46,100	-	4,325
1986–87	89,615	50,333	-	6,866
1987–88	100,105	64,300	-	7,874
1988–89	96,304	62,200	-	-
1989–90	118,017	84,800	10,000	15,138
1990–91	103,539	69,800	-	11,800
1991–92	117,410	74,900	-	13,052
1992–93	141,510	81,500	-	13,308
1993–94	143,523	75,054	38,000	14,497
1994–95	139,810	87,245	-	21,617
1995–96	119,539	106,713	37,050	22,055

SOURCE: Winter Visitor Use Management: a Multi-Agency Assessment, Greater Yellowstone Winter Visitor Use Management Working Group, April 1997.

During the winter season, the major recreational activity in the Horse Butte area is snowmobiling, which begins around December 1 each year and lasts until March 30. Records are not kept of dispersed recreational use in the area. Snowmobile use occurs throughout the groomed trail system and play areas, and the majority of the play areas are located on Horse Butte Peninsula. Snowmobiles are also used to reach ice-fishing areas, most notably on the Madison Arm of Hebgen Reservoir.

Minor amounts of cross-country skiing occur in the area, primarily on Horse Butte itself. Snowmobiling and cross-country skiing are also important winter recreational activities that take place mostly at the upper elevations above Jardine. Records are not kept for dispersed recreation use in the Horse Butte area.

HUNTING

Big-Game Hunting

The focus of this discussion will be on elk, the type of hunt most likely to be affected by bison management. Hunting seasons occur during the fall and early winter in Montana. The elk general rifle season occurs from the fourth week of October to the fourth week of November for a five-week season. An archery season occurs from the first week of September to mid-October, allowing one-either-sex elk per hunter. Special permits are issued for harvest of antlerless elk during the general hunting season and late hunts for elk. Mean harvest of elk in and near the analysis area is 3,044. By comparison, deer harvest is 2,564, moose is 93, bighorn sheep is 22, mountain goats is 10, and pronghorn is 23.

In Montana, elk are managed in elk management units. These units are divided into one or more hunting districts (delineated in Montana's big-game hunting regulations) that share similar ecological characteristics and, in most cases, encompass the year-long range of major elk populations inhabiting the management unit (Youmans 1992). The analysis area outside the park includes three elk management units and their respective hunting districts: the Gallatin (hunting districts 301, 310, 314), the Madison (hunting districts 310, 360, 361, 362), and the Emigrant (hunting districts 313, 314, 316). The northern Yellowstone elk herd (approximately 18,000 animals) occupies winter and summer range in Yellowstone National Park, and is associated with hunting districts 313 and 316. These elk winter in what is described as the northern Yellowstone elk winter range, which includes about 400 square miles from the Lamar Valley in the park west and north to the Dome Mountain Wildlife Management Area outside Yellowstone National Park in hunting district 313. Hunting district 316 is primarily high elevation summer and fall range, with most elk typically migrating to the northern winter range in the park. Elk wintering and summering near the northwestern corner of the park are associated with hunting districts 360, 361, 362, and 310. The elk hunt is perhaps most similar to the proposed bison hunts for alternatives 3 and 4 and the special permit Gallatin and Gardiner Late elk hunts. These hunts are primarily for elk that have migrated out of Yellowstone National Park during the winter months.

Bison Hunting in North America

The American bison is a trophy animal for big-game hunters. Bison hunting takes place on both public lands and private game ranches in North America.

Private ranches charge relatively high prices (ranging from $2,250 to $4,000 in the Northern Rocky region) for hunting a trophy-sized bull (see table 21). Just north of Yellowstone National Park, the Flying D Ranch charges $3,500 per bison and receives about 10 customers per year (Numerous personal communications and WEB advertisements).

Bison are hunted on public lands in Wyoming, Utah, South Dakota, and Alaska. Lotteries are held for the Wyoming, Utah, and Alaska hunts. A percentage of the limited permits is reserved for resident applicants. A nonrefundable application fee of $5 to $10 is required. The permits for nonresidents range from $1,008 to $2,605. The tag cost for residents ranges from $0 (Alaska) to $1,105 (Utah). All hunters must have state big-game hunting licenses.

The Henry Mountains bison population in southern Utah is hunted annually to meet specific population objectives. According to Hodson and Karpowitz (1997), the annual hunt "really is a 'hunt,' as opposed to being a 'shoot.'" When hunts were first established for this population, bison were apparently relatively easy to find and kill. However, they rapidly became wary of humans during the hunting season. The number of days per kill has increased measurably in recent years, due to the ruggedness of the terrain and the tendency of bison to use areas not easily accessible by road. This hunt requires an orientation session to discuss weapon caliber and bullet placement, proper field dressing to protect the meat, and the nature and potential difficulty of the hunt. Emphasis is also placed on proper sex/age identification to ensure that appropriate bison are killed and management goals are met. Hunters are entirely independent after the orientation session (Division of Wildlife Resources, Karpowitz, pers. comm.). The Arizona Department of Game and Fish also manages hunts for two separate bison herds in northern and central Arizona. In the smaller, more confined Raymond Ranch area of central Arizona, hunters are accompanied by department personnel who assist hunters in identifying the correct sex and age of bison for the hunter to kill. Department personnel do not assist the hunter in any other way. In the approximately 65,000 acre House Rock Valley area of northern Arizona, hunting occurs in more remote conditions, hunters are unaccompanied, and bison tend to be wary of humans and are more difficult to find. An extensive orientation is also conducted for these hunters, emphasizing proper identification of bison sex and age (Lee 1993; AZ Game and Fish, Lee, pers. comm.). Hunts in both areas are generally well-accepted by the public.

Public bison hunts are also held in Alaska on four separate herds. All but the Delta herd are in extremely remote areas, with some hunting areas only accessible by air. The Delta hunt occurs in a less remote area on both public

Table 21: A Sample of Bison Hunting in the United States

Location/Ownership of Herd	Cost per Bison	Bison per Year	Number of Applicants
Private Herds			
Flying D (Gallatin County, MT)	$3,500	No set limit	About 10
Windels Wildlife Preserve (Hogeland, MT)	$4,000	4	First-come, first-served
Terrills (Cheyenne, WY)	$2,250	-	-
Fort Belknap Reservation (MT)	$2,500 for 4–6 year old $4,000 for trophy-size	4	First-come, first-served
Public Herds			
Henry Mountains, UT	$1,008 nonresident $408 resident	44	Data not available
Antelope Island, UT	$2,605 nonresident $1,105 resident	6	1,000
Delta Bison Range, AK	$450 nonresident $650 nonresident/alien $0 resident	40	6,000–11,000
Custer State Park, SD	$3,000 for 3-day hunt	10	About 20
Absaroka Herd, WY	$1,688 nonresident $275 resident	17	2,316
Discontinued Hunts			
Yellowstone Herd, MT (1990)	$1,005 nonresident $205 resident	Data not available	Data not available
Jackson Herd, WY (1990)	$1,000 nonresident $200 resident	16	3,000+

and private lands. The purposes of this hunt is to provide a recreational hunting opportunity and to reduce conflicts with bison and agricultural farmers on private lands. According to the Alaska Department of Fish and Game, this hunt is extremely popular with hunters and is well-received by the public and private landowners (DuBois and Rogers 1999).

Three public bison hunts have taken place in the Greater Yellowstone Area in the 1990s: a discontinued hunt in Montana, a discontinued hunt on the Jackson herd south of Yellowstone National Park, and an ongoing Wyoming hunt, officially called the "Wild Bison Reduction Season" held on a portion of the Yellowstone bison herd within the Absaroka management area. This area is located on the North Fork Shoshone River near Cody, Wyoming, on the east side of Yellowstone National Park. The Montana hunt, held in the mid-1980s and early 1990s, was discontinued after it received bad publicity. This hunt was unpopular with the public because the bison were shot in a firing line situation as they crossed the border of Yellowstone National Park into Montana. The hunters were accompanied by Montana Fish, Wildlife and Parks personnel, and many bison were shot within a short time period. The state of Wyoming conducts a small recreational hunt on the Jackson bison herd on national forest lands.

The wild bison reduction season on the portion of the Yellowstone population in the Absaroka management area is held in the following manner. Applicants are accepted during a specified time period in late summer and are randomly assigned a draw number. When the Wyoming Game and Fish Commission determines that the bison population needs to be reduced, they notify the applicants in the order of their draw number. Each participant chosen to hunt is required to participate in a two-hour hunter orientation program to cover issues concerning bison hunting and to demonstrate shooting proficiency. After completing the orientation and shooting, they are allowed to hunt on their own. In the Absaroka management area, public hunting is employed to remove all female bison and all male bison in excess of the population objective of 15 bull bison. In 1996, 17 bison were taken at a 100% success rate. Despite its close proximity to Yellowstone National Park, this hunt was not protested, perhaps because of its low profile, the small number of bison killed, the lack of a specific time or opening date, and because agency officials did not accompany hunters.

LIVESTOCK OPERATIONS

The purpose of taking action is to prevent the transmission of brucellosis from Yellowstone bison to cattle. Since some alternatives would have specific impacts on livestock operations in the region, cattle operations in the Greater Yellowstone Area are analyzed in greater detail in this environmental impact statement than are other land use practices (such as residential and commercial). The monetary aspects of ranching, e.g., the contribution to the regional economy, are included in the "Socioeconomics" chapter of this part.

CATTLE MANAGEMENT PRACTICES

The purpose of taking action is to prevent the transmission of brucellosis from Yellowstone bison to cattle.

In the Yellowstone area, the livestock industry is composed mainly of cow-calf operations with the exception of a few sheep producers. Privately owned land and leased public land grazing allotments provide summer pastures. After the first snowfall, or at the end of the allotment period in the fall, most cattle are returned to their home base, usually elsewhere in Montana or Idaho where snow depths are more shallow and hay sources are more accessible. Near Yellowstone National Park in the winter, the snow is too deep and the winters are too cold for cattle to graze, and extra feed is required to maintain their body heat. Cattle under lease are fed hay and retained at Royal Teton Ranch (adjacent to the park's northwestern boundary) year-round.

The mother cows of a cow-calf operation are usually bred in the spring or summer for calving in late winter or spring. Calves are with their mothers until fall, at which time they are weaned. Intensive management activities, including calving, neonatal care, branding, castration, dehorning, semen testing, and breeding usually take place at a producer's home operation.

Yearly phases of production include weaning of calves, feeding or selling steers and surplus heifer calves, and culling of old or unbred cows. Owners of cow-calf operations usually do not purchase cattle, with the exception of breeding bulls, but rather rely on replacement heifers from the same herd. Their incomes generally reflect the 10- to 12-year price cycle for beef. Income in some years may not cover expenses, but usually a positive cash flow is realized by the completion of the cycle.

At the producers' discretion, female cattle in the park vicinity are vaccinated against brucellosis one time, between 4 and 12 months of age. Yearly testing for brucellosis is performed on an estimated 80%–90% of the cattle grazed in the West Yellowstone area. These are herds brought from Idaho for summer grazing, since by agreement with Montana, Idaho requires that cattle 18 months or older pasturing in the West Yellowstone area be tested when entering Montana, and again before returning to Idaho, regardless of any known exposure. If Montana's Department of Livestock suspects that cattle may have been exposed to brucellosis, then area (whole herd) testing can be required, including calves as young as six months. Area testing last occurred in the Reese Creek area in 1989.

LAND USE

Land to the north and west of Yellowstone National Park is primarily part of the Gallatin National Forest, with some areas of privately owned property. The two existing management areas designated in the *Interim Bison Management Plan* are located on national forest land adjacent to the park. The Eagle Creek/Bear Creek area, located northeast of Gardiner, has about 23,000 acres. The Horse Butte area, located northwest of West Yellowstone, is about 24,000 acres in size. The interim plan allows for the winter migration of bison into these two management areas (only ones tested seronegative in West Yellowstone).

Tables 22–25 represent the estimated number of cattle currently (1999) being grazed on private and public lands north and west of the park boundary. The tables also show the areas where bison might occupy lands and the number of cattle that may be affected. See the maps showing private and public lands where cattle are currently grazed. For maps which show the private land holdings, please refer to tables 22 and 24 for the landowner designation.

A total of 390 cattle on the northern boundary occupy lands where bison may potentially range if allowed. In areas where cattle are present in the winter, bison are not allowed.

NOTE: After April 2002, the number of cattle on the RTR Trestle Ranch and the Park and Sentinel Butte public allotments could change to zero cattle per the conservation easement agreement under the Royal Teton Ranch land purchase. Based on the current Green Lake allotment boundary, bison could potentially use less than approximately 100 acres of that allotment near Yankee Jim Canyon due to topography.

Privately owned land in the Reese Creek area that could be affected by one or more of the alternatives includes both livestock holdings and nonranch residences, with the latter, in particular, found along the Yellowstone River. The largest of the livestock operations in the Reese Creek area is the Royal Teton Ranch, with about 300 cattle grazed on public and private land. It has many buildings and improvements.

Other private properties in the Gardiner Valley, between the Yellowstone National Park boundary and north to Yankee Jim Canyon, occupy a total area

Table 22: Estimated Number of Cattle Grazed on Private Lands Within Approximately 10 Miles of the Northern Yellowstone National Park Boundary

Bolded rows are those areas where bison might occupy lands during the winter

Cattle Owner	Map Designation	Number of Cattle	On/Off Date (when known)
Warren Johnson	WJ	2	-
John and Betty McDonald	JMC	29	-
James and Lorayne Stermitz	JS	30	-
Charles and Sharon Duffy	CD	1	-
RTR Trestle Ranch	**RTR-TR**	**300**	-
Henry and Dorine Rate	HR	24	-
Frank Rigler	FR	46	-
B Bar Ranch, Mary A. Mott	BB	Unknown	June–October
Robert Malcom	RM	290	May–December
Eardman Lawrence	EL	125	-
Hannibal Anderson	HA	77	-
Yellowstone Company	YC	252	-

Table 23: Number of Cattle Permitted (Cow-Calf Pairs) on Public Land Grazing Allotments Within Approximately 10 Miles of the Northern Yellowstone National Park Boundary

Bolded rows are those areas where bison might occupy lands during the winter

Public Allotment Name	Acreage	Number of Cattle	On/Off Date
Park	**14,650**	**24**	**4 on 6/16–11/05, 20 on 7/1–10/05**
Mill Creek	800	13	6/16–10/15
Section 22	586	22	6/16–10/15
Sentinel Butte	**570**	**7**	**6/16–10/15**
Green Lake	**3,558**	**59**	**6/16–10/15**
Slip and Slide	6,795	260	6/16–10/15
Lion Creek	7,000	53	6/16–10/15

Table 24: Estimated Number of Cattle Grazed on Private Lands Within Approximately 10 Miles of the Western Yellowstone National Park Boundary

Bolded rows are those areas where bison might occupy lands, if allowed bythe private landowner, during the winter

Cattle Owner	Map Designation	Number of Cattle	On/Off Date (when known)
Red Creek Ranch	RC	50	July–September
Munns Brothers	**MB**	**200**	**June–October**
Alma Investment	AI	20	August–October
Ryeburg Property	RP	45	June–September
Bar N Ranch	BN	100	June–September
Deep Well Ranch	DW	400	June–October
Diamond P Ranch	DP	35	September–November

Table 25: Number of Cattle Permitted (Cow-Calf Pairs) on Public Land Grazing Allotments Within Approximately 10 Miles of the Western Yellowstone National Park Boundary

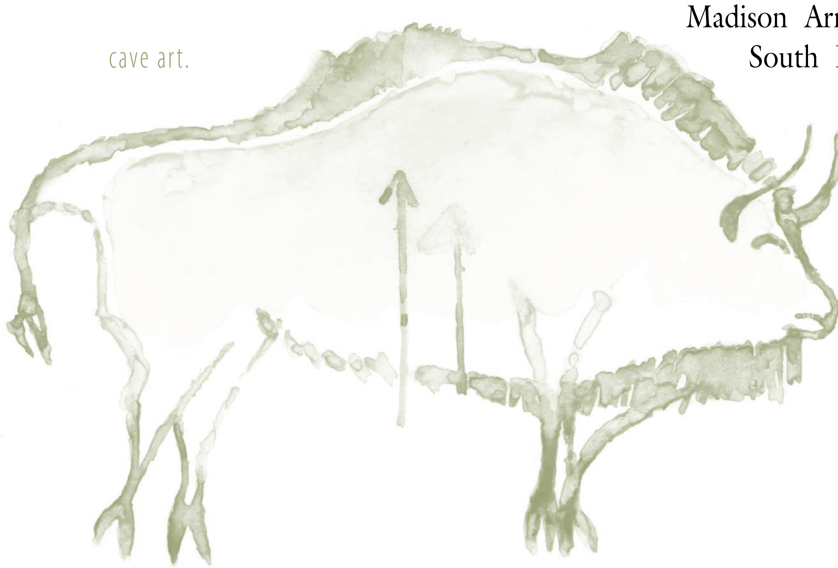
Bolded rows are those areas where bison might occupy public lands during the winter

Public Allotment Name	Acreage	Number of Cattle	On/Off Date
South Fork	217	19	7/01–9/30
Basin	26	16	7/21–9/13
Horse Butte	**2,200**	**147**	**6/01–9/15**
Sulphur Springs	233	38	7/01–9/30
Watkins Creek	4,689	55	7/01–9/30
Wapiti	7,979	222	7/11–9/30

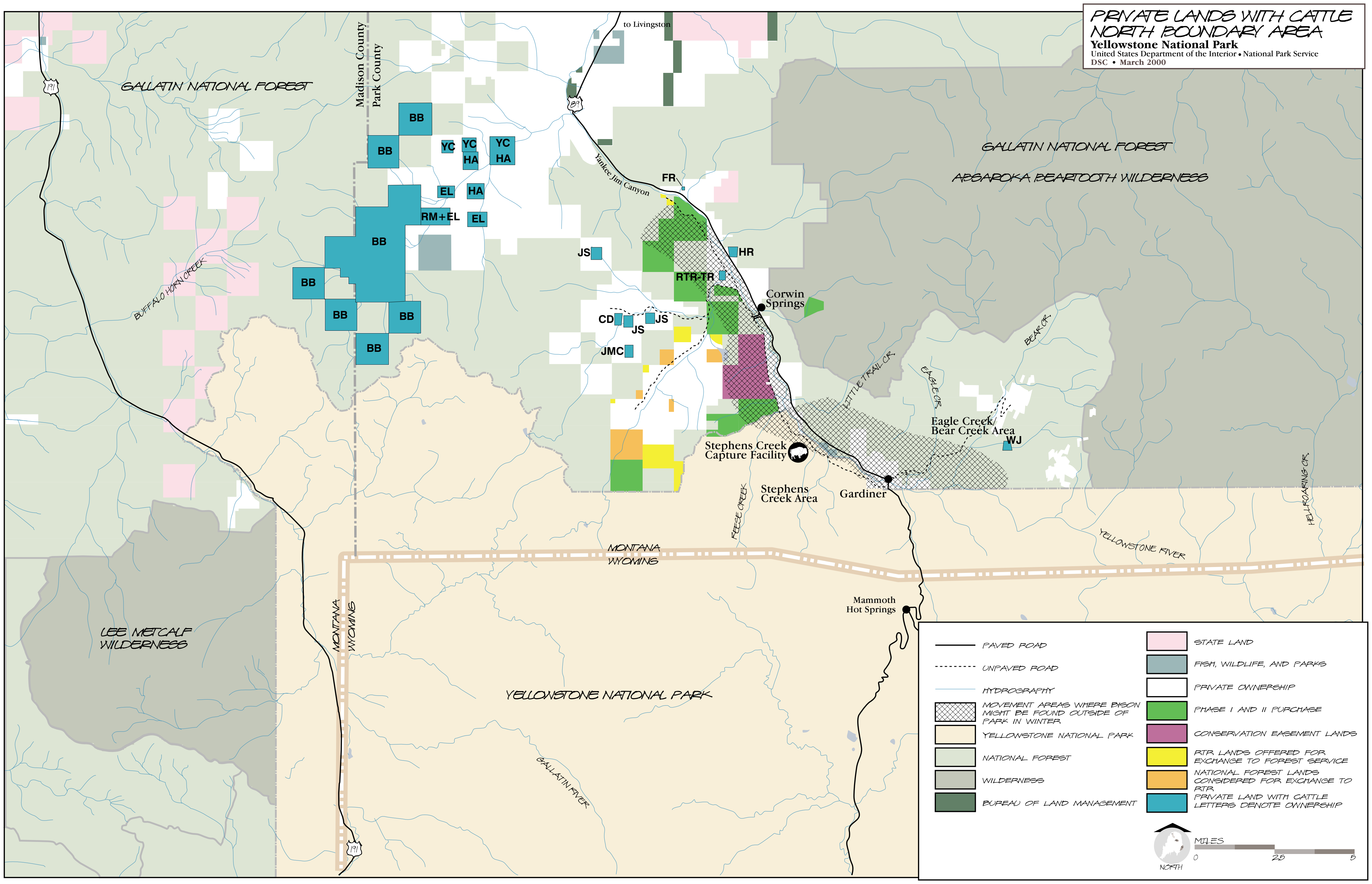
of about 2,100 acres. These property owners would only be affected should alternative 2 be implemented. Some of these properties do have cattle, but usually only a few head. As described in "Environmental Consequences," the number of cattle on grazing allotments and private holdings to the north of the park that may be directly affected varies, depending on the size and location of the SMAs proposed for each alternative.

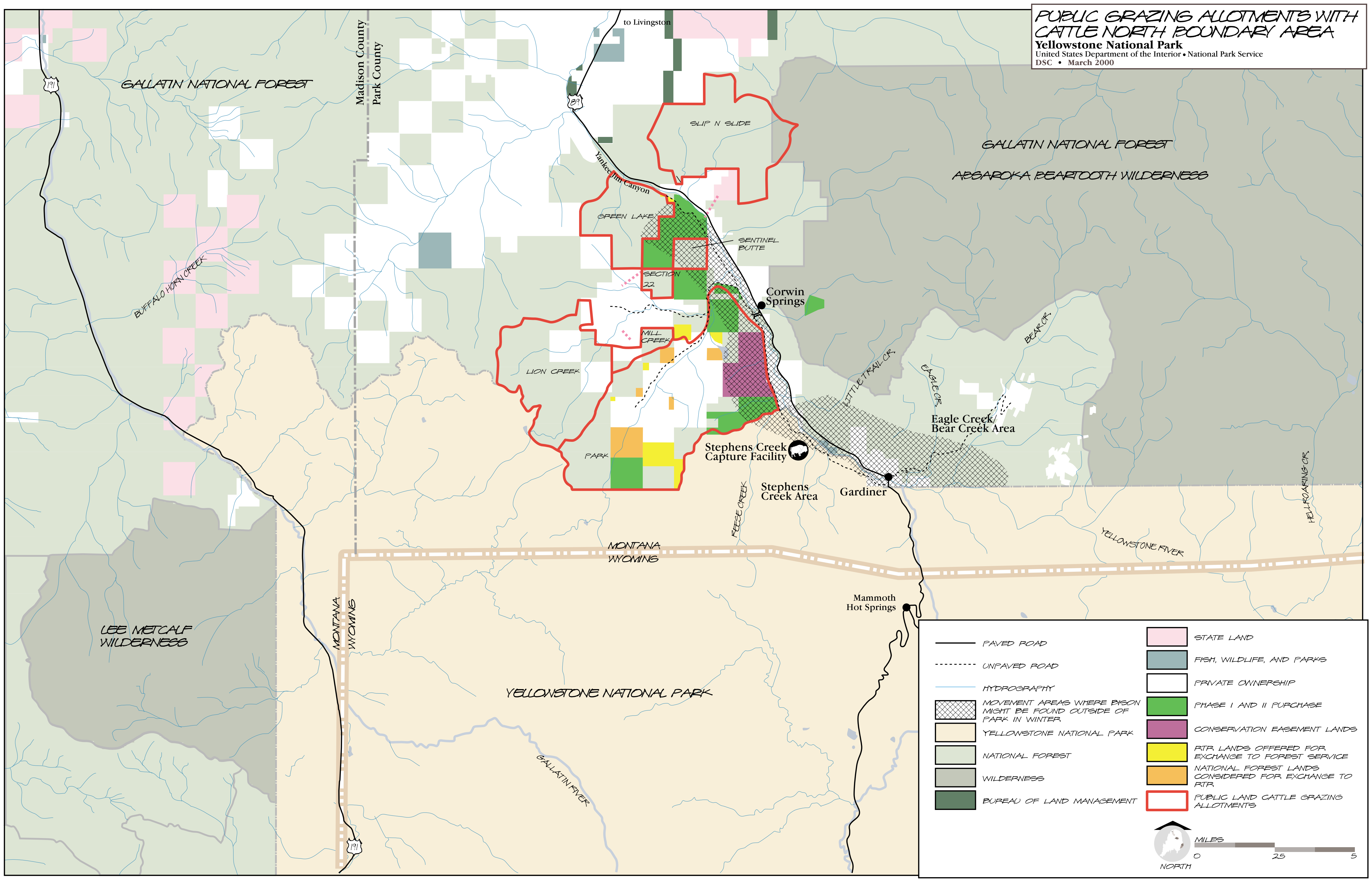
In the West Yellowstone area, there are private holdings (totaling about 1,250 acres) in the Horse Butte region between Duck Creek and the Madison River. Only the largest, with an area of about 650 acres, has cattle, with about 215 pairs on private land (as well as the 142 pairs on the Horse Butte allotments).

Additional private holdings to the west of Hebgen Lake, and south of the Madison Arm of Hebgen Lake (west of the South Fork), would be directly affected only by alternative 2, which has the most extensive SMAs. These areas have an additional 585 cow-calf pairs.

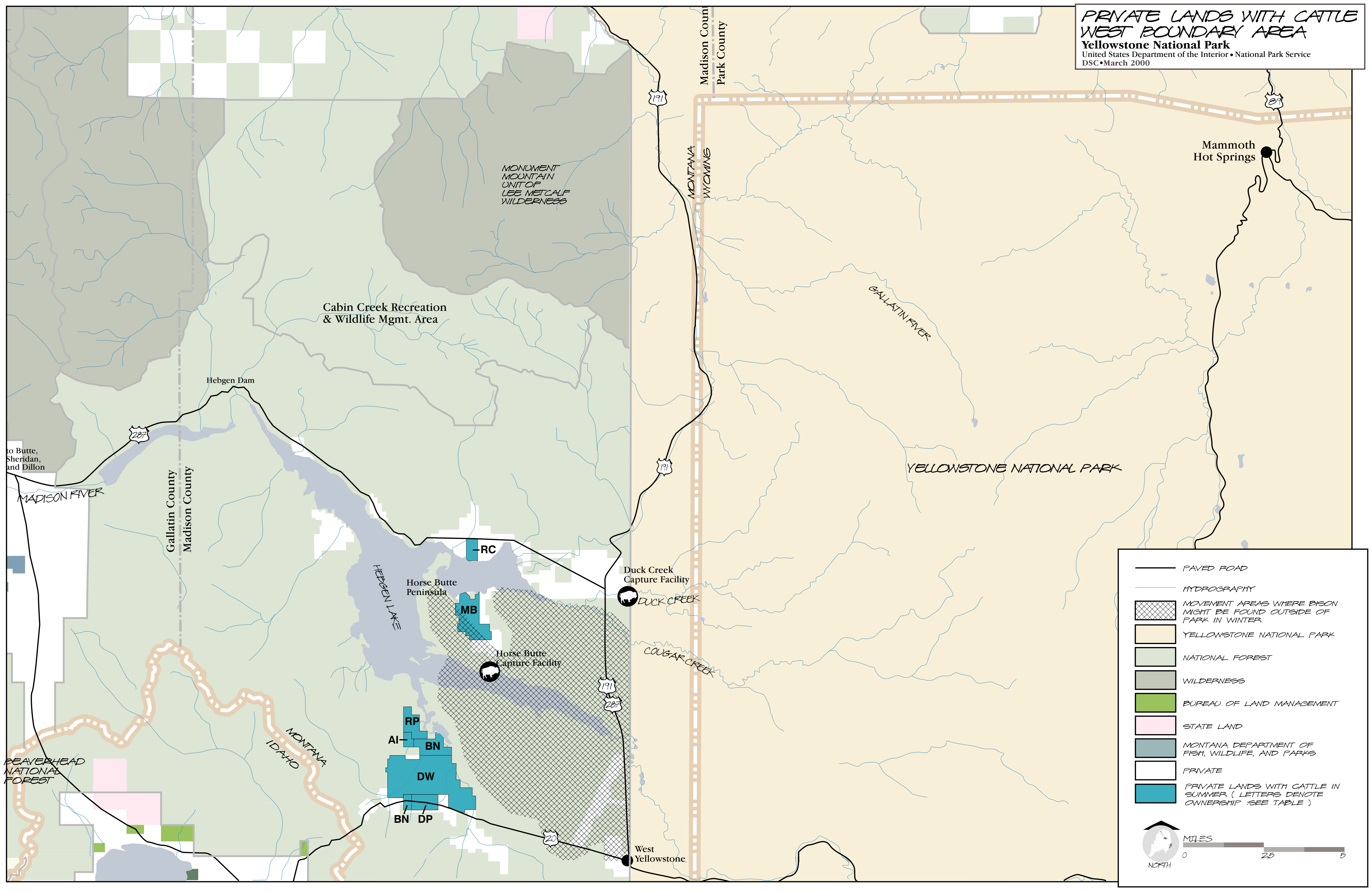


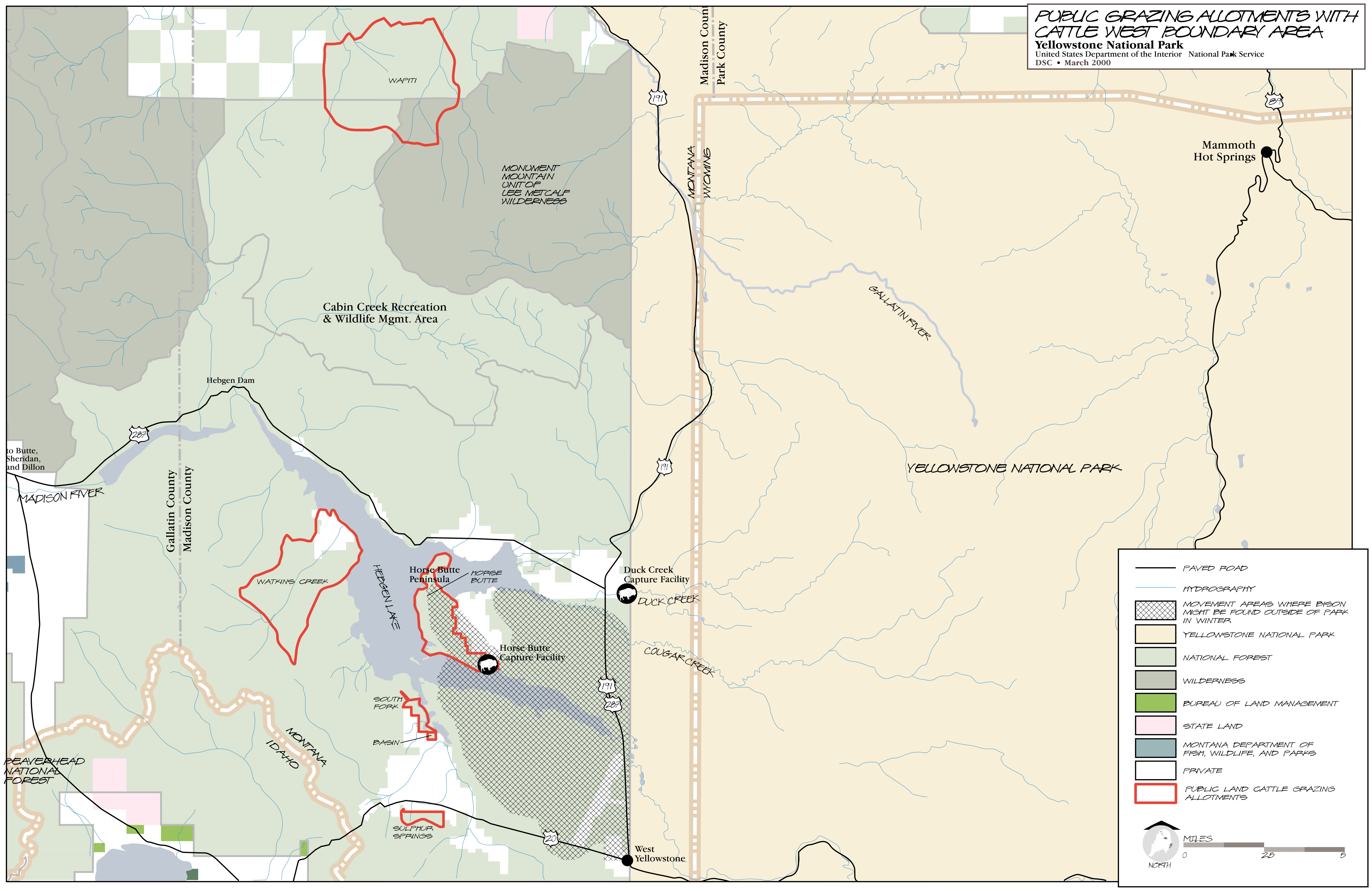
Ancient Indian cave art.


PRIVATE LANDS WITH CATTLE
NORTH BOUNDARY AREA
Yellowstone National Park
United States Department of the Interior • National Park Service
DSC • March 2000
GALLATIN NATIONAL FOREST
ABSAROKA BEARTOOTH WILDERNESS
LEE METCALF WILDERNESS
YELLOWSTONE NATIONAL PARK
Madison County
Park County
MONTANA
WYOMING
to Livingston
Yankee Jim Canyon
Corwin Springs
Stephens Creek Capture Facility
Stephens Creek Area
Gardiner
Eagle Creek/ Bear Creek Area
Mammoth Hot Springs
BUFFALO HORN CREEK
LITTLE TRAIL CR.
EAGLE CR.
BEAR CR.
REESE CREEK
YELLOWSTONE RIVER
HELLROARING CR.
GALLATIN RIVER
BB
YC
HA
EL
RM+EL
JS
FR
HR
RTR-TR
CD
JMC
WJ
PAVED ROAD
UNPAVED ROAD
HYDROGRAPHY
MOVEMENT AREAS WHERE BISON MIGHT BE FOUND OUTSIDE OF PARK IN WINTER
YELLOWSTONE NATIONAL PARK
NATIONAL FOREST
WILDERNESS
BUREAU OF LAND MANAGEMENT
STATE LAND
FISH, WILDLIFE, AND PARKS
PRIVATE OWNERSHIP
PHASE I AND II PURCHASE
CONSERVATION EASEMENT LANDS
RTR LANDS OFFERED FOR EXCHANGE TO FOREST SERVICE
NATIONAL FOREST LANDS CONSIDERED FOR EXCHANGE TO RTR
PRIVATE LAND WITH CATTLE LETTERS DENOTE OWNERSHIP
MILES
0
2.5
5
NORTH



PUBLIC GRAZING ALLOTMENTS WITH CATTLE NORTH BOUNDARY AREA
Yellowstone National Park
United States Department of the Interior • National Park Service
DSC • March 2000
to Livingston
GALLATIN NATIONAL FOREST
Madison County
Park County
BUFFALO HORN CREEK
SLIP N SLIDE
Yankee Jim Canyon
GREEN LAKE
SENTINEL BUTTE
SECTION 22
Corwin Springs
MILL CREEK
LION CREEK
PARK
GALLATIN NATIONAL FOREST
ABSAROKA BEARTOOTH WILDERNESS
LITTLE TRAIL CR.
EAGLE CR.
BEAR CR.
Eagle Creek Bear Creek Area
Stephens Creek Capture Facility
Stephens Creek Area
Gardiner
REESE CREEK
HELLROARING CR.
YELLOWSTONE RIVER
MONTANA
WYOMING
Mammoth Hot Springs
LEE METCALF WILDERNESS
YELLOWSTONE NATIONAL PARK
GALLATIN RIVER
PAVED ROAD
UNPAVED ROAD
HYDROGRAPHY
MOVEMENT AREAS WHERE BISON MIGHT BE FOUND OUTSIDE OF PARK IN WINTER
YELLOWSTONE NATIONAL PARK
NATIONAL FOREST
WILDERNESS
BUREAU OF LAND MANAGEMENT
STATE LAND
FISH, WILDLIFE, AND PARKS
PRIVATE OWNERSHIP
PHASE I AND II PURCHASE
CONSERVATION EASEMENT LANDS
RTR LANDS OFFERED FOR EXCHANGE TO FOREST SERVICE
NATIONAL FOREST LANDS CONSIDERED FOR EXCHANGE TO RTR
PUBLIC LAND CATTLE GRAZING ALLOTMENTS
NORTH
MILES
0
2.5
5


PRIVATE LANDS WITH CATTLE
WEST BOUNDARY AREA
Yellowstone National Park
United States Department of the Interior • National Park Service
DSC•March 2000
Madison County
Park County
MONTANA
WYOMING
Mammoth Hot Springs
MONUMENT MOUNTAIN UNIT OF LEE METCALF WILDERNESS
Cabin Creek Recreation & Wildlife Mgmt. Area
GALLATIN RIVER
Hebgen Dam
to Butte, Sheridan, and Dillon
MADISON RIVER
Gallatin County
Madison County
YELLOWSTONE NATIONAL PARK
RC
Duck Creek Capture Facility
DUCK CREEK
Horse Butte Peninsula
HEBGEN LAKE
MB
Horse Butte Capture Facility
COUGAR CREEK
RP
AI
BN
DW
BN
DP
MONTANA
IDAHO
BEAVERHEAD NATIONAL FOREST
West Yellowstone
PAVED ROAD
HYDROGRAPHY
MOVEMENT AREAS WHERE BISON MIGHT BE FOUND OUTSIDE OF PARK IN WINTER
YELLOWSTONE NATIONAL PARK
NATIONAL FOREST
WILDERNESS
BUREAU OF LAND MANAGEMENT
STATE LAND
MONTANA DEPARTMENT OF FISH, WILDLIFE, AND PARKS
PRIVATE
PRIVATE LANDS WITH CATTLE IN SUMMER (LETTERS DENOTE OWNERSHIP SEE TABLE)
NORTH
MILES
0
2.5
5


PUBLIC GRAZING ALLOTMENTS WITH CATTLE WEST BOUNDARY AREA
Yellowstone National Park
United States Department of the Interior National Park Service
DSC • March 2000
WAPITI
MONUMENT MOUNTAIN UNIT OF LEE METCALF WILDERNESS
Madison County
Park County
MONTANA
WYOMING
Mammoth Hot Springs
Cabin Creek Recreation & Wildlife Mgmt. Area
GALLATIN RIVER
Hebgen Dam
to Butte, Sheridan, and Dillon
MADISON RIVER
Gallatin County
Madison County
YELLOWSTONE NATIONAL PARK
WATKINS CREEK
HEBGEN LAKE
Horse Butte Peninsula
HORSE BUTTE
Duck Creek Capture Facility
DUCK CREEK
Horse Butte Capture Facility
COUGAR CREEK
SOUTH FORK
BASIN
MONTANA
IDAHO
BEAVERHEAD NATIONAL FOREST
SULPHUR SPRINGS
West Yellowstone
191
287
89
20
PAVED ROAD
HYDROGRAPHY
MOVEMENT AREAS WHERE BISON MIGHT BE FOUND OUTSIDE OF PARK IN WINTER
YELLOWSTONE NATIONAL PARK
NATIONAL FOREST
WILDERNESS
BUREAU OF LAND MANAGEMENT
STATE LAND
MONTANA DEPARTMENT OF FISH, WILDLIFE, AND PARKS
PRIVATE
PUBLIC LAND CATTLE GRAZING ALLOTMENTS
NORTH
MILES
0
2.5
5

BISON RANCHING

There are approximately 200,000 bison in North America — about 5% on public lands managed by state and federal governments, about 5% on tribal lands, and about 90% on private lands, primarily commercial herds. There are several private bison herds that are more than 30 miles from any proposed SMA boundary, the largest being on the 107,000-acre Flying D Ranch, which has over 3,000 head. Bison are raised for meat, novelty items, breeding stock, trophy hunting, and wildlife preserves and zoos. Bison ranching is a young and rapidly growing industry. The National Bison Association estimates that 7.5 million pounds of meat from approximately 15,000 bison are sold annually in the United States. However, the industry is extremely small compared to the cattle industry, which slaughters over 124,000 cattle per day.

The auction price of live bison was fairly constant in the United States from 1975 to 1985, averaging about $600 per animal at the National Bison Association Gold Trophy auction in Denver. Since then, however, the average price per animal has steadily increased to about $4,300 per animal in 1997. A two-year-old bull sold for as much as $90,000 at the Gold Trophy Show in January of 2000. The price of a live bison depends on its age, sex, and the location of the sale. Heifers, mature cows, and mature bulls are generally more valuable as breeding stock than as meat. Table 26 samples the results of recent auctions in Kansas and South Dakota and compares them to the 2000 National Bison Association Gold Trophy auction.

The alternatives are not expected to have more than a negligible impact on bison ranching; therefore, it is not analyzed as a topic in the "Environmental Consequences: Impacts on Livestock Operations" chapter. However, it is included here to show auctioning live bison may result in agency income higher than the $337 average from the auction of bison meat, hides, and heads used to calculate revenues for each alternative (also see the "Socioeconomics" section). Only those alternatives with quarantine facilities (currently alternatives 3, 4, and 7) would be able to provide a source of live bison, as any seronegative Yellowstone bison must complete a full quarantine protocol before it could be transported to a reservation or other location.

PROPERTY DAMAGE BY BISON

In 1991, 90 incidents involving bison (1 to 55 bison per incident, but usually involving small groups of bulls) were recorded by the Montana Department of Fish, Wildlife and Parks, the agency responsible before 1994 for managing and recording bison-related complaints and incidents. Most reported

Table 26: Average Auction Sales for Bison from Different Regions

Sex/Age Group	Kansas Buffalo Association November 17, 1998	Custer State Park (Black Hills, SD) September 1998	Gold Trophy Show (Denver, CO) January, 2000
Heifer	$2,362 (yearlings)	$2,526 (calves)	$6,274 (yearlings)
Bull	$906 (2-year olds)	$875 (calves)	$9,615 (2-year olds)
Mature cow	$3,091 (bred)	-	$4,177 (bred)
Average (all bison sold)	$1,834	$1,700	$4,323

SOURCE: National Bison Association 2000.

Table 27: Number and Type of Bison Nuisance Incidents in the State of Montana, 1991–1993*

Type of Incident	1991	1992	1993
Reported bison incidents	90	47	6
Bison involved in total incidents**	435	124	21
Incidents			
Road nuisance	23	12	2
Road kills	5	2	2
Fence damage	12	6	0
Landscape damage	2	2	1
Property damage	1	1	1
Personal safety	19	5	2
Threat to livestock	24	9	0
Vehicle damage	7	5	2
On property	17	10	0
Injured bison on road	4	5	1

* Most recently recorded data.

** May involve the same bnison more than one time.

incidents (92%) were complaints originating in the West Yellowstone area along U.S. Highway 191, with the remainder reported in the Gardiner area. The incidents include road nuisances, threats to personal and livestock safety, and property damage, as shown in table 27 for 1991–93. Losses due to road accidents, livestock damage, and fences and landscape destruction were not recorded, with the exception of damage to one vehicle in 1992 valued at $1,000.

In Yellowstone National Park during 1993 and 1994, five motor vehicle accidents were the only visitor reports of private property damage caused by bison. Damages were estimated to total $17,800. Records were not examined before 1993, but personal accounts indicate that this frequency of bison-related accidents is typical. Records of damage to public property by bison are not maintained. During 1996, a total of 15 motor vehicle accidents involving bison inside Yellowstone National Park were recorded. In 1997, 14 accidents inside the park and 2 in the vicinity of neighboring areas of Montana were recorded (NPS, unpubl. data).

While anecdotal accounts might suggest that bison damage to public and private property is not a major problem, the individuals directly affected sometimes sustain sizable costs. Recent instances in which horses have been gored by bison demonstrate the serious but infrequent threat bison can pose for livestock producers.

SOCIOECONOMICS

REGIONAL ECONOMY

The analysis area for the regional economy is a part of the Greater Yellowstone Area. It includes Park and Gallatin Counties, and in some cases (livestock sector analysis) Madison County, as well as portions of Yellowstone National Park (see the Region and Greater Yellowstone Area maps).

Throughout the Greater Yellowstone Area, public lands provide the basis for much of the economic activity (recreation, mining, forestry, and agriculture) that occurs in the region. The area's overall economy has been changing for more than 20 years. The economy has shifted from commodity-extraction dependence to a more diversified economy based on recreation, tourism, and service industries. For example, between 1969 and 1989, more than 96% of all new jobs in the Greater Yellowstone Area came from sectors other than timber, mining, and agriculture (Rasker, Tirrell, and Kloepfer 1992).

> *Throughout the Greater Yellowstone Area, public lands provide the basis for much of the economic activity (recreation, mining, forestry, and agriculture) that occurs in the region.*

Employment

The diversification of the economy in the Greater Yellowstone Area and the growth in the total number of jobs has helped keep unemployment in Gallatin and Park Counties relatively low, between 2.6% and 4.8% in 1996 (Montana Department of Labor and Industry annual figures). The economy is diversifying to include both extractive industries and service industries and provides a more stable employment for the region.

Employment by economic sector in the two counties is shown in table 28. Approximately 8% of Park County employment and 5% of Gallatin County employment is in the agriculture, forestry, and mining sectors. In addition, some component of employment in manufacturing, wholesale and retail trade, and services is derivative of activity in these resource-based sectors. Most jobs pertaining to the recreation and tourism industry are found in the retail trade and service sectors of a county's economy.

Income

Total employment for the two-county area is shown in table 28, while the percent allocation of income by major industry is shown in table 29; retail trade and services account for approximately 43%–50% of each county's earnings. These sectors, along with the government sector, have a strong tie to the region's resources and are expected to continue to be important and sustaining segments of the economy of the Greater Yellowstone Area.

Recreation Sector

Park Visitors. As noted in the "Recreation" chapter, recreational use of the affected environment is a key component of the area's economy. Summer visitors to Yellowstone National Park from outside Montana, Wyoming, and Idaho spent an average of $735 during their trips (Duffield et al. 2000a), and winter visitors to the park spent an average of $1,129 during their trips (Duffield and Neher 1999).

A 1994 report on snowmobiling in Montana found nonresidents spend approximately $40 million annually in the state, and three-fourths of those nonresidents spent time in or near West Yellowstone (Sylvester and Nesary 1994).

Table 28: Industry Breakdown of Employment for Park and Gallatin Counties, 1997 (Number of Individuals Employed)

Industry	Park County	Gallatin County	Total
Total farm	442	974	1416
Total nonfarm	8,632	45,098	53,730
Private	7,796	36,553	44,349
Miscellaneous agriculture and forestry	209	712	921
Mining	41	145	186
Construction	759	3,804	4,563
Manufacturing	535	2,985	3,520
Transport/utilities	371	1,559	1,930
Wholesale	206	1,665	1,871
Retail	1,931	9,678	11,609
Insurance/real estate	614	2705	3,319
Services	3,130	13,300	16,430
Government	836	8,545	9,381

SOURCE: U.S. Dept. of Commerce, Bureau of Economic Analysis, Regional Economic Information System, 2000.

TABLE 29: PERCENT ALLOCATION OF INCOME BY MAJOR INDUSTRY FOR PARK AND GALLATIN COUNTIES, 1997

Industry	Park County	Gallatin County
Mining and construction	13.51	12.68
Manufacturing	9.74	9.15
Other*	8.93	6.07
Retail trade	15.31	15.73
Finance, insurance, and real estate	5.13	5.38
Services	33.21	27.95
Government	13.03	21.44
Farm	1.14	1.60

SOURCE: U.S. Dept. of Commerce, Bureau of Economic Analysis Regional Economic Information System, 2000.

*Includes agricultural services, forestry, and fisheries; transportation and public utilities; wholesale trade.

A remaining element of the affected environment with regard to park visitors is the possibility of a tourism boycott. The call for a boycott would likely be associated with the killing of bison, either by agencies or hunters. Boycotts have been attempted in response to the hunting of Yellowstone bison in 1988–89, and in response to high levels of agency shooting and slaughter during the winter of 1996–97 under the provisions of the interim plan.

Hunters. From 1987 to 1990 bison that migrated out of Yellowstone National Park into Montana were hunted by sportsmen in a controlled situation. Expenditures associated with this activity were not measured, but elk hunter expenditures probably provide a good estimate of what bison hunters would spend. Big-game hunting is a major activity in the Greater Yellowstone Area in Montana, and elk and deer are the primary species hunted during the season. Resident elk hunters spent an average of $54.00 per day while resident deer hunters spent $41.00 a day. Average nonresident hunters expenditures associated with elk and deer hunting are $252.00 and $115.00 per day, respectively (Duffield 1988).

Livestock Sector

Based on U.S. Forest Service information on cow-calf operations to the north and west of Yellowstone National Park, it is estimated that there are about 725 cow-calf pairs to the north of the park and 1,294 pairs in the West Yellowstone area grazing land that would lie within the boundaries of the most extensive of the SMAs described in this environmental impact statement. Gallatin County has about 58,000 cattle and calves, and Park County has about 45,000 cattle and calves, as shown in table 30.

Table 30 also indicates some differences between the livestock populations in the two counties. Gallatin County has livestock cash receipts 1.7 times those of Park County. Whereas Gallatin County has a smaller number of beef cows, this is balanced by larger milk cow, sheep, and swine populations, and twice the number of total farms and ranches found in Park County. As the last column of the table shows, livestock cash receipts for the two counties together represent about 4.3% of livestock cash receipts statewide.

Madison County is also included in table 30 (and table 31). Although it does not border Yellowstone National Park, during the winter of 1996–97 there were two instances of bison migrating along roads to within 1 mile of livestock in Madison County. Nine bison made the trek in January, and 13 bison made the trek in late February. As shown in table 30, Madison has a significant livestock industry that could be jeopardized by such incursions. Although Gallatin, Park, and Madison Counties contain a relatively small portion of Montana's total livestock wealth, cattle are as important to these counties' economies as they are for the state as a whole, as indicated in table 31. About one-half of agricultural cash receipts for Gallatin County and for Montana are from the sale of livestock and livestock products. In Park and Madison Counties, livestock provide around 80% and 70% of agricultural cash receipts, respectively.

About 54% of Montana's agricultural cash receipts come from the sale of livestock and livestock products (table 31).

This demonstrates the importance of cattle, and especially cow-calf production, for the state. Statewide, the number of cow-calf operations in 1998 numbered 14,000, and the inventory of cattle and calves totaled 2.6 million in January 1999. Because Yellowstone National Park bison are exposed to brucellosis, their movement into Montana subjects livestock producers in that state to risks of disease transmission and economic sanctions from state animal health authorities.

Table 30: Livestock Production in Gallatin, Park, and Madison Counties, and State of Montana

	Total Farms/ Ranches 1997	Approximate Total Acres and Proportion in Farmes/Ranches 1997	All Cattle & Calves Jan 1999	Beef Cows Jan 1999	Milk Cows Jan 1999	Sheep Jan 1999	Swine Jan 1997	Livestock Receipts 1997
Gallatin Co.	835	1,604,386–47.4%	58,000	27,000	4,600	6,700	3,982	$30,564,00
Park Co.	420	1,699,943–44.1%	45,000	30,500	-[1]	3,000	207	$18,081,000
Madison Co.	460	2,295,443–47.0%	78,000	47,000	-[1]	8,600	99	$25,156,000
State of MT	24,279	92,999,006–63.0%	2,600,000	1,532,000	18,000	380,000	177,740	$1,130,207,000

SOURCE: All 1997 data are taken from the 1997 Census of Agriculture. All 1999 data are taken from Montana Agricultural Statistics Service (www.nass.usda.gov/mt).

1. Not available.

Table 31: Cash Receipts from Livestock for Gallatin, Park, and Madison Counties, and Montana, 1997

	Livestock and Livestock Products	All Agricultural Cash Receipts	Proportion from Livestock
Gallatin County	$30,564,000	$63,080,000	48%
Park County	$18,081,000	$22,890,000	79%
Madison County	$25,156,000	$36,647,000	69%
State of Montana	$1,130,207,000	$2,090,562,000	54%

SOURCE: Bureau of Economic Analysis, U.S. Department of Commerce, as reported by the Montana Agricultural Statistics Service.

Therefore, the affected environment potentially includes, indirectly, Montana's entire cattle industry, in addition to livestock producers directly affected in areas adjacent to Yellowstone National Park.

BISON AS FOOD

Bison meat sells for nearly twice the cost of beef because it is considered a health food by some consumers. It is lower in fat than beef and is generally organically grown. The current retail price of bison meat ranges from $3.95/lb (90% lean hamburger) to $17.95/lb (tenderloin) in Colorado.

Most of the commercially available meat comes from 24- to 30-month-old bulls that weigh from 900 to 1,100 pounds. This slaughter weight is equivalent to the standard cattle slaughter weight. The dressing percentage of bison (60%) is similar to cattle (Hawley 1989). Finished bulls are sold for 1.30/lb, or $1,450 for a 1,100-pound bison (adjusted to 1996 U.S. dollars) (Baier 1991). The hides, horns, and skulls are also valuable (Hawley 1989).

The meat of older bison is tough and gristly and used mostly for hamburger. The salvage (hamburger) value for a mature cow bison is about $800 and a mature bull is $1,500 (National Bison Association 1997b).

During the 1996–97 winter, the Montana Department of Livestock slaughtered and sold at auction 459 bison for a total of $154,506, averaging $337 per animal. This value per animal was probably much lower than market price for several reasons: (1) the bison were not necessarily of marketable age (either older or younger than the optimal market age), (2) some of the bison were suspected to have brucellosis, which, although not a human health risk in consuming the meat, may have been perceived as such, (3) the perception that the bison left Yellowstone National Park in search of food suggests they had low body weight, (4) there is not an established market in Montana for bison auctioned by the Department of Livestock, and (5) the unexpectedly large number of bison sold in such a short time may have lowered the going price. The most saleable item apparently was trophy-size heads (skulls and horns), which sold for as much as $380 apiece (Wilkinson 1997).

MINORITY AND LOW-INCOME POPULATIONS

Alternative bison management strategies have the potential to affect differing socioeconomic groups in different ways. Table 32 gives an overview of how Park and Gallatin Counties compare to the state of Montana in per capita income and percent of population in poverty and unemployment rate. Also shown in the table are these statistics for the Montana Native American population. As of the 1990 U.S. census, Park County had a per capita income of $11,378, approximately equal to that of the state of Montana. Gallatin County had a substantially higher income level of $17,032 per person. The percent of the population in poverty across the two counties and the state was relatively consistent in 1990 at between 15.2% and 17.1%. Unemployment in the two counties in 1996 was below the state average of 5.3% (Park and Gallatin County unemployment was 4.8% and 2.6%, respectively). Table 32 shows that Montana's Native American population had a much lower per capita income ($5,422) than either the two counties or the state, and a much higher percent of population living in poverty (46.1%) and unemployment rate (26.2%) much higher than the counties or the state.

Table 32: Comparative Statistics on Economic Status, 1989

Statistic*	Montana Native Americans	Park County	Gallatin County	State of Montana
Per capita income	$5,422	$11,378	$17,032	$11,213
Percent of population in poverty	46.1%	15.2%	17.1%	16.1%
Percent unemployment	26.2%	4.8%	2.6%	5.3%

* Per capita income and poverty status statistics and Native American unemployment rate are from U.S. Bureau of the Census, 1990 U.S. Census Data. Percent unemployment is from Montana Department of Commerce, Office of Research and Analysis, Helena, MT.

Management officials and hunters have killed a total of 3,076 bison outside the park in Montana between 1984–85 and 1996–97, including 1,084 killed under the federal- and state-approved interim management plan in 1996–97. The killed bison have been donated to charities and Native Americans who were able to go to the shooting location and gut and haul away the carcasses. Native American tribes, tribal members, and affiliated organizations received about 60% of the bison killed in 1991–92, 90% of those killed in 1994–95, and 47% of those killed under the interim management plan in 1996–97. Native Americans have received over 1,000 bison carcasses since the 1991–92 winter. Charities received about 7% of those killed in 1996–97 (State of Montana, Clarence Siroky, pers. comm.), and have also received bison carcasses in previous years.

Tribes, Indian alliances, and individual tribal members that have received bison include the Blackfeet, Salish and Kootenai, Gros Ventre, Assiniboine, Nez Perce, Shoshone-Bannock, Crow, Cherokee, Chippewa, Little Shell, Yakima-Umatilla, Rosebud Lakota Sioux, Ogalala Sioux, Sisseton Wahpeton, Northern Cheyenne, the Montana State University-Big Sky Indian Alliance, Helena Indian Alliance, and the Butte Indian Alliance.

In addition, charities (not directly affiliated with Native American groups) receiving bison include the Baptist and Community Churches in Gardiner, Gallatin Food Bank, Bozeman Shelter Care, Gold Hill Lutheran Church in Butte, Livingston Food Bank, Powell County Senior Citizen Group, St. Paul's Lutheran Church in Harlowton, St. Mary's Catholic Church in Livingston, West Yellowstone Food Bank, Montana Guides and Outfitters Food For the Hungry, and the Whitefish Food Bank.

SOCIAL VALUES

This section describes general attitudes toward wildlife and the livestock industry. None of these attitudes is superior or inferior to another.

The general public has strongly held divergent values and opinions on public policy issues concerning wildlife management. As an example, the draft environmental impact statement concerning wolf recovery in Yellowstone National Park received over 160,000 comments, more than any other federal action ever proposed in the U.S. (E. Bangs, pers. comm.). Similarly, proposals concerning the use of leg-hold traps, bear-baiting, and aerial gunning of wolves have been decided through public referenda in states including Colorado, Idaho, and Alaska.

The general public also has strongly held divergent values and opinions on public policy concerning ranching. Since the mid-1890s, livestock ranching has been an integral part of Montana's social character. Ranching and other agricultural activities continue to provide open range for wildlife. All 56 of Montana's counties have livestock operations.

The social values at issue in the bison-brucellosis conflict in the greater Yellowstone ecosystem are as disparate as the participants. As Thorne, Meagher, and Hillman (1991) comment: "Whereas most people regard the GYE [Greater Yellowstone Ecosystem] and its wildlife as a world treasure, because of its reservoir of brucellosis, others regard the GYE as a threat to an important international industry and economy and a black eye to their efforts."

Management of bison in the Yellowstone area has become a matter of national attention and interest. In recent years individuals and groups representing many viewpoints have challenged management practices, both in court and in a variety of public forums.

Some residents across the country may not understand the science behind the management actions of alternatives in this environmental impact statement because many perceive the bison as an endangered species, which it is not.

During 1999 three surveys on issues related to the bison/brucellosis issue were administered to both visitor and resident populations. The surveys of winter and summer park visitors and regional and national residents asked respondents several questions on attitudes towards wildlife, recreation, and bison issues. Tables 33, 34, and 35 show aggregate levels of agreement and disagreement with various statements on wildlife and bison issues for the random phone, summer visitor, and winter visitor samples, respectively.

Table 36 summarizes the ratio of respondents (who expressed an opinion) that agreed and disagreed with the survey questions.

As an example of these findings, the 1999 summer visitor survey in Yellowstone National Park found that summer park visitors expressed strong environmental concerns on some general issues (96.9% agreed that they have a great deal of concern for protecting wildlife habitat, and 89.9% agreed that it is important to protect rare plants and animals to maintain genetic diversity). On a more specific bison-related issue, 42.9% agreed that it was appropriate to kill bison at park boundaries in order to protect domestic livestock (Duffield et al. 2000a). Among a national random phone population, the results were similar (93.7% expressed great concern for wildlife habitat, 91% agreed with the importance of protecting rare plants and animals, yet 51.5% felt it was appropriate to kill bison to protect domestic livestock. (Duffield et al. 2000b). These results seem to indicate that many divergent and confounding issues and concerns are at play in the Yellowstone Bison issue, and people consider all aspects of the problem in formulating their attitudes and opinions on the subject.

Rural Way of Life

Montana has remained a very rural state deep in traditions founded in this rural way of life. Most Montanans believe agriculture and the businesses and communities it supports are paramount in maintaining this way of life.

While Montana's population and distribution of population has fluctuated and changed over its history, it remains rural. In 1989 about 53% of Montanans lived in urban areas compared to 74% nationally. Montana's first census conducted in 1870 found that the territory had fewer than 21,000 people. Today Montana is the fourth largest state geographically (145,388 square miles), and the 1990 census concluded that Montana had about 800,000 residents. There are 5.5 people per square mile in Montana, and no city has a population of 100,000 (Montana Agriculture Statistic 1996).

NATIVE AMERICANS

Bison embody the culture of many native Plains peoples. Bison are a link to the spiritual world; many tribes connect their cultural and spiritual identity to them. Bison were perceived as the "great provider" for non-agrarian tribes as they were essential to the spiritual, cultural, and physical well-being of the tribe. These relationships and beliefs have spanned the centuries of bison and tribal interaction. Today bison are directly tied to ceremonies such as traditional powwows. Bison skulls are used as altars, bone is used on traditional costumes,

Table 33: Level of Agreement and Disagreement with Statements Regarding Bison and Brucellosis Management in the National Phone Survey: By Population

Variable/Statistic*	Local Sample	Regional Sample	National Sample
Access			
% Agree	63.7%	63.1%	49.0%
% Disagree	28.1%	27.5%	37.6%
Disturb			
% Agree	62.4%	67.6%	77.4%
% Disagree	27.8%	24.4%	9.3%
Grazing			
% Agree	66.9%	61.2%	49.2%
% Disagree	33.2%	26.9%	33.5%
Kill			
% Agree	55.7%	56.0%	51.5%
% Disagree	33.6%	31.9%	33.2%
Range			
% Agree	43.3%	43.5%	42.6%
% Disagree	45.0%	45.4%	41.7%
Don't Vaccinate			
% Agree	53.6%	59.8%	61.4%
% Disagree	30.3%	27.0%	20.5%
Sample Size	413	408	405

*Note:

Access: Visitors should have the opportunity for mechanized winter access into Yellowstone National Park.

Disturb: I am concerned about the possible disturbance of Yellowstone wildlife in the winter.

Grazing: Livestock grazing is an appropriate use of national forest lands around Yellowstone National Park.

Kill: It is appropriate to kill bison at park boundaries as necessary to protect domestic livestock.

Range: Yellowstone bison should be allowed to range onto public lands outside Yellowstone National Park.

Don't Vaccinate: All bison in Yellowstone National Park should be rounded up and tested for the disease rather, then either slaughtered or vaccinated.

Table 34: Level of Agreement and Disagreement with Statements Regarding Bison and Brucellosis Management in the Summer Visitor Study: By Population

Variable/Statistic*	Resident	Nonresident	Sample size
Access			
% Agree	51.4%	37.5%	1067
% Disgree	33.7%	25.9%	
Disturb			
% Agree	67.2%	60.2%	1067
% Disagree	15.4%	9.4%	
Grazing			
% Agree	48.6%	48.6%	1064
% Disagree	31.3%	36.3%	
Kill			
% Agree	42.5%	43.1%	1064
% Disagree	44.8%	44.8%	
Range			
% Agree	48.1%	39.8%	1061
% Disagree	35.0%	33.4%	
Vaccinate			
% Agree	21.5%	35.4%	1061
% Disagree	52.7%	28.4%	

*Note:

Access: Visitors should have the opportunity for mechanized winter access into Yellowstone National Park.

Disturb: I am concerned about the possible disturbance of Yellowstone wildlife in the winter.

Grazing: Livestock grazing is an appropriate use of national forest lands around Yellowstone National Park.

Kill: It is appropriate to kill bison at park boundaries as necessary to protect domestic livestock.

Range: Yellowstone bison should be allowed to range onto public lands outside Yellowstone National Park.

Vaccinate: All bison in Yellowstone National Park should be rounded up and tested for the disease, then either slaughtered or vaccinated.

Table 35: Level of Agreement and Disagreement with Statements Regarding Bison and Brucellosis Management in the Winter Visitor Study: by Population

Variable/Statistic*	Park/Resident	Park/Nonresident
Access		
% Agree	57.2%	73.1%
% Disagree	30.0%	15.6%
Disturb		
% Agree	2.8%	60.3%
% Disagree	23.7%	21.0%
Grazing		
% Agree	47.6%	40.4%
% Disagree	38.4%	33.6%
Kill		
% Agree	38.6%	45.3%
% Disagree	51.1%	36.0%
Range		
% Agree	58.6%	43.9%
% Disagree	26.2%	32.0%
Vaccinate		
% Agree	20.8%	30.3%
% Disagree	56.9%	38.4%
Sample size	440	697

*Note:

Access: Visitors should have the opportunity for mechanized winter access into Yellowstone National Park.

Disturb: I am concerned about the possible disturbance of Yellowstone wildlife in the winter.

Grazing: Livestock grazing is an appropriate use of national forest lands around Yellowstone National Park.

Kill: It is appropriate to kill bison at park boundaries as necessary to protect domestic livestock.

Range: Yellowstone bison should be allowed to range onto public lands outside Yellowstone National Park.

Vaccinate: All bison in Yellowstone National Park should be rounded up and tested for disease, then either slaughtered or vaccinated.

** Resident = a resident of Idaho, Montana, or Wyoming.

Table 36: Social Values: Ratio of Attitude Statements of Respondents from Phone, Summer Visitor, and Winter Visitor Surveys

	Phone			Summer Visitor		Winter Visitor	
	Local	Regional	National	Resident	Nonresident	Resident	Nonresident
Access	2:1 agree	2:1 agree	1.3:1 agree	1.5:1 agree	1.4:1 agree	2.4:1 agree	4.7:1 agree
Disturb	2:1 agree	3:1 agree	9:1 agree	4.4:1 agree	6.4:1 agree	2.6:1 agree	3:1 agree
Graze	2:1 agree	2:1 agree	1.5:1 agree	1.6:1 agree	1.1:1 agree	1.2:1 agree	1.2:1 agree
Kill	1.7:1 agree	1.8:1 agree	1.6:1 agree	1:1 divided	1.2:1 agree	1.3:1 disagree	1.3:1 agree
Range	1:1 divided	1:1 divided	1:1 divided	1.4:1 agree	1.2:1 agree	2.2:1 agree	1.4:1 agree
Don't vaccinate	1.8:1 agree	2.2:1 agree	3:1 agree	-	-	-	-
Vaccinate	-	-	-	2.5:1 disagree	1.2:1 agree	2.7:1 disagree	1.3:1 disagree

and they are the subject of many dances. Appendix I summarizes the comments by tribes regarding the importance of bison to their culture.

The Inter-Tribal Bison Cooperative is dedicated to the restoration of bison to the daily lives of Indian people for economic development, cultural enrichment, and environmental restoration. They have proposed transporting surplus bison from Yellowstone to tribal reservations where they would join bison already on ranches. Some tribes are not members of the cooperative because they do not agree with the economic emphasis placed on the return of bison.

A relatively small number of responses to the 1999 survey questions detailed in tables 33 and 34 were from Native Americans (15 responses in the summer visitor survey and 17 in the phone survey). These responses from Native Americans generally indicate a greater level of concern for bison populations and well-being than do the responses from the non-Native American population. Among summer visitors, 46.7% of Native American respondents felt bison should be allowed to range onto public lands outside of the park, while 41.2% of the total sample of summer visitors agreed they should.

Additionally, while 42.9% of the total sample of summer park visitors felt it is appropriate to kill bison at park boundaries to protect domestic livestock, only 21.4% of Native American respondents agreed this action is appropriate. Lastly, while 42% of the full sample of summer visitors agreed livestock grazing was an appropriate use on national forest lands outside the park, only 33.3% of Native American respondents agreed this was appropriate.

Hunters

Bison represent a prize game animal "due to its symbolism as part of the West, part is due to its value as meat and as a trophy." Hunting in general is viewed as essential and a natural part of ecosystems, as it is a natural human activity and may be "an instinct after millions of years."

Cattle Ranching

Cattle ranches and the cowboys who ran them represent a different type of "popular cultural icon" as "people around the world recognize the American cowboy as a national symbol" (Slatta 1991). Cattle frontiers "separated indigenous and European cultures" from the onset. "White, European values met and mixed with indigenous cultures on the Plains" resulting in competition for resources (Slatta 1991).

Organization advocates include the Montana Stockgrowers Association, which is dedicated to promoting the economic, political, environmental, and cultural interests of the livestock industry in Montana. The association works to improve economic opportunities for ranchers, improve access to political avenues in areas of concern, and ensure that the traditional farming and ranching livelihoods are not adversely affected by the continuing evolution of the human or natural environments.

A 1999 random phone survey (Duffield et al. 2000b) found that 49.2% of national respondents and 61.2% of regional respondents agreed with the statement "Livestock grazing is an appropriate use on national forest lands around Yellowstone National Park" (see table 33). The 1999 Yellowstone National Park summer visitor survey similarly found that more agreed than disagreed with the statement.

Bison Ranching

Private ranchers are involved with managing bison for meat production. The relatively low-maintenance bison have become lucrative market animals.

There are also those who oppose bison ranching (e.g., Farm Animal Reform Movement, Humane Farming Association). They note the environment is damaged enough without bison ranching. They feel that "if left alone by humans, bison do a good job of protecting themselves, and don't need to be exploited in order for the species to survive."

Other groups, such as the Humane Society of the United States, note both positive and negative aspects of bison ranching. As an industry, bison ranching is "ecologically a step forward as an alternative to continuing to graze the wrong species, namely, cattle, on the high plains and prairies." The negative aspects revolve around questionable husbandry practices, primarily transportation and slaughter. Currently, bison ranchers get more income from skins and skulls than from the carcasses (Dillingham 1997).

Conservation Associations

It is impossible to define a single "conservation ethic," as conservation associations differ in their views depending on the resource they are attempting to conserve. The following views represent only two of many different and divergent conservation groups.

The Greater Yellowstone Coalition's mission is to preserve and protect the Yellowstone area and its unique quality of life including its biodiversity, geothermal activity, rural lifestyle, ranches, and small towns. According to the coalition there is a "fundamental question" for the park's bison management policy: "Is Yellowstone a sanctuary for wildlife or are we going to allow the livestock industry to turn it into a livestock yard and zoo?"

The National Parks and Conservation Association believes "bison should be allowed to roam freely in Montana," and has asked supporters to inform government agencies to that effect. It also holds that "there is an insignificant risk, if any, of the transmission of the bacteria causing brucellosis from bison to cattle," and that "Yellowstone bison are scientifically, historically, and aesthetically important and should be protected." If the state of Montana implements and defends the "anti-bison" policy the association has encouraged that "vacation dollars be spent elsewhere."

Animal Rights Concerns

Animal rights groups believe bison should not be shot regardless of jurisdictional boundaries. Also, they voice concerns over animal rights violations within the overall ranching industry, which they perceive as dominating bison management decisions.

Animal protectionists and open-range cattle ranchers agree on some issues. The most humane domestic ranching operations, according to both, sends fewer animals to market; raises them in the way most natural to the species; treats them with the least cruelty possible; and uses husbandry practices that avoids cruelty to other species. Western cattle ranchers, for the most part, do not confine animals nor are calves separated from their mothers. The animals live in "semi-natural herds under semi-natural conditions." Open-range ranchers are the smallest part of the beef industry but provide a more humane form of meat production for the future (Rollin 1989).

The 1999 random phone survey found that more respondents agreed than disagreed with the statement "It is appropriate to kill bison at park boundaries, as necessary, to protect domestic livestock," by about a 1.7 to 1 ratio. Park visitors were more divided on the issue with resident and nonresident visitors having an agreement/disagreement ratio of approximately 1.2 to 1 (see table 36).

Attitudes Toward Wildlife

There is extensive literature concerning general social attitudes and values towards wildlife. For example, Kellert (1976) identified a number of distinct attitudes toward wildlife including naturalistic, ecologistic, humanistic, moralistic, scientistic, aesthetic, utilitarian, dominionistic, and negativistic (see table 37 for definitions).

Most people typically possess more than one attitude toward animals and react differently in different situations. Nonetheless, it is possible to identify in most people predominant characteristics of a primary attitude toward animals. For example, animal rights groups tend to have a moralistic attitude towards animals, while scientists tend to take a scientific view (Kellert 1976).

A number of empirical studies reflect attitudes toward wildlife, particularly large carnivores (e.g., McNaught 1987; Llewellyn 1978; Bath 1991; Kellert et al. 1996). Llewellyn classified comments received concerning a proposed change in wolf status in Minnesota from endangered to threatened. Those commenters who favored maintaining the endangered species classification most frequently expressed ecologistic, moralistic, and naturalistic attitudes (as defined in table 37). By contrast those favoring declassifying wolves had predominantly utilitarian and negativistic attitudes.

Approximately 260 comment letters were received concerning the *Interim Bison Management Plan/Draft Environmental Assessment* (NPS and State of Montana 1995). The assessment was issued in December 1995 and most comments were received in January 1996. Based on a review of the written comments, the feature of the proposed plan about which commenters felt most strongly was the killing of bison. This suggests, not surprisingly, that

TABLE 37: PERCEPTIONS OF ANIMALS IN AMERICAN SOCIETY

Attitude	Key Identifying Terms	Highly Correlated With	Most Antagonistic Toward
Naturalistic	Wildlife exposure, contact with nature	Ecologistic, humanistic	Negativistic
Ecologistic	Ecosystem, species interdependence	Naturalistic, scientistic	Negativistic
Humanistic	Pets, love for animals	Moralistic	Negativistic
Moralistic	Ethical concern for animal welfare	Humanistic	Utilitarian, dominionistic, scientistic, aesthetic, negativistic
Scientistic	Curiosity, study, knowledge	Ecologistic	None
Aesthetic	Artistic character and display	Naturalistic	Negativistic
Utilitarian	Practicality, usefulness	Dominionistic	Moralistic
Dominionistic	Mastery, superiority	Utilitarian, negativistic	Moralistic
Negativistic	Avoidance, dislike, indifference, fear	Dominionistic, utilitarian	Moralistic, humanistic, naturalistic

SOURCE: S. Kellert (1976)

social values related to moralistic and humanistic beliefs and attitudes are definitely at issue in the bison-brucellosis conflict. Also, just as in Llewellyn's (1978) analysis of the wolf declassification issue in Minnesota, another opinion apparent in these letters often strongly expressed practical or utilitarian views concerning the impact of brucellosis on livestock.

The bison-brucellosis controversy concerning the Yellowstone area is not the only such conflict in North America. There is a parallel in Wood Buffalo National Park in the Northwest Territories of Canada. Research into social and economic values is apparently underway in this case (J. Chisholm, pers. comm.). While no formal analysis of social values is yet complete, general public opinions toward several possible management options in Canada have been revealed through public debate. In 1990 the Canadian Environmental Assessment Panel on this issue recommended that "all free-ranging bison now living in Wood Buffalo National Park and surrounding areas be removed and replaced by disease-free bison" (Wood Buffalo National Park 1997).

According to Wood Buffalo National Park: "The recommendation of the panel received mixed response. While agricultural interests and some environmental groups supported it, other environmental groups and aboriginal communities protested. There was a national outcry against the recommendation. More than 11,000 written protests were sent to the Minister responsible for Parks Canada; the largest response to any wildlife-related issue in Canada to date." In response to the outcry over the Canadian Environmental Assessment Panel recommendation, the proposal was abandoned and another panel formed. In 1992 the latter panel recommended that because of significant knowledge gaps concerning the epidemiology and ecological role of the disease and effects of possible management actions that a bison research program be initiated before developing a final action plan. A five-year research program was announced in 1995 and is underway. (Depopulation to the degree proposed in the Wood Buffalo herd is not part of any alternative analyzed in this environmental impact statement. It is cited here simply to show public reaction to bison slaughter.)

NONMARKET VALUES

The wildlife and natural environments of the Yellowstone area bison are of substantial value to winter and summer park visitors, hunters, and other individuals who value the idea that these resources are maintained in a viable state. Part of this value is reflected in the expenditures that visitors make for lodging, food, and other travel services [e.g., see "Regional Economy (Recreation Sector)" above]. However, the main reason that visitors make the often long and expensive trip to see Yellowstone National Park is not primarily to eat in West Yellowstone or spend a night in a motel in Gardiner. Visitors make these trips because the benefits of the trip exceed the dollar costs.

Benefit studies are concerned with the demand side of the tourism industry. Because visitors are charged only nominal or no fees for park visits or use of surrounding public lands for hunting or snowmobiling, trip values do not have market prices.

The nonmarket value (values for items not exchanged in established markets) of trips for both park visitors and hunters is measured by how much they would be willing to pay over and above the costs of the trip before they would choose to forego the trip (Ward and Duffield 1992).

Two 1999 studies of visitors to Yellowstone National Park estimated the median nonmarket value of a trip to the park. It was estimated that this nonmarket value was $56 for the three-state-resident summer visitors and $349 for summer nonresident visitors (Duffield et al. 2000a). A parallel study of winter visitors to Yellowstone National Park found that winter resident visitors had a median nonmarket trip value of $30, and winter nonresidents had a median value of $145. These median estimates indicate that visits to Yellowstone National Park are, as one would expect, highly valued experiences. However, it may be noted that this range of values is not without precedent for recreational trips. For example, Loomis, Cooper, and Allen (1988) estimated the value of elk hunting trips in some Montana districts at around $400/trip. These values would likely be considerably higher at present. Montana Department of Fish, Wildlife and Parks is currently using variable market prices to sell outfitter-sponsored nonresident combination licenses (which are mainly purchased for elk hunting). The market-clearing price in the last two years has been $835. Duffield (1988) estimated the value per day of elk hunting in districts around Gardiner, Montana, at $92.08 (1991 dollars).

Wildlife viewing is an important aspect of the Yellowstone National Park visitor experience, and it is likely that the abundance and variety of wildlife a given visitor actually sees affects the satisfaction and value placed on the trip. Duffield (1991) examined how the value of trips to Yellowstone National Park that were taken in October 1989 and August-September 1990 varied by whether the survey respondent had or had not seen elk. The median trip value for regional residents (Idaho, Montana, Wyoming) was $22 higher and $145 higher for nonresidents if elk were seen by the respondent. This study also estimated the impact of a 20% decline in elk populations on trip value. It was estimated that this would lead to only a small (3%) change in the probability that any given visitor would see an elk. The corresponding change in trip values was also small: $0.63 for residents and $4.61 for nonresidents. The annual value park visitors place on having wolves present in Yellowstone National Park for purposes of seeing or hearing them has been estimated at $7.34 for regional residents and $5.48 for out-of-region visitors (Duffield 1992).

The economic value of Yellowstone National Park resources is only partly measured by the demand for onsite use by park visitors, hunters, and other users. As the world's first national park, Yellowstone is clearly a resource of national and even international significance (Keiter and Boyce 1991). Many individuals value the idea that this resource and its wildlife are being maintained in a viable state independent of whether they will actually themselves be able to visit the park (USFWS 1994). This type of nonmarket value is sometimes termed "intrinsic," or "existence," or "bequest" value (Krutilla 1967). The existence of the resource itself (separate from direct use) or the motivation to provide the resource for future generations are the sources of this economic value.

A series of 1999 surveys (winter and summer visitors to Yellowstone National Park and samples of regional and national resident populations) asked respondents a series of questions designed to estimate nonmarket values associated with two specific aspects of the bison issue: expansion of winter range to allow for more bison to exit the park in winter months without being either hazed back into the park or killed and funding a bison vaccination program to eradicate brucellosis from Yellowstone area bison. Table 38 presents the estimated nonmarket values associated with the two programs (winter range acquisition and vaccination) for the different populations in the park visitor and resident phone samples.

The random phone survey of local (17 counties of the Greater Yellowstone Area), regional (3 states), and national populations was conducted in May and June of 1999. The calculated mean estimated value (bids were capped at $100) presented in table 38 are the values respondents placed on an action (either purchase of winter range or undertaking a bison vaccination program) next year, given the assumption that the same action would be free in 10 years. This assumption provides a conservative estimate of the mean willingness-to-pay values. The mean estimated values show a consistent pattern across programs — local area residents value a given program more highly than regional residents, and more highly still than the national population. Comparing the two actions, there appears to be little difference between the values for the two alternative actions. Additionally, the estimated standard errors for the means are relatively large, reflecting substantial uncertainty regarding the estimates. Although the estimates for the local and regional subsamples are imprecise, the response rate for these survey populations is sufficiently high for these estimates to be reliable. However, based on a standard of at least a 50% response rate (Arrow et al. 1993), the estimates for the national sample are probably unreliable and are not used in aggregation calculations presented in "Environmental Consequences."

The mean estimated values for the summer visitor population is also shown in table 38. Among summer visitors, the winter range acquisition option was valued more highly than was the vaccination program. It is difficult to compare the resident visitor and nonresident visitor populations because the very small sample size of the resident visitor sample resulted in large estimated standard errors (of the same general magnitude as the mean estimates).

A third survey of winter visitors to the park were asked similar valuation questions on the issues of winter range acquisition and vaccination of bison; however, no difference was found in this population between values for an action done next year and one undertaken 10 years from now. Because the

Table 38: Estimated Nonmarket Values for Bison Winter Range Expansion and Bison Vaccination Program

Population/ Valuation Scenario	Mean Estimated[2] ($) Nonmarket Values	Standard Error of Mean Value[3]	Sample Size	Survey Response Rate
Random Resident Phone Survey				
Local/Winter Range	$17.68	$9.07	189	58%
Regional/Winter Range	$15.12	$8.24	186	52%
National/Winter Range	$8.94	$7.81	170	36%
Local/Vaccination Program	$18.79	$10.86	190	58%[1]
Regional/Vaccination Program	$14.70	$6.98	198	52%
National/Vaccination Program	$9.20	$3.44	204	36%
Yellowstone National Park Summer Visitor Survey				
Nonresident/Winter Range	$24.45	$7.93	365	68%
Resident/Winter Range	$25.28	$19.88	70	68%
Nonresident/Vaccination Program	$12.65	$4.92	345	68%
Resident/Vaccination Program	$12.08	$15.08	82	68%

SOURCES: Duffield et al. 2000a, 2000b.

1. One response rate was calculated for each of the three different sample populations.
2. Mean was calculated after capping to $100 all bids in excess of $100.
3. Standard errors were simulated using the methods of Krinsky and Robb (1985), with 10,000 random draws from the estimated model's parameters.

winter visitor survey values lack a consistent framework, the more conservative summer visitor values are used in the impact analysis in this final environmental impact statement.

THREATENED, ENDANGERED, AND SENSITIVE SPECIES

This section describes the threatened, endangered, and sensitive species (collectively referred to as species of special concern) that may be affected by the alternatives (also see appendix H). Other species of special concern inhabit the project area, but are not expected to be affected in any way by the actions described in any of the alternatives.

Bison management has the potential to affect species of special concern in three ways: (1) directly through management actions, such as shooting and hazing, (2) by removing or polluting habitat that would otherwise be available for threatened or endangered plants or wildlife, and (3) indirectly by affecting the numbers and distribution of bison, which serve as live prey or carrion for threatened or endangered animals in some cases. The habitat and other relevant information for species that might be affected by such actions is described below.

ENDANGERED SPECIES

Peregrine Falcon

At the time the *Draft Environmental Impact Statement* was published, the peregrine falcon was listed as an endangered species. However, on August 26, 1999, the peregrine falcon was delisted.

Peregrine populations have been increasing in the Greater Yellowstone Area. The peregrine is found in open country near riparian areas and typically nests on rocky cliffs or in gorges. Birds are the primary component of the peregrine diet (Langelier 1989).

THREATENED SPECIES

Bald Eagle

The bald eagle nests and winters within the northern part of the Greater Yellowstone Area. In the analysis area, bald eagles winter and nest in the Seven-Mile Bridge area (between the west entrance and Madison Junction). They also concentrate around Hebgen and Quake Lakes near the Horse Butte area (U.S. Forest Service 1998). The Horse Butte nest has been occupied by bald eagles annually since 1977. The nest produced young between 1977 and 1987 and in 1992 (McMaster 1998). Although this nest had not produced young since 1992, it did produce young in 1999 and is occupied this year (2000). In addition, there are two other bald eagle nests in the Horse Butte area that were

…species of special concern inhabit the project area, but are not expected to be affected in any way by the actions described in any of the alternatives.

discovered in the early 1990s. These two nests have been active and have produced young during the 1990s and are occupied this year (2000).

In the Greater Yellowstone Area, bald eagles tend to nest around the periphery of lakes and reservoirs and in forested corridors along major rivers. Nests are most commonly constructed in multi-layered, mature, or old-growth stands of large-diameter trees of a variety of species including Douglas fir, pine, cottonwood, and spruce (U.S. Forest Service 1998). Large trees and snags provide important nesting and perching habitat.

Bald eagles display strong fidelity to a breeding area and often to a specific nest site. Activities associated with nesting follow a general timeline. Following building or repair of a nest, egg laying usually occurs between late February to mid-March. However, egg laying can occur as early as early February or as late as mid-April. With an incubation period that lasts 31 to 35 days, eagle chicks usually hatch between late March and early April. Once hatched, the eaglets remain in the nest for 11 to 14 weeks. Although the eaglets fledge somewhere between late June and late July, they depend on the adults for another 6 to 10 weeks.

The response of bald eagles to the approaching winter varies by age. As winter approaches, immature and subadult eagles typically leave the park. Research has found that many eagles in these age classes migrate in a westerly direction, often ending up near the Pacific Coast. In contrast, some pairs of adult bald eagles spend the entire winter near their nesting territory. Other pairs migrate to lower elevations, such as the area around Gardiner, Montana, to secure food (T. McEneaney, pers. comm.).

Foraging Habits of Bald Eagles. In the summer, bald eagles are often found in close association with water. However, they can be found venturing over mountain meadows and even the summits of mountain peaks on occasion. Their summertime prey is primarily fish and waterfowl.

Because bald eagles are opportunistic feeders, winter habitat for bald eagles often centers around the winter ranges of ungulates and portions of lakes that are not frozen and free-flowing rivers. Carrion and waterfowl are the primary food items taken by bald eagles in the winter. Fish can be a winter food item, but the icing of lakes and rivers decreases their availability compared with summer.

As noted above, bald eagles will scavenge the carcasses of large mammals succumbing to winterkill. This includes winterkills of bison. Scavenging most commonly occurs in winter and early spring (Stalmaster 1981; U.S. Forest Service 1998). Two studies on food habits in the Yellowstone area showed that mammals comprised 18% (Swenson 1975; U.S. Forest Service 1998) and 11% of the bald eagle's diet (Alt 1980; U.S. Forest Service 1998).

Sensitivity of Bald Eagles to Human Activities. Bald eagles are sensitive to human activities, including recreational activities, research, and resource and urban development. In general, they respond to human activities by avoiding them temporally or spatially. The magnitude of the response often depends on the type, intensity, duration, timing, predictability, and location of the human activities. Overall, eagles are most sensitive to human activities during the nest-building, egg-laying, and incubation phases of reproduction (about February 1 to May 30). Human activities during this time may cause a pair of eagles to abandon their nest. Although the adults are less likely to abandon the nest once the young have hatched, they may abandon the nest if disturbances are prolonged.

Although bald eagles are sensitive to human activities, they do appear to acclimate to at least some activities, particularly those that predictably occur at constant frequencies or intensities and within identifiable spatial limits. For example, recreational activities that occur along a specific corridor, such as snowmobiling and cross-country skiing along groomed trails, may be tolerated by bald eagles if they occur at a relatively constant rate of speed. Fishing from boats may also be tolerated more than fishing from shore. In contrast, if the snowmobilers or skiers stop along a trail or if they participate in more dispersed activities (e.g., traveling off groomed trails), bald eagles may not tolerate the activities (USFWS 1998c).

Grizzly Bear

The grizzly bear is classified as a threatened species. The project area is entirely within the Greater Yellowstone Grizzly Bear Recovery Zone and is almost exclusively management situation 1 (MS1) grizzly bear habitat. MS1 contains grizzly population centers (areas key to the survival of grizzlies where seasonal or year-long grizzly activity, under natural, free-ranging conditions is common) and habitat components needed for the survival and recovery of the species or a segment of its population. A portion of the project area falls within MS2 grizzly bear habitat. MS2 areas are those lacking distinct grizzly bear population centers or highly suitable habitat, although some habitat exists and grizzlies may be present occasionally. The entire area inside the park is considered MS1. The majority of the area proposed under the alternatives to be within SMAs or management zones outside the park lies within MS1 except for the area west of the park in the Horse Butte area (which is stippled on the alternative maps) and the lower elevation area along the Yellowstone

River north of the park both of which are MS2. The percentage of the SMAs that is comprised of MS2 varies from 0% to approximately 10%, depending on the alternative. In addition, MS3 has not been mapped on the national forest, but consists of developed areas, such as campgrounds and summer home sites where grizzly bear presence is untenable for humans and/or grizzly bears. Some of these MS3 areas lie within the areas considered as SMAs in the alternatives (e.g., Baker's Hole campground).

The grizzly bear population has increased in recent years (Knight and Blanchard 1995).

General Grizzly Bear Food Habits. Food habits of grizzly bears in the Yellowstone area vary greatly from year to year depending on availability of preferred foods. Although some bears depended heavily on garbage in the interior of the park prior to 1969–70, they shifted their diets to other foods when the dumps were closed in 1969–70 (Craighead et al. 1995). Craighead et al. (1995) suggest that bears may have increased their annual range sizes to compensate for loss of garbage food sources. They also suggest that the bear population decreased and bears redistributed themselves away from the Central Plateau and moved toward the park peripheries following the closing of the dumps. Researchers relate reduced litter sizes in grizzly bears to the loss of garbage in the diet. Human-caused mortality of grizzly bears increased after the dumps were closed (Craighead et al. 1995), and the grizzly bear population is reported to have declined from 1967 through 1980 (Craighead, Varney, and Craighead, Jr. 1974; Knight and Eberhardt 1985). By the mid-1980s, human-caused mortality of adult female grizzly bears had decreased and began to allow the grizzly bear population to increase again (Eberhardt and Knight 1996).

Bears are omnivores that have relatively unspecialized digestive systems similar to those of carnivores. The primary difference is that bears have an elongated digestive tract, an adaptation that allows bears more efficient digestion of vegetation than other carnivores (Herrero 1985). Unlike ruminants, bears do not have a cecum and can only poorly digest the structural components of plants (Mealey 1975). To compensate for inefficient digestion of cellulose, bears maximize the quality of vegetal food items ingested, typically only foraging for plants in the phenological stages that are highly nutritious and digestible(Herrero 1985).

From March through May, ungulates, mostly elk and bison carrion, are the most important food in the grizzly bears diet (Mattson, Blanchard et al. 1991). By mid-May few winterkilled ungulate carcasses remain, and grizzlies begin preying on newborn elk calves (Gunther and Renkin 1990). During spring, they also consume grasses and sedges, biscuit root, dandelion, and clover (Mattson, Blanchard et al. 1991). If seed production was abundant the previous fall, red squirrel caches provide a source of over wintered whitebark pine seeds in the spring for the grizzlies (Mattson, Gillin et al. 1992).

From June through August, grizzly bears continue to consume succulent grasses and sedges, dandelion, clover, and whitebark pine seeds, if available (Mattson et al. 1991a). In addition, biscuit root, pondweed roots, sweet-cicely roots, thistle, horsetail, fireweed, and ants are eaten. Predation on elk calves continues until mid-July, when most grizzly bears are no longer able to catch calves (Gunther and Renkin 1990).

Bears with home ranges adjacent to Yellowstone Lake feed extensively on spawning cutthroat trout in tributary streams during the summer season (Reinhart and Mattson 1990). During summer, army cutworm moths are an important food source on the east side of the ecosystem (Mattson, Gillin et al. 1991b). Starting around mid-summer, grizzly bears begin feeding on strawberry, globe huckleberry, grouse whortleberry, and buffaloberry in localized areas where berries may be abundant (Mattson, Blanchard et al. 1991). By late summer, yampa and truffles become significant parts of the diet and grasses and sedges become less prominent.

From September through October, whitebark pine nuts (from the current year's production) and army cutworm moths are the most important bear foods (Mattson and Jonkel 1990; Mattson, Gillin et al. 1991b). A secondary peak in consumption of ungulates occurs during the fall, as bears scavenge carcasses of bison, elk, and moose that die or are preyed upon during the rut. Other items commonly consumed during the fall include yampa roots, berries, clover, and truffles.

Overall, army cutworm moths, elk, bison, cutthroat trout, and whitebark pine seeds are the highest sources of digestible energy and the most important foods available to grizzly bears in the Yellowstone area (Mealey 1975; Pritchard and Robbins 1990; Craighead et al. 1995). These food sources may exert a positive influence on grizzly bear fecundity and survival. Each of these food sources is limited in distribution and is subject to wide annual fluctuations in availability. During years when these food sources are abundant, there are few human/bear conflicts in the Yellowstone ecosystem (Gunther, Biel et al. 1997). In contrast, during years when there are shortages of one or more of these foods, especially whitebark pine seeds, human/bear conflicts are more frequent, and there are generally higher numbers of human-caused grizzly bear mortalities (Mattson, Gillin et al. 1992; Gunther, Bruscino et al. 1997).

Ungulate Availability as a Food Source for Grizzly Bears. The number of ungulates has increased dramatically since herd-reduction programs in the park ceased in the early 1970 (Mack and Singer 1992). The elk herd increased from less than 5,000 animals around 1968 to an estimated 14,000–16,000 on the northern winter range. The population of the interior elk herd (Madison-Firehole) has remained fairly constant at about 800 animals year-round (Craighead et al. 1995). Bison also increased during this same time period from about 460 animals in 1961–68 to about 4,000 in 1994 (see table 17), and currently (March 2000) there are an estimated 2,500 bison in the Yellowstone area.

Grizzly Bear Use of Meat in the Diet. Grizzly bears in the Yellowstone ecosystem are unique among interior North American grizzly bear populations in their substantial consumption of ungulates, as indicated by bear scats (Mattson 1997), feed site analysis (Mattson 1997), and bear-hair nitrogen analysis (Hilderbrand et al. 1999). Approximately 79% and 45% of the energy intake of adult male and adult female grizzlies, respectively, is from meat (Hilderbrand et al. 1999). In contrast, in Glacier National Park, over 95% of the energy intake of both adult male and female grizzly bears is from vegetation (Hilderbrand et al. 1999). Ungulate meat ranks as the second highest source of net digestible energy available to bears in the Yellowstone area (Mealey 1975; Pritchard and Robbins 1990; Craighead et al. 1995). During early spring, ungulates provide a high quality food source before most vegetal foods become available to bears. Grizzly bears with home ranges in areas depauperate of vegetal foods depend extensively on ungulate meat (Harting 1985).

For grizzly bears, the peak time to consume ungulates occurs from March through mid-May when they scavenge winterkilled elk and bison (Schleyer 1983; Green et al. 1997; Mattson 1997). From mid-May through early July, most ungulate meat is obtained through predation on elk calves (Gunther and Renkin 1990), although some individual bears successfully prey on elk calves all through the spring, summer, and fall seasons. In late summer and fall, grizzly bear consumption of ungulates is associated with the annual rut of ungulate species. Grizzly bears scavenge bison (July through August) and scavenge or prey on elk (September) and moose (September through October) when bulls of these species are injured or killed from intraspecific aggression during the rut (Schleyer 1983; Mattson 1997). In addition, predation on ungulates by recently reintroduced wolves has probably increased the amount of ungulate carrion available to adult male and solitary adult female bears because grizzly bears frequently usurp ungulate kills made by wolves (NPS, YNP, Smith, pers. comm.).

From 1977 to 1992, 53% of the ungulate meat consumed by Yellowstone grizzlies was from elk, 24% from bison, 18% from moose, 4% from domestic livestock, and 1% from mule deer (Mattson 1997). The amount of moose and bison was 20 times and 3 times greater, respectively, than what would have been expected by the population size of either species. Bear use of ungulates appears to be more closely tied to amount and availability of carrion and the whitebark pine seed crop than simply to numbers of live ungulates. Ungulate use was 2.1 times higher in years of low use of pine nuts.

An important source of ungulate carrion is from road kills, which accounts for 16% of the meat consumed on average (Mattson 1997). The largest biomass consumed per carcass is from scavenged male bison, and the least from elk calves and mule deer. Only 4% of bison consumed is from predation.

Spring Food Habits of Bears. Green, Mattson, and Peek (1997) found spring use of carcasses was positively related to elevation and use was lower near roads or recreational developments. The correlation with elevation may be related to the fact that grizzly bears den and are first active in the spring at higher elevations and that fewer competitors for the carrion live at these elevations. Grizzly bear use of carrion is affected by the number of winterkilled ungulates on winter range. Variation in numbers of elk and bison that die on the winter range are likely to have the greatest effect on bears.

Grizzly bears more often used larger-sized carcasses as a source of carrion, and bison carcasses are used more frequently than elk. Other scavengers such as coyotes, black bears, and probably wolves tend to outcompete grizzly bears for ungulates that are less than 16 kg of edible biomass (Mattson 1997).

Use of Bison Carrion in the Bear Diet. Grizzly bears make use of available carrion, and when the number of bison increases, the proportion of bison carrion in the grizzly bear diet also increases, as shown in surveys in 1980–81 and 1985–92 (Craighead et al. 1995). These surveys indicate the frequency of bison carcass use was much greater in 1985–92 (39.9% of the number available, or 258 bison carcasses) than in 1980–81 (26.1% of the number available, or 86 bison carcasses).

The same survey showed grizzly bear use of carcasses was greater in 1985–88 and 1990–91 when it was 52% of elk and 48.2 % of bison than in 1989 when it was only 16.5% of elk and 12.0% of bison (Craighead et al. 1995). This was likely due to the flush of carrion available that spring after the fires of 1988 and a subsequent hard winter. During the 1960 to 1972 time frame, frequency of use of bison was 82.8% and of elk was 39.2%. This was probably due to the relative size and number of bison carcasses compared with elk carcasses and the apparent preference of grizzly bears for bison carcasses, as well as less competition with other scavengers for bison carcasses (Craighead et al. 1995).

In the Firehole River drainage, the number of ungulate carcasses found varied from six in 1990 to 401 in 1989 (Mattson and Knight 1992). Bison that were least vulnerable to mortality in this area were from one to six years of age. Adult bison carcasses were used proportionally more often (92% of those available) than any other carcass type; however, carcasses of adult bison went unused if located near human facilities. Bears used adult elk least often (38%). In all years and areas, adult bison cows were the most consistently and heavily used by grizzly bears.

Competition for Carrion. Grizzlies dominate other scavengers at carcasses (Servheen and Knight 1990), but many carcasses get consumed prior to being found by a bear (Green 1994). Individual bears benefit if they can be the only consumers of an ungulate carcass. This is less likely as the ungulate body size increases. Individual bears are most likely to get their largest meals from adult moose and elk that are prey and from adult female bison that are scavenged (Mattson 1997).

Gray Wolf

The gray wolf was reintroduced into the Yellowstone area in 1995 and has the status of a nonessential, experimental population in this area according to section 10 (j) of the Endangered Species Act (1973, as amended). This means that the species is treated either as proposed for listing in the national forest or as threatened in the national park (50 CFR 17) for the purposes of several sections of the Endangered Species Act, including section 7 consultation.

At this time, 11 named packs of wolves exist in the Greater Yellowstone Area (8 breeding pairs existed in 1999), as well as an additional 115 to 120 wolves living independently in the Greater Yellowstone Area as pairs or individuals (Smith 2000).

In the Yellowstone area, wolves feed on live and dead elk, deer, bison, and smaller mammals. Wolves rarely prey on live bison, but do eat bison carrion if it is available. By their large body size and pack social organization, the wolf is adapted to feed on large species of prey animals. Wolves are believed to play a beneficial role in removing sick or inferior animals from a herd through predation. They will prey on large ungulates such as moose, and, to some degree, bison (Mech 1970).

Due to their size and shape, bison in deep snow are vulnerable to wolves (Telfer and Kelsall 1984). However, wolves are not expected to successfully prey on many bison on the northern winter range of Yellowstone because (1) there are alternate prey such as elk, which research has shown is preferred by wolves (Carbyn, Oosenbrug, and Anions 1993) and whose biomass and numbers greatly exceed that of bison, (2) snow depths are shallower on the northern winter range than the other winter ranges in and near the park (NPS, Meagher 1973), and (3) bison will fend off predators (Carbyn and Trottier 1987, 1988). Historically, bison in Yellowstone National Park may not have been heavily preyed upon by wolves (NPS, Meagher 1973).

It appears that wolves killing live bison in Yellowstone is a rare phenomenon, as only two incidents of this have been observed since wolves were reintroduced in 1995 (NPS, D. Smith, pers. comm.). However, as their numbers increase, wolves may increasingly use bison as a prey source (Koth et al. 1990). Boyce and Gaillard (1992) modeled bison numbers after wolf reintroduction and projected an average bison population less than 15% lower with wolves than without wolves.

On December 12, 1997, the United States District Court for the District of Wyoming ruled that the gray wolf reintroduction program in Yellowstone National Park and northern Idaho violated certain provisions of the Endangered Species Act. The court ordered the federal government to remove the reintroduced wolves and their offspring. The court stayed the effect of the order pending appeals. On January 13, 2000, the 10th U.S. Circuit Court of Appeals ruled that the U.S. Fish and Wildlife Service did not violate the Endangered Species Act when it reintroduced gray wolves to the park. The circuit court decision overturned a lower court ruling that ordered the removal of the wolves.

Lynx

On March 24, 2000, the U.S. Fish and Wildlife Service listed the Canada lynx as a threatened species in the distinct population segment of the contiguous United States (65 FR 16051). Because the lynx is such a secretive animal and there is no reliable population estimate for any region (including the Greater Yellowstone Area), the size of the total population in the contiguous United States is unknown. The information that is available indicates the population is declining (USFWS 1998a). Although lynx are scarce in the Greater Yellowstone Area, there have been some documented occurrences (Nellis 1989). Lynx would not prey on bison, but may consume bison as carrion. This is expected to happen only rarely, as lynx normally consume snowshoe hares and occupy lodgepole pine forests in the winter when bison migrate to lower elevation range. Should a bison die in the winter in lynx habitat, its carcass may be quickly consumed by other carnivores and can be fully used within a day or two of the bison's death. Therefore, bison would be only an occasional food source for the lynx (Meagher, pers. comm.).

SENSITIVE SPECIES

Sensitive species do not receive the same degree of protection as endangered or threatened species, although decreasing numbers or loss of habitat makes them of concern to federal land management agencies.

Wolverine

Wolverines are considered rare or scarce in the Greater Yellowstone Area. Wolverines inhabit high elevation conifer forests in the summer and move to mid or lower elevations in winter. Wolverines tend to avoid large openings, the preferred habitat of Yellowstone bison. The wolverine is an opportunistic carnivore and will eat whatever is available (Hash 1989). This species may occasionally use a bison carcass, but bison would not be a major food for the wolverine (Meagher, pers. comm.). Wolverines den at high elevations and are very susceptible to human disturbance. It has been noted in several studies that wolverines have abandoned den sites in response to what was believed to be very minor disturbance (Copeland 1996).

Trumpeter Swan

This species may be affected by the location and operation of bison management facilities such as capture facilities or quarantine facilities. The swan occupies meadows and open fields, as well as lakes, ponds, or slow-moving water inside the park on the Madison River at Seven-Mile Bridge (see alternative 6 map in "The Alternatives") and outside the park on the Madison arm of Hebgen Lake.

SENSITIVE AND SPECIAL CONCERN PLANT SPECIES

In addition to Ross' bentgrass (*Agrostis rossiae*) and Yellowstone sand verbena (*Abronia ammophila*), many other sensitive (as classified by the U.S. Forest Service) and special concern plants may occur within the area affected by the alternatives. The lists of these species are updated regularly by the Montana Natural Heritage Program, the Wyoming Natural Diversity Database, and the U.S. Forest Service. Plants do not maintain any Montana or Wyoming protective status. No plant species are discussed in this environmental impact statement because no general impacts are anticipated.

Specific impacts would be avoided through the siting criteria outlined in "The Alternatives" for capture and/or quarantine facilities on public land. These criteria include a site-specific survey and completion of biological assessments for threatened, endangered, sensitive, or other special concern species that may be affected. Surveys to determine the location of listed plants (or wildlife, if appropriate) would be conducted before the construction of capture facilities, quarantine facilities, or associated structures (such as fences and installing utilities). If threatened or endangered species would be affected by these facilities, they would be redesigned, moved, or their impacts otherwise mitigated.

OTHER WILDLIFE SPECIES

The Yellowstone area is a diverse ecosystem, with 10 species of amphibians, 11 species of reptiles, 317 species of birds, 88 species of mammals, and 18 species of fishes.

The categories of species most likely to be affected by bison management are (1) other large ungulates, in terms of competition for food, (2) predators and scavengers, in terms of food base, and (3) species associated with bison grazing and behavior. A brief overview of these categories of species follows.

UNGULATES

In addition to bison, seven other large ungulate species exist in the affected area: elk, pronghorn, mule deer, white-tailed deer, bighorn sheep, moose, and mountain goats. Because there is little habitat overlap between bison and mountain goats (Chadwick 1983), they will not be addressed further.

The Yellowstone area is a diverse ecosystem, with 10 species of amphibians, 11 species of reptiles, 317 species of birds, 88 species of mammals, and 18 species of fishes.

Yellowstone supports large migratory herds of numerous ungulates due to its climate, geology, elevational and vegetational diversity, and its relatively undeveloped state. Differences in size, habitat preferences, food sources, tolerance of snow depth, and behavior likely minimize competition between species. Singer and Norland (1994) found that competition among ungulate species during a period following release from artificial controls was not great enough to curtail population growth of any species, although it is possible that growth rates of some species (except bison) were slowed.

In Yellowstone, as in most areas, winter is the critical time period for ungulates. Snow depth and density limit the amount of range accessible for use (Gilbert, Wallmo, and Gill 1970). The severity of the winters also makes ungulates more vulnerable to other stresses. Unfamiliar activity on winter range can be extremely draining on energy reserves compared to predictable and habitual activities, or to disturbances occurring during other seasons.

Elk

Management, Distribution, and Abundance. In Montana, elk are managed in elk-management units (EMUs). The area affected by bison management actions in this environmental impact statement includes three EMUs: the Gallatin, the Madison, and the Emigrant. The northern Yellowstone elk herd (approximately 14,000 to 16,000 animals) occupies winter and summer range within Yellowstone National Park. These elk winter in a 400-square-mile area from the Lamar Valley in the park west and north to the Dome Mountain Wildlife Management Area outside Yellowstone

Table 39: Comparative Ungulate Habitat Use and Food Habits in the Yellowstone Bison Management Area

Species		Winter	Summer	Areas of Competition
Bison (NPS, Meagher, pers. comm.)	Habitat Use	Open valleys, swales and sedge bottoms; snow may limit areas; wide variety of sites	Follow plant phenology-rest rotation grazing; open valleys-always on move-nomadic	
	Food Habits	Grass/Sedge-99% Forbs- Browse-1%	Grass/Sedge-91% Forbs-6% Browse-2%	
Mule deer (Pac and Frey 1991; Singer and Norland 1994)	Habitat Use	Semiopen rugged foothills, sagebrush steppe, Douglas-fir interspersed with sage and juniper bunchgrass	Open to moderately dense-canopy montane forest; follow greenup to higher elevation from wintering areas	Some habitat overlap but no evidence of competition for food
	Food Habits	Grass-20% Forbs-15% Browse-65%	Grass-5% Forbs-80% Browse-15%	
White-tailed Deer (MT DFWP, Dusek, pers. comm.)	Habitat Use	Agricultural/riparian	Intermittent wooded hardwood drainages	No evidence of competition for food; some overlap in habitat use, especially in bison movements out of park-displacement
	Food Habits	Grass-Negligible Forbs-Negligible Browse-High Detritus-High	Grass-Negligible Forbs-May 30 – July Browse-Deciduous species-leaves	

National Park. Elk are hunted outside the national park in all these EMUs, with a late-season hunt conducted in the area between Yellowstone's north boundary and the Dome Mountain area.

Table 39: Comparative Ungulate Habitat Use and Food Habits in the Yellowstone Bison Management Area *(continued)*

Species		Winter	Summer	Areas of Competition
Pronghorn Antelope (Scott 1994; Goodman 1996)	Habitat Use	Sagebrush shrublands-flats	Open grasslands, shrubfields, and forest edges at all elevations	Winter range overlap in Stephens Creek area; Sagebrush in winter, distinct from bison food preferences
	Food Habits	Grass - 4% Forbs - 14% Browse - 82% (Rabbitbrush, winter fat, greasewood)	Grass - 7% Forbs - 38% Browse - 54%	
Bighorn Sheep (Irby et al. 1971; Singer and Norland 1994)	Habitat Use	Lower open grasslands near rocky outcrops	Open grassland-edge of timber at higher elevations	Some spatial overlap, but separated by diet, tolerance of snow
	Food Habits	Grass - 55% Forbs - 10% Browse - 35%	Grass - 50% Forbs - 36% Browse - 14%	
Elk (Houston 1982)	Habitat Use	Open grassland	Open to dense forest by August and September	Mixture of habitat types, similar to bison; low to moderate food overlap
	Food Habits	Grass - 80% Forbs - 10% Browse - 10%	Grass - 60–65% Forbs - 30% Browse - 5–10%	

Ecology, Habitat Use, and Food Habits. Elk are versatile generalists (Houston 1982) and use a mixture of habitat types in all seasons. In winter they use primarily open grassland, in spring they use relatively open grassland with some timber, and in late summer and fall they use a variety of grassland and forest types. Where hunted, elk may use dense forest (Hamlin, pers. comm.). Cole (1969) found that northern Yellowstone elk distribution in winter occurred along an elevational gradient in relation to suitable foraging areas, distribution of other elk, response to human disturbance, and weather variables. Elk select preferred plant species and plant parts during spring and summer, whereas winter grazing of grasses appears to be indiscriminant (Houston 1982). Grass comprises most of the elk diet in all seasons (see table 39). Elk can cope with a wide variety of deep and crusted snow conditions (Barmore 1980).

Areas of Competition With Bison. Singer and Norland (1994) found a low to moderate degree of diet overlap between bison and elk, although the two species share a high degree of habitat overlap. During a period in which both species increased rapidly following release from artificial control, neither bison nor elk appeared to suffer any decrease in population growth due to competition from the other species. It is possible that stimulation of production and nutrition in grasses may have resulted in a beneficial effect for both species at observed population levels (Singer and Norland 1994).

Pronghorn Antelope

Management, Distribution, and Abundance. The pronghorn antelope (known simply as pronghorn) population in the affected area numbers between 200 to 250 animals (NPS, unpubl. data). This population has experienced a major decline in recent years, dropping from a high of nearly 600 pronghorn in 1991 to the present level. Goodman (1996) has indicated that this pronghorn population is at a high risk of extinction within the next 100 years. Pronghorn winter range is restricted to approximately 2,900 ha (7,168 acres), 75% of which is within Yellowstone National Park. This area is located between Mammoth Hot Springs and Cinnabar Mountain, with the core use area in the predominantly open grasslands near Stephens Creek. Approximately 25% of the pronghorn population migrates to summer range on the Blacktail Plateau and in the Lamar Valley (D. Scott, unpubl. data). Periodic depredation hunts have been conducted on private land adjacent to the north boundary of the park, with harvests ranging from 2 to 37 animals.

Ecology, Habitat Use, and Food Habits. The Yellowstone pronghorn population contains unique genetic elements, and has been shown to have greater genetic variability than many other pronghorn populations (Lee, Bickham, and Scott 1994). The cause of the recent population decline is unknown, but possible contributing factors include predation, winter habitat quality, human-caused mortality, and competition with other ungulate species on winter range. Scott (unpubl. data) suggested that coyote predation may be the cause of 90% of pronghorn fawn mortality, and coyote predation has been implicated as a source of mortality in adult pronghorn as well. Of all the ungulates native to the Greater Yellowstone Area, pronghorn are least able to cope with deep snow. Sagebrush is an important food item for pronghorn, with forbs and grasses making up a significant portion of their diet (Singer and Norland 1994). Sagebrush may be important in winter both as food and as shelter from severe weather. Because running from danger, over sometimes long distances, is the pronghorn's major defense against predation, they require suitable forage distributed over a large area in both summer and winter ranges (Pyrah 1987). Pronghorn appear to be less able to successfully cross fences than most other ungulates (BLM, USDI, Yoakum 1980). Pronghorn may also be quite vulnerable to harassment by humans (Autenreith 1983).

Areas of Competition With Bison. Yellowstone bison and pronghorn are separated by habitat selection, food habits, snow tolerance, and seasonal distribution (Barmore 1980; Singer and Norland 1994). Bison and pronghorn winter ranges overlap in the Stephens Creek area of the park.

Deer

Management, Distribution, and Abundance. Mule deer and white-tailed deer are both found in and adjacent to Yellowstone. White-tailed deer, however, were quite rare in the park in the early historical period (Schullery and Whittlesey 1992), and few currently summer or winter in the park. White-tailed deer numbers increase with increasing distance from the park boundary and become more numerous along major riparian areas and river drainages north and northwest of Yellowstone National Park. Small numbers of white-tailed deer winter in thickets along the lower Gardiner River and along the Yellowstone River in and adjacent to the park (Barmore 1980). Viable populations occur in dense contiguous thickets along the Yellowstone River beginning about 19 miles (30 km) north of the park. White-tailed deer winter along the Madison River, and a few winter in the Hebgen Basin, which is described as good summer range (MDFWP, unpubl. data). Currently no estimates are available of the number of white-tailed deer in the northern Yellowstone area, but they appear to exist at very low population levels (MDFWP, T. Lemke, pers. comm.).

Mule deer are the primary deer species found in and adjacent to Yellowstone. Mule deer in the northern Yellowstone National Park area winter predominantly along the Yellowstone River valley to the north of the park boundary. Mule deer winter range also includes the Gallatin River valley and neighboring foothills, and the edge of mountain slopes in the Madison Valley. Many of the mule deer wintering in these areas summer in the high elevation mountains throughout the northern Yellowstone National Park area.

Since 1986, biologists have conducted spring aerial surveys of the northern range mule deer herd. Mule deer numbers declined 30% from 2,493 in spring 1996 to 1,748 in spring 1997, following a significant winterkill in winter 1996-97. In April 1999, a total of 1,677 mule deer were counted. The 1999 count is 18% below the 13-year average of 2,053 mule deer and represents the second lowest count recorded (MDFWP, Lemke, unpubl. data).

Ecology, Habitat Use, and Food Habits. While-tailed deer occur in mesic and more forested habitats within the affected area, preferring thickets and cottonwood stands along river valleys, and other areas of relatively dense cover. They consume mostly browse and some forbs.

Mule deer occur in more open, xeric portions of the study area. Houston (1982) observed that mule deer used xeric steppe, sage steppe, and mesic steppe on 80% of feeding observations in the park. Sagebrush steppe is very important to mule deer outside Yellowstone National Park, although Barmore (1980) indicated that use of Douglas-fir is underestimated throughout the area. Mule deer are found in semiopen rugged foothills in winter, and in spring they follow greenup adjacent to foothills. In summer and fall they use open to moderately dense canopy and montane forest, depending on hunting pressure (MDFWP, H. Pac, pers. comm.).

Areas of Competition With Bison. There appears to be little, if any, habitat or diet overlap between white-tailed deer and bison. Although bison and mule deer experience some degree of overlap in habitat use, there appears to be little or no competition between these two species because of differing diet preferences (Singer and Norland 1994). Competition may also be precluded by seasonal distribution differences and by the limited ability of deer to deal with deep snow (Barmore 1980).

Bighorn Sheep

Management, Distribution, and Abundance. Between 1992 and 1999, the number of bighorn sheep wintering along the northern park border and in areas just north of Yellowstone National Park ranged from 125 to 222 animals (Northern Yellowstone Cooperative Wildlife Working Group 1999). An outbreak of chlamydia in the early 1980s resulted in a rapid decline in bighorn sheep numbers, from which the population appears not to have recovered (Legg 1996). The 1997 count represents a decrease of about 13% overall from the previous year. Although bighorn sheep wintering ranges inside and outside the park appear to be quite distinct, recent research has demonstrated that there is some degree of mixing of subpopulations (Legg 1996).

Therefore, all bighorn sheep in the northern Yellowstone area, both inside and outside the park, should be considered part of a contiguous population. A limited, special-drawing hunt is conducted for bighorn sheep in the area outside the park.

Ecology, Habitat Use, and Food Habits. Upland grassy habitat accounts for 60%–80% of observations of feeding bighorn sheep (Houston 1982). Bighorn sheep traditionally use steep slopes and ridgetops, and can occupy high elevation windswept cliffs (Barmore 1980). In spring they follow greenup to higher elevations, and in summer and fall use open grasslands and timber edge areas at higher elevations (see table 39). Grasses comprise approximately 58% of bighorn diets, with shrubs and forbs as additional important diet components (Singer and Norland 1994). In winter, bighorns use lower elevation, open grasslands near rocky outcrops. Proximity to escape terrain appears to be a primary factor in bighorn sheep habitat selection (Legg 1996), although some groups of 10–20 or more rams often feed far from cliffs on grasslands near the Yellowstone and Gardiner rivers (Houston 1982). Bighorn sheep appear to be particularly vulnerable to a variety of diseases that can have adverse effects on individuals and on the population as a whole.

Areas of Competition With Bison. While there has been some increase in habitat overlap between bighorn sheep and bison in recent years (Singer and Norland 1994), the two species are separated ecologically by differences in distribution, diet, and tolerance of snow. During spring, bison increasingly select habitats with characteristics important to bighorn sheep, but there does not appear to be an appreciable degree of overlap in use of those areas.

Moose

Moose exist in small numbers in the northern portion of Yellowstone National Park and vicinity and are known for their ability to winter in deeper snows that other ungulates. They are most common in the Cooke City and West Yellowstone areas and tend to use riparian habitats. Moose and bison are not likely to compete for forage.

Recent research has shown that *B. abortus* may be fatal to moose (Forbes, Tessaro, and Lees 1996). Other studies indicate that brucellosis may not be a threat to moose (Zarnke 1983). In Grand Teton National Park where bison with brucellosis and moose co-exist, no one has observed a decline in moose population that can be attributed to the disease.

PREDATORS AND SCAVENGERS

Mammalian predators and scavengers that are potentially present in the affected area include grizzly bears, wolves, black bears, mountain lions, coyotes, foxes, wolverines, bobcats, and a variety of smaller mammals. Avian predators and scavengers include bald eagles, golden eagles, ravens, magpies, and several smaller bird species. Specialized scavengers also include a variety of insect species. Impacts on grizzly bears, wolves, wolverines, lynx, and bald eagles are analyzed in the chapter on "Impacts on Threatened, Endangered, and Sensitive Species." Because of their size and social organization, healthy bison of all ages would be difficult prey even for large predators (Fuller 1962). Scavengers in the Greater Yellowstone Area, however, rely heavily on carcasses of bison and elk for both winter and early spring food. Although the number of winterkilled bison varies from year to year (Gunther, Biel et al. 1997), carcasses are likely to occur in predictable locations. Some scavengers may have learned to rely on those locations to provide food during the period from late winter through early spring.

SPECIES ASSOCIATED WITH BISON GRAZING AND BEHAVIOR

Large numbers of bison can physically alter environments. Bison rub trees and saplings, debarking and sometimes killing them (NPS, Meagher 1973). It has been suggested that this activity may impede or even prevent forest invasion of open grasslands (NPS, Meagher 1973; J. Shaw, pers. comm.). Grazing may also maintain open grassland communities by preventing accumulation of dead grass litter that would otherwise suppress growth of grasses (T. Baumeister, pers. comm.). These physical impacts, in combination with the previously mentioned stimulation of productivity in grazed areas, are likely to help maintain open grasslands that are important to many other species. Historically, prairie dog distribution in the U.S. overlapped completely with bison distribution (J. Shaw, pers. comm.). It is likely that burrowing rodents benefit from disturbances created by bison trampling and wallowing. Trampled areas and wallows, however, may also provide opportunities for invasion by nonnative vegetation, and may contribute to soil and streambank erosion.

HUMAN HEALTH

Brucellosis is a zoonotic disease that can infect people exposed to infected tissues or fluids, causing undulant fever. Symptoms include intermittent fever, chills, night sweats, body and joint pain, poor appetite, and weakness. Undulant fever can be caused by several different species of bacteria including *Brucella suis* (found in swine), *B. melitensis* (found in goats), *B. abortus* (found in cattle, elk, and bison) and vaccines containing live bacteria (strain 19). RB51 has never been documented to cause undulant fever in humans.

Historically, people who have been at greatest risk for undulant fever are those who tend infected livestock, especially during birth or abortion events; veterinarians who work with pregnant animals or who vaccinate livestock; people who work in abattoirs (slaughterhouses); and people who consume unpasteurized dairy products and raw organs that have been contaminated and not properly prepared.

Native American.

Risk of transmission to people is dose-dependent. People generally become infected either through exposure to tissues with large quantities of *Brucella* organisms, e.g., infected reproductive tissues, or frequent, multiple exposure to tissues and fluids with smaller quantities of bacteria. Subsequent transmission of brucellosis from person to person is unlikely.

Prompt and accurate diagnosis is essential for effective treatment of human brucellosis. Accurate diagnosis may be complicated because early symptoms are similar to those for several other diseases. Moreover, with progress toward the eradication of brucellosis, many physicians are not familiar with the disease.

As a part of all alternatives, the agencies would employ a number of standard practices, including routinely advising everyone who is potentially at risk for exposure to the disease of appropriate precautions and the symptoms of the disease. Veterinarians or others who work with bison carcasses would take standard measures such as wearing gloves, masks, and protective eyewear. Laboratory workers may also wear protective clothing. Slaughterhouses should be well ventilated, and workers should wear gloves, masks, and eyewear, although enforcement of these measures for slaughterhouse personnel is beyond the ability of the agencies. Hunters would receive training on the disease and appropriate precautions. All who work with open carcasses or tissues would be advised of health risks and appropriate safety measures. This information also would encourage people who manifest these symptoms to seek immediate medical attention and to advise their physicians that they may have been exposed to brucellosis.

Visitors to Yellowstone National Park and the analysis area may also be subject to injury from car collisions, either with bison crossing roads or with other cars whose passengers are stopping to view bison. Bison may be dangerous and can charge and gore people if approached too closely.

CULTURAL RESOURCES

HISTORY

The Great Plains and the northern Rocky Mountains of western Montana and Wyoming served as home for bison. This region is also the homeland of various native peoples who hunted these ranging herds. Archeological evidence within Yellowstone National Park places earliest human occupation at 11,000 years ago (although some tribes believe they have occupied the lands much longer). No less than 10 tribes dwelled in the Yellowstone area during both historic and prehistoric times. Those tribes whose traditional territory falls within the Yellowstone area include the Crow, Eastern Shoshone, Salish and Kootenai, Shoshone-Bannock, Blackfeet, Nez Perce, Northern Arapaho, and the Northern Cheyenne Tribes (Turek 1994).

For many the Yellowstone area contained hunting grounds. As late as the l880s, a band of Shoshone known as the Sheepeaters occupied portions of what is now Yellowstone National Park. Currently a few tribes claim hunting rights within the national park; the Shoshone-Bannock, who roamed the western portion; the Crow, who traversed the east; and some First Nations of Canada (Blackfoot, Blood, Piegan, and Assiniboine), who also hunted in the region (Waldman 1985).

Shoshone Indians, by William Henry Jackson, 1871. (NPS photo)

Treaties allowed the use of lands within the Yellowstone area by various tribes. Prior to 1872 the areas now known as Yellowstone National Park, Gallatin National Forest, Bridger-Teton National Forest, and Shoshone National Forest were reserved for some Plains tribes. The land west of the Yellowstone River was used traditionally by the Blackfoot, land to the southeast was part of the historic Crow territory, and the lands near the upper Missouri River constituted a common hunting ground for the above-mentioned as well as the Piegan, Blood, Gros Ventre, Flathead, Upper Pend d Oreille, Kooteniai, and the Nez Perce Tribes according to the 1851 Treaty of Fort Laramie. Seventeen years later, the 1868 Fort Laramie Treaty removed many acres of Yellowstone area land from tribal control but allowed for hunting in "unoccupied" lands. Shoshone and Bannock treaties did not include reference to the Yellowstone area, yet they lived and hunted there until the end of the 19th century (Turek 1994).

Bison were and still remain critical to the indigenous cultures of North America and were an important part of the landscape covering over half of the continent. They once ranged from the Appalachian Mountains to the "deserts" of the Great Basin south into Mexico and as far north as the Yukon territory in Canada. English settlers arriving in what is now Georgia wrote of the "innumerable" bison they encountered. The numbers were so great that early Euro-American explorers could only describe them as "numberless," and wrote that the plains were "black and appeared to be moving" with the herds of bison. The most commonly used estimates of their numbers were between 30 and 65 million.

Bison provided food, clothing, fuel, tools, and shelter, and were central to Plains tribal spiritual culture. Bison were viewed as an earthly link to the spiritual world. For many tribes, bison represent power and strength. For example, the Shoshone believe that spiritual power is concentrated in the physical form of the bison. Many contemporary tribes maintain a spiritual connection with bison. These beliefs and values are still very much present today, as represented by a summary of comments by tribes provided in appendix I.

Buffalo bones at Buell, 1885.

Horses, brought to the Americas by Europeans in the 16th century, made the hunting of bison far more efficient. Europeans introduced a radically different notion of land use that emphasized resource-dependent, extractive industries. Consumptive use of land and its resources and the subsequent killing of the bison herds helped to alter the interrelated world of both tribes and bison.

The near extinction of the American bison did not occur in short violent years. By the 1820s, bison were confined almost exclusively to lands west of the Mississippi River. Many of these herds began to decline after 1830 as market hunting for hides accelerated. Prolonged drought in the 1840s further reduced bison numbers. After the Civil War, competition from domestic cattle and greatly intensified market hunting for "buffalo" robes and tongues decimated the Great Plains herds. Tourists on railroad shooting excursions killed thousands more. A final contributing factor was the introduction of cattle-borne contagious diseases, which reached epidemic proportions between 1881 and 1882. The combination of cattle, hunting, and epidemic disease all but eradicated the once immense western herds. By 1890, only about 300 bison remained in the United States (Malone et al. 1976).

Many Americans believed that the bison had completely vanished from the American landscape. While private herds existed throughout the U.S., by 1902 no more than 23 individual bison remained of the thousands that had occupied the Yellowstone area since prehistoric times (Callenbach 1996).

On the heels of the near-destruction of the bison, some Americans were determined to preserve what remained of the herds. Prior to the formation of the American Bison Society in 1905, its honorary president, Theodore Roosevelt, had persuaded Congress to establish a number of wildlife preserves. Also the creation of the nation s first national park helped protect the remaining bison. Because of concerns that the small wild herd might vanish, park managers imported 21 bison from captive herds in Montana and Texas into the park. From 1902 to about 1915 the imported bison were raised using livestock techniques in the "Buffalo Ranch" in Lamar Valley. They were fenced, fed, and separated for shipment to slaughter. The native population was not managed or fenced and was allowed to increase on its own (NPS, Meagher 1973). After about 1930, management moved from ranching bison to preservation of bison in a more natural state although vaccination and herd reductions occurred within the park to varying degrees until 1968 (NPS, Meagher 1973).

The herds of the Yellowstone area are of special importance as the last remnant of the indigenous wild herds in North America (UC Davis, Van Buren, pers. comm.). Some other bison herds, such as the Henry Mountain herd in Utah, are direct descendants of the Yellowstone herd. As bison continue to inhabit the landscape of what remains of the western frontier, a part of the unique American experience is preserved for future generations.

LIVESTOCK AND AGRICULTURAL INFLUENCES

The Montana Territory was greatly changed by the introduction of domestic livestock. While the trade of cattle from Montana did not prosper until the gold rushes of the 1860s, cattlemen were found in the Montana Territory before this time. They include Jesuit missionaries and other small producers. These producers found new local markets for beef with the existence of mining camps and military facilities. These markets led to more livestock being brought in through cattle drives from other areas of the nation. For example, Nelson Story drove the first Texas longhorns into Montana in 1866.

When Montana producers were raising more livestock than could be consumed locally, they looked for new markets which included Wyoming, Utah, and Canada. Some of these new markets were the result of economic development activities due to the construction of railroad lines in other states and Canada. One of the first long drives of Montana cattle to new markets took place in 1868. In addition, new world markets were formed. New urban populations in America and Europe resulted in an increased demand for beef. These new markets and the increased demand for cattle are factors in the decrease in bison herds due to the rise in the amount of livestock grazed on lands within Montana, which were used by bison.

The increased amount of livestock, the increased economic importance of this new industry, and the presence of disease resulted in the 1885 Montana Territory legislature authorizing "a territorial veterinary surgeon who had the power to quarantine cattle" (Malone, Roeder, and Lang 1976).

AFFECTED CULTURAL RESOURCES

Archeology

Traditional use of bison by humans centers on hunting and is evidenced in the archeological record. The remains of drive lanes, chipping stations, wickiups, and weapons are all associated with the importance of hunting bison for tribal economy and culture.

Less than 2% of Yellowstone National Parks 2.2 million acres and a small percentage in the project areas of Gallatin National Forest have been archeologically surveyed. Approximately 1,100 prehistoric and historic archeological sites have been recorded to date within Yellowstone National Park. The sites contain evidence of hunting and gathering, trails, obsidian quarries (most notably Obsidian Cliff, a national historic landmark), hearths, base camps, stone for manufacturing tools, rock shelters, and stone circles.

To this point, there has been little in the way of recordation of tribal place names and identification of cultural use sites within Yellowstone National Park. Within the work done by Peter Nabokov and Lawrence Loendorf (1999) there is much discussion regarding the inadequate archeological data base and "for tribe after tribe, this suppression of traditional ties to their old Yellowstone hunting and traveling grounds precipitated a century-long period of broken connections." (Nabokov and Loendorf 1999). Yellowstone National Park continues to sponsor projects that will add to its knowledge base regarding cultural resources. Recently reaching a final draft stage is "Restoring A Presence: A Documentary Overview of Native Americans and

Yellowstone National Park" (1999), by Peter Nabokov and Lawrence Loendorf. The authors examine those with aboriginal territory, including the Crow on the eastern side of the park proper, the Shoshonean people known as Sheep Eaters (believed to be the only Indians who were full-time residents of the highlands in the park), and the Eastern or Wind River Shoshone for whom the bottom third of the Plateau was apparently within their traditional territory, and they suggest a possible Kiowa connection to the area (Nabokov and Loendorf 1999). Nabokov and Loendorf also attempt to organize what information is readily available concerning movements and possible cultural associations with the region for the Blackfeet, Flathead, Pend d'Oreville, and Kootenai (Nabokov and Loendorf 1999).

Subsequent projects that have been identified include a Traditional Use Study, an Ethnographic Resources Inventory, American Indian Consultation Plan, Ethnographic Landscape Survey, and the collection of Ethnographic Oral Histories.

Historic archeological sites present are representative of both Indian and Euro-American cultures, the latter including early hunters, miners, ranchers, U.S. military occupation, and park administration. Historic archeological sites include remains of soldier stations, transportation routes, farming and ranching operations, remains of buildings, pastures, cultivated fields, irrigation ditches, and the ruins of the town of Cinnabar.

The range of alternatives considers a number of areas for possible construction of new facilities. Any areas ultimately selected for construction would need to be archeologically inventoried to locate sites and evaluate them for inclusion in the National Register of Historic Places before determinations of effect can be made for each alternative.

Historic Structures

The greatest number of historic buildings and structures within the analysis area are located in Yellowstone National Park and are associated with civilian activities (1872–1886), U.S. military occupation (1886–1918), and NPS administration (1918–present). None of the buildings and structures is considered to be within the area of potential effect. The Yellowstone road system, which includes the Grand Loop Road and five entrance roads, has been nominated for inclusion in the National Register of Historic Places. While alternative 2 considers no grooming or closure of sections of certain roads to bison use, neither would change the character or overall condition of the circulation system.

Cultural resources within Yellowstone National Park and the Gallatin National Forest are managed to maintain their scientific, social, and historical value in compliance with all applicable federal and state laws (*Gallatin National Forest Plan*, p. II-3). Near the Reese Creek area, archeological and historic structure inventories were conducted by the U.S. Forest Service and the National Park Service. No national register eligible or listed archeological resources were located and no historic structures exist. In West Yellowstone, the U.S. Forest Service conducted archeological and historic structure inventories in some of the areas of effect, and no national register eligible or listed archeological resources or historic structures were located.

Ethnographic Resources

The ethnographic record for Yellowstone National Park and project areas of Gallatin National Forest is incomplete. An ethnographic overview and assessment is being developed for Yellowstone National Park. As funds become available, agencies anticipate conducting site-specific ethnographic research in consultation with affiliated Native American tribes. Yellowstone National Park consults with several affiliated tribes with lands near the Yellowstone area. These include the Nez Perce Tribe and the Shoshone-Bannock Tribes of the Fort Hall Reservation in Idaho; the Blackfeet and Northern Cheyenne Tribes, the Salish and Kootenai Tribes, and the Crow Nation in Montana; and the Eastern Shoshone and Northern Arapaho Tribes of the Wind River Reservation in Wyoming.

Cultural Landscapes

Cultural landscapes in Yellowstone National Park and Gallatin National Forest have not yet been formally inventoried or evaluated for national register eligibility. A cultural landscape is a geographic area, including both cultural and natural resources, that is associated with a historic event, activity, or person that exhibits other cultural or aesthetic values. Four different landscape types may be found in Yellowstone National Park, Gallatin National Forest, and the Yellowstone area — historic vernacular, specific historic sites, historic design, and ethnographic landscapes.

While landscapes are not fixed in time and continue to evolve, they maintain certain character-defining features that make them distinctive. Many Yellowstone area landscapes and viewsheds have changed over time and retain various degrees of historical integrity. Within the Greater Yellowstone Area, the bison constitute an important element of these landscapes. For further discussion of landscapes, see the “Visual Resources” chapter.

VISUAL RESOURCES

Visual resources consist of landform (topography and hydrology) and land cover (vegetation, buildings, roads, etc.). Visual resources are centered on significant and intrinsic features. Assessment of visual resources also includes visibility of the proposed undertaking, such as exposure and location, in relation to current viewsheds. Yellowstone bison are an important part of the visual resources. They have existed within the Yellowstone area for centuries and remain the only herd to continuously occupy their original rangeland. The bison herd is a characteristic element of the viewshed.

visual

LANDSCAPES AND VIEWSHEDS

Yellowstone bison are an important part of the visual resources. They have existed within the Yellowstone area for centuries…

Visitors to and residents of the Greater Yellowstone Area have many opportunities to experience various landscapes and viewsheds that make up the visual resources. This area is world renowned for its scenery, wildlife, wilderness, rivers, and geologic and thermal features. The area contains high elevation mountains and riverbed valleys. There are steep mountain walls, clear-running streams, geothermal formations, and mountain prairie grasslands. The landscape consists of both natural and cultural elements. Yellowstone National Park, Gallatin National Forest, other public lands, and surrounding communities contain infrastructure such as roads, turnouts, rural housing, campgrounds, and groups of administrative and concession buildings. The landscape is rugged and formidable due to the rapid rises in elevation, and most of the area remains in a natural state. Bison and other wildlife are frequently observed on the landscape.

PUBLIC LANDS

Visual resources within Yellowstone National Park fall into two general zones: the natural zone and the park development zone. The natural zone encompasses those lands classified as wilderness in the *Wilderness Recommendation* of 1972, which applies to 90% of the park. The viewshed in this zone is characterized by primeval nature, lack of facilities, and low-level visitor use. The development zone makes up the remaining 10%, and is broken down into two broad categories: developed areas and transportation corridors (NPS 1972). Bison are observed within both zones, although they are mostly within the natural zone. Generally, people in the developed zone are able to observe bison in the natural zone.

Vehicle pullouts within Yellowstone National Park are designed specifically for visitors to stop and experience the visual resources, including bison and other wildlife. Thus, many of these pullouts are placed in areas where bison are most frequently found, in valley lowlands off the main roads. Some locations include the open areas within Hayden Valley, the Old Faithful/Firehole area, the Madison River (past Seven-Mile Bridge), Indian Creek in the Mammoth area, the Norris Campground, Gibbon Meadows, Elk Park, and others. The view from these pullouts is an unobstructed natural setting containing habitat desirable to bison as well as other wildlife species.

National forest land use is managed to maintain specific visual quality objectives or a level of scenic quality and diversity of natural features based on physical and sociological characteristics of an area. Project areas contain national forest lands with visual quality objectives ranging from preservation to maximum modification. "Preservation" allows only ecological changes; "retention" means that human activities are not evident to the casual visitor; "partial retention" allows evidence of human activity if it is subordinate to the characteristic landscape; "modification" means that human activity may dominate the land but should appear as a natural occurrence, and "maximum modification" allows human activity to dominate, yet it should appear natural when viewed as background (*Gallatin National Forest Plan*, p. VI-44)

In the Gardiner area, forest lands are managed for recreation, livestock, big game winter habitat, timber harvest, and wilderness within which the visual quality objectives are primarily focused on preservation, partial retention, and modification. The West Yellowstone lands also support recreation, livestock, and timber harvest as well as forest operations, electrical corridors, heavily used public areas, and research areas. The visual quality objectives accommodate modification, partial retention, and retention. Near Cooke City, national forest lands accommodate a combination of recreation, livestock, timber harvest, and wilderness with portions that have heavy public use and mining operations. This area contains visual quality objectives primarily focused on partial retention and retention, with pockets of preservation and maximum modification (USFS, Jane Ruchman, pers. comm.).

BISON MANAGEMENT ACTIVITIES

Residents and visitors who view bison management operations in the analysis area currently include primarily the approximately 100 persons living near the West Yellowstone area as well as accidental or intentional observers in the Stephens Creek area. Bison management activities include hazing, capture, testing, agency shooting, and shipment to slaughter. Future actions may include hunting or quarantine, depending on the alternative selected.

Bison could be marked with ear tags, paper backtags, or paint/peroxide stripes to indicate they have tested negative for the *Brucella* organism. Tagging and marking associated with capture facilities could be done between November and April.

In capture and testing procedures, all bison in capture facilities on both the western and northern boundaries receive a small metal ear tag when they are tested for the *Brucella* organism. The brown and silver tags that would most likely be used are difficult to detect because of the long hair that covers the bison ear. Other markings currently used to identify bison testing negative for the *Brucella* organism differ according to agency and location. Marks are often visible until the bison shed their winter fur in the spring.

On the western park boundary, a variety of marking techniques are currently used by the Montana Department of Livestock. Bison determined to be seronegative may be marked with a paint/peroxide stripe, backtags, and clipped hair (Montana state veterinarian, Gertonson, pers. comm.). All three methods are used to increase visibility in adverse weather conditions.

The paint/peroxide stripes are created using both paint and a peroxide or hair dye mixture. The solution is applied over the shoulder or hip of a bison in a strip approximately 2 to 4 inches wide. The mark is visible from 100 yards or farther; it lasts for varying lengths of time depending on weather conditions.

Paper backtags and clipped hair are also used to identify seronegative bison. These backtags, marked with an identification number on white or yellow oval tags (approximately 3 by 4 inches), are glued to the shoulder. The paper backtags stay attached for varying lengths of time depending on weather conditions. Hair clipping, done in a 3- to 4-inch patch over the shoulder, is more visible on dark hair shades. On the northern boundary, paper backtags are used on some seronegative bison released in the spring.

Bison that are vaccinated with a safe and effective vaccine (when available) will also require a mark or tag. Bison that are vaccinated within capture facilities will receive a metal ear tag. Any bison vaccinated by remote delivery system (e.g., dart, biobullet) could be marked by a paint ball. In Wyoming, the remote delivery vaccination program and the paint ball marking system are used together to identify the vaccinated elk habitating the feeding grounds. This ensures they are not vaccinated more than once. The remote delivery system currently used by Wyoming requires an air gun fitted with two barrels and two triggers. One trigger and barrel releases a biobullet containing a vaccine and the other trigger and barrel releases the paint ball. The oil-based paint will last approximately 2 to 6 weeks depending on weather conditions.

The marks disappear when the animal sheds its winter coat in the spring (WGFD, Thorne, pers. comm.).

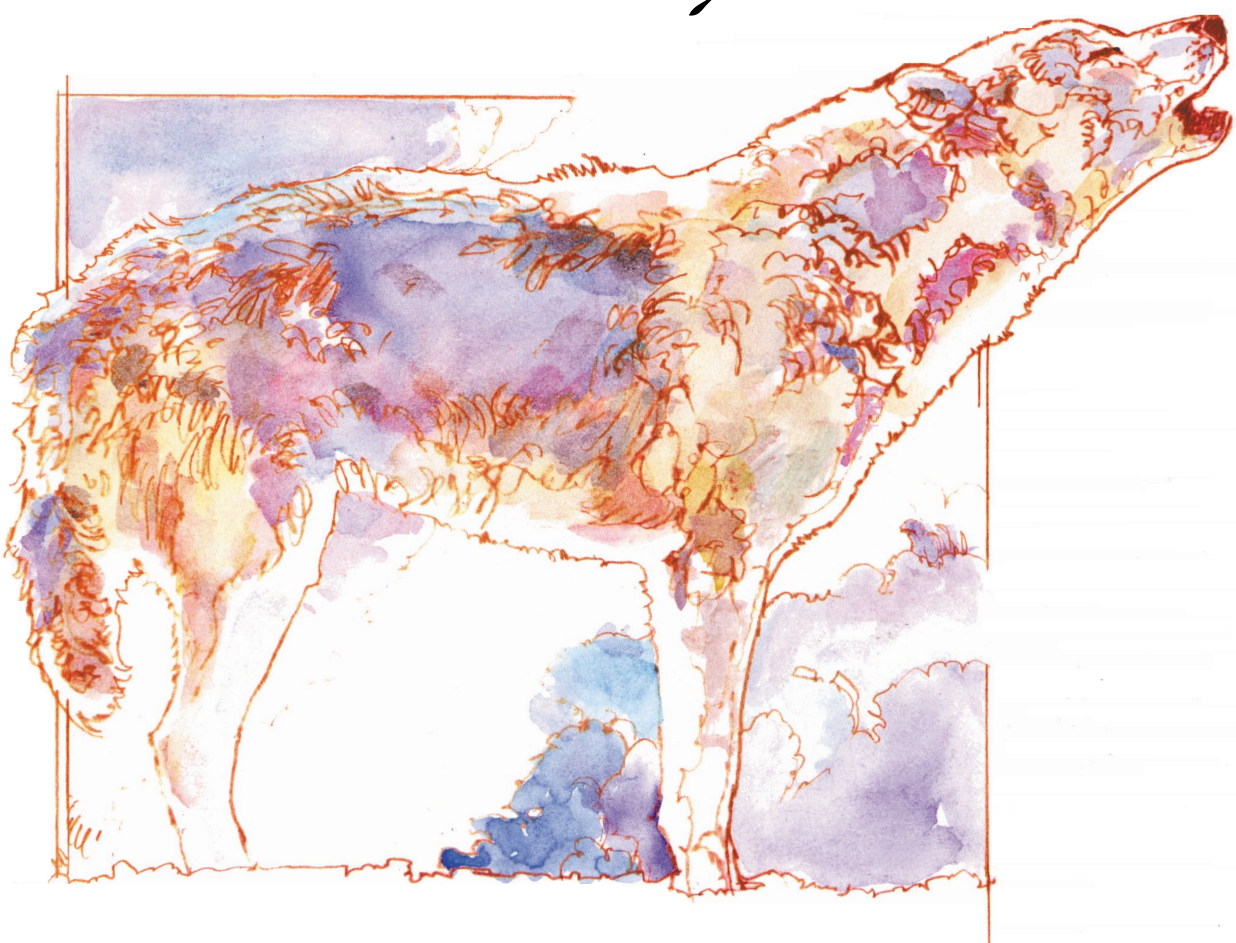
Although these tags are visually intrusive, they are necessary to minimize the need to capture and handle the bison more than once to determine its brucellosis status.

Visible hazing activities that may have an adverse impact on visual resources include herding bison by helicopter, by vehicle, and on horseback or foot; shooting with rubber bullets; and possible use of dogs. Various hazing activities affect visual resources and quality for residents and visitors in the Yellowstone area. Hazing is visible from roads and lands near areas where bison leave the park and enter other public or private lands. Most hazing activities occur outside the park as needed. In addition under state law, the Department of Livestock is required to remove the bison from private property if requested by the property owner. Capture and test facilities are visible from the county road in the Stephens Creek area and from a few residences in the West Yellowstone area. Activities such as testing and tagging are not visible due to the solid high walls, except for the initial herding and final loading operations. The solid walls are used to facilitate the handling of bison within the facilities.

Some agency shooting is visible in areas where bison leave the park boundary. Current exit locations include the Yellowstone River drainage basin near Stephens Creek and Gardiner and near West Yellowstone by way of the Madison Valley. Agency shooting is undertaken mostly in the morning hours, as needed, depending on bison out-migration. After bison are shot, they are towed to a central location to be processed and transported to carcass recipients. In West Yellowstone the act of dragging bison across the snow results in highly visible trails of blood. This does not occur in the Stephens Creek area because of the limited or absence of snowfall; thus, blood trails are less visible. The entrails are occasionally piled up as carcasses are processed (amount depends on processing volume) and may remain until proper disposal is arranged by truck or bucket loader. Reproductive organs are immediately disposed of by agency officials because they pose the highest threat in the spread of brucellosis to humans and domestic livestock.

Shipment of bison to slaughter requires large transport vehicles, which are visible in the Yellowstone area and along highways leading to the slaughter facilities within a 160-mile radius from the northern and western park boundaries.

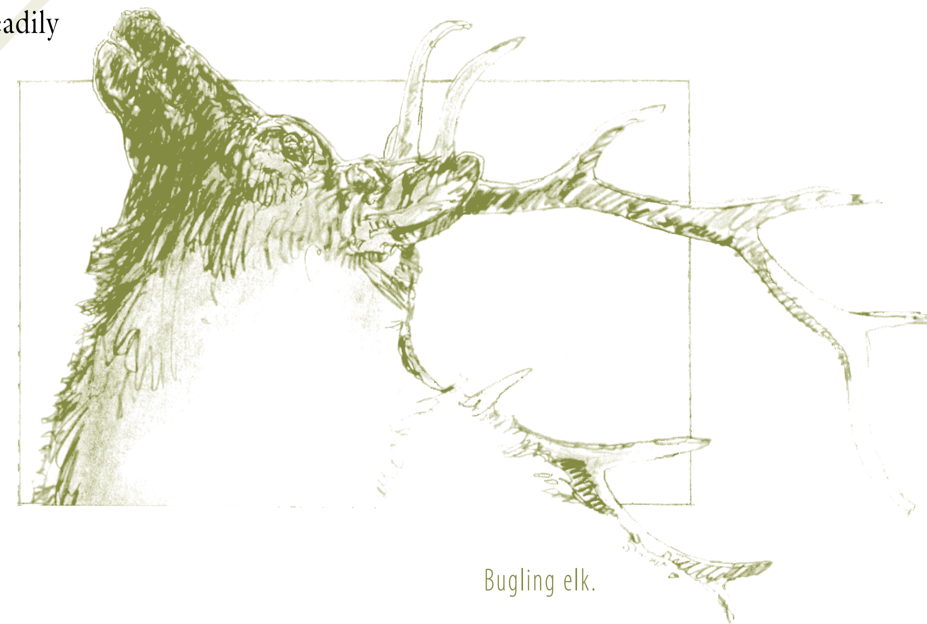
Environmental consequences



INTRODUCTION

The following chapters discuss the environmental impacts of each of the alternatives on natural, cultural, and other resources of concern. The degree of impact can be quantified in some cases, such as when a model is used or data are obtainable. However, often only qualitative descriptions of impact are available. The following definitions are applied throughout the environmental impact statement:

- Negligible — the impact is at the lower levels of detection.
- Minor — the impact is slight, but detectable.
- Moderate — the impact is readily apparent and has the potential to become major.
- Major — the impact is severe, or if beneficial, has exceptional beneficial effects.



Bugling elk.

IMPACTS ON BISON POPULATION

SUMMARY OF REGULATIONS AND POLICIES

Several planning and policy documents, including the *Yellowstone National Park Master Plan* (NPS 1974), the *Yellowstone National Park Statement for Management* (NPS 1991), and the National Park Service Management Policies (NPS 1988), require the protection of ecological processes and native species in a relatively undisturbed setting, and prescribe that park planning be accomplished in a regional context. This latter concern is summarized in the *Management Policies* as follows: "Recognizing that parks are integral parts of larger regional environments, the National Park Service will work cooperatively with others to anticipate, avoid, and resolve potential conflicts, to protect park resources, and to address mutual interests in the quality of life for community residents, considering economic development as well as resource and environmental protection."

When bison leave Yellowstone National Park, they are no longer within the jurisdiction of the National Park Service, and management is governed by Montana statutes…

When bison leave Yellowstone National Park, they are no longer within the jurisdiction of the National Park Service, and management is governed by Montana statutes (81-2-201 M.C.A., 81-2-120, M.C.A; and, 87-1-216, M.C.A.). These laws define bison that originate from Yellowstone National Park as "a species requiring disease control." In combination with the mandates of the U.S. Department of Agriculture, Animal and Plant Health Inspection Service, brucellosis-infected bison originating from Yellowstone National Park are not permitted to freely roam in Montana.

The National Parks Omnibus Management Act of 1998 (Publ. L. 105-391, 112 Stat. 3498, 16 USC 5901 et seq.) directs the National Park Service to manage park resources through the application of science and scientific principles to its decision making. Specifically, the sections most relevant to bison management are sections 202 ("Research Mandate") and 206 ("Integration of Study Results into Management Decisions"). These sections direct the secretary of the interior to ensure that national parks are managed using the highest quality science and information. The selected bison management plan, therefore, must be based upon science and scientific principles and have the capacity to adapt as new research becomes available.

METHODOLOGIES FOR ANALYZING IMPACTS

Population Estimates

Bison population changes were estimated using both the scientific literature and predictive models based on that literature.

First, a review of relevant literature was conducted to determine a population range within which to base analyses of management actions on the bison population. Green herbaceous vegetation (Merrill et al. 1988) and winter severity have been used in stochastic (e.g., based on frequency of random events, such as winter mortalities and weather conditions) and deterministic (e.g., using an averaging approach) population models to predict bison numbers within Yellowstone National Park (Boyce 1990; Boyce and Gaillard 1992). Based on average forage production, winter severity, and other factors, Yellowstone National Park will support a long-term average of 2,700 bison. However, weather and forage production are quite variable and, correspondingly, the maximum herd size fluctuates between 1,700 and 3,500 (Boyce 1990; Boyce and Gaillard 1992). The low end of the range would result from effects of harsh winters and poor annual forage production, with the high range representing bison numbers after a series of mild winters and high annual forage production. For all alternatives except alternative 7 (where the upper limit is lower), population numbers were assumed never to exceed 3,500 because of random, periodic environmental events (poor forage production, severe weather) bison emigration, and the agencies' increasing levels of lethal control of bison (or removal to quarantine) at higher population levels.

The National Academy of Sciences also conducted a review of bison population size and movements out of Yellowstone National Park in relation to winter weather. In general, bison movement beyond park boundaries, and hence removals, was significantly related to bison population size above 3,000 animals. At populations below 3,000, substantially fewer bison moved beyond park boundaries and bison movement appeared unrelated to winter weather conditions. At populations above 3,000, the amount of snow was strongly related to bison movements beyond the park (NAS 1998). Although this analysis examines the relationship between bison movement and a population size, 3,000 bison is within the upper end of the ecological range identified in other studies and is the early spring bison population limit in the modified preferred alternative.

A first step in the quantitative analysis was to construct a basis for estimating the expected early winter bison population for 1997. The spring bison population was estimated at 1,900 based on aerial counts. Based on findings from the 1960s (NPS, Meagher 1973) and 1980s (Pac and Frey 1991) the bison male/female ratio was 57/43. Using this ratio, the spring 1997 female component of the population was estimated at 817 animals.

Calves and yearlings do not produce calves (NPS, Meagher 1973; Kirkpatrick et al. 1996). Results from data collected during four winters between 1988 and 1997 showed that calves and yearlings comprised an average of 40% of total female bison killed (Pac and Frey 1991; Aune, unpubl. data). Using these data, approximately 60% of the female component, or 490 bison, would be of reproductive age and capable of producing calves.

Calf production for the Mary Mountain and northern range subpopulations was observed at 42.6% and 52.6%, respectively (Kirkpatrick et al. 1996). Using a 52% calf production value, approximately 255 calves would be born, and assuming no additional calf mortality the 1997 early winter population is estimated at approximately 2,156. This number was used as a beginning population for the analysis. This number closely approximates the 1997 early winter aerial counts of approximately 2,200 bison.

Bison with nursing calf.

The next step in the analysis was to construct a simple deterministic (averaging) population model that included estimates of the rate of change in the population, taking management actions into account, and estimates of changing seroprevalence rate. The rate of increase was calculated using the rate of change between the late winter population, after management removals and natural mortality, and the fall high population count for the following year (Eberhardt 1987). Early winter bison population counts and removals (Meagher, unpubl. data; National Park Service and state of Montana 1996; NPS, unpubl. data) from 1979 to 1997, when the population ranged between 1,700 and 3,500 animals, were used to calculate the rate of change for the bison population (see table 40). The geometric mean of the rate of change was calculated to be 1.082 (see table 40); this means the bison population increased at an average rate of 8.2%/year over this time period. This rate was validated using actual population counts through 1996.

TABLE 40: TOTAL PARKWIDE WINTER BISON COUNTS AND BISON MANAGEMENT REMOVALS OUTSIDE YELLOWSTONE NATIONAL PARK, 1979–80 TO 1999–2000[1]

Winter	Total Winter Bison Counts	Management Removals Outside Yellowstone National Park: West Boundary	Management Removals Outside Yellowstone National Park: North Boundary	Management Removals Outside Yellowstone National Park: Total Removals	Percent of Population Removed	Est. Spring Population After Removals[2]	Rate of Increase
1979–80	1,727	-	-	-	-	1,727	-
1980–81	1,803	-	-	-	-	1,803	1.044
1981–82	2,396	-	-	-	-	2,396	1.329
1982–83	2,239	-	-	-	-	2,239	0.934
1983–84	2,160	-	-	-	-	2,160	0.965
1984–85	2,114	0	88	88	4.2	2,026	0.979
1985–86	2,291	16	41	57	2.5	2,234	1.131
1986–87	2,433	7	0	7	0.3	2,426	1.089
1987–88	2,644	37	2	39	1.5	2,605	1.090
1988–89	3,159	2	567	569	18.0	2,590	1.213
1989–90	2,606	3	1	4	0.2	2,602	1.01
1990–91	3,178	14	0	14	0.4	3,164	1.221
1991–92	3,426	22	249	271	7.9	3,155	1.083
1992–93	3,304	79	0	79	2.4	3,225	1.047
1993–94	3,551	5	0	5	0.1	3,546	1.101
1994–95	3,956	119[3]	305	424	10.7	3,532	1.116
1995–96	3,398	393	33	426	12.5	2,972	0.962
1996–97	3,436	358	726	1,084	31.5	2,352	1.156
1997–98	2,105	11	0	11	0.5	2,094	NA[4]
1998–99	2,239	94	0	94	4.2	2,145	NA[4]
1999–2000	2,470	0	0	0[5]	0	2,470	NA[4]
MEAN	-	-	-	-	5.1[6]	-	1.082[7]

NOTE: Table 17 in "Affected Environment" contains population sizes and removals starting in 1902.

1. From NPS, unpubl. data; M. Meagher, unpubl. data; M. Meagher, pers. comm.; Montana Department of Fish, Wildlife and Parks, unpubl. data; Montana Department of Livestock, unpubl. data.
2. These estimated totals assume zero losses to winterkill.
3. Does not include four illegal kills.
4. Not used for deterministic model.
5. As of March 11, 2000.
6. Mean includes management removals from 1984–85 to 1995–96 for use in the deterministic model.
7. Geometric mean of rate of increase from 1980–81 through 1996–97 for use in the deterministic model.

Based on management removals from 1984–85 to 1995–96, an average of 5.1% of the total early winter bison population exited Yellowstone National Park into the Reese Creek area north of the park and the West Yellowstone area west of the park (see table 40). The 5.1% value was used in the model to calculate the average total number of bison exiting the park each year. Past data indicate that after large removals in the Reese Creek area, few bison exit the north boundary area for approximately two years. This trend is expected to continue, and very few or no bison are expected to exit to the north boundary area prior to 1999. Based on the large number of bison removed from the Reese Creek area in the winter of 1996–97, the model assumed no bison would exit the Reese Creek area until 1999. Bison were assumed to exit the park during winter at the West Yellowstone area for all years in the model. Comparing total removals across all years, 65% of the total bison removed were from the Reese Creek area, and 35% were from the West Yellowstone area. These ratios were used in the model to estimate the proportion of bison exiting at the two areas. Average numbers of bison entering the Eagle Creek/Bear Creek area in the winter are unknown, but it was assumed approximately 100 would inhabit this area.

The model used the above assumptions to calculate average population growth, the average number of bison leaving the park by area, and predictions of population size based on specific management actions. A minor increase or decrease in population size is defined for purposes of analysis as less than 10%, a moderate change is 11%–20%, and a major change is greater than 20%. Methods and assumptions used to calculate seroprevalence in the model are explained below. Those calculations resulted in predictions of seroprevalence rates for each alternative. The same definitions of minor, moderate, and major apply to changes in seroprevalence as population size.

Past data demonstrate that rates of increase and removals are highly variable from year to year and show no strong or discernible correlation. Because averages of rates of increase and removals are used, the model could predict population numbers that are higher or lower than those that might actually be observed in the future. It is important to note that results from the simple deterministic model presented in the analyses are intended to compare impacts of the alternatives based on the different management actions occurring in the alternatives.

Seroprevalence Estimates

Since publication of the *Draft Environmental Impact Statement*, additional research and data have been collected on seroprevalence in bison; of 246 bison tested in the winter of 1996–97, 39% were serologically positive (NPS, unpubl. data). Although the precise relationship between serological tests and the presence of *B. abortus* in bison is not well understood, existing data suggest that 15%–46% of those bison testing serologically positive also test positive for the culture test, indicating presence of the bacteria. The data also show that all of the seronegative pregnant females tested from 1997 through 1999 were also culture negative (see "Affected Environment: Bison Population — *Brucella abortus* in Yellowstone Bison").

Additional research on RB51 brucellosis-vaccine safety in bison and nontarget species is ongoing or completed (see "The Alternatives: Actions Common to All Alternatives — Vaccination" section for more information).

METHODOLOGIES OF THE STOCHASTIC MODEL

The National Park Service funded development of a more refined stochastic model to examine what influences stochastic (i.e., random) events might have on bison management, bison population dynamics, and brucellosis seroprevalence. Below is a brief description of the stochastic model and model outputs.

Model Structure and Assumptions

The sex- and age-class composition of the initial population, index of winter severity, rates of bison movement from the park, natural mortality, exchange between herds, reproduction, and the dynamics of brucellosis infection were all estimated from the best available information on Yellowstone bison population dynamics and brucellosis epidemiology. The stochastic bison model provided a framework for organizing and synthesizing these numerous sources of information and enabling the simultaneous consideration of multiple influences on the bison population, including alternative management actions.

The model assumed the Yellowstone bison population comprised two distinct wintering segments, the Central Range (those bison associated with the Pelican Valley, Hayden Valley, and Madison-Firehole areas) and the Northern Range (associated with the northern winter range). These population segments experience different mortality rates, use different routes to leave the park, and would be affected differently by proposed management alternatives. Separate model projections were prepared for the two segments, and results were subsequently combined to give a projection for the entire population. Because both population segments are subjected to annual variations in weather patterns, each population segment was subjected to the same randomly determined index of winter severity for each year in the model. This index was generated from historic weather records and used to specify rates of bison movement from the park, rates of winter mortality, and rates of exchange between wintering herds.

The bison model begins in 1997 (year 1 of the model) and assumes the *Interim Bison Management Plan* would be in operation until 2000 (year 4 of the model), when a record of decision would be made and implementation of a particular alternative would begin. Model results are presented for the life of the plan or 15 years (through year 18 of the model) beginning in 2000. The model assumes a beginning population of 2,108 (based on an actual early winter count of 2,105 in 1997) and a 50:50 sex ratio(1,054 females). The model initially set the number of bison in the Central area and Northern Range area at a ratio of 70:30. The bison in the stochastic model comprised three age classes: calves 1 year of age or less, yearlings greater than 1 year and less than 3 years of age, and adults 3 years of age or older. The age classes were set at 16% calves, 11% yearlings, and 73% adults.

For each year, based on fall population size and the stochastic influence of winter severity, the model calculated the number of bison that would remain within the park (residents) and those bison that would move outside the park (migrants). Residents and migrants were then subjected to removals prescribed by 1 of the 8 proposed management alternatives. Surviving migrants were combined with those remaining in the park and numbers were adjusted to reflect winter mortality (based on winter severity for the Central population and a random, low percentage for the Northern Range), as well as exchanges of animals between wintering population segments. Reproduction was added to the resulting spring population and juvenile animals advanced to the next age class. The model predicted the number of animals in each age class every fall, after one full cycle of the model.

After births were added to the spring population, brucellosis epidemiology was addressed in the model. The model incorporated four categories of disease status: susceptible/uninfected, infected, recovered, and vaccinated. The proportion of animals in each disease class was adjusted to reflect vaccinations the previous winter, new infections of susceptible animals, and recoveries of previously infected animals. Based on the current research described above that showed about 40% of bison test positive for exposure to brucellosis (NPS, unpubl. data; Roffe, unpubl. data), the stochastic model assumed in year 1 that 10% of the population was infected, 30% was resistant to or had recovered from infection, and approximately 60% of the Yellowstone bison population was classified as uninfected and/or susceptible. As discussed in the following sections, the initial parameters and results of this model are only intended for comparisons among alternatives. The results are not presumed to describe what may be the true seroprevalence in the population.

Influence of Parameterization on Model Performance. Like most models, the structure and parameterization of the bison model were based on a combination of sample data and professional judgment. As a result, more than one reasonable choice exists for each aspect of the model structure or parameter value.

This fact has important implications when considering the model results. Model construction could have predicted bison populations or disease prevalence rates for a given management alternative. Moreover, the bison model is based on historic information gathered under circumstances that may change in the future. The greatest strength of the bison model is in providing information that allows comparison of management alternatives, rather than in predicting actual bison populations or actual disease prevalence rates that will result if a particular alternative is chosen.

If, for example, the rate of natural mortality (winterkill) was underestimated, or if natural mortality increased as a result of unprecedented events (e.g., increased wolf predation), model projections would overestimate the growth rate of the bison population; however, these types of effects on projections would be the same across all management alternatives. Comparisons of alternatives would still be informative.

Parameters Used for Comparing Alternatives. Using a set of calfhood vaccination rates (50%, 75%, and 90%), vaccine efficacies (25% and 70%), and rates of brucellosis transmission from elk to bison (1 infection/year, 1 infection/15 years, and 1 infection/100 years) in the model would result in up to 18 separate sets of results for each management alternative. Fortunately, certain assumptions are possible and permit valid comparisons based on the resulting smaller set of results. Some of these generalities and the implication for modelling are explained below.

Results presented in the analysis are based on an intermediate rate of interspecific elk transmission (1 infection/15 years). Transmission from elk to bison, particularly elk associated with feedgrounds, appears probable (NAS 1998). Brucellosis transmission from elk to bison is likely to prevent the long-term eradication of brucellosis from bison (NAS 1998); indeed, preliminary model runs simulating a test and slaughter program without vaccination illustrated this point. After brucellosis was eliminated from the model population, reinfection of bison from elk led to an increase of seroprevalence to pretest and slaughter levels in about 20 years (R. Angliss, unpubl. data). Different interspecific transmission rates, however, are likely to have a relatively small difference on the projected seroprevalence rates (hence, other metrics) of infected bison populations, because the number of seronegative bison that acquire infections from elk is small compared with the number of bison that test seropositive within an affected population.

For alternatives specifying calfhood vaccination of bison, seroprevalence was related in a roughly linear fashion to the proportion of calf bison effectively protected by vaccination. Differences among alternatives, with respect to predicted seroprevalence rates, were most pronounced for the most effective vaccination programs modelled and least pronounced for the least effective vaccination programs modelled, but the relative predicted seroprevalence rates for the different alternatives was similar across the range of effective protection rates. Results presented in this document are thus based on vaccination rates of 75%, a vaccine efficacy of 70%, and reinfection of bison by elk at a rate of 1 case in 15 years. However, any combination of calfhood vaccination rate and vaccine efficacy that results in a similar effective protection rate of approximately 50% would have results similar to those presented in these analyses.

Winter Severity. Mortality rates, rates of bison movement from Yellowstone, and rates of exchange between wintering herds are all related to winter severity. Thus, stochastic events (chance) will play an important role in the future course of bison population dynamics and brucellosis epidemiology. For example, a series of mild winters could occur and lead to low rates of natural mortality, few bison leaving the park, and few management removals, resulting in rapid population growth. Alternatively, a series of harsh winters could lead to high rates of natural mortality, large-scale movements of bison out of the park, and extensive management removals, hence a reduction in the bison population.

MODEL RESULTS AND INTERPRETATION

The Yellowstone bison population is unique. The actual bison population and disease dynamics that will occur from future environmental conditions will be observed only once. The stochastic model, however, allows the opportunity to observe different possible dynamics of a simulated bison population resulting from a wide range of environmental circumstances that might occur in the future. Estimated bison populations, and disease dynamics, and other parameters can be calculated as many times as desired to obtain information about the expected impacts of each alternative and their variability and predictability.

A model *trajectory* is an 18-year series of predicted population sizes, management removals, or disease rates. A trajectory results from one *projection*, or run of the bison model. An *average trajectory* is a mean of two or more 18-year trajectories. Initial model parameters and settings heavily influence the initial trajectories of model projections. Because the same set of initial conditions was specified for each management alternative, resulting projections were quite similar for the first several model years (cycles). Except for alternative 5, where extensive capture, test, and slaughter of bison occurs beginning in year 4 (2000), most model results under each of the alternatives do not begin to appreciably differ until after about year 5 (2001).

Terms used to interpret the modelled performance of the management alternatives are defined below.

Mean: Measures the central tendency or average trajectory of 100 projections of the model for a particular variable, such as bison population or bison removals. The mean is useful for estimating long-term expectations but does not provide information about how much variability occurs in individual model trajectories.

Standard deviation (SD): A measure of the deviation of predicted values (for a set of trajectories) from the mean predicted values (calculated by taking the square root of the average square deviations about the mean). Standard deviations were calculated for each year of the model projections. The larger the standard deviation for a given year, the less predictable the result of a particular management strategy is likely to be.

Likely maximum or likely minimum (Mean ± SD): A statistic used to describe the range of results that are predicted for a given alternative. For normally distributed results, this range encompasses approximately 68% of all potential outcomes. This statistic is useful for answering the question, "What is the range of values that will likely be encountered in any given year during the life of the plan?"

Expected total over lifetime of plan: This value was obtained by summing means across the 18-year span of model projections. Expected totals were used, for example, to answer the question, "What are the expected total number of female bison that would be killed under each management alternative during the life of the plan (1997–2014)?"

Results Reported for All Alternatives

Four different results are described for all eight management alternatives and are discussed in the section "Stochastic Influence on Bison Population."

These results are useful for comparing relative impacts among all the alternatives. Although model results are useful for describing impacts of management actions on the bison population and for examining relative comparisons among different alternatives, the results presented are model projections and are not intended to describe the actual bison population.

Total Population Size. For ease of interpretation, projected numbers of female bison were doubled (based on a 50:50 sex ratio), so results could be reported on the familiar scale of total population size.

Seroprevalence. Using an approach adapted from Dobson and Meagher (1996), the stochastic model provides a more refined analysis of the effects of each management alternative on brucellosis seroprevalence in the bison population. The model estimates the proportion of female bison that test positive for exposure to brucellosis. Assuming equal seroprevalence between sexes in the population, males would have a seroprevalence similar to females. Many management actions within each alternative are directly related to the serological status of bison and for some alternatives, it also determines which action is to be taken: sending seropositive bison to slaughter, allowing some seropositive bison to remain on public lands, or putting seronegative bison in quarantine.

Bison Removed from the Population. The computer model identifies (1) management removal actions for each alternative, including slaughter, agency shooting, hunting, and quarantine; (2) the relative proportions of the different types of removals; and (3) additional bison subject to management action (see "Additional Removals"). For ease of interpretation, female removals were predicted and then doubled to more simply estimate the total number of bison that might be removed. Since some alternatives (e.g., alternative 1) kill or remove a larger proportion of female bison (because of pregnancy status), doubling female removals in some alternatives would overestimate the number of males that would be removed from the population, and thus the total number.

IMPACTS COMMON TO ALL ALTERNATIVES

All of the alternatives include lethal management actions to control the distribution of bison and prevent situations in which brucellosis might transmit from bison to cattle. Except for alternatives 5 and 6, all lethal actions occur in response to stochastic events.

All alternatives require brucellosis vaccination of bison calves and yearlings with a safe and effective vaccine using a safe and effective delivery system.

Additional research on the safety of the RB51 brucellosis vaccine in bison and nontarget species has been ongoing or completed. Evaluations of the RB51 vaccine in bison calves indicate the vaccine is clinically safe when administered to bison calves from three to at least six months of age. Research is ongoing to evaluate safety and efficacy of RB51 booster vaccination of bison yearlings previously vaccinated as calves. Results of these safety evaluations will be available in 2001 and efficacy data will be available in 2004 (Steve Olsen, pers. comm.). RB51 vaccination did not cause morbidity or mortality in adult male bison and administration of RB51 to adult males meets biosafety requirements (Olsen et al. 1999; Elzer et al. 1998). Available evidence regarding vaccination of adult females is ambiguous. Initial tests of RB51 administered on pregnant adult females indicated a substantial number of them had vaccine-induced abortions, fetal RB51 infections, and placentitis. At this time, vaccination of adult pregnant bison with RB51 would not meet the biosafety protocols. For more information regarding brucellosis vaccine safety in bison, see "The Alternatives: Actions Common to All Alternatives — Vaccination" section and "*Volume 2: Responses to Comments.*"

Evaluations of RB51 safety on nontarget species including coyote, ravens, ground squirrels, meadow voles, and deer have been completed and results show that RB51 did not cause morbidity, mortality, or significant clinical pathology in any of these species. Evaluations have also been completed on moose, mule deer, bighorn sheep, and pronghorn, and exposure to RB51 did not cause morbidity or mortality in any of the test animals. For more detailed information see "The Alternatives: Actions Common to All Alternatives — Vaccination."

The movement of bison to the boundary area of Yellowstone National Park is affected by many factors, including annual summer forage production, the severity of winter weather, (particularly snow depth and condition), and previous bison movement experience. There are also dramatic differences between the movements of bison on the northern winter range and the interior areas such as Pelican Valley, Hayden Valley, and Madison-Firehole area.

The northern winter range is lower elevation grassland area that has significantly lower snow depths than other areas of the park. The road between Mammoth Hot Springs and Cooke City is plowed for wheeled vehicle use all winter. There is an elevational gradient from the upper areas of the winter range in the Lamar River valley to the lower elevations along the Yellowstone River as it exits the park near Gardiner, Montana. There are no significant areas of geothermal activity that are used by bison on the northern range.

Bison movements on the northern range are highly variable. They are not correlated with population size, but appear to be influenced by extremely severe winter weather, particularly deeper than normal snow combined with saturated and frozen snow conditions or ice layers. These conditions occurred in the winters of 1988–89, 1991–92, and 1996–97 and correspond to years of very high removals of bison when most of the northern herd moved to lower elevations and exited the park. Consequently, at current population levels, movements on the northern range appear to be highly influenced by extreme winter weather events, which sometimes result in episodic movements of most bison to lower elevations of the northern winter range.

In the park interior, snow depths are normally much greater, and there is little elevational gradient. A distinguishing feature is the large areas of geothermal activity, offering bison a thermal buffer during winter. Bison foraging in these areas, where temperatures are modified, minimize energy expenditure and experience body heat savings. Bison movements from the interior seem to be less episodic than on the northern range although they are still highly variable. Movements beyond park boundaries range from 0% to 10% of the interior populations compared to the near total migrations of northern range population during extreme weather events.

Except for short-term reductions that might be associated with extreme stochastic events, none of the alternatives, except alternative 5, would reduce the bison population below a level of 1,700, i.e., the maximum herd size that can be supported in Yellowstone National Park during periods of severe winter and limited forage production.

Agency-implemented lethal controls would decrease as the population approached 1,700 bison and would cease at 1,700 bison in certain areas described in management sections of each area. In general, bison would be hazed from areas where they are not permitted, such as outside SMAs or on private land, and shot only if hazing were unsuccessful. Bison posing a low possibility of brucellosis transmission as designated by the Montana state veterinarian and those that tested negative and were previously released would be allowed on public land. Bison posing a higher possibility of brucellosis transmission would be removed.

All alternatives predict increasing bison population within the range of 1,700 and 3,500, resulting in effective genetic population size well above the recommended minimums (see "The Alternatives: Actions Common to All Alternatives — Bison Population Numbers"). Since the population models predict all alternatives will maintain the bison population within the recommended genetic population size, no alternative is expected to compromise the genetic viability of the Yellowstone bison population.

Management actions in all alternatives, except alternative 5, would not measurably affect the age/sex distribution or reproductive rates of bison. In alternative 5, either or both could be affected.

CUMULATIVE IMPACTS COMMON TO ALL ALTERNATIVES

The bison population is affected by a number of factors, including severe weather, forage production, and predation, as well as human actions not part of this management plan. Periodic severe winter weather can cause varying (sometimes significant) levels of natural winterkill. Typically, young (calves and yearlings) and older animals die first. During the severe winter of 1996–97, approximately 300–400 bison (8%–11% of the early winter population) were estimated to have died due to natural mortality. Wolf and grizzly predation may also reduce the bison population (see "Environmental Consequences: Impacts on Threatened, Endangered, and Sensitive Species"). Studies predict wolf predation at its maximum would result in no more than a 15% decrease in the bison population (Boyce and Gaillard 1992). Since reintroduction, observed wolf predation on bison has been less than 1% of the total bison population and is considered negligible (Smith et al. 1999; NPS, unpubl. data). Grizzly bears eat bison meat, but it is usually in the form of carrion, rather than prey that the bears have killed. Cumulative effects from grizzly bears on the bison population to date are negligible. Vehicle collisions might also contribute to negligible mortality. Also, a small number of bison move from Yellowstone into the North Fork Shoshone River drainage, where a few could be removed through hunting in Wyoming. These hunting removals would have a negligible impact on the bison population.

The National Park Service is currently completing work on a winter use plan for Yellowstone and Grand Teton National Parks. Since a final environmental impact statement and record of decision have not been completed, current winter use management actions are assumed to continue to occur and no additional cumulative impacts to the bison population were identified; however, the closing of groomed roads could have the effect of reducing population size and shifting distribution back to patterns observed before grooming, if closures were part of a selected alternative.

IMPACTS OF ALTERNATIVE 1: NO ACTION

Analysis

Effects on the Bison Population. Alternative 1 has no specific population management objectives identified, and therefore, ecological factors and bison management actions were assumed to maintain the population between the ecologically defined range of 1,700 to 3,500 animals. This alternative emphasizes capture of bison at Stephens Creek and shipment of all these animals to slaughter (see NPS and State of Montana 1996). Seropositive bison and seronegative pregnant females captured at West Yellowstone are sent to slaughter. Seronegative males and seronegative nonpregnant females are released on public lands in the Horse Butte area.

Given the assumptions described in the "Methodologies for Analyzing Impacts," the model predicts selecting alternative 1 would result in an increasing bison population. From 1997 to 2006, the bison population is projected to increase from about 2,100 bison to approximately 3,100 (overall average increase 4% per year following capture and slaughter operations; see table 41). By 2011 the population is estimated to reach 3,500. Capture and shipment of bison to slaughter and periodic severe environmental conditions would likely maintain the bison population within the range of 1,700 to 3,500. Episodic movements of bison caused by severe winters could result in larger than estimated removals and reduce population growth and overall population size. Similarly, a series of mild winters could result in increased population sizes. If assumptions described above under "Methodologies for Analyzing Impacts" for the population model are correct, implementation of this alternative would result in an increase in the bison population of about 63% over the life of the management plan. The population growth rates of all other alternatives are contrasted to this "no action" rate for comparison purposes.

Effects on Free-Ranging Status and Distribution of Bison. Management activities such as capture, slaughter, and shooting would keep bison from moving beyond the identified management areas. On private lands where the landowner wanted bison removed, agency personnel would shoot those bison. For the life of the plan, there would be no bison north of the park boundary at Reese Creek. Bison would freely range in Yellowstone National Park except near the Stephens Creek capture facility. Winter management objectives would allow up to 50–100 seronegative bison in the West Yellowstone region, but modelling indicates only 18 to 52 seronegative nonpregnant (i.e., those that were tested and released) bison would remain after testing in this area.

Table 41: Deterministic Model of Estimated Early Winter Population, Rate of Population Increase, Projected Management Removals, and Estimated Seroprevalence Rate for the Bison Population under Alternative 1

Year	Early Winter Population	Yearly Percent Increase	Management Removals Outside Yellowstone National Park			Remaining on Public Land Outside Yellowstone National Park at West	Estimated Percent Sero-prevalence[1]
			North Boundary	West Boundary	Total Removals		
1997	2,156	-	-	62	62	48	50
1998	2,266	5.1	-	64	64	52	49
1999	2,383	5.2	80	23	103	18	48
2000	2,467	3.5	83	22	105	21	47
2001	2,556	3.6	86	22	108	22	45
2002	2,649	3.6	89	22	111	24	42
2003	2,746	3.7	92	22	114	26	39
2004	2,848	3.7	96	21	117	28	37
2005	2,955	3.8	99	22	121	29	35
2006	3,066	3.8	103	22	125	31	33
2011	3,500	-	-	-	-	-	24
Mean[2]	-	4.0	-	-	-	-	-

1. Based on calfhood vaccination beginning in 1999 and 70% vaccine efficacy
2. Mean rate of increase calculated from 1997 to 2006. Under this alternative, bison movements would probably remain similar to what they have been in recent years. To date, bison continue to winter in the interior of the park (Pelican and Hayden Valleys) and provide a spring source of carrion to grizzly bears in this area (Meagher, pers. comm.).

This alternative would provide for 100–200 bison to freely range on public lands in the Eagle Creek/Bear Creek SMA.

Bison Population Trends. Predictions of bison population trends, seroprevalence, and removals needed to carry out management objectives in each alternative were also estimated using a stochastic model (see "Methodologies for Analyzing Impacts: Methodologies of the Stochastic Model"). This model was more refined than the model used to predict the possible outcomes resulting from stochastic influences in the *Draft Environmental Impact Statement,* and results in this final environmental impact statement should be substituted for the stochastic results reported in the *Draft Environmental Impact Statement*. As noted in "Methodologies of the Stochastic Model," deterministic models present averages, whereas stochastic models attempt to capture the range of possibilities, given unpredictable events such as severe winter weather. The results of the more refined stochastic model are presented here as a kind of "second opinion" on what might happen to the bison population given assumptions regarding management actions and random weather conditions.

Under alternative 1, the stochastic model projected a mean total population increasing from about 2,100 in 1997 to about 3,100 in 2001 (one year after assumed implementation of alternative 1, which is equivalent to year 5 of the model), to a "peak" of about 3,900 in 2010. The model projected population stabilization after 2012, with a mean of about 3,700 animals that fluctuated between 3,100 and 4,400 (see table 42).

Table 42: Stochastic Model Results of Mean Bison Population for Selected Years after Implementing Alternative*

Year	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7	Modified Preferred Alternative
Year 1 (1997)	2,108	2,108	2,108	2,108	2,108	2,108	2,108	2,108
Year 5 (2001)	3,113	3,089	3,186	3,118	2,080	3,029	3,033	3,117
Year 6 (2002)	3,326	3,358	3,393	3,221	2,157	3,210	3,191	3,282
Year 8 (2004)	3,600	3,892	3,616	3,541	2,494	3,569	3,331	3,520
Year 10 (2006)	3,825	4,355	3,716	3,703	2,828	3,689	3,534	3,668
Year 12 (2008)	3,942	4,868	3,803	3,687	3,140	3,826	3,539	3,714
Year 14 (2010)	3,831	5,217	3,740	3,699	3,357	3,711	3,644	3,650
Year 16 (2012)	3,721	5,175	3,726	3,592	3,487	3,683	3,575	3,660
Year 18 (2014)	3,734	5,247	3,752	3,669	3,587	3,681	3,640	3,703

*Implementation of the plan was assumed to begin in the year 2000, or year 4 of the model.

Epidemiology. More realistic assumptions were incorporated into the stochastic model to assess the effect of management actions, including vaccination, on seroprevalence. In general, the new model showed a greater effect from vaccination and other management actions on reducing seroprevalence in bison than did the deterministic model. The stochastic model assumed calfhood vaccination would begin in 2002, with effective protection for about 53% of vaccinated calves (75% of calves vaccinated and 70% vaccine efficacy). Mean predicted seroprevalence fell from this time and continued to decline throughout the life of the plan, from about 36% in 2002 (year 6 of the model) to about 11% in 2013, as shown in figure 2. This is a 69% reduction in the first 11 years of vaccination, compared with a 49% reduction (from 47% seropositive to 24% seropositive) in 11 years of vaccination (from 2000 to 2011) predicted by the deterministic model.

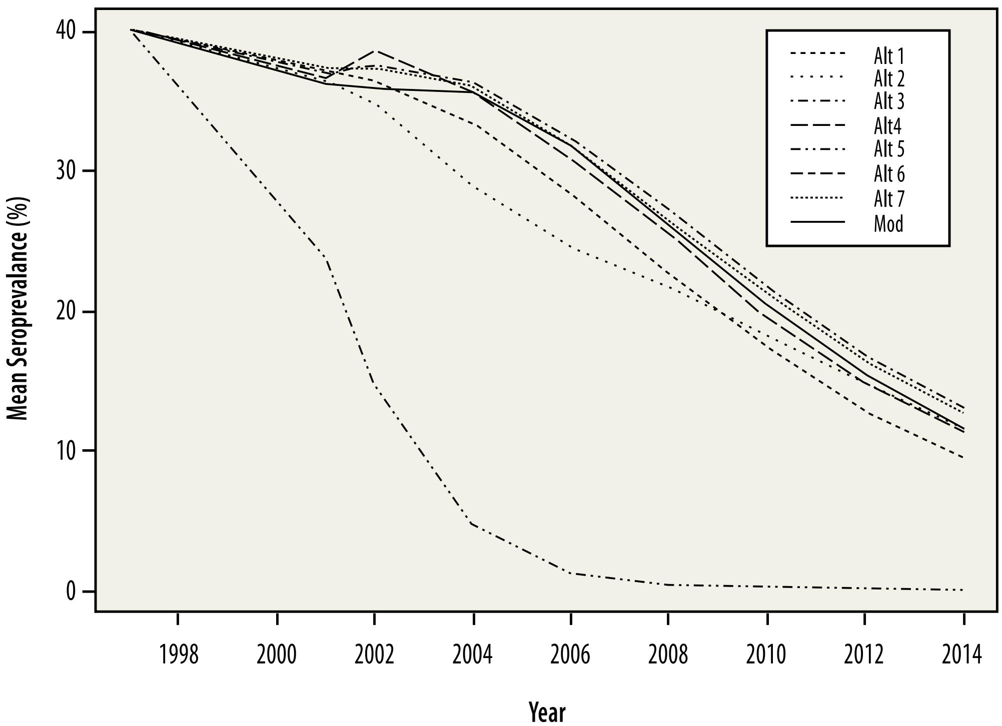


Figure 2: Comparison of Alternatives — Stochastic Model Estimates of Yearly Mean Seroprevalence over Time

Bison Removals from the Population. As noted in "Methodologies of the Stochastic Model," the stochastic model estimated the number of bison removed over the life of the plan, given certain random events and management actions. Alternative 1 does not include any population objectives (as do alternatives 7 and the modified preferred alternative, for example); therefore, removals are a function of continued, steady bison population growth inside the park, corresponding bison movements outside the park, and continuation of existing management practices, i.e., lethal removal of bison. Based on summing the mean number of removals across the 18-year span of model projections, the stochastic model predicted a total of 4,664 (2,332 females) bison would be removed over the lifetime of the plan (see table 43). A total of 2,150 (1,075 females) of these 4,664 bison would be sent to slaughter because alternative 1 calls for slaughter of all seropositive bison and seronegative pregnant bison. The model and this analysis assumed that the remaining 2,514 bison would need to be removed by lethal means since alternative 1 does not have a quarantine option for seronegative bison.

TABLE 43: STOCHASTIC MODEL RESULTS OF TOTAL NUMBER OF BISON SLAUGHTERED, HUNTED, OR QUARANTINED OVER THE LIFE OF EACH ALTERNATIVE (SUM OF MEANS FOR 1997–2014)

Alternative	Captured, Tested, and Slaughtered	Hunted	Bison Subject to Other Lethal Removals[1]	Total Bison Killed	Removal of Live Bison to Quarantine
1	2,150	-	2,514	4,664	-
2	876	-	5,332	6,208	-
3	662	702	2,196	3,560	1,752
4	1,434	206	4142	2,054	2,468
5	2,190	-	3,266	5,458	-
6	3,438	-	786	4,224	-
7	1,290	114	1,314[2]	2,718	2,254
Modified Preferred	1,382	-	-	1,382	3,792

1. Additional removals may include seropositive and seronegative bison subject to test and slaughter, agency shooting, or additional hunting. Alternatives might include one or a combination of the methods of removal. See text for information concerning particular alternatives.
2. An indeterminate number of bison could be available for quarantine in alternatives 4 or 7.

One limitation of the model is that it does not reflect that under alternative 1 (continuation of existing management practices), capture, test, and slaughter operations occur all winter, as bison move back and forth across the park borders. For this reason, model estimates of bison removal might be lower than what could occur in the field.

Bison Distribution. Alternative 1 would allow 100–200 bison to freely range on public lands in the Eagle Creek/Bear Creek area. For the life of the plan, no bison would be allowed north of the park boundary at Reese Creek. Bison could freely range in Yellowstone National Park, except near the Stephens Creek capture facility. While alternative 1 would allow up to 100 bison in the West Yellowstone area, the model projected that in later years (after 2012), a yearly average of 61–66 seronegative nonpregnant bison would remain in this area during winter.

Cumulative Impacts

There would be no additional sources of cumulative impact beyond those described in "Cumulative Impacts Common to All Alternatives."

Conclusion

Capture and shipment of bison to slaughter, periodic severe environmental conditions, and additional mortality would likely maintain the bison population in the range of 1,700 to 3,500, with the bison population near the higher end of the range during the later years of the management plan.

This alternative would allow bison to freely range throughout Yellowstone National Park and would provide for 100–200 bison to freely range in the Eagle Creek/Bear Creek area. Bison would not be allowed to freely range north of the Reese Creek area, and a limited number of bison would be allowed to winter in the West Yellowstone area from November 1 to May 1.

Removal of seropositive bison at Reese Creek and West Yellowstone and calfhood vaccination at 70% efficacy would be expected to decrease seroprevalence in the bison population to at least 33% by 2006 and 24% by 2011. Other factors, such as protection from abortion as a result of vaccination, might contribute to an additional decrease in seroprevalence in the bison population.

A recalculation of population trends, removals, and seroprevalence using an enhanced stochastic model indicated the population would stabilize at a mean of about 3,700 bison. The enhanced stochastic model indicated greater effectiveness of management actions in reducing seroprevalence than did the deterministic model, from about 36% in 2002 (year 6 of the model) to about 11% in 2013. This is a 69% reduction in 11 years of vaccination, compared with a 49% reduction (from 47% seropositive to 24% seropositive) in 11 years of vaccination (from 2000 to 2011) predicted by the deterministic model.

Because alternative 1 relies on lethal removals as its primary management tool and no quarantine facility is included for seronegative bison, the total bison killed over the life of the plan would reach 4,664, an average of 300 bison per year.

The enhanced stochastic model indicated that it would take nearly the entire life of the plan to get close (61–66 bison predicted) to the management objective of 100 bison in the West Yellowstone area in the winter.

IMPACTS OF ALTERNATIVE 2

Analysis

Effects on the Bison Population. Assumptions used in alternative 1 were also used in this alternative to construct bison population dynamics. For alternative 2, the agencies would attempt to manage the Yellowstone bison population within the range of 1,700 to 3,500 animals. This alternative has two phases. In phase 1, the management actions described in alternative 1 (the interim plan) would continue. For the analysis of impacts on the bison population, phase 1 actions were assumed to occur for five years. During this time, development and implementation of phase 2 elements of alternative 2, such as changes in winter road grooming, purchase or easement of lands from willing sellers, site-specific and localized fencing, or conversion of high risk breeding cattle operations to nonbreeding cattle would occur. For purposes of analysis, these management changes were expected to be in place by 2002. At this time, alternative 2 would switch to emphasize nonlethal methods of bison control, such as hazing, to control bison distribution and reduce conflicts with other land uses. Killing of bison would be allowed to protect human safety, but such occurrences would likely be limited. Bison could be shot on private property, but other measures such as hazing or fencing would be emphasized to reduce conflicts and the need for lethal control. For purposes of this analysis, it was assumed that a lower percentage of bison would access boundary areas than in other alternatives because the groomed roads they used to leave the interior of the park would either not be maintained or would be closed.

Given the assumptions of the model, this alternative would result in growth of the bison population (4.3%) similar to alternative 1 to the year 2002 (five years). After that time the bison population was predicted to grow at about 8.2%/year due to the emphasis on nonlethal methods to control bison. The bison population would be expected to increase from about 2,100 bison to 3,500 by 2006 and remain near that level through the duration of the management plan (average increase 5.7% per year; see table 44). This would be about 14% higher than alternative 1 after 10 years of management. Lethal management removals were expected to be minimal after 2002, and as population numbers increased, conflicts with private property could increase. At higher population numbers, it was expected agencies would use lethal control, such as shooting rather than hazing, to remove bison from private lands and resolve management conflicts. Periodic severe environmental conditions, closure of some road segments to winter use, and increased use of lethal control, particularly for some bison that moved beyond the identified management areas, would likely maintain the population near 3,500 animals.

Table 44: Deterministic Model Results of Estimated Early Winter Population, Rate of Population Increase, Projected Management Removals, and Estimated Seroprevalance Rate for the Bison Population under Alternative 2

Year	Early Winter Population	Yearly Percent Increase	Management Removals Outside Yellowstone National Park			Remaining on Public Land Outside Yellowstone National Park at West	Estimated Percent Sero-prevalence[1]
			North Boundary	West Boundary	Total Removals*		
1997	2,156	-	-	62	62	48	50
1998	2,266	5.1	-	64	64	52	49
1999	2,383	5.1	80	23	103	18	48
2000	2,467	3.5	83	22	105	21	47
2001	2,556	3.6	86	22	108	22	45
2002	2,649	3.6	-	-	-	46	42
2003	2,866	8.2	-	-	-	50	40
2004	3,101	8.2	-	-	-	54	38
2005	3,355	8.2	-	-	-	58	36
2006	3,500	-	-	-	-	61	34
2011	3,500	-	-	-	-	-	26
Mean[2]	-	5.7	-	-	-	-	-

1. Based on calfhood vaccination beginning in 2000 and 70% vaccine efficacy.
2. Mean rate of increase calculated from 1997 to 2005 because the maximum modeled value of 3,500 bison was met in 2006.

* Management removals are expected to occur during phase 1 of this alternative for approximately 5 years and be the same as contemplated under alternative 1. Consistent with the management objectives of this alternative, no management removals are contemplated for this alternative after 2001. However, management removals, primarily by shooting, might occur on private land and outside SMAs beginning in 2002, but were assumed to be zero for this analysis.

Effects on Free-Ranging Status and Distribution of Bison. This alternative would provide the maximum potential for bison to freely range beyond Yellowstone National Park boundaries onto other public lands and private lands where they were tolerated. Few bison would be expected to move beyond the defined management area boundaries, but if they did, they would be removed.

Although management objectives would allow approximately 200 bison to winter in the Reese Creek area, estimates of between 0 and 120 bison would be expected for the first 10 years. Between 20 and 60 bison would be expected to winter in the West Yellowstone area, an area where management objectives would allow up to 50–100 bison (see table 44). Closure of some park roads during winter might reduce movement into the West Yellowstone area.

This alternative would provide for 100–200 bison to freely range on public lands in the Eagle Creek/Bear Creek area. On private lands where the landowner wanted bison removed, agency personnel could haze or shoot those bison. When the bison population was near the high end of the range (2,700 to 3,500), agency personnel would likely shoot those bison on private lands where their presence was not tolerated. At these population levels, the agencies would also be more likely to shoot rather than haze any bison moving beyond the management boundaries defined for this alternative.

In phase 1 of this alternative, no bison would be allowed north of Reese Creek, seronegative nonpregnant females and seronegative males would be allowed in the West Yellowstone area, and untested bison would be allowed to range in the Eagle Creek/Bear Creek area. In phase 2, bison distribution would be affected by the implementation of a different set of management actions, in which winter grooming of park roads for snowmobiles would cease from the west side of the park. Bison numbers in the park were relatively low until recent times, after which snowmobile grooming had already been initiated in the park (the early 1970s). Therefore, determining what bison, at current and higher population levels, would do if there were no grooming is difficult. Without grooming, bison would not be able to move as efficiently. Whether or not they would chose to move on alternate routes is uncertain. Bison might learn to start moving to winter range earlier in the year (Aune, pers. comm.). The closing of groomed roads could have the effect of reducing population size and shifting distribution back to patterns observed before grooming, thus accomplishing the goal of restoring 'as near as natural conditions' as possible for bison.

Bison Population Trends. Based on stochastic model projections, the bison population would increase from an estimated mean of 2,100 bison in 1997 to a mean of 3,100 in 2001 (one year after the assumed implementation of phase 1 or year 5 in the model). In phase 1 the bison population continued to increase to about 3,900 animals in 2004 (five years in phase 1), after which capture, test, and slaughter would stop and phase 2 would begin. In phase 2 the bison population continued to increase to about 5,200 animals (table 42) after 2010, in response to the increased availability of additional range for bison and stopping capture, test, and slaughter operations. This increased population is about 40% higher than alternative 1 (3,700 bison). After model stabilization, the mean bison population was estimated to fluctuate between 4,600 and5,700 animals.

Epidemiology. The stochastic model estimated that the mean population seroprevalence rate would decline from approximately 35% seropositive in 2002 to about 13% in 2013 (see figure 2). This represents a 62% reduction in 11 years compared with a 42% reduction in 11 years (from 45% seropositive in 2000 to 26% seropositive in 2011) estimated by the deterministic model for alternative 2.

Bison Removals from the Population. Based on summing the mean number of removals across years, an estimated total of 6,208 bison (3,104 females) would be removed over the lifetime of the plan. The total number removed over the life of the plan for alternative 2 is approximately 33% higher than alternative 1 (4,664). Over the life of the plan, an estimated total of 876 bison (438 females) would be sent to slaughter and that would take place while alternative 1 (the interim plan) was still in effect. Bison subject to additional removal constitute 86% (5,332 animals or 2,666 females) of the total estimated number of bison removed over the life of the plan. Those bison subject to additional removal would be bison that crossed the SMA boundaries and were shot. The higher number of removals under alternative 2 compared with alternative 1 is likely due to the overall higher population levels that alternative 2 allows compared with alternative 1 (see table 43).

Bison Distribution. Specific to alternative 2, the model assumed for analysis purposes that the new lands acquired for bison on the western and northern special management areas (SMAs) could support as many as 1,294 bison (approximately 647 females) on the west and 726 bison (approximately 363 females) on the north which is equivalent to the number of cattle these lands currently support (see the *Draft Environmental Impact Statement*, table 18).

During phase 1 no bison would be allowed north of the park boundary, and up to 100 seronegative nonpregnant bison would be permitted in the West Yellowstone area. After implementation of phase 2 of the plan in 2005, an average of 462 to 530 bison (231 to 265 females) was estimated to winter in the area north of the park, and an average of 366 to 1,128 bison (183 to 564 female) could winter in the SMAs west of the park.

Cumulative Impacts

No additional sources of cumulative impact would exist beyond those described in "Cumulative Impacts Common to All Alternatives."

Conclusion

Periodic severe environmental conditions, closure of some road segments within the park to winter use, and increased use of lethal control, particularly for some bison that moved beyond the identified management areas, would allow the population to fluctuate up to 3,500 animals. It is estimated this alternative would result in moderately more bison in the population (14%) than alternative 1.

This alternative would provide the maximum potential for bison to freely range beyond Yellowstone National Park boundaries onto other public lands and private lands where they would be tolerated. Between 100 and 200 bison could freely range in the Eagle Creek/Bear Creek area. Between 0 and 120 bison could winter in the Reese Creek area, and 20–60 could winter in the West Yellowstone area.

Calfhood vaccination at 70% efficacy of this population was predicted to decrease seroprevalence to at least 34% in 2006 and 26% by 2011. This alternative would be expected to result in a minor increase in seroprevalence rate (3%–8% higher) compared to alternative 1.

Based on the stochastic model projections, the population in alternative 2 would increase during the life of the plan and stabilize at a mean of approximately 5,200 bison, which is a major increase in the bison population (about 40% higher) compared with alternative 1. Management actions associated with this plan would likely maintain the bison population between 4,600 and 5,700 animals. The new model predicted a greater reduction (62%) in seroprevalence in 11 years of vaccination compared with a 42% reduction predicted using the deterministic model.

The new model estimated a major increase (33% higher) in the total number of female bison removed over the life of the plan in alternative 2 compared with alternative 1. Over the life of the plan, 86% of the total removals would be those animals crossing the SMA boundaries that could not be successfully hazed. The higher number of removals compared with alternative 1 is likely a result of the higher population levels predicted in alternative 2.

The new model indicated that once test and slaughter operations ceased, up to 530 bison could occupy areas north of the park, and up to 1,128 bison could occupy areas to the west. This would be a major increase in the number of bison found on public lands outside of the park, compared with alternative 1, which does not permit any bison to use areas north of the park and only up to 100 seronegative nonpregnant bison in the West Yellowstone area.

IMPACTS OF ALTERNATIVE 3

Analysis

Effects on the Bison Population. Assumptions used in alternative 1 were also used in this alternative to construct bison population dynamics. For alternative 3, the agencies would attempt to manage the Yellowstone bison population within the range of 1,700 to 3,500 animals. This alternative emphasizes recreational hunting as the primary method to control bison numbers and distribution on adjacent public and private lands in Montana. If bison moved to the Reese Creek area prior to approved hunting or large numbers were present that make hunting infeasible, the capture facility at Stephens Creek (or a possible facility north of the Reese Creek area) could be used as a backup measure to control bison numbers. Captured seronegative bison would be sent to quarantine. If population numbers were low (near 1,700), bison might be held temporarily at capture facilities and released in the spring when forage was available. No capture operations would occur in the West Yellowstone area, and bison numbers would be primarily controlled through hunting.

The model assumed hunting would begin in 2000 and initial quotas would provide for a minimum of 15 permits in the Eagle Creek/Bear Creek area. Bulls would likely be harvested in this area. Assuming land acquisition (see description of alternative 3 in "The Alternatives"), 30 permits would be offered in the Reese Creek area. Bulls and larger females would likely be harvested in this area. Due to increasing bison numbers moving into the Reese Creek area, the model assumed 35 permits would be offered beginning 2005. Thirty permits would be initially offered in the West Yellowstone area; 35 would be offered beginning 2005. Nearly all bison, except possibly calves, would be harvested in this area. Based on bison population numbers, winter distribution on public and private lands, and other factors, the agencies might conduct additional special drawings to harvest additional bison.

Given the assumptions described in the "Methodologies for Analyzing Impacts," the model predicts moderately higher growth rates for alternative 3 than the no-action scenario (alternative 1). For the life of the management plan, bison distribution and population numbers would be controlled through hunting.

From 1997 to 2006, the bison population would be expected to increase from about 2,200 bison to 3,500 (average increase 6%/year; see table 45), where it would remain (on average) until 2011. This would be about 14% higher following 10 years of implementation than alternative 1. Limited capture operations, agency shooting, hunting, and periodic severe environmental conditions would likely maintain the bison population above the population midpoint of 2,500–2,700 but within the long term range of 1,700–3,500.

Effects on Free-Ranging Status and Distribution of Bison. Under this alternative, bison movements would probably remain similar to what they have been in recent years. Few bison would be expected to move beyond the identified management area, but if they did, they would be removed. Agency personnel would shoot bison on private lands where the landowner wanted them removed and hunting was not allowed. Management objectives would allow 100–200 bison to winter in the Eagle Creek/Bear Creek area, and approximately 100 bison would be expected to winter in this area.

During phase 2, winter management would allow up to 50–100 bison in the Reese Creek area when additional lands were acquired. Following hunter harvests, approximately 60–80 bison would winter in the area for the 15 years the plan was in effect. The population would likely consist of younger males and females and calves. More bison could be allowed in this area if additional winter range was purchased or easements were acquired from willing sellers on private lands.

In the West Yellowstone area, management objectives would allow up to 50–100 bison to winter in the West Yellowstone area. However, nearly all bison would be removed, with 16–30 (and 44–120 remaining before the hunt begin in 2000) bison remaining after the hunt (see table 45). Those remaining would likely be subadult males, females, or calves. More bison could be allowed in this area if winter range was purchased or easements were acquired on private lands and hunting quotas were modified.

Bison Population Trends. In alternative 3 the stochastic population model estimated an increase in mean bison population from about 2,100 animals in 1997 to 3,200 animals in 2001 (one year after assumed implementation) and predicted a high of 3,800 in 2008 (see table 42). By 2012 (year 16 of the model) the mean population would stabilize at about 3,700 animals and would range between about 3,100 and 4,400 bison. Overall, trends in the bison population in alternative 3 would be similar to alternative 1.

Epidemiology. Based on the enhanced stochastic model projections, the population seroprevalence rate would decline from an estimated 37% seropositive in 2002 to approximately 15% seropositive in 2013 (see figure 2). This 60% reduction in seroprevalence rate predicted by the new stochastic model that would occur over 11 years of vaccination in alternative 3 is greater than the 40% reduction (reduced from 47% seropositive to 28% seropositive) estimated over the same time period (first 11 years of vaccination) using the deterministic model.

Table 45: Deterministic Model Results of Estimated Early Winter Population, Rate of Population Increase, Projected Management Removals Due to Hunting, and Estimated Seroprevalance Rate for the Bison Population under Alternative 3

Year	Early Winter Population	Yearly Percent Increase	Management Removals Outside Yellowstone National Park[1]			Remaining on Public Land Outside Yellowstone National Park at West	Estimated Percent Sero-prevalence[2]
			North Boundary	West Boundary	Total Removals		
1997	2,156	-	0	0	0	110	50
1998	2,333	8.2	0	0	0	119	50
1999	2,524	8.2	85[3]	0	85	44	50
2000	2,639	4.6	45	30	75	16	50
2001	2,775	5.2	45	30	75	18	47
2002	2,921	5.3	45	30	75	21	45
2003	3,079	5.4	45	30	75	23	43
2004	3,250	5.6	45	30	75	26	40
2005	3,435	5.7	50	35	85	25	38
2006	3,500	-	50	35	85	26	36
2011	3,500	-	-	-	-	-	28
Mean[4]	-	6.0	-	-	-	-	-

1. Beginning in the year 2000, hunting on the north boundary would remove 30 bison in the Reese Creek area (35 beginning 2005), 15 bison at Eagle Creek/Bear Creek, and 30 bison in the West Yellowstone area (35 beginning 2005).
2. Based on calfhood vaccination beginning in 2000 and 70% vaccine efficacy.
3. This total included bison captured at the Reese Creek area because hunting does not begin until 2000.
4. Mean rate of increase calculated from 1997 to 2005 because the maximum modeled value of 3,500 bison was met in 2006.

Bison Removals from the Population. Based on the sum of the mean number of bison removals for each year of the plan, the estimated total removal of bison over the life of the plan is 5,312 bison (2,656 female; see table 43). This represents a total removal of approximately 14% more bison than alternative 1. Over the life of the plan, an estimated total of 662 (331 females) would be slaughtered, 702 (351 females) would be hunted, 1,752 (876 females) would be quarantined, and 2,196 (1,098 females) would be subject to additional removal, which includes slaughter, additional hunting, or quarantine. The number of bison slaughtered would be 69% lower than that estimated for alternative 1 because a large portion (33%) of the bison being removed from the population would be sent to quarantine under alternative 3 (table 43).

Bison Distribution. On the northern boundary, alternative 3 would allow as many as 100–200 bison (approximately 50–100 females) to winter on public lands in the Eagle Creek/Bear Creek area throughout the life of the plan. In phase 1 no bison would be allowed north of the park boundary at Reese Creek. Bison could freely range in Yellowstone National Park, except near the Stephens Creek capture facility. During phase 2 and after land acquisition had occurred, alternative 3 would allow up to 100 bison (approximately 50 females) to winter in the Reese Creek area. After the population model stabilized, projections estimated that 68–80 (34–40 females) bison would remain in the Reese Creek area during winter after hunting.

In both phase 1 and phase 2 of alternative 3, up to 100 bison (approximately 50 female bison) would be allowed to winter in the West Yellowstone area. After the model stabilized, projections estimated an average of 62 to 68 bison (31 to 34 females) could remain in this area during winter after hunting.

Cumulative Impacts

No additional sources of cumulative impact would exist beyond those described in "Cumulative Impacts Common to All Alternatives."

Conclusion

This alternative would maintain the bison population within the range of 1,700 to 3,500 and would be expected to result in growth of the population. Limited capture operations, agency shooting, hunting, and periodic severe environmental conditions would allow the population to fluctuate up to 3,500 animals. This alternative could result in moderately more bison in the population (14%) compared to alternative 1.

This alternative would allow bison to freely range throughout Yellowstone National Park, and approximately 100 bison would be expected to freely range in the Eagle Creek/Bear Creek area. Following hunter harvests, approximately 60–80 bison would winter in the Reese Creek area for the life of the management plan. Fewer bison might winter in this area if the capture facility was used to control bison numbers in this area. More bison might be allowed in this area if additional winter range was purchased or easements were acquired on private lands from willing sellers. After hunter harvests, fewer than 30 bison would winter in the West Yellowstone area.

Calfhood vaccination at 70% efficacy were predicted to decrease seroprevalence to at least 36% in 2006 and 28% by 2011. The model predicts a minor to moderate increase in seroprevalence rate (9%–17% higher) compared to alternative 1.

The new stochastic model predicted the bison population would increase over the life of the plan and stabilize at approximately 3,700 animals. Hunting, capture, and shipment of bison to slaughter or quarantine, periodic severe environmental conditions, and additional removal of bison would likely maintain the bison population between 3,100 and 4,400 animals. Overall, population trends in alternative 3 would be similar to alternative 1.

The 60% reduction in seroprevalence rate predicted in the stochastic model to occur during 11 years of vaccination was greater than the 40% reduction predicted by the deterministic model.

Bison removals resulted from slaughter, quarantine, hunting, and agency shooting. The total removal of bison over the life of the plan under alternative 3 was moderately greater (14% higher) than that estimated under alternative 1. This alternative would result in a large number of bison (33% of the total removed) sent to quarantine. Alternative 3 would result in 69% fewer bison being slaughtered compared with alternative 1, which has no provision for live removal of bison crossing the park's Reese Creek boundary. This is considered a major difference in the number of bison sent to slaughter compared with alternative 1.

After acquisition of lands and conservation easements, up to 100 (50 females) might be allowed to freely range on land north of the park boundary in the Reese Creek area; however, after hunter harvests, 68–80 bison were estimated to winter in the Reese Creek area. After the population stabilized near the end of the plan, an average of 62–68 bison were estimated to winter in the West Yellowstone area.

IMPACTS OF ALTERNATIVE 4

Analysis

Effects on the Bison Population. Assumptions used in alternative 1 were also used in this alternative to construct bison population dynamics. For alternative 4, the agencies would attempt to manage the Yellowstone bison population within the range of 1,700 to 3,500 animals. This alternative emphasizes capture of bison at Stephens Creek and shipment of seronegative bison to quarantine. As the population approached 3,500, the agencies might be more likely to use lethal control (capture and shipment to slaughter, agency shooting, or hunting) or quarantine to manage bison numbers, distribution, and conflicts with other land uses. As the population approached 1,700, the agencies might emphasize nonlethal means (such as hazing or fencing) to manage bison numbers, distribution, and conflicts. Bison could be temporarily held at capture facilities through the winter if population numbers were low (near 1,700) and the winter severe. Hunting would be used to control populations in the Eagle Creek/Bear Creek area. Capture operations would occur at West Yellowstone, and only seronegative males and seronegative nonpregnant females would be allowed on public lands in the West Yellowstone area. Low levels of hunting would be allowed in the West Yellowstone area as an adjunct to capture operations.

Hunting would begin in 2000, and quotas would provide for a minimum of 15 permits in the Eagle Creek/Bear Creek area and 20 in the West Yellowstone area. Based on bison population numbers, winter distribution on public and private lands, and other factors, the agencies could conduct additional special drawings to harvest additional bison.

Under this alternative, bison population numbers would be controlled through capture, shipment of seropositive bison to slaughter, and hunting. Modelling indicates the population would increase at a slower rate than alternatives 1, 2, 3, or 6. From 1997 to 2006, the bison population was expected to increase from about 2,100 bison to 2,800 (average increase 3%/year; see table 46). This would be about 8% fewer bison after 10 years of management than if alternative 1 was implemented. By 2011 the model predicted the population could reach nearly 3,200. However, in combination with periodic severe environmental conditions, it would be likely that capture operations and limited hunting would maintain the long-term bison population between 2,800 and 3,200 after 10 years.

Effects on Free-Ranging Status and Distribution of Bison. Under this alternative, bison movements would probably remain similar to what they have been in recent years. Bison would not be expected to move beyond the identified special management area, but if they do, they would be removed. On private lands where the landowner wants bison removed and hunting was not allowed, agency personnel would shoot those bison.

Winter range management objectives would allow 100–200 bison to freely range in the Eagle Creek/Bear Creek area. Beginning in the year 2000, an annual hunter harvest of 15 animals would be expected in the Eagle Creek/Bear Creek area. Bulls would likely be harvested in this area.

Bison would be allowed to freely range in Yellowstone National Park except near Stephens Creek where the capture facility was located. No bison would be allowed in the Reese Creek area. Management objectives would allow up to 50–100 seronegative male and seronegative nonpregnant female bison in the West Yellowstone area, and 18–52 animals would be expected following the removal of animals testing seropositive (and seronegative pregnant female bison). Beginning in 2000, annual hunter harvests of 20 bison would likely consist of males, but some larger females might also be taken. Following hunter harvests, few if any bison would winter in the West Yellowstone area for the life of the management plan (see table 46).

Bison Population Trends. Stochastic modelling predicted this alternative would result in an estimated increase in the mean bison population from about 2,100 in 1997 to about 3,100 in 2001 (one year after the date the plan was assumed to begin or year 5 of the model). The mean population peaked at about 3,700 in 2006 (year 10 of the model or 6 years after the plan began) and stabilizes for the remainder of the plan (see table 42), fluctuating between about 3,000 and 4,300 animals. These results are similar to those predicted to occur in alternative 1.

Epidemiology. Based on the enhanced stochastic model projections, the population seroprevalence rate would decline from an estimated 37% seropositive in 2002 to approximately 13% seropositive in 2013 (see figure 2). This 65% reduction in seroprevalence rate predicted by the new stochastic model, during 11 years of vaccination, is greater than the 42% reduction (reduced from 45% seropositive to 26% seropositive) estimated using the deterministic model.

Removals from the Population. Based on summing the mean number of removals across years, a total of 4,522 bison (2,261 females) would be removed over the lifetime of the plan (see table 42). This number is similar (3% lower) to alternative 1. Over the life of the plan, a total of 1,434 (717 females) bison would be sent to slaughter, 206 (103 females) would be hunted, 2,468 (1,234 females) would be sent to quarantine, and 414 (207

Table 46: Deterministic Model Results of Estimated Early Winter Population, Rate of Population Increase, Projected Management Removals, and Estimated Seroprevalance Rate for the Bison Population under Alternative 4

Year	Early Winter Population	Yearly Percent Increase	Management Removals Outside Yellowstone National Park			Remaining on Public Land Outside Yellowstone National Park at West	Estimated Percent Sero-prevalence[3]
			North Boundary[1]	West Boundary[2]	Total Removals		
1997	2,156	-	-	62	62	48	50
1998	2,266	5.1	-	64	64	52	49
1999	2,383	5.2	80	23	103	18	48
2000	2,467	3.5	98	42	140	1	47
2001	2,518	2.1	100	42	142	2	45
2002	2,571	2.1	102	42	145	3	43
2003	2,626	2.1	103	42	145	4	41
2004	2,684	2.2	105	41	146	6	38
2005	2,746	2.3	107	40	147	8	36
2006	2,812	2.4	110	40	150	9	34
2011	3,188	-	-	-	-	-	26
Mean[4]	-	3.0	-	-	-	-	-

1. Totals include seropositive and seronegative bison captured at Stephens Creek facility and sent to slaughter, and 15 bison hunted at Eagle Creek/Bear Creek beginning in 2000.
2. Totals include seropositive and seronegative pregnant bison captured in the West Yellowstone area and sent to slaughter and 20 bison hunted in the West Yellowstone area beginning in 2000.
3. Based on calfhood vaccination beginning 2000 and 70% vaccine efficacy.
4. Mean rate of increase calculated from 1997 to 2006.

females) seronegative bison in the western area would be subjected to additional removal, which could include any combination of slaughter, additional hunting permits, or quarantine. The number of bison slaughtered over the life of the plan would be 33% lower and the total number of bison killed would be 56% lower than estimated for alternative 1. The reduction in the number of bison subject to lethal removal compared with alternative 1 is likely due to the large number of bison sent to quarantine under alternative 4.

In alternative 1, since quarantine is not an option for seronegative bison, those bison subject to additional removal would be sent to slaughter.

Bison Distribution. No bison would be allowed north of the park boundary in the Reese Creek area. Winter range management objectives would allow 100–200 bison (approximately 50–100 females) to freely range in the Eagle Creek/Bear Creek area. Management objectives would allow up to 100 bison (or about 50 female bison, all of whom would be seronegative and none of whom would be pregnant) in the West Yellowstone area. After the model stabilized and quarantine and hunting were implemented as tools to control bison population, an estimated average of 56 to 60 bison (approximately 28 to 30 females) could winter in the SMA in the West Yellowstone area.

Cumulative Impacts

There would be no additional sources of cumulative impact beyond those described in "Cumulative Impacts Common to All Alternatives."

Conclusion

This alternative would maintain the bison population within the range of 1,700 to 3,500 animals and would be expected to result in an increasing bison population. Capture operations, limited hunting, and periodic severe environmental conditions would likely maintain the population between 2,800 and 3,200 bison in the long term. It was estimated this alternative would result in fewer but minor differences in numbers of bison in the population (8.2% fewer) after 10 years of implementation compared to alternative 1.

This alternative would allow bison to freely range within Yellowstone National Park except in the Stephens Creek area. Approximately 100–200 could freely range in the Eagle Creek/Bear Creek area, and no bison would be allowed to range in the Reese Creek area. Although seronegative nonpregnant bison would be released in West Yellowstone, few would be expected to remain after hunting.

Capture and removal of seropositive bison and calfhood vaccination at 70% efficacy were predicted to decrease seroprevalence to at least 34% in 2006 and 26% by 2011. This alternative would be expected to result in a minor reduction (less than 10% change) in seroprevalence compared to alternative 1.

Based on stochastic model projections, the estimated bison population in alternative 4 would increase during the life of the plan and stabilize at a mean of approximately 3,700 bison, similar to that estimated for alternative 1. Management actions associated with this plan would likely maintain the bison population between an estimated 3,000 and 4,400 animals.

The new stochastic model predicted that seroprevalence would decrease by 65% during 11 years of vaccination. The reduction in seroprevalence rate predicted using the stochastic model is greater than the 42% reduction estimated by the deterministic model.

Total estimated number of bison removals over the life of the plan is similar (3% lower) to that estimated for alternative 1. Alternative 4 would result in 55% more animals, including seronegative pregnant females being saved through quarantine compared with alternative 1, which requires that all seropositive bison and all pregnant females be slaughtered.

Under alternative 4 no bison would be allowed to range north of the park boundary in the Reese Creek area. Winter management objectives would allow up to 100 bison (50 females) in the West Yellowstone area. After the model stabilizes, an average of 56 to 60 bison would winter on public lands within the SMA west of the park.

IMPACTS OF ALTERNATIVE 5

Analysis

Effects on the Bison Population. In calculating the impacts on the bison population, it was assumed that capture, test, and slaughter operations would take place in nine areas simultaneously within and at the boundary of Yellowstone National Park. Simultaneous captures would be necessary to reduce the likelihood that untested, potentially infected bison would come into contact with seronegative bison that had been tested and released in the park. Based on methods used in the livestock industry, it was assumed that capture, test, and slaughter operations would begin in 1998 and be conducted for three consecutive years (Peterson, Grant, and Davis 1991). All seropositive bison would be sent to slaughter. Unlike alternatives 1 through 4, in which only calves were vaccinated, this alternative calls for all seronegative bison to be vaccinated before release. During a fourth and possibly fifth year, all unmarked (untested) bison more than one year old would be shot.

It was assumed that 95% of the bison population would be captured each year (Peterson, Grant, and Davis 1991), with the remaining 5% exhibiting a seroprevalence rate similar to that found in the total precapture population for that year. The seroconversion rate for adult bison used in the Yellowstone National Park model was assumed to be zero because approximately 95% of seropositive bison would be removed in the first year of capture operations beginning in 1998 (see table 47). Dobson and Meagher (1996) found that brucellosis transmission rate in Yellowstone National Park bison appeared to

Table 47: Deterministic Model Results of Estimated Early Winter Population, Rate of Population Increase, Projected Management Removals, and Estimated Seroprevalance Rate for the Bison Population under Alternative 5

Year	Early Winter Population	Yearly Percent Increase	Management Removals Outside Yellowstone National Park: North Boundary	West Boundary	Total Removals[1]	Remaining on Public Land Outside Yellowstone National Park at West	Estimated Percent Sero-prevalence[2]
1997	2,156	-	-	-	110	-	50
1998[3]	2,214	2.7	-	-	1,052	-	50
1999	1,257	-43.2	-	-	56	-	4.7
2000[4]	1,299	3.3	-	-	-	4	0.3
2001	1,401	7.8	-	-	65	-	0
2002[5]	1,446	3.1	-	-	-	-	0
2003	1,565	8.2	-	-	-	-	0
2004	1,693	8.2	-	-	-	-	0
2005	1,832	8.2	-	-	-	-	0
2006	1,982	8.2	-	-	-	-	0
2011	2,940	-	-	-	-	-	0
Mean	-	0.7	-	-	-	-	-

1. In 1997, all bison exiting at West Yellowstone are removed. In years 1998–2001, total bison removals are from capture, test, and slaughter operations.
2. Seroprevalence of the population just prior to early winter capture, test, and slaughter operations.
3. Beginning of three-year capture, test and slaughter.
4. Beginning of whole-herd vaccination, at 70% efficacy in 2000.
5. Beginning of no lethal management, but continued calfhood vaccination.

be a function of the proportion of individuals in the bison population that are infected. Also, all captured seronegative bison would be vaccinated. In addition to protecting against infection, vaccination prevents abortion and hence transmission of the bacteria. The seroprevalence rate for unvaccinated and vaccinated but unprotected calves was assumed to be equal to the seroprevalence in the adult population for that year.

For alternative 5, the agencies would attempt to manage the Yellowstone bison population within the range of 1,700 to 3,500 animals; however, this alternative is impossible to implement without reducing the population below 1,700 for at least six years following its start. The bison population would be expected to be reduced to approximately 1,250 animals in 1999, after removal of over 1,000 bison in the first year of capture, test, and slaughter. This compared to nearly 2,400 animals in 1999 under the continued implementation of alternative 1 (a 47% decrease compared to alternative 1). The bison population would be expected to number approximately 2,000 by 2006, and approximately 2,900 bison by 2011, 10 years after capture, test, and slaughter operations have ceased. This was comparable to model simulations (Peterson, Grant, and Davis 1991) that showed the Grand Teton National Park bison population recovered to preremoval size within about 10 years following test, slaughter, and vaccination operations. It is possible under alternative 5, in which bison numbers were projected to be reduced as low as 1,250, certain segments of the park bison population would be more affected than others.

Slowing the rate at which bison were slaughtered might result in higher population numbers, but doing so would compromise the ability of the capture, test, and slaughter program to separate tested and untested bison. Potential contact with infected animals could increase the number of bison testing seropositive and therefore increase the number sent to slaughter when capture operations were resumed. Populations would not be expected to drop to 580 animals, the minimum number needed (based on current data) to maintain genetic viability. If the bison population approached this number, capture and slaughter operations would slow or cease until the population recovered.

Effects on Free-Ranging Status and Distribution of Bison. Under this alternative bison would not be permitted to move outside Yellowstone National Park boundaries. During the anticipated three-year capture period, a minimum of 95% of the bison within the park would be captured and tested for exposure to brucellosis. Those testing negative and released into the park during the final year would be visibly marked to facilitate removal of the remaining untested animals. Several areas in the park would be likely to have few to no bison following the three years of capture, test, and slaughter, and this condition could last as long as 10 years following the final year of captures. Bison movements toward the winter range as well as distribution and overwintering within the park by bison would likely be affected.

Bison Population Trends. For purposes of analysis, the enhanced stochastic model assumed capture, test, and slaughter operations would begin in the year 2000. Under this alternative, capture, test, and slaughter operations, as well as vaccination of all captured seronegative bison, would continue until the overall seroprevalence rate of the population was reduced to 0.1% (essentially zero). Once this is achieved, capture, test, and slaughter operations would cease, and remote calfhood vaccination would occur. Any untested bison greater than 1 year old remaining in the population after capture operations were stopped could be removed through shooting. The analyses presented are for annual capture and testing of 90% of the total bison population.

Using a 90% annual capture rate, the predicted mean bison population would increase from about 2,100 in 1997 to around 2,900 in the year 2000. After the first year of capture, test, and slaughter operations in 2000 and following calf recruitment, the population would be nearly 29% lower (approximately 2,080 animals in 2001). Capture, test, and slaughter operations were assumed to continue for an additional three years until 0.1% seroprevalence was achieved in 2004. After 2001, the bison population would increase throughout the remaining years of the plan, but would not recover to the population level (2,900) existing prior to parkwide capture, test, and slaughter operations for seven years. In 2004, four years after beginning capture, test, and slaughter operations, the bison population in alternative 5 would be 31% lower than the population at the same time under alternative 1. The model predicted the population would then continue to increase, rather than stabilize as it would in other alternatives, throughout the life of the plan. The population would total approximately 3,600 animals in 2014 and fluctuate between 2,900 and 4,300 (see table 42). Eleven years after capture, test, and slaughter operations had stopped, the peak mean population size achieved under alternative 5 would be 9% lower than the peak mean projected for alternative 1.

Epidemiology. At 90% capture efficiency, implementation of this alternative would require three years to reduce mean seroprevalence to 0.1%. Continued calfhood vaccination for the remainder of the plan would maintained seroprevalence at 0.1% (see figure 2). These results are comparable to those from the deterministic model.

Bison Removals from the Population. Based on summing the mean number of removals (assuming 90% capture efficiency), a total of 5,458 (2,729 female) bison, or 17% more than alternative 1, would be removed from the population over the life of the plan (see table 43). Of this total, 2,190 (1,095 females) would be removed through capture, test, and slaughter operations, while the remaining 3,266 (1,633 females) would be shot as they attempted to move across the park boundary.

Bison Distribution. Based on summing mean bison population values across years (under the 90% capture efficiency scenario), it is estimated that a total of 3,266 (1,633 female) bison would attempt to move beyond park boundaries during the life of the plan. These bison would be shot so they would not move across the park boundary throughout the life of the plan.

Cumulative Impacts

During the first four years of alternative 5, total management removals would range from 4% to 35% of the bison population and average 13%. Cumulative impacts as described in "Cumulative Impacts Common to All Alternatives" would add to decreases in the population.

Conclusion

The bison population would rapidly decline under this alternative, representing a major reduction of 47% over a period of only three years. More than 95% of the bison in the park would be rounded up and handled in capture facilities, with the remainder being shot at the end of the three-year capture period.

Bison would not be free-ranging during the capture period, although negative-testing bison would be set free immediately after capture and vaccination. All seronegative bison would be marked to facilitate future testing and post-capture shooting operations. The extensive capture operation, as well as confinement to the park might detract from the wild, free-ranging qualities of the bison population during the three- to four-year period these actions were in effect. This alternative would have a major impact on the distribution of bison. Bison would not be allowed outside Yellowstone National Park, and many areas within the park where bison have previously existed would be expected to have few or no bison for as long as 10 years.

This alternative would have a major impact on seroprevalence rate in bison, decreasing the proportion of seropositive bison from 50% to approximately 0% by the year 2001. Continued vaccination of bison with a safe and effective vaccine would be expected to maintain a low seroprevalence rate for the long term.

During the initial stages of capture, test, and slaughter operations, the stochastic model estimated the mean bison population would decrease by 29%

in one year, assuming a 90% capture efficiency. This decline would represent a major adverse impact on the bison population. In 2004, four years after beginning capture, test, and slaughter operations, the bison population in alternative 5 would be 31% lower than the population at the same time under alternative 1. The peak mean population size achieved under alternative 5 at the end of the plan (approximately 2014) would be 9% lower than the projected peak population that occurred seven years earlier in alternative 1.

Similar to the results of the deterministic model, the stochastic model predicted that implementing this alternative would have a major impact on seroprevalence in the bison population. Assuming a 90% capture efficiency, a reduction in seroprevalence to 0.1% would occur in three years. Vaccination of calves for the remaining years of the plan would maintain the seroprevalence rate at or below 0.1%. Without continued calfhood vaccination, due to the possibility of reinfection from elk, seroprevalence would likely return to the levels observed prior to implementation of this alternative within approximately 20 years (R. Angliss, pers. comm.).

Unlike all other alternatives, bison would not be free-ranging within the boundaries of Yellowstone National Park during the capture period (four years at 90% capture efficiency), although seronegative bison would be set free immediately after capture and vaccination. All seronegative bison would be marked to facilitate future testing and postcapture shooting operations. The extensive capture operations, as well as confinement to the park, might detract from the wild free-ranging qualities of the bison population. This alternative could have a major adverse impact on the distribution of bison.

IMPACTS OF ALTERNATIVE 6

Analysis

Effects on the Bison Population. For alternative 6, the agencies would attempt to manage the Yellowstone bison population within the range of 1,700 to 3,500 animals. In this alternative, whole-herd vaccination would be used initially to reduce the seroprevalence rate in the bison population. After the seroprevalence rate has appeared to stabilize, capture, test, and slaughter operations as described in alternative 5 would remove the remaining seropositive animals. For this analysis, the capture, test, and slaughter operations occurred after 10 years of vaccination. In calculating the impacts on the bison population, the effects of vaccination were calculated at 70% and 25% efficacy, and, as in all other alternatives, assumed to begin in the year 2000. The model assumed 95% of total bison population was vaccinated each year. The seroprevalence rate for unvaccinated and vaccinated but unprotected calves was assumed to be equal to the seroprevalence in the adult population for that year.

Scenario A - 70% Vaccine Efficacy

The bison population would be expected to increase from 2,100 to approximately 3,100 animals in 2006 (average increase 4.2%; see table 48) and 3,500 by 2010. Bison population numbers would be controlled through capture and removal of all bison leaving Yellowstone National Park at Reese Creek, and removal of seropositive bison moving west near the Seven-Mile Bridge area in the park. Bison would not be expected to move beyond the identified management area, but if they did, they would be removed by agency shooting, usually within the park. Implementation of capture, test, and slaughter operations was assumed to begin in 2010 after 10 years of vaccination. Assumptions used for this portion of calculations were as described under the impacts of alternative 5. This stage of operations resulted in a reduction of the bison population from about 3,500 in 2010 to 2,900 in 2011, followed by an increase to 3,400 by 2014.

Alternatives 6 and 4 differ on the west side in that seronegative pregnant female bison would be slaughtered in alternative 4, but released in alternative 6 for the first phase. By the year 2006, modelling predicted the population in alternative 6 would have reached 3,100, whereas implementation of alternative 4 would result in only about 2,800 animals. Much (but not all, as limited hunting would be a part of alternative 4 as well) of the difference in population sizes in these two alternatives would be a result of the release of seronegative females.

Winter range management objectives would allow up to 100–200 bison in Eagle Creek/Bear Creek, 0 in the Reese Creek area, and up to 50–100 seronegative bison in the West Yellowstone area. Approximately 22–60 seronegative bison were predicted to winter in the West Yellowstone area.

Scenario B - 25% Vaccine Efficacy

During the 10-year vaccination phase, the bison population would be expected to increase from 2,100 to approximately 3,100 animals in 2006 (average increase 4.2%; see table 49). During this 10-year period, bison population numbers would be controlled as described under the 70% vaccine efficacy model. Implementation of the capture, test, and slaughter program would begin in 2010 and reduce the population from 3,500 to approximately 2,500 bison in 2011, followed by an increase to 3,000 animals by 2014. The lower number of bison estimated in this model would be a result of more bison being slaughtered because of the lower vaccine efficacy.

Table 48: Deterministic Model Results of Estimated Early Winter Population, Rate of Population Increase, Projected Management Removals, and Estimated Seroprevalance Rate for the Bison Population under Alternative 6 at 70% Vaccine Efficacy

Year	Early Winter Population	Yearly Percent Increase	Management Removals Outside Yellowstone National Park			Remaining on Public Land Outside Yellowstone National Park at West	Estimated Percent Sero-prevalence[2]
			North Boundary	West Boundary	Total Removals[1]		
1997	2,156	-	-	55	55	55	50
1998	2,273	5.4	-	56	56	60	49
1999	2,399	5.5	81	20	101	22	47
2000[3]	2,486	3.6	84	19	103	24	47
2001	2,578	3.7	87	19	106	26	44
2002	2,675	3.8	90	18	108	28	42
2003	2,777	3.8	93	18	111	30	39
2004	2,885	3.9	97	17	114	33	37
2005	2,998	3.9	101	17	118	35	34
2006	3,116	3.9	105	17	122	37	32
2007	3,240	4.0	109	16	125	40	30
2008	3,370	4.0	113	16	129	42	28
2009	3,500	-	118	15	133	46	27
2010[4]	3,500	-	-	-	826	46	25
2011	2,893	-17.3	-	-	45	49	1.6
2012	3,082	6.5	-	-	2	53	0.1
2013	3,333	8.1	-	-	154	58	0
2014	3,440	3.2	-	-	0	60	0
Mean[5]	-	4.2	-	-	-	-	-

1. From 1997 to 2006, removals included all seronegative and seropositive bison exiting the north boundary (Reese Creek) and seropositive bison captured at the west boundary area (Seven-Mile Bridge area). In years 2010–2013, total removals included seropositive and untested bison removed in capture, test, and slaughter operations.
2. Seroprevalence of the population just prior to early winter operations.
3. Whole-herd vaccination beginning in 2000 and 70% vaccine efficacy.
4. Capture, test, and slaughter operations begin 2010 and end 2013.
5. Average rate of increase from 1997 to 2006.

Table 49: Deterministic Model Results of Estimated Early Winter Population, Rate of Population Increase, Projected Management Removals, and Estimated Seroprevalance Rate for the Bison Population under Alternative 6 at 25% Vaccine Efficacy

Year	Early Winter Population	Yearly Percent Increase	Management Removals Outside Yellowstone National Park			Remaining on Public Land Outside Yellowstone National Park at West	Estimated Percent Sero-prevalence[2]
			North Boundary	West Boundary	Total Removals[1]		
1997	2,156	-	-	55	55	55	50
1998	2,273	5.4	-	56	56	60	49
1999	2,399	5.5	81	20	101	22	47
2000[3]	2,486	3.6	84	20	104	23	47
2001	2,577	3.7	87	20	107	25	46
2002	2,673	3.8	90	20	110	26	44
2003	2,773	3.7	93	20	113	28	43
2004	2,878	3.8	97	21	118	29	42
2005	2,986	3.9	101	21	122	31	41
2006	3,099	3.8	104	21	125	33	40
20074	3,218	3.8	108	21	129	35	38
2008	3,342	3.9	117	21	133	37	37
2009	3,472	3.9	117	21	138	39	36
2010	3,500	-	-	-	1168	39	35
2011	2,523	-27.9	-	-	63	43	2.6
2012	2,662	5.5	-	-	3	46	0.1
2013	2,877	8.1	-	-	133	50	0
2014	2,969	3.2	-	-	0	51	0
Mean[5]	-	4.1	-	-	-	-	-

1. From 1997 to 2009, removals included all seronegative and seropositive bison exiting the north boundary (Reese Creek) and seropositive bison captured at the west boundary area (Seven-Mile Bridge area). In years 2010–2013, total removals included seropositive and untested bison removed in capture, test, and slaughter operations.
2. Seroprevalence of the population just prior to early winter operations.
3. Whole-herd vaccination beginning in 2000 and 25% vaccine efficacy.
4. Capture, test, and slaughter operations begin 2010 and end 2013.
5. Average rate of increase from 1997 to 2006.

Effects on Free-Ranging Status and Distribution of Bison. Management actions under this alternative would not be expected to appreciably alter the age/sex structure of the bison population for either vaccine efficacy. Bison would be allowed to freely range in the Eagle Creek/Bear Creek area, and seronegative bison would be allowed to range in the West Yellowstone area. During the three-year capture, test and slaughter phase, a minimum of 95% of the bison within Yellowstone National Park would be rounded up and tested for exposure to brucellosis. Those testing negative and released into the park would be visibly marked to facilitate removal of the remaining untested animals.

Bison Population Trends. For purposes of analysis, the enhanced stochastic model assumed whole herd vaccination would begin by 2002 (year 6 of the model). The model also assumed that those bison subject to capture, test, and slaughter operations in phase 1 of this alternative are bison that would eventually move beyond park boundaries. Bison subject to capture, test, and slaughter operations at the north boundary of the park would be managed in a manner similar to alternative 1. When tests indicated that seroprevalence ceased to decline as a result of vaccination, phase 2 — the herd-wide capture, test, and slaughter program (described in alternative 5) — would begin. For phase 2 the analyses presented are for an annual capture rate of 90% of the total bison population. In preliminary model simulations in phase 1, seroprevalence did not stabilize for approximately 17 years after the alternative was implemented. It was necessary to run model projections for 26–30 years to fully analyze this alternative. For purposes of fair comparisons with the other alternatives, total population, seroprevalence, bison movements out of Yellowstone National Park, bison removals, and bison distribution, were only summarized for the life of the plan (15 years).

The enhanced stochastic model predicted the mean bison population would increase from about 2,100 in 1997 to around 3,000 in the year 2001 (one year after implementation or year 5 of the model) and would stabilize after 2006 at about 3,700 animals (table 42). The mean population size would peak at about 3,800 bison in 2008 (year 12 of the model). This is 3% lower than the peak mean population size during this same year for alternative 1 and 22% greater than for alternative 5. The peak mean number of bison in alternative 6 is also about 10% higher than the peak achieved during the life of the plan in alternative 5. Mean bison population size would fluctuate during phase 1 (the entire length of the plan) between 2,800 and 4,400.

Whole-herd vaccination of calves was assumed to continue for 17 years (year 23 of the model) until seroprevalence stabilized at about 4%. After phase 2, parkwide capture, test, and slaughter operations had been implemented for three years, the model showed the mean bison population size would likely range from 2,900 to 4,300.

Epidemiology. Under alternative 6, remote whole-herd vaccination along with vaccination of all captured seronegative bison was assumed to begin in the year 2002. By the end of the 15-year plan (phase 1), seroprevalence was estimated to decrease from approximately 38% in 2002 to 9% in 2014, similar to alternative 1. For phase 1 of this alternative, this program was estimated to require about two additional years (17 years total) to stabilize seroprevalence at about 4%. After phase 2 (beyond the 15-year plan) where capture, test, and slaughter operations occurred for about three years, seroprevalence would be reduced to below 0.1% in 2020 and mean seroprevalence remain below 0.1% for the subsequent years modelled. This reduction in phase 2 is comparable to that achieved in alternative 5.

Bison Removals from the Population. For purposes of fair comparison among the other alternatives, estimates of bison removals from the population under alternative 6 are summarized for the life of the plan (15 years after the record of decision).

It was estimated that a total of 4,224 (2,112 females) bison would be removed from the population over the life of the plan (see table 43). Of this total, 3,438 (1,719 females) would be removed through capture, test, and slaughter operations, while the remaining 786 (393 females) would be shot or slaughtered. Although alternative 6 would result in fewer total removals than either alternative 1 (by 9%) or alternative 5 (23%), the way in which bison would be removed differs. Alternative 6 would result in 60% more bison being sent to slaughter than alternative 1 and 57% more than alternative 5 (see table 43). The number of bison removed by shooting and other lethal means (because they attempted to cross boundaries of the park or SMAs and could be hazed) would be 69% fewer than under alternative 1 and 76% fewer than alternative 5.

Bison Distribution. During the vaccination phase of this alternative (phase 1), management activities such as capture, slaughter, shooting, and hazing would keep bison from moving beyond the identified management areas. Alternative 6 would allow 100–200 bison (approximately 50–100 females) to freely range on public lands in the Eagle Creek/Bear Creek area. No bison would be allowed north of the park boundary at Reese Creek. Winter management objectives would allow for up to 100 seronegative bison (approximately 50 female bison) in the West Yellowstone area, and an estimated average of 58–80 seronegative bison (29–40 females) might winter in the area. This is 5%–21% greater than the number predicted to use the West Yellowstone area in alternative 1. In alternative 5, no bison are allowed outside the park into the West Yellowstone area.

In phase 1, the capture, testing, and slaughter of bison in the park on the west side would limit the number of bison within the park between Seven-Mile Bridge and the park boundary. Because of capture, testing, and slaughter at Stephens Creek, bison on the north end of the park would not freely range in the Stephens Creek area. After seroprevalence had stabilized and herd-wide capture, test, and slaughter operations (as described in alternative 5) had begun, bison would not be free ranging inside the park. Bison movements toward winter range, as well as distribution within the park, would be temporarily affected.

Cumulative Impacts

Under alternative 6, bison management removals during the 10-year vaccination phase (through 2009) would average between 3.8% at 70% vaccine efficacy and 4.0% at 25% vaccine efficacy of the bison population. In the capture, test, and slaughter phase, removals would average 7.5% at 70% vaccine efficacy to 10.2% at 25% vaccine efficacy of the bison population from 2010 to 2013. Cumulative impacts as described in "Cumulative Impacts Common to All Alternatives" would add to decreases in the population.

Conclusion

During the vaccination phase of alternative 6, the bison population would be expected to increase an average of 4.2% each year, a negligible to minor increase compared to alternative 1 (less than 10% difference). After the capture, test, and slaughter phase began in 2010, this alternative would result in a moderate (17% decrease, 70% vaccine efficacy) to major reduction (28% decrease, 25% vaccine efficacy) in the bison population.

Bison would not be free ranging for a short time during the capture, test, and slaughter period. This alternative would likely have a minor to moderate impact on bison distribution, by limiting the number of bison allowed outside Yellowstone National Park and by temporarily removing bison from some areas within the park where they previously existed.

This alternative would have a similar impact on seroprevalence rate for the initial 10 years of vaccination, compared to alternative 1. Following capture, test, and slaughter, the reduction in seroprevalence rate would be major, decreasing to 0.

The enhanced stochastic model indicated seroprevalence would not stabilize during the life of the plan, and phase 2 would not be implemented. Bison population trends and seroprevalence results would be similar to those reported for alternative 1. The bison population would increase during the 15-year life of the plan and stabilize at a mean of approximately 3,700 bison, similar to alternative 1. Capture and shipment of bison to slaughter, periodic severe environmental conditions, and additional mortality would likely maintain the bison population between 2,800 and 4,400 animals.

During phase 1, seroprevalence would be reduced from 38% to approximately 9%. This reduction in seroprevalence is similar to alternative 1. In phase 2, which would occur in about years 2017–2019 of the model (beyond the 15-year life of this plan), parkwide capture, test, and slaughter operations would reduce seroprevalence to 0.1%, similar to alternative 5. Without continued calfhood vaccination and due to the possibility of reinfection from elk, seroprevalence would likely return to the levels observed prior to implementation of this alternative within approximately 20 years (Angliss, unpubl. data).

Under alternative 6, capture, testing, and shipment to slaughter and agency shooting would contribute to bison removals. An estimated total of 4,224 (2,112 females) bison (9% less than alternative 1) would be removed over the life of the plan (15 years). Over the life of the plan, a total of 3,438 (1,719 females) bison would be sent to slaughter, and a total of 786 (393 female) bison would be removed by other lethal means. This is a 60% increase in the number of bison sent to slaughter and a 69% decrease in bison removed by other means compared with alternative 1.

Winter management objectives would allow up to 100 seronegative bison (approximately 50 female bison) in the West Yellowstone area and an estimated average of 58–80 seronegative bison (29–40 females) might winter in the area.

Although phase 2 would not occur during the life of the plan, parkwide capture, test, and slaughter operations would confine bison to the park boundaries and would have a major impact on distribution during the three years this phase was in full effect. Some areas might have few or no bison, while other areas, particularly near the nine capture facilities, might have unnaturally high concentrations of bison.

IMPACTS OF ALTERNATIVE 7

Analysis

Effects on the Bison Population. Assumptions used in alternative 1 were also used in this alternative to construct bison population dynamics. Unlike the other alternatives, the agencies would attempt to manage the bison population within a range of 1,700 to 2,500 in alternative 7. This alternative would emphasize capture of bison at Stephens Creek (or at a facility north of Reese Creek if additional lands were purchased), shipment of seropositive bison to slaughter, and shipment of seronegative bison to quarantine. If populations were high and/or quarantine space was unavailable, seronegative bison would be shipped to slaughter. If the population was near the low range (1,700), seronegative bison could be held at the capture facility and released in Yellowstone National Park in spring rather than quarantined. Hunting would be used to control populations in the Eagle Creek/Bear Creek area. Capture operations would occur in the West Yellowstone area, and only seronegative males and seronegative nonpregnant females would be released on public lands in the West Yellowstone area. Seropositive bison would be shipped to slaughter, and seronegative pregnant females would be shipped to quarantine. Low levels of hunting were assumed in the West Yellowstone area as an adjunct to capture operations. Property north of the park in the Gardiner Valley might be acquired from willing sellers through purchase, easement, or leases. If so, limited hunting could be allowed here as well.

When the bison population was approaching or above 2,500 animals, management efforts would emphasize additional lethal controls. These controls would include shipment of additional seropositive and seronegative bison to slaughter, shipment of seronegative bison to quarantine, increased hunting, and agency shooting outside the park. However, these actions could only occur in response to the movement of large numbers of bison to or beyond the park boundary.

Hunting would begin in 2000, and quotas would provide for a minimum of 15 permits in the Eagle Creek/Bear Creek area. It was also assumed a total of 10 permits would be offered in the West Yellowstone area beginning 2002 as an adjunct to capture operations and 10 (if approved) in the Reese Creek SMA. Based on bison population numbers, winter distribution on public and private lands, and other factors, the agencies could conduct additional special drawings to harvest additional bison.

Under this alternative, bison population numbers would be controlled through capture, shipment of seropositive bison to slaughter, shipment of seronegative bison to slaughter or quarantine, hunting, and agency shooting outside the park. Modelling predicts this alternative would initially result in a small increase in the bison population, and assumes management actions (increased removals) would limit the total population to approximately 2,500. This alternative would be expected to result in lower long-term population levels than any of the other alternatives except alternative 5. From 1997 to 2004, the bison population would be expected to increase from about 2,100 bison to 2,700 bison (average increase of 2.6%/year; see table 50) where it would remain over the life of the management plan. At 10 years and assuming 70% vaccine efficacy, population levels under alternative 7 would be about 12% lower than alternative 1. The population would be 23% lower by 2011. However, because of the limitations of the deterministic model discussed previously, the differences between alternatives 1 and 7 could be less. This might result because more bison could be removed in alternative 1 than that displayed in the analysis. The agencies would expect severe winter conditions to periodically force additional bison outside park boundaries. When these conditions occurred and the early winter bison population was near or above 2,500 animals, this alternative would require the agencies to ship additional bison to slaughter or quarantine, increase hunter harvest, or increase agency shooting outside the park to maintain the spring bison population below or near 2,500. If the assumptions of the model proved true (e.g., average winters and average number of bison exiting), such removals would begin in the year 2003. Average removals from slaughter, quarantine, and hunting were predicted to remove between 132 and 137 bison each year. The agencies would expect to remove 42–73 additional bison each year as they moved outside the park boundary at the north boundary and West Yellowstone areas, for total annual removals of 179–205 bison.

Management actions in this alternative would not measurably affect the age/sex distribution or reproductive rates of the Yellowstone bison population. Capture operations, shipment of bison to slaughter and quarantine, limited hunting, agency shooting outside the park, and periodic severe environmental conditions would likely maintain the spring bison population near 2,500.

Effects on Free-Ranging Status and Distribution of Bison. Bison would not be expected to move beyond the identified SMA, but if they did, they would be removed. If the bison population approached the low range (1,700), efforts would be made to haze bison back into the SMAs. Agency personnel would shoot bison or haze them off private lands where the landowner wanted bison removed and hunting was not allowed.

Management objectives would allow 100–200 bison to freely range in the Eagle Creek/Bear Creek area. Approximately 100 bison would be expected to winter in this area. Beginning in the year 2000, an annual hunter harvest of 15 animals would be expected in the Eagle Creek/Bear Creek area. Bulls would likely be harvested in this area.

Initially, no bison would be allowed in the Reese Creek area. If additional lands were purchased, management objectives would allow up to 50–100

Table 50: Deterministic Model Results of Estimated Early Winter Population, Rate of Population Increase, Projected Management Removals, and Estimated Seroprevalance Rate for the Bison Population under Alternative 7

Year	Early Winter Population	Yearly Percent Increase	Management Removals Outside Yellowstone National Park: North Boundary[1]	West Boundary[2]	Total Removals	Remaining on Public Land Outside Yellowstone National Park at West	Estimated Percent Sero-prevalence[3]
1997	2,156	-	-	55	55	48	50
1998	2,266	5.1	-	57	57	51	49
1999	2,381	5.1	80	23	103	18	48
2000	2,465	3.5	98	23	121	20	47
2001	2,536	2.9	100	23	123	21	45
2002	2,611	3.0	103	32	135	13	42
2003	2,679	2.6	105	32	179[4]	14	39
2004	2,705	1.0	106	31	205[5]	16	37
2005	2,705	0.0	106	30	205	17	34
2006	2,705	0.0	106	29	205	18	32
2011	2,705	-	-	-	-	-	23
Mean[6]	-	2.6	-	-	-	-	-

1. Totals include seropositive and seronegative bison captured at Stephens Creek facility and sent to slaughter, and 15 bison hunted at Eagle Creek/Bear Creek beginning in 2000.
2. Totals include seropositive and seronegative pregnant bison captured in the West Yellowstone area and sent to slaughter and 10 bison hunted in the West Yellowstone area beginning in 2002.
3. Based on calfhood vaccination beginning 2000 and 70% vaccine efficacy.
4. Includes additional opportunistic removal of 42 bison that are exiting Yellowstone National Park at the north boundary or West Yellowstone areas.
5. For the years 2004 to 2006, includes additional opportunistic removal of 68–70 bison that are exiting Yellowstone National Park at the north boundary or West Yellowstone areas.
6. Mean rate of increase calculated from 1997 to 2006.

bison in the Reese Creek area, although the total number of animals in the entire bison population would not be increased.

Management objectives would allow up to 50–100 seronegative male and seronegative nonpregnant female bison in the West Yellowstone area and 13–51 animals would be expected. Beginning in 2002, annual hunter harvests of 10 bison would likely consist of males, but some larger females could also be taken. Following hunter harvests and potential additional removals that might be required to manage the population at 2,500 animals, few if any bison would winter in the West Yellowstone area during the life of the plan (see table 50).

Seroprevalence in the Bison Population. The population seroprevalence rate would be expected to decline from a starting point of 50% seropositive in 1997 to at least 32% seropositive in 2006 due to removal of seropositive bison in West Yellowstone and Reese Creek area and vacination at 70% efficiency beginning in 2000 (see table 50). Continued management efforts and vaccination at 70% efficiency would reduce seroprevalence to 23% in 2011. With vaccination and a vaccine efficacy of 25%, seroprevalence was predicted to drop from 50% to 40% by 2006.

Bison Population Trends. Modelling predicted this alternative would result in an increase in the mean bison population from about 2,100 animals in 1997 to about 3,000 in 2001 (one year after implementation) and to a "peak" of approximately 3,600 in 2010. The mean population appeared to stabilize after 2010 at approximately 3,600 animals, ranging between 3,000 and 4,200 (see table 42). The stabilized mean population size achieved under this alternative is similar (4% lower) to that projected under alternative 1.

Using the model projections, the population objective of 2,500 bison established under this alternative would never be achieved, as the population would stabilize at 3,600; therefore, 31% of the bison population would need to be removed to meet the objective. The model predicted mean bison removals in the range of 358 to 424 bison, which is not high enough to result in a population size close to the objective of 2,500 animals. Even when using the estimated likely maximum (mean + SD) removals, which is 830 bison, the population would remain higher than the objective.

Epidemiology. Based on model projections, the mean population seroprevalence rate would decline from a starting point of 37% seropositive in 2002 to approximately 14% seropositive in 2013. This 61% reduction in seroprevalence is greater than the 49% reduction (from 45% seropositive to 23% seropositive) predicted by the deterministic model over the same 11-year time period (i.e., the 11 years of vaccination following its initiation).

Bison Removals from the Population. Based on summing mean removals, which includes bison killed, bison subject to other lethal removals, and bison quarantined across years, a total of 4,972 bison (2,486 females) would be removed over the life of the plan (see table 43). The total number removed in alternative 7 would be approximately 7% higher than alternative 1. Over the life of the plan, a total of 1,290 bison (26% of total removed) would be sent to slaughter, 114 (2%) would be hunted, 2,254 (45%) would be sent to quarantine, and 1,314 (26%) would be subjected to additional removal.

Under alternative 7, all bison attempting to leave the park would be removed because the mean population during the life of the plan was estimated to be above 2,500 animals in every year following implementation of the plan, beginning in 2000. Based on the mean estimated population, from 2001 (year 5) until the end of the plan, it would be necessary to remove between an additional 500 and 1,100 bison to meet a population objective of 2,500 animals (see table 42).

Bison Distribution. Under alternative 7, initially no bison would be allowed in the Reese Creek area. Following purchase of additional lands, up to 100 bison (approximately 50 females) would be permitted in the Reese Creek area. According to model projections, no bison would winter in the Reese Creek area because all bison moving beyond park boundaries would be subjected to removal in an attempt to limit the population to 2,500 animals.

Management objectives would allow up to 50–100 bison (approximately 50 female bison, all of whom would be seronegative and none of whom would be pregnant) in the West Yellowstone area; however, no animals are expected to occupy this area in the winter. All bison attempting to enter the West Yellowstone area would be removed from the population in an attempt to limit the population to 2,500 animals or less.

Cumulative Impacts

For alternative 7, total management removals would average about 5% of the total bison population from 1997 to 2002. Beginning in 2003, additional removals would be required to manage the bison population near 2,500 animals, and these removals would average about 7.6% of the early winter population. These removals would be in addition to those described in "Cumulative Impacts Common to All Alternatives."

Based on the stochastic model, alternative 7 management actions over the life of the plan would result in 4,972 bison (2,486 females) being removed from the population. Compared with alternative 1, the number of bison that would be removed is approximately 7% higher in alternative 7, removal of bison would be required to maintain the population near 2,500 animals. The model predicted it would be necessary to remove 31% of the early winter population to meet the population objective. These removals would be in addition to those described in "Cumulative Impacts Common to All Alternatives."

Conclusion

This alternative would maintain the bison population within the range of 1,700 to 2,500 animals. Capture operations, shipment of bison to slaughter or quarantine, limited hunting, agency shooting outside the park, and periodic severe environmental conditions would likely maintain the population near 2,500 bison. It was estimated this alternative would result in a moderate decrease (12%) in the bison population by 2006 and a major decrease (23%) by 2011 compared to alternative 1. Because of the limitations of the deterministic model, the differences between alternatives 7 and 1 might be less.

This alternative would allow bison to freely range within Yellowstone National Park except in the Stephens Creek area. Approximately 100–200 could freely range in the Eagle Creek/Bear Creek SMA, and up to 50–100 in the Reese Creek SMA if additional winter range was acquired. After capture and removal of seropositives, and hunting, few if any bison would be expected to winter in the West Yellowstone area.

Capture and removal of seropositive bison and calfhood vaccination at 70% efficacy were predicted to decrease seroprevalence to at least 32% in 2006 and 23% by 2011. This would be a negligible to minor decrease in seroprevalence compared to that predicted to occur if alternative 1 was implemented.

Management actions under this alternative are expected to maintain the bison population within the range of 1,700 to 2,500 animals. Based on the stochastic model projections, however, the population in alternative 7 would increase during the life of the plan and stabilize at a mean of approximately 3,600 bison, ranging between 3,000 and 4,200 animals. The stabilized population size under alternative 7 is 4% lower than that projected for alternative 1, and relative impacts of implementing alternative 7 on population size are considered negligible. Once the population stabilized in 2010 at about 3,600 bison, however, at least 31% of the bison in the early winter population would have to be removed to reach a population goal of 2,500 bison or less. Based on the model projections, the population objective established in alternative 7 would never be achieved

The enhanced stochastic model predicted a 61% decline in seroprevalence from 37% in 2002 to 14.4% in 2013 (11 years of vaccination) compared with the deterministic model, which predicted only a 49% decline in seroprevalence rate over this same period.

Total removals of female bison over the life of the plan would be 7% higher than that projected for alternative 1, which is considered to be a negligible to minor difference. Unlike alternative 1, however, of the estimated 5,000 removed, 45% would be removed as live bison to quarantine.

After capture and slaughter of seropositive bison and hunting, few (if any) bison would be expected to winter in the West Yellowstone or the Reese Creek areas. Based on model projections, all animals attempting to move beyond the park boundaries would be removed either to slaughter or quarantine in an effort to reach the population objectives of this alternative.

IMPACTS OF THE MODIFIED PREFERRED ALTERNATIVE

Analysis

Effects on the Bison Population. Modelling assumptions used in alternative 1 were also used in this alternative to construct bison population dynamics. Unlike the other alternatives, the agencies would attempt to manage the bison population to a limit of 3,000 animals in the modified preferred alternative. This alternative would emphasize adaptive management that initially involves capturing bison and shipping only seropositive bison to slaughter, while keeping seronegative bison in the population or taking them to quarantine. Reduction in seroprevalence would primarily be accomplished through remote calfhood vaccination using a safe and effective vaccine and keeping as many seronegative bison (including seronegative pregnant females) as possible in the population.

In the western boundary area, stepwise implementation of management actions within an adaptive management framework would emphasize limiting the removal of bison to those necessary to mitigate risk and maintain a population of 3,000 bison. For three years, up to 100 seronegative bison would be tolerated on public lands during winter in the West Yellowstone management area; for the remainder of the plan, up to 100 untested bison would be tolerated. This alternative would remove only seropositive bison during the first three years and would remove bison in excess of the 3,000 population limit or the 100 bison tolerance limit for the remainder of the plan. For the northern boundary, the alternative calls for no bison being allowed north of the park at Reese Creek for two years, while livestock grazing continues. Bison would be hazed or, if hazing was unsuccessful, captured with seropositive bison being sent to slaughter. Approximately 125 seronegative bison would be temporarily held in the Stephens Creek capture facility until early spring. Following permanent cessation of cattle grazing in the Reese Creek management zone north of the park boundary, up to 100 seronegative bison would be tolerated within the Reese Creek management area for two years. For the remainder of the plan, up to 100 untested bison would be tolerated, with bison being removed to meet the 3,000 population limit or 100 bison tolerance limit.

Modelling predicts this alternative would result in an increasing bison population and assumes that management actions (increased removals) would limit the total spring bison population to approximately 3,000, with an estimated long-term early winter population of 3,246 bison. From 1997 to 2004, the bison population was estimated to increase from about 2,100 bison to 3,250 bison (average increase of 4.6%/year; see table 51), where it would remain over the life of the management plan. In 2006 (year 10), assuming 70% vaccine efficacy, population levels would be about 6% higher than alternative 1 and in 2011 7% lower than alternative 1. Although this alternative would have a bison population approximately 1% to 15% greater than alternative 1 for the first 10 years of the plan, the deterministic model suggests the population would be similar to alternative 1 in the long run. The slightly lower predicted population later in the plan would result from the 3,000 population limit, compared with no population limit for alternative 1. The modified preferred alternative consistently had a higher estimated bison population than alternative 7, due to the higher population limit of 3,000 bison and tolerance for seronegative pregnant bison. After 2004 and for the remaining life of the plan, the modified preferred alternative would have a 20% higher population than alternative 7, a moderate to major increase.

When the early winter bison population was above 3,000 animals and bison exited the park, this alternative would require the agencies to ship seropositive bison to slaughter and additional seronegative bison to quarantine in order to maintain the spring bison population near 3,000. With average winters and average numbers of bison exiting, management actions are expected to remove between 159 (62 to slaughter and 97 to quarantine) and 165 (49 to slaughter and 124 to quarantine) bison each year; however, to maintain the population below 3,000, the agencies would need to remove an additional average of 79–81 bison each year as they moved outside the park boundary, for total average annual removals of 159–246 bison. Larger removals would occur to maintain this average removal rate when severe winter conditions periodically forced additional bison outside park boundaries.

Management actions under this alternative would not measurably affect the age/sex distribution or reproductive rates of the Yellowstone bison

Table 51: Deterministic Model Results of Estimated Early Winter Population, Rate of Population Increase, Projected Management Removals, and Estimated Seroprevalance Rate for the Bison Population under the Modified Preferred Alternative

			Management Removals Outside Yellowstone National Park				
Year	Early Winter Population	Yearly Percent Increase	North Boundary[1]	West Boundary[2]	Total Removals	Remaining on Public Land Outside Yellowstone National Park at West	Estimated Percent Sero-prevalence[3]
1997	2,156	-	-	55	55	55	50
1998	2,273	5.4	-	56	56	60	49
1999	2,399	5.5	38	20	58	22	47
2000	2,533	5.6	39	0	39	44	46
2001	2,699	6.6	0	0	0	47	43
2002	2,920	8.2	0	0	0	51	41
2003	3,159	8.2	106	53	159[4]	55[5]	39
2004	3,244	2.3	109	56	244[6]	56	37
2005	3,246	0.0	109	56	246	56	35
2006	3,245	0.0	109	56	245	56	33
2011	3,246	-	-	-	-	-	25
Mean[7]	-	4.6	-	-	-	-	-

1. Totals include seropositive bison captured at Stephens Creek facility and sent to slaughter in 1999 and 2000. Beginning in 2003, totals include seropositive bison sent to slaughter and seronegative bison sent to quarantine so that the agencies can attain the 3,000 population limit in spring and meet the 100 maximum bison limit for the Reese Creek management zone.
2. Totals include seropositive bison captured in the West Yellowstone area and sent to slaughter from 1997 through 1999. From 2000 through 2002, no bison are removed because neither the 3,000 population limit nor the 100 bison tolerance limit for the West Yellowstone area was exceeded. Beginning in 2003, totals include seropositive bison sent to slaughter and seronegative bison sent to quarantine so that the agencies could attain the 3,000 population limit in spring. Model results estimated the 100 bison tolerance limit for the West Yellowstone area was never exceeded.
3. Based on calfhood vaccination beginning 2000 and 70% vaccine efficacy.
4. Beginning in 2003, totals include seropositive bison sent to slaughter and seronegative bison sent to quarantine so that the agencies could attain the 3,000 population limit in spring and meet the 100 bison tolerance limit for the Reese Creek management zone.
5. Beginning in 2003, approximately 56 untested bison could winter in the West Yellowstone area, but if the late winter/early spring population was greater than the 3,000 animals predicted in the model, all those bison would likely be captured and tested in late winter or early spring, with seropositive bison being sent to slaughter and seronegative bison being sent to quarantine.
6. For the years 2004 to 2006, totals include additional opportunistic removal of 68–70 bison that would exit Yellowstone National Park at the north boundary or West Yellowstone areas.
7. Mean rate of increase calculated from 1997 to 2006.

population. Capture operations, shipment of bison to slaughter and quarantine, and periodic severe environmental conditions would likely maintain the spring bison population near 3,000.

Effects on Free-Ranging Status and Distribution of Bison. Within the 100 bison tolerance limits, bison would not be expected to move beyond the management zones, but if they did, they would first be hazed and, if unsuccessful, they would be removed. If the population approached the low range of 1,700, efforts would be made to haze bison back into the park or to public lands within the management zones. Agency personnel would haze bison off private lands or shoot them when the landowner wanted bison removed.

Management objectives would allow 100–200 bison to freely range in the Eagle Creek/Bear Creek area. From zero to 100 bison would be expected to winter in this area.

During the first two years of implementation, bison would not be allowed north of the park boundary in the Reese Creek area. Following land exchange, the purchase of additional wildlife winter habitat, and the purchase of conservation easements, tolerance limits would allow up to 100 seronegative bison north of the park boundary in the Reese Creek area during the second two years, an estimated 43–46 seronegative bison would winter in the area. During the third two-year phase, up to 100 untested bison would be allowed to winter in the Reese Creek management zone, and 91 to 98 bison are expected. Tolerance of up to 100 bison north of the park in the Reese Creek area would be a major difference compared with no tolerance of bison in this area under alternative 1. Tolerance limits of the modified preferred alternative would be similar to alternative 7. Beginning in 2003 under the modified preferred alternative, more than 100 bison are estimated to move into the Reese Creek area (106–109). When the tolerance limit was exceeded, those bison would be captured and tested, and seropositive bison would be sent to slaughter to maintain the 100 bison tolerance limit. The remaining 65–82 seronegative bison would be allowed to winter in the area. In early spring if the population remained above 3,000, seronegative bison would be captured and sent to quarantine in order to maintain the 3,000 population limit.

Tolerance limits in the modified preferred alternative would initially allow up to 100 seronegative bison in the West Yellowstone area, with 22–60 animals expected. This is similar to alternatives 1 and 7; however, alternatives 1 and 7 would not allow seronegative pregnant bison to winter in the West Yellowstone area. For three years (2000–2002 in the model), this alternative would allow untested bison to winter in the West Yellowstone area, with 44–51 predicted. This aspect is different from both alternative 1 and alternative 7, where no untested bison would be allowed. Alternative 1 would have no population limits, and the modelling predicted 26–31 seronegative nonpregnant bison would winter in the area. Beginning in 2003 as many as 56 untested bison could winter in the West Yellowstone area; however, in late winter or early spring, bison wintering in this area might be captured and tested, with seropositive bison sent to slaughter and seronegative bison sent to quarantine to limit the population to 3,000 animals. These actions would result in few (if any) bison remaining in the West Yellowstone area in spring during the life of the plan (see table 51).

Seroprevalence in the Bison Population. The deterministic model estimates that the population seroprevalence rate would decline from 50% seropositive in 1997 to about 33% seropositive in 2006, due to removal of seropositive bison and remote calfhood vaccination (at 70% efficacy) beginning in 2000 (see table 51). Continued management efforts and vaccination would reduce seroprevalence to 25% in 2011. Seroprevalence under the modified preferred alternative would be similar to that predicted in alternative 1 (24%) and alternative 7 (23%).

Stochastic Influence on Bison Population. During the first years of adaptive management, the modified preferred alternative would transition from allowing up to 100 seronegative bison to allowing up to 100 untested bison to winter in designated management areas. This aspect of the modified preferred alternative is different from both alternatives 1 and 7 because alternatives 1 and 7 would require capture and testing of any bison moving onto public lands in the western boundary area during winter.

With full implementation of the modified preferred alternative, tolerance of up to 100 untested bison would be allowed in both the Reese Creek and West Yellowstone management areas, with no capture operations as long as the 3,000 population limit or the 100 bison tolerance limit for each of the management zones was not exceeded. If the population limit or tolerance limit was exceeded, capture operations would be implemented to send seropositive bison to slaughter and seronegative bison to quarantine.

Bison Population Trends. Under the modified preferred alternative, the enhanced stochastic model projected a mean total population increasing from about 2,100 in 1997 to 3,100 in 2001 (one year after implementation or year 5 of the model). Beginning in 2008, the population stabilized at approximately 3,700 animals for the life of the plan, with populations ranging between 3,099 and 4,215 (see table 30). These trends and totals are similar to those in alternatives 1 and 7.

Both alternative 7 and the modified preferred alternative would establish bison population objectives of 2,500 and 3,000, respectively. Comparing those objectives with modelled population trends indicates that the mean estimated stabilized population of alternative 7 (3,600) would be 31% greater than the management objective of 2,500 bison. In comparison, the modified preferred alternative results in a stabilized mean bison population 19% greater (3,700) than its objective of 3,000. The combination of natural bison mortality in winter and predicted likely maximum (mean + SD) removals would likely be sufficient to achieve the population objective set by the modified preferred alternative. As noted above, however, this is not the case for alternative 7, since it would require the agencies to remove approximately 1,100 bison to meet the goal of 2,500 animals. This is 57% more than the estimated 700 bison that could be removed under the modified preferred alternative. The relative inability to meet a population objective of 2,500 bison for alternative 7 and differences in timing and management actions between alternative 7 and the modified preferred alternative would have implications for bison removal and distribution, as discussed below.

Epidemiology. The enhanced stochastic model estimated that mean population seroprevalence would decline from 36% in 2002 to about 15% in 2012, 13% in 2013, and 11% by 2014 at the end of the plan (see figure 2). The model predicted seroprevalence for alternatives 7 and 1 in 2013 would be 14.4% and 11%, respectively. The mean seroprevalence reduction of 63% from 36% to 13% in 2013 is greater than the 46% reduction (from 46% 25% seropositive) predicted by the deterministic model for the 11 years of vaccination following its initiation.

Bison Removals from the Population. A notable difference between the modified preferred alternative and alternatives 1 and 7 is that it would provide management flexibility and allow the agencies to preserve seronegative pregnant bison in the population. This includes both nonvaccinated bison and those previously and remotely vaccinated as calves. Alternative 1 would remove seronegative pregnant females from the population through slaughter and alternative 7 would remove them through quarantine, both regardless of their vaccination status. By preserving seronegative pregnant females under the population in the modified preferred alternative, the reproductive potential of the bison population can be more easily maintained, particularly after severe winters when large removals might be required.

Based on summing mean removals across the 18-year span of model projections, the stochastic model predicted a total of 1,382 bison (691 females) would be sent to slaughter, while an additional 3,792 (1,896 females) were estimated to be subjected to nonlethal shipment to quarantine, if available (see table 43). Under the modified preferred alternative the use of a quarantine facility would result in 70% fewer bison being lethally removed (slaughter and agency shooting) from the population than alternative 1. By sending bison to quarantine in excess of the allowed total population (3,000) outside the park, the modified preferred alternative would save 68% more seronegative bison from lethal removal compared with alternative 7. The modified preferred alternative would also require 36% fewer female bison to be sent to slaughter than alternative 1.

Bison Distribution. For the life of the plan after 2002 when cattle grazing stops north of the park boundary at Reese Creek (year 6 of modelled plan), up to 100 bison (approximately 50 females) would be allowed in that area in winter. Alternative 1 would not permit any bison on wildlife winter range north of the park boundary in the Reese Creek area. The modified preferred alternative would provide the agencies management flexibility to allow bison to move back and forth across the park boundary within the Reese Creek area, as long as the 100 tolerance limit was not exceeded. Considering that management actions may occur when tolerance limits were exceeded, the enhanced stochastic model projected that between the years 2002 and 2014, an average 10–20 bison (5–10 females) would remain outside the park within this prescribed management area during winter. Unlike alternatives 1 and 7, which would require management actions be taken when any bison attempted to cross the northern boundary, the modified preferred alternative might provide for less capture and handling of bison when the tolerance limits outside the park were not exceeded.

Similarly, management objectives would allow up to 100 bison (an estimated 50 female bison) within the prescribed West Yellowstone management area during winter. Under this alternative, management actions could occur when tolerance limits were exceeded, and prior to 2004, only seronegative bison would be allowed in West Yellowstone. Given these features, the enhanced stochastic model estimated that between 2–10 bison (1–5 females) would occupy the prescribed management area. After 2004, when untested bison would be tolerated outside the park within prescribed management areas, the model projected that an average of 10–12 bison (5–6 females) would remain outside the park at West Yellowstone during winter. Under the modified preferred alternative, the predicted number of bison that might occupy public lands during winter is lower than for alternative 1 and is likely due to management maintaining the 100–bison tolerance limit and the total early spring population at 3,000 animals. The modified preferred alternative, however, would provide a minor benefit of 10 to 12 bison on public lands outside the park in the West Yellowstone area compared with alternative 7. No bison would likely occupy the West Yellowstone area under alternative 7, according to model results, because the population objective of 2,500 could be maintained without removing all bison that might move into the management area.

The maximum total number of bison tolerated outside the park in the West Yellowstone area would be similar for alternative 1 and the modified preferred alternative. Alternative 1, however, only permits seronegative males and seronegative nonpregnant females outside of the park, whereas the modified preferred alternative would initially allow all seronegative bison to inhabit public lands and later would allow untested bison to occupy those lands. The modified preferred alternative would allow for management flexibility and potentially less hazing, capture, and handling of bison when the tolerance limits outside of the park were not exceeded.

Cumulative Impacts

The deterministic model predicted that management removals would average about 1.5% of the total bison population from 1997 to 2002. Beginning in 2003, additional removals would be required to manage the bison population near 3,000 animals, and these removals would average about 7.6% of the early winter population. These removals would be in addition to those described in the "Cumulative Impacts Common to All Alternatives" section.

The enhanced stochastic model indicated that after tolerance of untested bison outside the park in 2002, additional removals totaling 19% of the early winter population would be required to manage the early spring total size to near 3,000 animals. These removals would be in addition to those described in "Cumulative Impacts Common to All Alternatives."

Conclusion

The modified preferred alternative would provide for an increasing bison population and would maintain the population near the spring limit of 3,000 animals. Capture operations, shipment of seropositive bison to slaughter, shipment of seronegative bison to quarantine, and periodic severe environmental conditions would likely maintain the population near 3,000 bison. Based on the deterministic model, the predicted mean population was from 1% to 15% greater than alternative 1 for about 10 years, but was numerically similar to the population of alternative 1 in the long term. This alternative consistently had a higher bison population than alternative 7, due to the higher 3,000 population limit and tolerance for seronegative pregnant bison in management areas. The population was 20% higher than alternative 7, a moderate to major increase. Because of the limitations of the deterministic model, the differences between the modified preferred alternative and alternatives 7 and 1 might be less.

Bison would be allowed to freely range within Yellowstone National Park except in the Stephens Creek area. Approximately 100–200 could freely range in the Eagle Creek/Bear Creek SMA, and up to 100 untested bison could winter on public and conservation easement lands north of the park in the Reese Creek area. The tolerance of 100 bison in the Reese Creek area is similar to alternative 7, but is a major difference compared with alternative 1, where bison would not be tolerated. For the West Yellowstone area, this alternative would allow up to 100 seronegative or untested bison to winter on public lands in the area. This aspect is different from both alternative 1 and alternative 7, where no untested bison or seronegative pregnant bison would be allowed.

For the deterministic model, the capture and removal of seropositive bison and calfhood vaccination at 70% efficacy were predicted to decrease seroprevalence to at least 33% in 2006 and 25% by 2011. This would be a comparable decrease in seroprevalence compared with that predicted in alternative 1 (24%) or alternative 7 (23%).

Based on the enhanced stochastic model, the bison population would increase during the life of the plan and stabilize at a mean population level of 3,700, similar to alternative 1. Winterkill and planned management removals would likely mean the modified preferred alternative would meet its management limit of 3,000 bison in spring. Comparatively, based on the enhanced stochastic model projections, alternative 7 would never approach the population objective of 2,500 bison. Additionally, alternative 7 would require the agencies to remove approximately 1,100 bison (57% more than the modified preferred alternative) to meet the population objective of 2,500 bison.

The enhanced stochastic model predicted that a remote calfhood vaccination program that protects about 53% of calves would continue to reduce the seroprevalence of the bison population throughout the life of the plan, eventually reaching an estimated 11% seroprevalence. This reduction in the seroprevalence rate is considered a major positive impact. The modified preferred alternative would provide management flexibility and allow the agencies to preserve seronegative pregnant bison in the population, both nonvaccinated bison and those previously and remotely vaccinated as calves.

For the modified preferred alternative, total removals over the life of the plan using the enhanced stochastic model would be 11% greater than alternative 1, which is considered a moderate adverse impact. Over the life of the plan, the modified preferred alternative would require 36% fewer female bison to be sent to slaughter than alternative 1, a major positive impact. The modified preferred alternative sends a large number of bison to quarantine and would result in 70% fewer bison being killed compared with alternative 1, a major beneficial impact, because all bison under alternative 1 would be shot or slaughtered. Compared with alternative 7, the modified preferred alternative would likely result in a greater number of bison being saved, because the modified preferred alternative would not require as many bison be removed to meet population limits and would emphasize sending bison to quarantine. The modified preferred alternative does not rely on agency shooting or slaughter if numbers exceeded population or tolerance limits.

Compared with alternatives 1 and 7, the modified preferred alternative allows for potentially more bison to winter beyond park boundaries, particularly at Reese Creek. The modified preferred alternative would allow for management flexibility when low numbers of bison move to other public lands in early winter. Alternatives 1 and 7 require the agencies to capture and test, haze, or shoot bison that might move onto public lands outside the park during winter.

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

No irreversible (long term or permanent) commitments of the bison population were identified in any of the alternatives.

The federal government recently (1999) acquired approximately 4,800 acres of land north of Reese Creek for wildlife winter range, including bison. Under alternatives 1, 4, 5, and 6, bison would be prevented from using these public lands and wildlife conservation easement lands, because these alternatives would not allow bison north of the Reese Creek boundary. Also, under alternatives 1, 3 (short term), 4, 5, 6, 7 (short term), and the modified preferred alternative, approximately 13 acres of winter range habitat inside Yellowstone National Park in the Stephens Creek area would be unavailable to bison because of the management actions to capture bison at the Stephens Creek facility. Under alternative 6, approximately 13 additional acres of habitat inside Yellowstone would be unavailable to bison, because of management actions to capture bison in the Seven-Mile Bridge area. Under alternative 5 and alternative 6 (phase 2), approximately 104 acres of habitat inside Yellowstone would be unavailable to bison for as many as four years because of eight additional capture facilities used to conduct the parkwide capture, test, and slaughter operations. Under alternative 5, bison would not be allowed to use any public land beyond Yellowstone National Park boundaries. Under alternatives 1, 3, 4, 6, and 7, bison would be prevented from occupying public lands, primarily in the West Yellowstone area, from about May 1 through October 31. Under the modified preferred alternative, bison would be prevented from occupying public and conservation easement lands north of the park boundary at Reese Creek from about mid-April through October 31, and bison would be prevented from occupying public lands in the West Yellowstone area from about mid-May through October 31.

No irretrievable commitments to the bison population were identified. Irretrievable commitments of resources would include only those individual bison killed as part of management actions (capture and shipment to slaughter or agency shooting) that might have otherwise survived.

LOSS IN LONG-TERM AVAILABILITY OR PRODUCTIVITY OF THE RESOURCE TO ACHIEVE SHORT-TERM GAIN

The long-term ecological potential of the bison population would average 2,700 and would fluctuate between 1,700 and 3,500 animals. No loss in long-term availability or productivity of the bison population was identified in alternatives 1 through 6. In alternative 7, the agencies would manage the bison population to approximately 2,500. Although the stochastic model estimated that the bison population would fluctuate within the ecological range, if the agencies were able to kill as many as 1,100 bison and manage the population at 2,500, this could represent a loss in long-term availability compared with the ecological potential of the Yellowstone ecosystem. No short-term gain for the bison population was identified in alternative 7. Under the modified preferred alternative, the agencies would manage the early spring bison population to approximately 3,000 animals. The stochastic model estimated that the early winter bison population would average 3,700 animals (near the long-term ecological range) in the modified preferred alternative and that winterkill and planned management removals would likely mean the modified preferred alternative would meet its management limit of 3,000 bison in early spring. Depending on the number of winterkill and management removals, the bison population under the modified preferred alternative would likely be near or at the ecological potential in spring and throughout the year.

UNAVOIDABLE ADVERSE IMPACTS

Although individual bison from a brucellosis-affected herd would be killed in each alternative, all alternatives except alternative 5 would maintain the population within the 1,700 to 3,500 range. In alternative 5, the bison population would be quickly reduced to about 1,300 animals and would not recover to the low end of the range (1,700) until after 2005. However, this alternative would not lower the population to levels where genetic population viability concerns might be expected. In alternative 7, the bison population would be managed to maintain it between 1,700 and 2,500 animals.

Bison skull, by J.R. Douglas, 1969. (NPS photo)

In alternative 5, bison distribution would be limited only to Yellowstone National Park. Agency personnel would shoot any bison found on public or private lands outside the park. In alternative 5, bison could be absent in some areas and habitats that were previously occupied.

Although the stochastic model predicted that implementation of any alternative would maintain the bison population within or above the 1,700 to 3,500 range, the population would drop quickly by 29% to about 2,100 animals in the parkwide capture, test, and slaughter phase of alternative 5. The bison population would not recover in alternative 5 to the preparkwide capture, test, and slaughter operations population size for seven years. After capture, test, and slaughter operations, the stochastic model predicted that the bison population would continue to increase and would not reach the upper end of the ecological range until the end of the plan in 2014, when the population was estimated to be 3,600 animals.

Under the modified preferred alternative, the bison population would be managed to maintain a spring population limit of 3,000, which would allow the population to be near or at its ecological potential throughout the year. Agency personnel would haze or shoot bison on private land at the request of the landowner.

IMPACTS ON RECREATION

SUMMARY OF REGULATIONS AND POLICIES

The Act of March 1, 1872 (17 Stat. 32, 16 U.S.C. 22) established Yellowstone National Park and states it is "dedicated and set apart as a public park or pleasuring ground for the benefit and enjoyment of the people." The Act of August 25, 1916 (Public Law 64–235, 39 Stat. 535, 16 U.S.C. 1–3) established the National Park Service and states its basic mission: "[T]o conserve the scenery and natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as would leave them unimpaired for the enjoyment of future generations." The *Yellowstone National Park Master Plan* (NPS 1974) requires that wildlife management actions be directed toward reducing or eliminating disruptive human influences, relying, whenever possible, upon natural controls to regulate animal numbers.

METHODOLOGIES FOR ANALYZING IMPACTS

Impacts on recreation users and facilities were based on a literature review of previous planning, management, and social and economic literature concerning the topics at issue, including the Yellowstone National Park visitor experience, wildlife viewing, winter recreation, and hunting as referenced in the "Affected Environment" part and the following sections. In addition to relying on existing studies and documents, new data on both visitor and resident opinions and intentions were collected for use in the following analysis (Duffield et al. 1999, 2000a, 2000b).

In evaluating impacts on recreation, four areas of potential impact were analyzed: overall visitor use and experience, bison viewing, winter recreation, and hunting. In analyzing impacts on the overall visitor use and experience, particular attention was paid to information and data on potential visitation restrictions or other visitor impacts related to bison management actions. Data on anticipated bison population levels, based on the deterministic model, were primarily used in estimating impacts on bison viewing. Estimates of impacts on winter recreation were developed based on anticipated changes in winter access to the park under each alternative. Lastly, impacts on hunting were estimated based on anticipated levels of permits for bison hunting issued under several of the alternatives.

The Act of March 1, 1872…established Yellowstone National Park and states it is "dedicated and set apart as a public park or pleasuring ground for the benefit and enjoyment of the people."

CUMULATIVE IMPACTS COMMON TO ALL ALTERNATIVES

The gray wolf was reintroduced into the Yellowstone area in 1995. Currently, nine breeding pairs inhabit the Greater Yellowstone Area, mostly within park boundaries. Wolves are one of the top 10 mammals visitors come to the area to view, and their reintroduction has had a positive impact on their recreational experience in many cases. This would be an added benefit in alternatives where bison viewing opportunities would increase, and somewhat offsetting where the number of bison and relative chance to view them would decrease.

IMPACTS OF ALTERNATIVE 1: NO ACTION

Analysis

Overall Visitor Use and Experience. Alternative 1 would be expected to have a substantial number of bison slaughtered or shot at both the north and west entrances; the annual average was estimated at 103. These management actions, as well as the presence of capture facilities, might affect recreational opportunities in the following ways: (1) use of areas by visitors might be restricted while bison management activities were taking place, and (2) visitors might react to seeing management activities either positively or negatively (curiosity or negative emotional response). Some visitors might be attracted to the Stephens Creek capture facility or SMAs to see the bison and capture activities.

Alternative 1 would have the potential to restrict visitor use at or near the capture facilities during winter months when bison were occupying the areas and bison management activities are occurring. These areas might be closed for periods ranging from one day to weeks, depending on the number of bison, weather conditions, and other factors. Recreation on the balance of the park, forest, and state wildlife management area lands in the analysis area would not be restricted through the implementation of alternative 1.

Bison Viewing. The various alternatives evaluated in this environmental impact statement would affect wildlife viewing primarily by affecting bison distribution throughout the park and adjacent areas and by affecting bison population numbers. Continued implementation of alternative 1 would not likely affect the overall distribution of bison in the park. Alternative 1 would be expected to result in a 4% increase of the bison population per year to an estimated 42% increase over the estimated population in 1997 (about 2,156 animals including calves) to 3,066 animals by the year 2006. This would be a positive impact relative to current population levels.

Winter Recreation. Alternative 1 would not affect winter recreation.

Hunting. There would be no hunting of bison under alternative 1.

Cumulative Impacts

Continued implementation of alternative 1 would have a positive impact on bison viewing relative to the status quo. It would have a minor negative impact on the overall visitor experience due to the presence of management actions and capture facilities. These impacts would probably be slight compared to or in addition to other ongoing changes.

Conclusion

Continued implementation of alternative 1 would likely have offsetting minor positive and negative impacts on recreation relative to the status quo.

IMPACTS OF ALTERNATIVE 2

Analysis

Overall Visitor Use and Experience. Because alternative 2 would include no capture facilities or management actions relative to bison slaughter, there would likely be no adverse impacts on the overall park visitor experience during phase 2.

During phase 1 of alternative 2, a substantial number of bison would likely be shot or slaughtered. In phase 2 of implementation of alternative 2, the number of bison shot or slaughtered would likely be negligible except during severe winters.

Bison Viewing. Alternative 2 would be expected (by 2006) to increase to a population of 3,500 bison, 14% larger than in alternative 1, and 62% higher than current levels. Growth is then expected to level out, and by 2011, the estimated bison population under alternative 2 would be roughly the same as under alternative 1. If this alternative were selected, bison could be relatively common outside the park at certain times of the year. As bison spread from the park, they might attract more visitors to the area and lead to a minor to moderate positive impact on overall bison viewing.

Bison with snowmobilers.

Winter Recreation. Alternative 2 would call for the elimination of winter snow grooming on approximately 60 miles of park roads (West Yellowstone to Madison Junction, Madison Junction to Mammoth, Madison Junction south to Fountain Flats). This closure would have the effect of eliminating oversnow travel from the town of West Yellowstone to Madison Junction and therefore also on to all points north and south from Madison. Also, oversnow access from Mammoth Hot Springs south to Madison Junction could be eliminated. Oversnow vehicles could still enter the park at the south and east entrances for access to the popular destination of Old Faithful. Currently a majority of winter travel into Yellowstone National Park enters from the west and north entrances (47% and 32% of total winter visitation, respectively). Only a portion of the winter visitors using the north entrance also use the road proposed for closure (Mammoth to Madison Junction). Still, the proposed road and trail closures would likely affect well over 50% of current winter oversnow visitors to the park and either displace their activities to other roads and trails in the area or, in the case of some nonresident visitors, cause them to go to areas other than the greater Yellowstone area for their winter recreation. A 1999 survey of winter visitors to Yellowstone and Grand Teton National Parks asked respondents how they would change their travel plans to the Greater Yellowstone Area in the future if the roads from Mammoth to Madison and West Yellowstone to Old Faithful were closed to motorized oversnow travel. Among park visitors, 40.6% said they would not change their number of winter visits to the area, 32% said they would visit the area less frequently, 5.1% said they would visit more frequently, 4.5% said they would visit the same amount to the Greater Yellowstone Area but would visit other destinations in the Greater Yellowstone Area, and 17.9% were not sure how their visitation would change. Given the relatively large percentage of winter survey respondents who said they would visit less after such a change, the alternative 2 winter road policies would lead to a major negative impact on winter recreationists in the park.

The approximately 60 miles of groomed roads slated for closure under this alternative represent approximately 30% of the groomed roads within the park, and perhaps 10% of the groomed trails in and out of the park in the areas near West Yellowstone. Estimates of the economic impact associated with park road closures under this alternative are detailed in the "Impacts on Socioeconomics."

Hunting. There would be no hunting of bison under alternative 2.

Cumulative Impacts

Under alternative 2, any potential positive impact on summer use would be more uncertain than the potential negative impact on winter recreation. Winter recreationists might experience impacts from winter-use decisions now under consideration by the park that have effects in addition to those described in this alternative.

Conclusion

Alternative 2 would have a positive minor to moderate impact on wildlife viewing relative to alternative 1. It would also have a negative minor to moderate impact (in the context of total annual use of the park) due to reduced winter recreation. This would be in the context of total annual use in winter recreation and comprises about 4.5% of the total annual park visitation. These offsetting impacts would lead to a likely negligible overall impact on recreation but a possible moderate to major negative impact on winter recreationists in the park.

IMPACTS OF ALTERNATIVE 3

Analysis

Overall Visitor Use and Experience. Alternative 3 would provide for capture facilities only as a backup to hunting in the long term, with only periodic removals when hunting could not be used. Accordingly, there would likely be negligible impacts on the overall visitor experience from bison capture. During phase 1 of alternative 3, a substantial number of bison would likely be shot or slaughtered. In phase 2 of implementation of alternative 3, the number shot or slaughtered would likely be dramatically reduced, and hunting could be used as the primary population control tool. This presumes that hunting would be approved by the Montana State legislature, the likelihood of which is unknown.

Bison Viewing. Alternative 3 would lead to a growth rate in bison that is about double that of alternative 1 and would lead to a population of 3,500 by 2006, 14% greater than in alternative 1 in this same year and 62% greater than current levels. The impacts of this alternative would therefore be likely to be similar to alternative 2, and constitute a minor to moderate positive impact on viewing relative to alternative 1.

Winter Recreation. Research on the use of groomed roads and trails and effectiveness of closures could lead to changes in road grooming with impacts on recreation users. However, these changes would either be consistent with Yellowstone National Park's winter use plan or involve future NEPA evaluation, and any impact would be analyzed in that evaluation.

Hunting. Under alternative 3, there could be 75 bison hunting permits beginning in 2000 and increasing to 85 permits beginning in 2005. This would be a minor to moderate beneficial impact on hunting as a recreational activity. A discussion of the economic impacts associated with these proposed hunts is discussed in the "Impacts on Socioeconomics."

Cumulative Impacts

The generally positive impacts of alternative 3 on recreation from increases in bison viewing and hunting opportunities would be additive to the positive impacts of wildlife restoration efforts (see "Cumulative Impacts Common to All Alternatives"). The exceptions would be the potential negative effects of winter trail closures.

Conclusion

This alternative would lead to a minor to moderate positive impact on recreation due to minor to moderate increases in viewing opportunities compared to alternative 1, and minor to moderate positive impacts for hunters. Potential winter trail closures could result in a minor to major adverse effect.

IMPACTS OF ALTERNATIVE 4

Analysis

Overall Visitor Use and Experience. Impacts would be similar to alternative 1. During phase 1 of alternative 4, a substantial number of bison would likely be shot or slaughtered. However, in phase 2 of implementation of alternative 4, the number of bison shot or slaughtered would likely be significantly reduced, and hunting would also be used as a population control tool.

Bison Viewing. Alternative 4 would be expected to result in a population of 2,800 by the year 2006, 8% smaller than alternative 1 and 30% larger than current population levels. This would result in a negligible to minor adverse impact on bison viewing relative to alternative 1.

Winter Recreation. Alternative 4 would not have an impact on winter recreation.

Hunting. Under alternative 4, there might be 35 bison hunting permits beginning in 2000. This would be a minor positive impact on hunting as a recreational activity. A discussion of the economic impacts associated with these proposed hunts is discussed in the "Impacts on Socioeconomics."

Cumulative Impacts

There would be additive beneficial impacts on recreation users under this alternative. Hunters would experience a minor benefit, which is an additional positive impact on recreation when combined with viewing benefits from wildlife restoration efforts (see "Cumulative Impacts Common to All Alternatives").

Conclusion

This alternative would have a similar impact to alternative 1, except there would be an additional minor positive impact for hunters to have an opportunity to hunt bison.

IMPACTS OF ALTERNATIVE 5

Analysis

Overall Visitor Use and Experience. This alternative would have nine capture facilities operating simultaneously for a period of three years. The total number of bison likely to be slaughtered or shot from 1998 to 2001 would be approximately 1,200 (almost 50% of the total population). Therefore, management actions would be highly visible to park visitors.

Operation of facilities would have moderate to major impacts to visitor use and experience, depending on the timing and visibility of bison capture activities. Under this alternative, bison management actions would have to take place throughout the year to achieve culling and vaccination goals. Facilities would need to be located close to park roads to provide access for livestock trucks and other equipment. This would potentially create conflicts between visitors and bison management operations. Depending on the time of year, impacts to visitor experience would be major, long-term, and adverse.

Bison Viewing. Alternative 5 would lead to a substantial, nearly 50%, reduction in bison numbers relative to alternative 1 (and 42% reduction compared to current levels) in the first year of areawide capture and slaughter (1999). Alternative 5 is the only alternative in which the deterministic model predicts the bison population would drop below the current low levels. By

2006, the model estimates bison populations under this alternative would be expected to be 35% lower than under alternative 1, and by 2011, they would be 16% lower. Bison populations would be 8% lower than current levels in 2006, but 36% higher than current levels by 2011. This alternative would also likely be the only alternative to possibly affect bison distribution in the park. The effect on visitation could be a minor adverse effect on wildlife viewing in the context of overall park visitation but a minor to moderate adverse impact on bison viewing in Yellowstone National Park.

Winter Recreation. This alternative would require intermittent plowing of some park roads during the winter to transport captured seropositive bison to slaughter. The impact of alternative 5 on winter recreation would be similar to alternative 2 in that there would be no winter snowmobile access into the park from West Yellowstone. In addition, there would be no snowmobile use from the east entrance (only 3% of the visitor use in the park) and the north entrance (32% of the visitor use in the park). The effect of this alternative on winter use from the north entrance would be limited, as there would still be access to Norris but not beyond. This alternative would displace a total of about 3,300 winter users. During the three to four years that areawide capture and slaughter was in effect, this alternative would have a major adverse impact on some winter park users. However, this would be a temporary effect, and over the duration of the management plan, the impact on snowmobile use would be minor to moderate.

Hunting. No hunting would take place under alternative 5.

Cumulative Impacts

Alternative 5 would have a minor to moderate adverse impact on the overall visitor experience from the presence of bison management activities throughout the park. This alternative would have a moderate to major adverse impact on wildlife viewing from decreases in the bison population size relative to alternative 1 during and for several years following the capture and slaughter operations.

Conclusion

Alternative 5 would have moderate to major adverse impacts on the overall visitor experience from the presence of bison management activities throughout the park. Moderate to major adverse impacts could arise, depending on how visitors react to the presence of bison management activities and facilities throughout the park. The impact on wildlife viewing would likely be adverse and minor to moderate. Minor to moderate adverse impacts on displaced snowmobile users would likely be long-term.

IMPACTS OF ALTERNATIVE 6

Analysis

Overall Visitor Use and Experience. Although management activities would be as visible in this alternative as in alternative 5, bison populations would be maintained at much higher levels. Therefore, impacts would likely be somewhat less adverse than, but similar to, alternative 5.

Similar to alternative 5, this alternative proposes bison capture facilities in key areas throughout the park, but focused at Seven-Mile Bridge for the first 10 years. In response to public comment and concern regarding impacts of capture facilities placed within the park at various locations, including the proposed Seven-Mile Bridge facility, a site-specific analysis was completed for that area. Capture operations at this site and others located in the Lamar Valley would be similar and have representative impacts of other capture facilities operating throughout the park.

The road from West Yellowstone to the Madison Junction crosses the Madison River at a location known as Seven-Mile Bridge. Based on data collected between 1994 and 1998, an average of approximately 896,000 visitors cross the bridge during peak summer use (June through September). The area also experiences heavy winter use by snowmobiles and snowcoaches, with an average of approximately 60,000 visitors in the winter season. The Gniess Creek Trail and areas along the Madison River to the north of the bridge are used heavily by hikers, photographers, and anglers.

Construction of a facility at Seven-Mile Bridge and throughout the park would have short-term direct moderate to major adverse impacts on visitor use and experience, depending on the timing and extent of construction. Construction of an access bridge across the Madison River, should a facility be sited on the high terrace, would have short-term major impacts to visitor use and experience.

The operation of facilities would have moderate to major impacts to visitor use and experience, depending on the timing and visibility of bison capture activities. Under this alternative, bison management actions would have to take place throughout the year to achieve culling and vaccination goals. Facilities would need to be located close to park roads to provide access for livestock trucks and other equipment. This would potentially create conflicts between visitors and bison management operations. Depending on the time of year, impacts to visitor experience would be major, long-term, and adverse.

Bison Viewing. Under alternative 6 in the year 2006, bison populations would be 1% higher than alternative 1 and 47% higher than current levels. Impacts on bison viewing would be the same as alternative 1 through the year 2009, and similar to alternative 5 after 2010.

Winter Recreation. This alternative would require plowing to pavement of the road between West Yellowstone and the capture facility at Seven-Mile Bridge inside the park boundary for the first 10 years. This would eliminate snowmobile use on these roads and have impacts on recreationists similar to those described under alternative 2. In the second phase of this alternative, roads inside the park that are now groomed for snowmobile use would be plowed to accommodate transport of seropositive bison to slaughter. Impacts on winter recreationists would be the same as those described in alternative 5 for the two to three years this phase was in effect.

Hunting. There would be no impacts as hunting is not part of this alternative.

Cumulative Impacts

Alternative 6 would have a minor to moderate adverse impact on the overall visitor experience from the presence of bison management activities throughout the park.

Conclusion

Alternative 6 would have moderate to major adverse effects on overall visitor use and experience. Adverse impacts could arise depending on how visitors reacted to the presence of bison management activities and facilities throughout the park Although bison population numbers would be comparable to alternative 1 and bison viewing would not be adversely affected for the first 12 years of the plan, the capture and slaughter activities in 2010 would adversely affect the overall visitor experience. Major adverse impacts on displaced snowmobile users would also be possible. Minor to moderate adverse impacts would occur overall. Site specific impacts to visitor use and recreation would be major at the Seven-Mile Bridge facility.

IMPACTS OF ALTERNATIVE 7

Analysis

Overall Visitor Use and Experience. Impacts under this alternative would be similar to those described in alternative 4. However, during phase 1 of alternative 7, a substantial number of bison would likely be shot or slaughtered. In phase 2, the slaughter of bison could be reduced by the use of quarantine, hunting, and land acquisition, although efforts to maintain the population size at 2,700 or less could result in substantial additional removals if large migrations occurred.

Bison Viewing. Under alternative 7 bison population levels would be expected to be 12% lower than under alternative 1 in 10 years (by 2006) and 23% lower in 15 years (by 2011). Bison population levels would be 25% higher than current levels in both 2006 and 2011. As was found for alternative 5, these population levels would likely result in a minor to moderate negative impact on general wildlife viewing in the park, and a minor to moderate negative impact on bison viewing relative to alternative 1.

Winter Recreation. All major park attractions would still be accessible from all entrance stations. Thus, there would be no impact on winter recreation.

Hunting. Under alternative 7, 15 bison hunting permits might be issued beginning in 2000, and another 10 permits might be issued beginning in 2002. This would be a minor beneficial impact on hunting as a recreational activity. A discussion of the economic impacts associated with these proposed hunts is discussed in "Impacts on Socioeconomics."

Cumulative Impacts

Alternative 7 would have an adverse impact on the overall visitor experience, and minor to moderate adverse impact on bison viewing relative to alternative 1.

Conclusion

The main reason that people come to Yellowstone National Park is to see wildlife. Changes in wildlife population could affect the viewing experience (Duffield 1991b). Bison are among the top 10 species visitors want to see (Duffield 1992). Alternative 7 would likely result in the smallest long-term bison population of all alternatives examined. Thus, alternative 7 would have the greatest long-term adverse effect on bison viewing (a minor to moderate effect) of all alternatives.

IMPACTS OF THE MODIFIED PREFERRED ALTERNATIVE

Analysis

Overall Visitor Use and Experience. Impacts under this alternative would be similar to those described in alternative 7, although impacts associated with bison removal could be less than in alternative 7, as the overall target population limit is higher in the modified preferred alternative.

Bison Viewing. Under the modified preferred alternative, the deterministic model predicted that bison population levels would be 6% higher than under alternative 1 in 10 years (by 2006) and 7% lower in 15 years (by 2011). Bison population levels would be 50% higher than current levels in both 2006 and 2011. Bison viewing would be comparable to alternative 1, with negligible to minor positive impacts through year 10, and negligible to minor adverse impacts for the remaining 5 years of the plan.

Winter Recreation. All major park attractions would still be accessible from all entrance stations. Thus, there would be no impact on winter recreation.

Hunting. Under the modified preferred alternative, there would be no hunting of bison.

Cumulative Impacts

The modified preferred alternative would have a minor adverse impact on bison viewing relative to alternative 1.

Conclusion

The primary reason that people come to Yellowstone National Park is to see wildlife. Changes in bison population could affect the viewing experience (Duffield 1991b). Bison are among the top 10 species visitors want to see (Duffield et al. 2000a). The modified preferred alternative would lead to long-term bison populations slightly lower than alternative 1 and result in negligible to minor impacts on bison viewing relative to alternative 1.

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

From an economic perspective there would be no irretrievable or irreversible commitments of resources affecting recreation under any of the alternatives. Reduced bison herds could grow again and closed roads and trails could be reopened.

LOSS IN LONG-TERM AVAILABILITY OR PRODUCTIVITY OF THE RESOURCE TO ACHIEVE SHORT-TERM GAIN

Moderate impacts to bison viewing are anticipated as a result of implementing alternative 5 or 6. These impacts are likely to last less than 15 years. Some negligible to minor long term impacts to the bison population and resulting viewing opportunities are possible from implementing either alternative 7, or to a lesser extent, the modified preferred alternative.

UNAVOIDABLE ADVERSE IMPACTS

Unavoidable adverse impacts on recreation would include reductions in winter snowmobiling and certain other over snow travel under alternatives 2, 5, and 6, and more than minor reductions in wildlife viewing options under alternatives 5 and 6.

IMPACTS ON LIVESTOCK OPERATIONS

SUMMARY OF REGULATIONS AND POLICIES

The National Environmental Policy Act requires that proposed major federal actions "attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable or unintended consequences." The *National Park Service Management Policies* also require that parks work with local and state communities to "anticipate, avoid, and resolve potential conflicts, to protect park resources, and to address mutual interests in the quality of life for community residents, considering economic development as well as resource and environmental protection."

The Animal and Plant Health Inspection Service (APHIS) is the federal agency with authority for implementation of the national brucellosis eradication program. The program was established in 1940. Cooperators include APHIS, state animal health authorities, and state livestock producers. Montana obtained its brucellosis class-free status in 1985. APHIS anticipates brucellosis will soon be eradicated from all cattle in the United States. When this occurs, brucellosis in bison and elk in the Greater Yellowstone Area will be the only remaining reservoir of brucellosis in the United States.

In Montana, the Department of Livestock and the Board of Livestock have the statutory and regulatory authority to control diseases that threaten the livestock industry…

In Montana, the Department of Livestock and the Board of Livestock have the statutory and regulatory authority to control diseases that threaten the livestock industry, including explicit statutory and regulatory authority to control bison emigrating from Yellowstone National Park. In addition, the Montana Department of Fish, Wildlife and Parks has statutory authority to assist the Board of Livestock in regulating bison.

The U.S. Forest Service is the federal agency with authority for managing habitat on the national forests. It is responsible for ecological conditions, and as such, makes jurisdictional decisions as to when livestock grazing allotments need modification of stocking rates to give preference to native animal species over domestic livestock. The issue of use of the same national forest grazing allotments by bison and cattle and the associated risk of brucellosis transmission is the jurisdictional responsibility of livestock agencies (APHIS and Montana Department of Livestock) having regulatory authority over animal diseases.

Proposals for changes in livestock operations in alternatives 2, 3, and 7 that involve (1) closing allotments, (2) changing season of use, or (3) changing type of livestock are the responsibility of livestock disease control agencies if animal disease is the reason for the proposed change. These proposed changes in allotments or livestock management for reasons related to disease are made to the U.S. Forest Service and national forest grazing permittees. The U.S. Forest Service then modifies allotment management plans and/or livestock grazing permits, as needed, to minimize risk of brucellosis affecting livestock.

Central to six of the seven alternatives is the establishment of special management areas (SMAs) where certain classes of bison would be allowed to graze during the winter without jeopardizing Montana's class-free status. SMAs could be implemented under current federal regulations, but would require approval of the state of Montana as specified by Montana law.

METHODOLOGIES FOR ANALYZING IMPACTS

As required by NEPA regulations, both direct and indirect impacts on livestock operations are analyzed. Areas of potential direct impact include livestock management (brucellosis testing and vaccinations, conversion from cow-calf operations to raising steers or spayed heifers), land use (modification of public land grazing allotments, private land acquisitions, and easements), and damage by bison Indirect or secondary effects are those effects that are a result of the action, but are separated in time and space from the triggering action. Indirect effects on livestock operations are those that might occur as a result of the presence of Yellowstone bison in the state (see "Purpose of and Need for Action: Economic Impacts of Brucellosis in Cattle"). All alternatives are designed to address the risk of brucellosis transmission to protect the economic viability of livestock interests in Montana. They do so using various management strategies.

Some of the expected impacts would be experienced sooner than others. Whereas modified testing and vaccinating practices could be undertaken with varying impacts on livestock producers, changes in land use and conversion of livestock enterprises would involve more complex decisions requiring a longer time period. Where data was available, impacts were estimated in dollar ranges.

Indirect effects on the livestock industry could include the perception within the markets where Montana producers sold their product that Montana cattle would be compromised by disease-exposed bison emigrating from Yellowstone National Park. Another area where perception could indirectly affect the marketplace was with respect to SMAs, which could be viewed by animal health authorities as buffer zones for diseased bison leaving Yellowstone National Park. There could also be concerns over the location of quarantine or capture facilities.

IMPACTS COMMON TO ALL ALTERNATIVES

Contact between bison and cattle should not occur as a result of any alternative under normal conditions, and therefore the disease would not be expected to spread from the bison herd in this manner. Disease transmission through persistence of the *Brucella* organism following abortions and births that might occur in the SMAs also should not occur. However, the economic threat of the disease to the livestock industry would come not only from the risk of actual disease spread, but also from perceptual problems associated with the fact that brucellosis was endemic to bison migrating into Montana from Yellowstone National Park.

The presence of SMAs or the operation of a quarantine facility in a brucellosis class-free state could heighten the concerns among state animal authorities that bison management increases the risk of brucellosis transmission from bison to cattle. Under current APHIS regulations a quarantine facility would require a waiver to be constructed within Montana.

Conversely, the following are examples of activities designed to ensure that bison management reduces the risk of transmission: actions that maintain separation of bison and cattle; actions that reduce the incidence of infection (test and removal, vaccination); and, actions that reduce the numbers of bison (shooting, hunting, shipment to quarantine, and shipment to slaughter).

CUMULATIVE IMPACTS COMMON TO ALL ALTERNATIVES

While direct costs in terms of brucellosis testing and vaccinating would not be great and sporadic incidents of damage caused by bison would usually not be severe, there is a cumulative impact on livestock producers in terms of perceived risks of grazing cattle to the north and west of Yellowstone National Park. This concern is evident in the recent decision by two producers to no longer graze cattle in the West Yellowstone area. They own highly valued purebred stock, with bulls and bred cows that sell for more than $3,200, and bred heifers that sell for more than $1,500. The greater value of their cattle would make the disease threat unacceptable. For producers with animals of lesser value as well, the perceived risk of brucellosis would be ever present.

Conversely, reduction of perceived risks due to successful accomplishment of any of the alternatives would have a beneficial cumulative impact. Because Yellowstone National Park bison emigrate into Montana from a herd that contains animals known to be infected with brucellosis, and because all those animals would be exposed to the disease, management control of the bison would be necessary to protect Montana s livestock industry from the known threat of brucellosis.

IMPACTS OF ALTERNATIVE 1: NO ACTION

Analysis

Brucellosis Testing and Vaccinating. Practically all Montana livestock operations in the vicinity of Yellowstone National Park vaccinate female calves, compared to an estimated statewide average of about 60%. Under alternative 1, producers north and west of the park would continue to vaccinate as at present. As described in "Affected Environment," brucellosis testing is required by the state of Idaho of cattle 18 months or older that are pastured in the West Yellowstone area, both when entering and leaving Montana. Other testing could take place, in any location, if the Department of Livestock suspected exposure could have occurred.

Including veterinary and handling expenses, it was estimated that vaccination costs for producers would total about $5 to $10 per female calf (with APHIS paying for the ear tags). With about 2,019 cow-calf pairs of cattle grazing to the north and west of Yellowstone National Park (herds located within SMA boundaries for the largest analysis area; see Alternative 2 map), yearly vaccination costs for these producers was estimated to total between $5,050 and $10,100.[1] Presumably, without the perceived threat posed by Yellowstone bison, rates of vaccination in the study area would more nearly match the current statewide rate of about 60%. Therefore, an additional annual cost of about $2,020 to $4,040 (or the 100%–60% = 40% of vaccination costs) would be borne by affected producers.

Brucellosis testing of Idaho herds grazed in the West Yellowstone area was estimated to cost between $7.50 and $15 per head per test, including veterinary charges. This amount is more than the cost of vaccination because vaccinations usually take place after the calves have already been gathered for weaning or other purposes. The rate at which cattle could be tested and the risk of an animal becoming crippled or otherwise injured in the process would depend largely on the handling facilities available. Costs of brucellosis testing twice yearly near Yellowstone National Park was estimated to total between $15,528 and $34,938.[2] Since this testing requirement was not made of

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1. Estimated cow-calf population of about 2,019 pairs, with about 1,010 female calves: $5 x 1,010 = $5,050, and $10 x 1,010 = $10,100.

2. Estimated West Yellowstone cow-calf population of about 1,294 pairs, with between 80% and 90% tested twice: $7.50 x 1,294 x .8 x 2 = $15,528, and $15 x 1,294 x .9 x 2 = $34,938.

Montana producers elsewhere in the state, the cost would be attributable to the perceived threat posed by Yellowstone bison.

Table 52 shows typical cow-calf production costs for the United States and western states. Based on these sets of costs, it was apparent that testing and vaccinating would be relatively minor expenses over the long run. Assuming the higher estimated costs per animal, $10 for vaccinating and $15 for testing, they represented 1.6% and 2.4%, respectively, of average yearly production costs in the western United States. In years of very low cattle prices, however, a producer's profit margin might be as small as, or smaller than, the costs of vaccination and testing. Therefore, although these costs would be minor in the long term, in years of low prices they could represent the difference between profit and loss.

Table 52: Cow-Calf Production Costs for the United States and Western States, 1995

	United States	Western States
	Dollars per Bred Cow	
Variable cash expenses[1]	321.82	363.88
General farm overhead	38.56	43.94
Taxes and insurance	15.96	20.77
Capital replacement	84.89	82.08
Operating capital	13.49	15.26
Other nonland capital	37.59	34.17
Land	0.04	0.03
Unpaid labor	92.42	79.26
Total	604.77	639.39

SOURCE: USDA, Economic Research Service.

1. Variable cash expenses include feeder cattle, feed costs (grain, protein supplements, by-products, harvested forages, and pasture), and other costs (including veterinary and medicine, livestock hauling, marketing, custom feed mixing, fuel, machinery and building repairs, and hired labor).

Conversion from Cow-Calf to Steer or Spayed Heifer Enterprise. No impacts would be expected as conversion from cow-calf operations to steer or spayed heifer enterprises would not be part of alternative 1 (the existing plan).

Gallatin National Forest Grazing Allotments. Grazing allotments would remain unchanged under the existing plan.

Private Land Acquisitions and Easements. No acquisition of private land or easements would take place under the existing plan.

Property Damage by Bison. Property damage occurs every year, and was especially evident during the winter of 1996–97 because of the large number of bison that moved outside Yellowstone National Park. There were at least four incidents of horses being gored in the winter of 1996–97, an event that rarely occurs. Under alternative 1, damage caused by bison could be expected to continue, with the number of incidents depending largely on the number of bison outside the park.

Perception of Risk of Transmission. Alternative 1 would reduce the perception of risk of transmission by monitoring the movement of bison, aggressively maintaining time and spatial separation between bison and domestic livestock, preventing bison from using private lands, selectively removing animals that test positive for brucellosis, and restricting bison distribution to public lands and situations in which brucellosis transmission from bison to cattle would be very unlikely. When a safe vaccine was developed, bison in the west boundary areas would be vaccinated for brucellosis. To date, this alternative has protected Montana's brucellosis class-free status, has avoided sanctions from other state animal health authorities, and has protected a viable population of Yellowstone National Park bison.

Cumulative Impacts

There would be no additional sources of impact.

Conclusion

Under alternative 1, direct impacts on livestock would be generally minor. Testing of most herds in West Yellowstone and vaccination of female calves would continue, but these costs would be a small portion of total production costs in the long term. However, producers who suffer property damage by bison might be moderately affected, or in some instances even more greatly affected, even though incidents are not common. Thus, while impacts overall would be relatively minor, individual ranchers could experience moderate to major adverse impacts due to bison.

Alternative 1 would provide sufficient control to prevent brucellosis transmission from bison to cattle. Infrequently, circumstances might occur in which brucellosis transmission from bison to cattle might occur. Protection from the risk of transmission of the disease would be premised upon all management actions being taken which prevent exposure of the disease to Montana livestock. Testing of contact livestock herds might be appropriate. However, it would be unreasonable for regulatory officials to impose general testing requirements on Montana cattle unless brucellosis was discovered in a contact herd. Unless sanctions were imposed due to disease-exposed bison being present at certain times and locations in Montana, the indirect economic effects on Montana's livestock industry would be negligible.

IMPACTS OF ALTERNATIVE 2

Analysis

Brucellosis Testing and Vaccinating. The interim plan would continue until cattle were removed from the proposed SMAs through changes in grazing allotments, acquisition of private land, and/or conversion of operations to steer or spayed heifer production. Therefore, vaccination and testing practices as described under alternative 1 would also continue until susceptible cattle were no longer present. Thereafter, if any cattle remained in the SMAs, they would be part of steer or spayed heifer operations. However, producers on the boundaries of the SMAs would probably feel compelled to continue vaccinating female calves if they were already doing so, and producers with herds from Idaho that graze near the West Yellowstone SMA would probably be required to submit to testing, even though containment of bison within SMA boundaries would be strictly enforced. Thus, while testing and vaccinating would no longer occur in the SMAs, these practices would likely continue in neighboring areas if already taking place. If these producers near the SMAs had not been testing or vaccinating their cattle, the impact of now doing so would be minor. The impact for these producers would be minor. As described under alternative 1, vaccination and testing costs would be a small fraction of total production costs in the long term.

Conversion from Cow-Calf to Steer or Spayed Heifer Enterprise. Cow-calf operations near Yellowstone National Park represent the predominant type of cattle enterprise in Montana. Less common are steer or heifer feeding operations, in which the cattle are usually bought in the spring, vaccinated, and placed on rangeland grass throughout the summer. When they are returned to feedlots for fattening in the fall or winter, ownership can either be retained or the cattle can be sold to the feedlot operators. Feeding operations tend to be less economically predictable than cow-calf operations, with greater fluctuations in the cash flow cycle; more money could be made or lost in a shorter time period.

One aim of this alternative would be to remove susceptible cattle in areas where the bison would be allowed to roam, by replacing cow-calf operations with steer or spayed heifer enterprises.

As indicated by the Montana Department of Livestock, the variables involved in making such a conversion would be too numerous to realistically estimate representative conversion costs. Structures and equipment, as well as managerial expertise, might need to be modified. Probably more significant than the capital and operational costs would be implicit changes in producers' objectives and their acceptance of greater market uncertainty. On the positive side, calf-related costs, including vaccination, would no longer be incurred.

Even with governmental incentives, most producers would likely balk at making the conversion, in essence, to a new type of livelihood within the livestock industry. Although their cattle would no longer be susceptible to brucellosis, it would be questionable whether this benefit would adequately justify for many producers the monetary and nonmonetary costs that conversion would entail. The amount of compensation that would be required by producers to convert from cow-calf operations could range widely, since each producer would differ in his perception of risks posed by bison and the personal satisfaction gained from raising calves. Some producers might be willing to convert at reasonable cost to the public, but others could be expected to refuse all feasible offers.

Without information on conversion costs or compensation amounts, estimates of conversion impacts for affected producers would be speculative. Clearly, it would be a voluntary decision, and, therefore, producers would only agree to conversion of their operations if they found the level of compensation acceptable. If conversion occurred, there would be an impact in terms of the livestock products produced, and compensation would result in producers' welfare, from each one's own perspective, at least being maintained. However, conversion from a cow-calf to a steer/spayed heifer operation would cause fundamental changes in nearly all aspects of the operation, from marketing and risk management, to labor and management demands, to capital and noncapital expenses (see volume 2, "Socioeconomics: Cost to Livestock Operators").

Gallatin National Forest Grazing Allotments. Efforts would be made to modify grazing allotments under alternative 2. A total of about 935 cow-calf pairs, 438 pairs on six allotments to the north and 497 pairs on six allotments to the west, would be directly affected by this alternative. These cattle numbers do not include 191 cow-calf pairs to the north and to the west that would be grazed on adjacent private lands that are included in the allotments (see tables 22 and 24). In the West Yellowstone area, the Basin, South Fork, Sulphur Springs, and Watkins Creek allotments would be affected, in addition to the Horse Butte and Wapiti allotments found within the alternative 1 SMA.

Closure or modification of grazing allotments would result in negligible foregone income for the U.S. Forest Service. Current fees are $1.35 per AUM (animal unit month), while the market value of grazing land is much higher, averaging $11.80 in Montana in 1996 (Montana Agricultural Statistics Service, pers. comm.). In addition to the fee paid by grazing permittees, the cost of grazing animals on allotments would include expenses for fence construction and maintenance, water developments, nutritional supplements, and animal management requirements such as herding and riding. Producers that needed to relocate their herds because of the closure of allotments would find it difficult to acquire other public grazing opportunities, and could experience moderate to major adverse impacts in shifting to privately owned land (U.S. Forest Service, pers. comm.). From a regional perspective, impacts would be minor, in that these herds represent less than 2% of all cattle and calves in Gallatin and Park Counties.

Private Land Acquisitions and Easements. Risk of brucellosis transmission to cattle could be reduced under this alternative by the acquisition or easement of private land. Cow-calf pairs potentially affected currently number about 100 in the Gardiner area. In the West Yellowstone area, about 215 cow-calf pairs that graze in the Horse Butte area could be affected. Purchase or easement costs have not been considered for private holdings in the Denny Creek/South Fork area on which about 585 cow-calf pairs are grazed.

Property Damage by Bison. Before susceptible cattle were removed from the areas designated to become SMAs, incidents of damage by bison would be expected to continue at about the same rate as under alternative 1. Following the changes proposed in alternative 2, there could still be occasional incidents of damage for producers that converted to steer or spayed heifer enterprises, but few of these operations would be expected. Therefore, alternative 2 should result in fewer occasions of damage to property or harm to livestock.

Perception of Risk of Transmission. This alternative would reduce the perception of risk of transmission by monitoring the movement of bison, restricting bison distribution until all susceptible livestock was removed from private and public lands within the SMAs, and removing bison from private lands in response to landowner complaints. This alternative would not eliminate the perception of risk of brucellosis transmission because it would include SMAs. The greatest potential for bison movements beyond the boundaries of the SMAs prior to removal would occur in this alternative. This would result in increased scrutiny of Montana's livestock industry by regulatory officials in other states.

Cumulative Impacts

There would be no additional sources of impact.

Conclusion

Once the SMAs, characterized by minimal bison management, have been established under alternative 2, testing and vaccinating would no longer be necessary in these areas. Producers near the boundaries of the SMAs would probably vaccinate female calves, and, in the West Yellowstone area, testing would continue. Thus, these safeguards would likely be maintained in areas bordering the SMAs, even though the boundaries would be strictly maintained. Continued testing and vaccinating by producers bordering the SMAs would have no impact on their operations. For producers newly testing or vaccinating, the impact would be minor since the costs per animal would be small in the long term, as described under alternative 1.

Substantial changes could occur for producers in the areas of the proposed SMAs, with the modification of grazing allotments, purchase or easement of private property, and possible conversion of operations. Public funds would be required for compensation of producers who agreed to convert from cow-calf to steer or spayed heifer operations, and for acquisition or easement of private lands. Damage by bison would decline.

Modification of grazing allotments would have moderate to major adverse impacts on the owners of displaced herds. They would probably need to acquire grazing rights on private property outside the SMAs, given that public grazing allotments in the region would be fully used. Although producers on private lands in the SMAs would receive payments, either for easement or selling of their property or as compensation for converting their operations to nonbreeding stock, such changes would also represent moderate to major impacts. The welfare of these producers might remain the same, or even be improved, but the location or composition of their herds would change. Impacts would not be major in terms of net monetary gains or losses for the affected producers, but their operations would be greatly altered.

While alternative 2 would provide control measures to prevent brucellosis transmission from bison to cattle, this alternative would have the greatest potential to change livestock operations in the vicinity of Yellowstone National Park. It would also provide for the largest number and broadest distribution of bison. This alternative would result in the greatest potential for regulatory officials to impose general testing requirements on Montana cattle because of their perception of risk. The indirect economic effects on Montana's livestock industry would be expected to be minor. If regulatory officials imposed general testing requirements, the effects would be moderate to major.

IMPACTS OF ALTERNATIVE 3

Analysis

Brucellosis Testing and Vaccinating. In the short term, testing and vaccinating could be expected to continue under this alternative as under the interim plan (alternative 1). In the long term, changes described under alternative 2 — conversion of cow-calf operations to steer or spayed heifer enterprises, modification or closure of grazing allotments, and acquisition or easement of private lands — would reduce the need for testing and vaccinating, but within smaller SMAs (although testing and vaccinating might still be necessary in the western SMA, where land acquisition/easement and herd conversion would be only options). Whereas approximately 2,019 cow-calf pairs were found within the areas designated to be SMAs under alternative 2, alternative 3 areas would contain about 895 cow-calf pairs (see Alternative 3 map). There would be no impact on producers already testing and vaccinating their herds. For producers newly testing or vaccinating, the impact would be minor at the relatively small long-term cost per animal already described.

Conversion from Cow-Calf to Steer or Spayed Heifer Enterprise. The impact would be the same as for alternative 2, but the more restricted SMAs would mean fewer cow-calf operators would need to consider conversion. In the West Yellowstone area of the western SMA in particular, hunting would be expected to greatly limit bison numbers. Any producers who chose to convert their operations would require compensation, as described under alternative 2.

Gallatin National Forest Grazing Allotments. The impact would be similar to that of alternative 2, but on a smaller scale. Only about 86 cow-calf pairs, on the Green Lake, Park and Sentinel Butte allotments, could be affected in the Reese Creek area. About 364 pairs, on the Horse Butte and Wapiti allotments, could be affected in the West Yellowstone area if bison numbers warranted allotment modifications.

Private Land Acquisitions and Easements. Alternative 3 would include the acquisition or easement of less winter range than alternative 2. Only about 100 cow-calf pairs would be affected in the Reese Creek area. Purchase or easement of private land in the West Yellowstone area of the western SMA would be an option under this alternative, and would affect about 215 cow-calf pairs.

Property Damage by Bison. In the short term, incidents of property damage under alternative 3 would occur as in alternative 1. In the long term, the removal of susceptible herds in the SMAs would result in a decrease in incidents.

Perception of Risk of Transmission. This alternative would reduce the perception of risk of transmission with actions similar to alternative 1 during the first phase and during the second phase by monitoring the movement of bison, maintaining time and spatial separation between bison and domestic livestock, removing bison that moved onto private lands, restricting bison distribution to public lands and situations in which brucellosis transmission from bison to cattle was unlikely, and eventually removing all susceptible livestock from private and public lands within the SMAs. This alternative would not eliminate the perception of risk of brucellosis transmission because it includes SMAs and quarantine facilities. Movements of bison beyond the boundaries of the SMAs might occur during some winters, but the alternative would specify removal of bison when this occurred. The potential for bison movements beyond the boundaries of the SMAs would be greater than for alternative 1 and less than alternative 2.

Cumulative Impacts

There would be no additional sources of impact.

Conclusion

In the long term, livestock producers would have impacts under alternative 3 similar to those described under alternative 2, but on a smaller scale. Privately and publicly grazed cattle that could be directly affected under this alternative number about 895 cow-calf pairs, compared to about 2,019 for alternative 2.

In terms of major long-term impacts, such as possible conversion from cow-calf to steer or spayed heifer production, modification of grazing allotments, and private land acquisitions or easements, the number of livestock directly affected could be smaller still because these changes are considered only possible options for the West Yellowstone area under alternative 3. As in alternative 2, impacts would be major not in terms of net monetary benefits or costs, but as locational or operational changes for affected producers.

Alternative 3 would provide control measures to prevent brucellosis transmission from bison to cattle and has the potential for modifying changing livestock operations in the vicinity of Yellowstone National Park similar to that described for alternative 2. It would also provide for similar numbers and distribution of bison, but would include more actions to control bison. This alternative would result in a greater potential for regulatory officials to impose general testing requirements on Montana cattle than in alternative 1 but less than alternative 2. The indirect economic effects of Montana's livestock industry would be expected to be minor. If regulatory officials imposed testing requirements, the effects would be moderate to major.

IMPACTS OF ALTERNATIVE 4

Analysis

Brucellosis Testing and Vaccinating. Impacts of brucellosis testing and vaccinating would be the same as described for alternative 1.

Conversion from Cow-Calf to Steer or Spayed Heifer Enterprise. No impacts would be expected as conversion from cow-calf operations to steer or spayed heifer enterprises would not be part of alternative 4.

Gallatin National Forest Grazing Allotments. Grazing allotments would remain unchanged under this alternative.

Private Land Acquisitions and Easements. No acquisition of private land or easements would take place under this alternative.

Property Damage by Bison. Incidents of property damage would be similar to alternative 1, but hunting would help control bison numbers in the West Yellowstone area under alternative 4.

Perception of Risk of Transmission. Similar to alternative 1, circumstances in which brucellosis transmission from bison to cattle might occur as infrequent events under alternative 4.

Cumulative Impacts

There would be no additional sources of impact.

Conclusion

Impacts on cattle producers under alternative 4 would be the same as under alternative 1, namely, minor overall with continuation of vaccination and testing costs and the occasional threat of bison damage. Hunting could provide an additional source of income for private holdings, as described in "Impacts on Socioeconomics."

IMPACTS OF ALTERNATIVE 5

Analysis

Brucellosis Testing and Vaccinating. Under alternative 5, no bison would be allowed outside Yellowstone National Park. However, cattle producers in the vicinity of the park might continue to vaccinate their herds, particularly in the short term, if they were not completely confident that all bison would be confined within park boundaries. In the long term, with vaccination of Yellowstone bison, cattle vaccinations might become less important to the producers, but could still be continued. Modification of testing practices in the West Yellowstone area would depend on changes in Idaho's agreement with Montana. Given that testing and vaccinating costs are relatively small, relaxation of these practices would only have a minor beneficial impact.

Conversion from Cow-Calf to Steer or Spayed Heifer Enterprise. No impacts would be expected as conversion from cow-calf operations to steer or spayed heifer enterprises would not be part of this alternative.

Gallatin National Forest Grazing Allotments. Grazing allotments would remain unchanged.

Private Land Acquisitions and Easements. No acquisition of private land or easements would be expected.

Property Damage by Bison. Incidents of private property damage would be unlikely to occur because the bison would not be allowed outside Yellowstone National Park.

Perception of Risk of Transmission. This alternative would reduce the perception of risk of transmission by limiting the distribution of bison to Yellowstone National Park and aggressively reducing the incidence of brucellosis infection in this herd. It was estimated that this alternative would eliminate brucellosis from the Yellowstone bison herd within five years after implementation.

Cumulative Impacts

No additional sources of impact would exist.

Conclusion

Restriction of bison to the park would lessen concerns over brucellosis transmission, even if testing and vaccinating of domestic livestock were to continue as at present. Private grazing resources might increase in value due to reduced risks of disease spread and damage by bison, although a small percentage of elk would continue to harbor the bacteria. Thus, the overall impact on affected livestock producers would be moderately beneficial.

Protection of Montana's brucellosis class-free status would be the greatest under alternative 5, and threats of sanctions against Montana livestock by other state animal health authorities would be the least under this alternative.

Implementation of alternative 5 would not negatively affect Montana's livestock industry.

IMPACTS OF ALTERNATIVE 6

Analysis

Brucellosis Testing and Vaccinating. Consequences of this alternative with respect to testing and vaccinating would be the same as for alternative 1 during the first years of vaccination of the bison herd. Once capture, test, and slaughter of bison were undertaken, the consequences for livestock producers would be like those under alternative 5, although seronegative bison would be allowed on public land in the western SMA (see Alternative 6 map). Cattle vaccination would probably continue, depending on producers' risk perceptions. Continued testing of herds in the West Yellowstone area would depend on Idaho's agreement with Montana.

Conversion from Cow-Calf to Steer or Spayed Heifer Enterprise. No impacts would be expected as conversion from cow-calf operations to steer or spayed heifer enterprises would not be part of this alternative.

Gallatin National Forest Grazing Allotments. Grazing allotments would remain unchanged.

Private Land Acquisitions and Easements. No acquisition of private land or easements would take place under this alternative.

Property Damage by Bison. Incidents of property damage would be similar to alternative 1.

Perception of Risk of Transmission. This alternative would reduce the perception of risk of transmission by monitoring the movement of bison, aggressively maintaining time and spatial separation between bison and domestic livestock, preventing bison from using private lands, restricting bison distribution to public lands and situations in which brucellosis transmission from bison to cattle would be very unlikely, and aggressively reducing the incidence of brucellosis infection in this bison herd, initially with vaccination and subsequently through test and removal. This alternative would not eliminate the perception of risk of brucellosis transmission because it would include SMAs.

Cumulative Impacts

No additional sources of impact exist.

Conclusion

In the long term, impacts would be generally the same under this alternative as under alternative 5. Benefits for livestock producers from the control of brucellosis in Yellowstone would be moderate overall.

Alternative 6 would have no adverse effects on Montana's livestock industry.

IMPACTS OF ALTERNATIVE 7

Analysis

The SMAs identified for phase 1 of alternative 7 would be the same as those under the interim plan (alternative 1), and impacts on livestock producers under the first phase would be the same as those described for alternative 1. If additional lands were acquired north of the park (the Reese Creek SMA) in phase 2 of alternative 7, SMA boundaries would match those described in alternative 3, and impacts on livestock would be similar to those discussed under that alternative, with the exception that no changes in livestock operations to remove breeding stock would be anticipated.

Brucellosis Testing and Vaccinating. Under both the short- and long-term phases of alternative 7, Montana would encourage producers that graze herds in the vicinity of Yellowstone National Park to vaccinate their calves with the RB51 vaccine. Since all producers currently vaccinate calves voluntarily, this requirement would have no impact. As estimated under alternative 1, producers in the region have herds totaling about 2,019 cow-calf pairs, and with vaccination costs of $5 to $10 per calf, spend annually between $5,050 and $10,100. As shown in the discussion of alternative 1, costs of vaccination would be less than 2% of all production costs.

Also as described in alternative 1, an estimated 80% to 90% of the affected herds in the West Yellowstone area have their home base in Idaho, and by agreement between the two states, would be tested for brucellosis before they enter Montana and again before they reenter Idaho. It would be expected that this agreement would continue under both phases of this alternative. Therefore, there would be no impact or change from existing testing practices. Costs of testing were estimated under alternative 1 as ranging between $7.50 and $15 per head. As shown under alternative 1, with an estimated 1,294 cow-calf pairs in the West Yellowstone area, testing costs for cattle from Idaho were estimated to total between $15,528 and $34,938.

Conversion from Cow-Calf to Steer or Spayed Heifer Enterprise. No conversion of livestock operations is expected under this alternative.

Gallatin National Forest Grazing Allotments. No changes in grazing allotments would occur in the West Yellowstone area. The status of three allotments to the north of Yellowstone National Park (Green Lake, Park, and Sentinel Butte), on which about 86 cow-calf pairs are grazed, could be affected in the long term. Approximately 130 cow-calf pairs are grazed on adjacent private land, as part of these allotments. Elimination of the three grazing allotments would adversely affect the permittees, since other public grazing land in the region would probably be unavailable (U.S. Forest Service, pers. comm.). Impacts would be moderate to major for the individuals affected, but negligible on a regional scale.

Private Land Acquisitions and Easements. No acquisition of private land or easements is anticipated in the West Yellowstone area. Cow-calf pairs potentially affected currently number about 100 in the Gardiner area. Purchase or easement costs have not been estimated for private holdings in the Denny Creek/South Fork area on which about 585 cow-calf pairs are grazed. Private lands north of the park boundary at Reese Creek and west of the Yellowstone River are the only private holdings that could potentially be acquired for use in the long-term management in this alternative.

Property Damage by Bison. As explained in the "Affected Environment" and in the discussion of impacts in alternative 1, livestock, structures, and humans are at risk when bison leave the park. Under this alternative, no bison would be allowed beyond SMA boundaries. However, property damage by bison could be expected to continue as in the past for producers and property owners within the SMA boundaries under phase 1. In particular, producers in the Horse Butte area of West Yellowstone might be affected. With the reduction in the bison population due to the severe 1996–97 winter, the number of incidents would likely be low for the immediate future.

Indirect Impacts. Under the modified preferred alternative, short-term impacts would be similar to alternative 1, and long-term impacts would be similar to alternative 3.

Cumulative Impacts

No additional sources of impact would exist.

Conclusion

Under the first phase of alternative 7, brucellosis testing and vaccinating of cattle in the vicinity of Yellowstone National Park would continue as under the interim plan, and no changes in or removal of livestock operations would occur. Damage caused by bison would likely continue, with the frequency of incidents dependent on the number of bison migrating outside the park. In the long term, modification or closure of the allotments and purchase or easement of the private property would eliminate any risk of disease transmission from bison in the newly created Reese Creek SMA. These have a combined cow-calf population of 316 pairs. This would have moderate to major impacts on three public grazing allotments, one large private holding, and several smaller holdings north of the park . The livestock producers that use these grazing resources might need to modify their operations or relocate to other areas outside the SMA. Public funds equal to the fair market price would be required to acquire the private land.

In the West Yellowstone area, temporal separation and capture, test and slaughter operations would minimize the risk of brucellosis transmission to affected herds; therefore, the long-term impact on operators in the western SMA would be minor to moderate, compared to major relocational impacts to affected operations in the Reese Creek/Gardiner Valley area.

IMPACTS OF THE MODIFIED PREFERRED ALTERNATIVE

Analysis

The SMAs identified for step 1 of the modified preferred alternative would be the same as those under the interim plan (alternative 1), and impacts on livestock producers during implementation of this step would be the same as those described for alternative 1. The additional lands acquired north of the park are those described in alternatives 3 and 7, and management area boundaries would match those described in these alternatives in steps 2 and 3 of the modified preferred alternative. Of the alternatives already analyzed, impacts on livestock would be most similar to those discussed in alternative 3. However, there would be some significant differences: 1) no changes in livestock operations to remove breeding stock would be anticipated; 2) the agencies would aggressively maintain SMA boundaries through the use of zone management; 3) the agencies would limit both the total number of bison and the number of bison allowed into SMAs; 4) the pace and scope of bison vaccination would increase; 5) mandatory vaccination of test-eligible cattle would begin in the fall of 2000 if they are not already voluntarily vaccinated; 6) APHIS and the state of Montana would conduct additional monitoring of cattle herds, including regular testing of cattle in the impact area and possible vaccination of adult cattle; 7) APHIS would make funds available to livestock operators to certify individual cattle herds grazing in the impact area as brucellosis free; 8) APHIS would fund any additional testing of cattle commingling with bison, if needed; and 9) the National Park Service would commit staff to cover the physical management of bison outside the park seven days per week.

Brucellosis Testing and Vaccinating. Beginning in the fall of 2000, Montana would require producers that graze herds in the vicinity of Yellowstone National Park to vaccinate their calves with the RB51 vaccine. APHIS would pay for the direct costs of vaccination, whether voluntary or mandatory. Producers in the region have herds totaling about 2,019 cow-calf pairs, and with vaccination costs of $5 to $10 per calf, they annually spend between $5,050 and $10,100. This cost would be transferred to APHIS and result in a savings to producers of about 2% of their production costs.

Also, as described in alternative 1, an estimated 80%–90% of the affected herds in the West Yellowstone area have their home base in Idaho, and by current agreement between the two states, would continue to be tested for brucellosis before they enter Montana and again before they reenter Idaho. This agreement might or might not continue under this alternative, but was assumed to do so in all three steps. Therefore, there would be no impact or change from existing testing practices. Costs of testing were estimated under alternative 1 as ranging between $7.50 and $15 per head. As shown under alternative 1 with an estimated 1,294 cow-calf pairs in the West Yellowstone area, testing costs for cattle from Idaho were estimated to total between $15,528 and $34,938.

Increased monitoring and testing of cattle herds grazing in areas occupied by bison in the winter would be a part of this alternative. The testing would be conducted by APHIS and the state of Montana. Livestock producers would incur no additional costs as a result.

Conversion from Cow-Calf to Steer or Spayed Heifer Enterprise. No conversion of livestock operations is expected under this alternative.

Gallatin National Forest Grazing Allotments. The status of three allotments to the north of Yellowstone National Park (Green Lake, Park, and Sentinel Butte), on which about 86 cow-calf pairs are grazed, could be affected in the long term. Approximately 130 cow-calf pairs are grazed on adjacent private land as part of these allotments and expiration of the private grazing lease might mean cattle would be absent on the associated public grazing allotments (i.e., the allotments would be vacant). This alternative would not call for elimination of grazing allotments and impacts would be negligible.

Private Land Acquisitions and Easements. In 1999, 6,131 acres of land north of the park's Reese Creek boundary and south of Yankee Jim Canyon were acquired through purchase or easement by the U.S. Forest Service. A cattle lease on a portion of the lands exists now, and would expire in 2002. It is assumed that step 2 of the modified preferred alternative, which includes the release of up to 100 seronegative bison into the Reese Creek management area designated on a portion of the acquired lands, would begin when the lease is no longer in effect. At that time, the 100 cow-calf pairs grazing on these private lands would be moved.

Property Damage by Bison. As explained in "Affected Environment" and in the discussion of impacts of alternative 1, livestock, structures, and residents can be at risk when bison leave the park. With the release of bison into the Reese Creek management area, an increased number of property owners could experience property damage by bison. The National Park Service would commit staff seven days per week, to haze, bison from private property in the management areas, if requested, to ensure they do not cross boundary lines. These actions would minimize property damage and/or bison interactions with livestock or residents.

Perception of the Risk of Transmission. Several features under the modified preferred alternative would be geared to address the perception of the risk of transmission. Bison would be allowed outside the park in the West Yellowstone area in all three steps and in the Reese Creek management area in steps 2 and 3. This could increase the perception of the risk of transmission. However, as the description of this alternative indicates, early steps would be geared to be completely safe and would help agencies collect information on the manageability of bison for later steps. Safety measures include instrumenting seronegative pregnant bison outside the park with radiotransmitters to help understand the risks associated with their presence and to develop appropriate mitigative measures if needed. In addition, the number of bison outside the park in either the West Yellowstone or Reese Creek management areas would be limited to ensure the agencies' ability to effectively manage the bison. The population size of the bison herd would be controlled to minimize both large migrations of bison and the associated management challenges these migrations can bring. The combination of these factors would likely mitigate any additional perception of the risk of allowing bison outside the park.

Vaccination of both bison and cattle would be stepped up. As noted above, all cattle calves in herds grazing on lands occupied by bison in the winter would be vaccinated with RB51. These same herds would be monitored, and adults tested regularly by the agencies. Adult cattle could be vaccinated if the agencies believe vaccination was warranted. Any cattle commingling with bison from the Yellowstone herd would be tested at the government's expense.

The agencies would also commit to specific conditions under which bison vaccination would begin. A safe vaccine would be administered to captured vaccine-eligible bison first. This would be followed by the remote vaccination of untested vaccine-eligible bison outside the park and eventually remote vaccination of all vaccine-eligible bison with a safe and effective vaccine. Modelling predicts this measure alone will drop seroprevalence in the bison population by 70% to 11% during the life of the plan (see "Impacts on Bison Population: Modified Preferred Alternative"). According to the model, continuing vaccination after the 15-year life of the plan would decrease seroprevalence further, to an estimated 4% (in 2 to 3 years) where it would then stabilize (see "Impacts on Bison Population: Alternative 6").

New research by Cook (1999) indicates the viability of the *Brucella* organism in the environment is affected by heat and light (see "Affected Environment: Bison Population," "Purpose of and Need for Action: Background — Risk of

Transmission," and volume 2, "Brucellosis: Transmission and Public Perception" for more information), and viability drops off rapidly during warm spring months. Cook found that in his test environment in Wyoming the separation of bison and cattle by as little as 4.7 days prior to cattle occupying grazing lands in May or June could be sufficient to eliminate the risk of cattle being exposed to viable *Brucella* bacteria. Planned research will evaluate the viability of *Brucella* in the western boundary area environment and examine the effects of weather variables. The modified preferred alternative calls for a 45-day separation.

In addition to imposing vaccination, testing, and enforced separation, the agencies (specifically APHIS) would work with the state of Montana to educate other states on the effectiveness of these measures in preventing risk. If another state threatens sanctions against the import of Montana cattle, APHIS would work to convince the state that sanctions are unwarranted. The majority (95%) of cattle exported from Montana are shipped to 10 states: Iowa, Kansas, Nebraska, South Dakota, Wyoming, Colorado, Idaho, Minnesota, North Dakota, and Washington. Some of these states briefly imposed sanctions during the winter of 1994–95 and then soon dropped them. Idaho continues to require testing of cattle grazing in the West Yellowstone area. Given this, it may be unlikely that any state normally importing a large number of Montana cattle and therefore capable of exerting more than a negligible effect on the Montana livestock industry would threaten sanctions or that the assistance of APHIS would be required. Individual producers might be affected by threatened sanctions, however, and the actions described above would mitigate the economic impact to those producers.

To further help livestock producers, APHIS would make funds available to certify individual cattle herds that graze in areas bison may occupy in winter as brucellosis free. This would ensure, at no cost to the producers, that no marketplace bias against these herds exists as a result of their proximity to the Yellowstone bison herd and the associated perception of risk.

Cumulative Impacts

No additional sources of impact would exist.

Conclusion

Vaccination costs of $5 to $10 per female calf would be borne by APHIS, a negligible or minor benefit to producers. Testing required by Idaho of herds grazing in the West Yellowstone might or might not continue. Overall, the cost to livestock producers from testing and vaccination would be negligible to minor.

About 100 cow-calf pairs now grazing on newly acquired lands adjacent to Yellowstone National Park's Reese Creek boundary would be moved assuming the private cattle grazing lease expires in 2002. The lessee may experience minor to major effects as a result.

Property damage could increase slightly when bison are allowed outside the park into the Reese Creek management area; however, bison management in both this and the West Yellowstone management areas would be provided seven days per week to keep such damage to a minimum. Overall, impacts on property would be negligible to minor, although individual ranchers may experience moderate to major adverse effects from bison.

The modified preferred alternative includes many measures directed at mitigating the perception of risk. The combination of these measures and the education of state animal-health professionals by agencies regarding results of new research and the effectiveness of management measures in the modified preferred alternative would offset the perception of risk associated with allowing bison outside of Yellowstone National Park. None of these measures would result in increased costs to livestock producers. The indirect effects of this alternative to livestock operators (e.g., perception of risk) would, therefore, be either the same or slightly more beneficial than those in alternative 1.

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

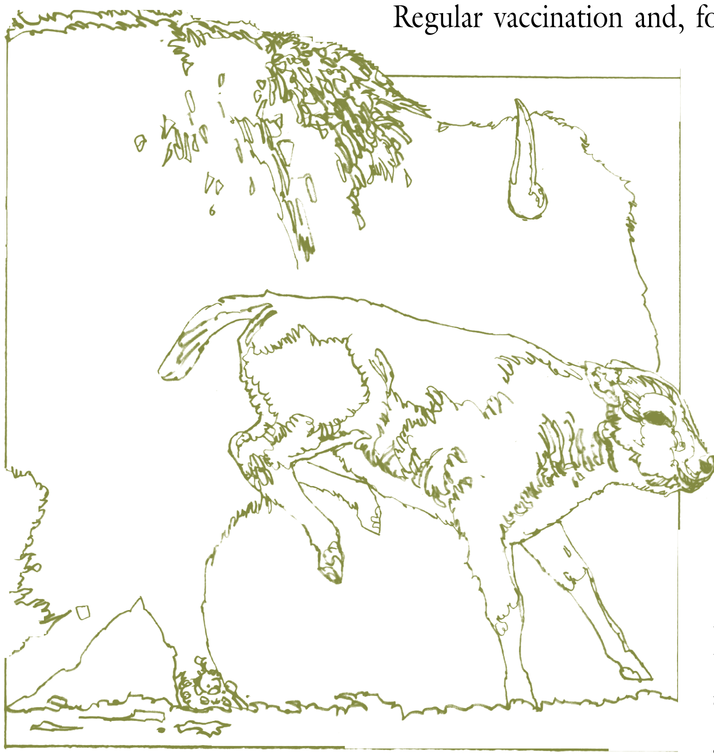
In the livestock industry, there would be no irreversible or irretrievable commitments of resources under the alternatives. Even in those instances in which public grazing allotments might be closed or modified and the title or use of private land acquired within SMAs, such decisions could be reversed if they were found over time to not result in expected societal benefits. Structures and other improvements might have to be replaced, but the basic resource — land for grazing — would remain.

LOSS IN LONG-TERM AVAILABILITY OR PRODUCTIVITY OF THE RESOURCE TO ACHIEVE SHORT-TERM GAIN

In none of the alternatives would long-term resource productivity be sacrificed because of short-term goals.

UNAVOIDABLE ADVERSE IMPACTS

Livestock producers in the vicinity of the park must be on constant guard against transmission of the disease to their herds because of the presence of brucellosis in bison of Yellowstone National Park and their off-park migration. Regular vaccination and, for herds from Idaho, testing of cattle would be two precautionary measures taken. Although their cost is relatively minor, these activities represent adverse impacts of raising cattle near exposed bison. The risk of bison damaging stock or property would be another adverse consequence of ranching near Yellowstone National Park. As long as the bison carried brucellosis and left the park, these types of impacts would continue, although they might be minimized through modification of grazing allotments, acquisition of private land, and other actions included in the various alternatives. Operations affected by the modification of grazing allotments would be unavoidably affected. Other changes in resource use — from selling or easement of private land, to conversion of cow-calf operations to nonbreeding stock enterprises — would be voluntary and therefore avoidable.



Bison cow with calf.

IMPACTS ON SOCIOECONOMICS

SUMMARY OF REGULATIONS AND POLICIES

National Environmental Policy Act regulations require analysis of social and economic impacts resulting from proposed major federal actions in an environmental impact statement. In addition, Executive Order 12898, dated February 11, 1994, on "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" requires federal agencies to assess the impact of actions on cultural minority and low-income communities. Although there are no specific regulations requiring protection of social values, impacts on social values are considered an important part of the federal planning processes. The assessment of the economic effects of the proposed action follow the general principles outlined in the U.S. Water Resources Council's Economics and Environmental Principles for Water and Related Land Resources Implementation Studies (U.S. Department of the Interior 1983).

National Environmental Policy Act regulations require analysis of social and economic impacts resulting from proposed major federal actions in an environmental impact statement.

METHODOLOGIES FOR ANALYZING IMPACTS

This assessment relied upon both original data and findings in the existing social science literature. Original data was collected in 1999 using a set of three surveys of both of park visitors (summer and winter) and of regional and national residents. Economic parameters related to nonmarket values were estimated from the 1999 survey responses and used contingent valuation methodologies (general methods are described in Braden and Kolstad 1991; Ward and Duffield 1992). Real discount rates of 7% were used to compute annual and present values following Office of Management and Budget (1992) guidelines.

The analysis of original survey data and existing literature relied on standard methods in sociology and social psychology, including survey research, focus groups, key informant interviews, and various statistical techniques such as multiple regression analysis and cluster analysis. Some of the assessments reported below were based on Kellert (1976). A case in point is the history of the Wood Buffalo National Park management proposals and the strong negative public response (by the Canadian people as a whole) to an alternative that relied heavily on the slaughter of bison. (Depopulation to the degree proposed in the Wood Buffalo herd is not a part of any alternative analyzed in the environmental impact statement. It is cited here simply to show public reaction to bison slaughter.)

A draft report also provides some information on social values of particular groups concerned about the bison management issue. This report was also used for analysis of this impact topic.

Additionally, appendix I provides information regarding Native American opinions concerning bison and bison management. The appendix contains a list of the tribes and tribal organizations that commented on the *Draft Environmental Impact Statement* along with a summary of those comments and identifies those tribes interested in receiving live bison for quarantine. It also provides a summary of Native American consultations that have occurred over the past three years.

IMPACTS COMMON TO ALL ALTERNATIVES

The management of bison would involve killing through agency shooting, transport of seropositive animals to slaughter, hunting, and other actions that some would find objectionable. People who do take offense might object for any number of reasons: that the killing of any animals is inappropriate, that human management of wildlife is not needed, or that bison do not need to be controlled to prevent brucellosis transmission from bison to cattle, for example. All alternatives would involve bison management, and so each would have some potential for adverse public reaction that might result in the call for a tourism boycott, although the potential would likely vary among the alternatives. The potential for such a call, and the effectiveness of such a boycott are difficult to judge.

A tourism boycott organized in Alaska in the early 1990s in response to a state policy to reduce populations of another wildlife species, the grey wolf, was effective. In response to the boycott, then Governor Hickle called off the wolf control program. It was estimated that, had the boycott continued, the impact on the Alaska tourism economy would have been major and adverse, on the order of approximately $85 million in lost business or about 15% of the dollar revenues of this sector in Alaska (Dindinger, undated).

Conversely, the impact of a boycott organized in response to bison hunting in Yellowstone in 1988–89 resulted in no lost tourism in Montana, and nonresident tourism increased during this period (Institute for Tourism and Recreation Research, pers. comm.). Peacock (1997) notes that the Fund for Animals purchased a full-page ad in USA Today in early winter 1997 calling for a boycott of Montana tourism in response to the slaughter of bison under the interim plan. Although the response to this call has not been measured, Montana believes its impact was negligible or minor. This is based on the relative ratio between the amount of inquires Travel Montana (Montana

Department of Commerce) received (400,000) and those inquiries related to bison (140 in Montana fiscal year 1997).

These conflicting data mean the effectiveness or economic impact of a boycott is unknown, and could be negligible, major, or somewhere in between. The probability of such a boycott being initiated is also unknown, but likely varies between alternatives with the number of bison killed and the visibility and exposure of the control methods used.

The Yellowstone National Park 1999 summer visitor survey collected data in order to examine the relationship between bison population levels within the park and the nonmarket value that park visitors place on their trip to Yellowstone National Park. Based on the survey responses, no clear relationship was found between the number of bison seen on a trip and the nonmarket value placed on that trip. An analysis of the data shows that almost all visitors to Yellowstone National Park see bison and most see a large number. Based on these survey results, it is assumed for all alternatives that the changes in bison populations estimated in the final environmental impact statement would not lead to measurable changes in visitor nonmarket trip values.

CUMULATIVE IMPACTS COMMON TO ALL ALTERNATIVES

The economies of Gallatin and Park Counties have benefited in recent years from growth tied to the area's high quality wildlife and wildland resources. Wildlife, in turn, have benefited from the large amount of public land in the counties, along with the open space provided by large tracts of privately held agricultural land. To the extent that the alternatives could augment wildlife resources (wildlife populations and habitat), this would be a benefit to the existing trend. Conversely, to the extent that the alternatives could diminish wildlife resources, the negative impacts are somewhat offset by the positive regional economic trend related to wildlife and the natural environment.

IMPACTS OF ALTERNATIVE 1: NO ACTION

Analysis

Regional Economy. Implementing alternative 1 would continue existing economic trends as described in the "Socioeconomics" chapter of "Affected Environment." Alternative 1, in allowing livestock production to the north and west of Yellowstone National Park to continue, would likewise enable its contributions in the economies of Gallatin and Park Counties to continue.

Producers grazing herds in the affected areas would maintain their current relatively minor role in the region's beef cattle industry and in the regional economy as a whole.

Minority and Low-Income Populations. Fifty-eight bison (56% of the average 103 bison expected to be slaughtered or shot each year under alternative 1) would be donated to Indian tribes and charitable organizations per year. The value of the donated carcasses would be equivalent to the value received in auction ($337/animal). The total annual value of the 58 donated carcasses would be $19,546. Charities would receive a net benefit of about $2,545, and Native Americans would receive about $17,000 worth of bison. Other members of society might also value the idea that bison were being distributed for food to minority and low-income populations.

Social Values. The scale of impacts on social values of any of the alternatives would depend on the intensity of impact on a representative individual of some population and on the size of that population. In general, this analysis would be hampered by the absence of any general population surveys concerning the bison-brucellosis issue. Accordingly, the analysis of impacts on social values would be largely qualitative, judgmental, and imprecise.

Based on a review of the written comments to the environmental assessment of the *Interim Bison Management Plan* (NPS and State of Montana 1995), the feature of the proposed plans about which commenters felt most strongly was bison slaughter. Strong statements were also made about the need to protect ranchers from the impacts of brucellosis. These were respectively moralistic-humanitarian versus utilitarian attitudes (see table 37). The analysis of responses to the 1999 surveys of both Yellowstone National Park visitors and regional and U.S. residents is consistent with the pattern of divergent views found in the written comments regarding the *Draft Environmental Impact Statement* on lethal control of bison. Among residents of the three states of Idaho, Montana, and Wyoming, 42.5% of summer visitors to Yellowstone National Park and 56% of all residents in the three states agreed with the survey statement "It is appropriate to kill bison at park boundaries, as necessary, to protect domestic livestock." Among the nonresident populations of both summer park visitors and U.S. residents, 43.1% of visitors and 51.5% of U.S. residents agreed with this statement. The responses to the survey question on the appropriateness of lethal control of bison at park boundaries shows that opinions both pro and con on this issue are well represented in both summer visitor and resident populations. To summarize, among the resident population, the number of respondents agreeing outnumbered those disagreeing by a ratio between 1.6 to 1 and 1.8 to 1.

Among park visitors, residents were either evenly divided (summer survey) or disagreed in a ratio of 1.3 to 1 (winter survey). Nonresident park visitors agreed with the statement in a ratio of 1.3 to 1 for summer visitors and 1.2 to 1 for winter visitors. Based on this analysis, the primary adverse impact on social values of any aspect of the alternatives would likely be the extent to which the alternative relied on slaughter. A positive impact would be associated with alternatives that maintained the livestock industry and cattle ranching as a way of life.

A continuation of alternative 1 would entail a continued reliance on slaughter of bison at the average annual level of 103 animals per year and would likely be a minor to moderate adverse impact. This would be at the middle level of slaughter for all alternatives, and, as in all alternatives, would be based on a model that predicted average numbers of migrating bison. However, bison leave the park in response to many factors, among them stochastic events such as severe winters. This was true in the winter of 1996–97, when more than 1,000 bison left the park and were captured and slaughtered according to the provisions of the interim operating plan. Based on the public reaction to this level of removal, the overall impact on social values of this alternative would likely be minor to moderately adverse. The majority of the U.S. population's values concerning humanitarian and moral treatment of animals would likely be negatively affected. No animals would be being quarantined, so Native Americans would only benefit via a share of slaughtered animals, which is a negligible benefit in the context of overall food needs for tribes.

Some tribes would view the capture, test, and vaccination operations as being in conflict with their cultural beliefs, i.e., that bison would be fully protected and respected. Impacts on social values associated with local ranching lifestyles would be negligible; current management operations and practices would continue.

Nonmarket Values. Impacts on benefits that visitors and others derive from Yellowstone National Park and the Greater Yellowstone ecosystem would result from changes in park visitation levels (both summer and winter) and existence values associated with bison population levels and distribution and bison health. Accordingly, impacts on nonmarket values for all alternatives would be based largely on the impacts previously described in "Impacts on Recreation."

Alternative 1 does not propose either expansion of the bison winter range or a herd-wide vaccination program. Furthermore, this alternative has no impacts on winter recreation or hunting. Therefore, no nonmarket values (either benefits or costs) are estimated for this alternative.

Conclusion

Alternative 1 would have a negligible impact on the regional economy or on nonmarket benefit accounting, compared to the status quo in 1996–97. There would be a minor to moderate adverse impact (due to the level of slaughter in this alternative) on social values associated with humanitarian and moral treatment of animals.

IMPACTS OF ALTERNATIVE 2

Analysis

Regional Economy. Because alternative 2 would lead to the largest bison spatial distributions of all alternatives, it would also afford the greatest bison viewing opportunities of all alternatives. Greater bison viewing opportunities under this alternative could lead to increased visitation to Yellowstone National Park and the Greater Yellowstone Area. Associated with this increased visitation would be increased visitor expenditures in the Greater Yellowstone Area. The probability and extent of any increased visitation or visitor expenditures related to alternative 2 bison management policies is unknown. The closure of approximately 60 miles of previously groomed roads and trails within Yellowstone National Park would have a moderate to major adverse impact on the distribution of oversnow travel within the park. Approximately 47% of winter visitation to the park enters through the west entrance, and the winter economy of West Yellowstone, Montana, is centered around tourists who come to recreate in the park, as well as on public lands outside the park.

The 1999 Greater Yellowstone Area winter visitor survey (Duffield et al. 1999) asked respondents how their visitation would be affected if the roads from Mammoth to Madison, West Yellowstone to Madison, and Madison to Old Faithful were closed to all vehicular travel from November 1 to April 30 and other roads were groomed for snowmobiles at the present time. Based on the responses to this survey question, visitation to the Greater Yellowstone Area by winter visitors who live outside of the Greater Yellowstone Area would be reduced by 24.9% if these roads were closed for winter travel.

In the winter visitor survey, park visitors who reside outside of the Greater Yellowstone Area made up 82% of the total sampled visitors. If 24.9% of these nonresident Greater Yellowstone Area visitors decided not to recreate within the Greater Yellowstone Area because of the westside road closure within the park, the local Greater Yellowstone Area would not benefit from the expenditures these potential visitors would have made.

It is estimated (using the winter survey responses and the IMPLAN input/output model) that total economic output in the 17 county Greater Yellowstone Area would be reduced by $13,750,000 as a result of the travel restrictions. Additionally, it is estimated that 333 jobs within the Greater Yellowstone Area would be lost due to reduced nonresident expenditures in the area.

A $13,750,000 loss would be a minor impact on the overall 12.7 billion dollar economy of the 17-county Greater Yellowstone Area. This impact, however, will likely be concentrated in small communities such as West Yellowstone and Gardiner, Montana. Because of the small size of the West Yellowstone and Gardiner economies and their proximity to the affected road segments, it can be assumed that these towns will bear a disproportionately large share of the reductions in nonresident expenditures. This would have a major negative impact on the West Yellowstone and Gardiner, Montana winter economies.

The estimated reductions in the GYA visitor and nonresident expenditures are based on responses to a survey of current winter visitors. The estimated reductions in local area spending could be offset if users not currently recreating in the park in the winter chose to come to the park because of new restrictions on motorized uses.

With respect to the livestock sector, in the long run if all cattle were removed from the SMA under alternative 2, any negative impact on the region would likely be countered by increased tourism and related revenues deriving from a minimal management strategy. These negative and positive impacts could be felt differently by members of local economies surrounding the park. The businesses and individuals experiencing positive economic impacts from increased tourism could be different from those experiencing negative impacts of reduced agricultural activity in the area. Some believe that agricultural operations and tourism activities would not be mutually exclusive and could have positive impacts on each industry.

The government sector would incur costs associated with any additional purchase of winter range. Although no appraisals have been conducted of lands under consideration, it is estimated by the U.S. Forest Service that purchase of affected private lands, not including holdings in the Denny Creek/South Fork area or the already secured Royal Teton Ranch, would require about $15 million. Easement costs were not estimated but would likely be less than outright purchase.

Minority and Low-Income Populations. No or very few bison carcasses would be donated to Native Americans or charitable organizations that provide food for the needy. This would be a negligible economic impact.

Social Values. Alternative 2 would have a minor adverse impact on social values favoring traditional ranching lifestyles in the areas immediately adjacent to the park. This would be negligible in the context of the Montana cattle industry. There would be no adverse impact on moral and humanitarian attitudes toward wildlife under this alternative, but rather a relative positive impact compared to the continued implementation of alternative 1.

However, some individual ranchers affected by changes in cattle operations might view this as a major impact on their lifestyles and values. Some tribes might view the management of bison in this alternative to be less severe compared to other alternatives. Some residents across the country might perceive an impact on cattle ranching while others might be supportive of the ability of bison to move more freely across the landscape.

The majority of winter visitors to Yellowstone National Park support mechanized access to the parks. In the context of overall access to the park, the changes to winter road grooming proposed in alternative 2 would likely result in major adverse impacts on winter park visitors by eliminating some of the most heavily used winter motorized routes within the park. On the other hand, a substantial portion of winter park users favor reductions in motorized use within the park. For this group, the alternative 2 travel restrictions would have a positive impact. Table 53 details the responses of different sample populations to a 1999 survey question on Yellowstone National Park winter access. The responses shown in table 53 (in conjunction with the responses previously detailed in the "Affected Environment: Socioeconomics — Social Values" section) indicate that while respondents in all samples favor mechanized access to Yellowstone in the winter months, they are also concerned about possibly disturbing park wildlife in the winter and are willing to consider closing motorized winter access to the park in order to help wildlife (specifically, to stop bison migration).

Nonmarket Values. Alternative 2 proposes increases in out-of-park winter range for bison (in addition to that already purchased). The 1999 YNP visitor and resident surveys asked a series of questions designed to obtain information regarding their willingness-to-pay for increased bison winter range. The most reliable resident estimate was $15.12 per household for residents in the three-state region. Multiplying this amount by the number of households in the region (944,800, U.S. Census Bureau) and applying a calibration factor that reflects the relationship between stated and actual willingness-to-pay yields an estimated nonmarket value for residents of the three-state area of approximately $2.8 million.

Table 53: Survey Responses to Question on Winter Access Management in Yellowstone National Park

Question: Grooming the roads into Yellowstone National Park from West Yellowstone and Mammoth for oversnow vehicles provides an easier winter route out of the park for bison. If roads were not groomed, more bison might remain in the park. Given this possibility, which of the following policies would you prefer?

	To choose the current policy that allows for winter access	To close motorized winter access	Not sure which policy to prefer	Sample size
Summer Survey				
Residents	37.4%	37.4%	25.1%	211
Nonresidents	25.0%	34.6%	40.3%	1,046
Winter Survey				
Park Sample	52.1%	23.4%	24.6%	1,134
Phone survey				
Local	50.0%	38.2%	11.7%	413
Regional	41.3%	48.2%	10.5%	408
National	29.6%	58.8%	11.6%	405

SOURCE: Duffield et al. (1999, 2000a, 2000b)

Responses to the YNP summer visitor survey indicate that summer visitors to the park who live outside of the three-state region have a mean willingness-to-pay for increased bison winter range of $24.45 per visitor. In order to aggregate this estimate up to the visitor population, it was conservatively assumed that the $24.45 value was for visitor groups and not individual visitors. Given the number of summer visitors to Yellowstone National Park, the percentage of visitors that are from outside the three states of Idaho, Montana, and Wyoming, and the average size of visitor groups, it is estimated that nonresident summer visitors to the park place a nonmarket value on expanded winter range of $1.64 million. (This figure also includes a calibration factor for stated vs. actual willingness-to-pay.) The resident nonmarket values and nonresident visitor values are additive and represent an estimated total nonmarket value of winter range expansion of $4.43 million.

The estimated nonmarket value of winter range expansion under alternative 2 is conservative in two respects. First, the nonmarket value of $4.43 million is an estimate for acquiring only the Royal Teton Ranch lands and their associated winter range capacity. Alternative 2 actually proposes increasing winter range beyond the Royal Teton Ranch acquisition, and therefore, a higher nonmarket value of winter range expansion would be expected. Second, if the nonmarket valuation estimate from the national population had been reliable, the aggregate nonmarket values from this population would have been much greater in comparison to the current estimate and would easily justify the purchase price for the proposed winter range expansions.

The proposed alternative 2 actions could potentially impact nonmarket values of winter visitors through a reduction in current winter user visitation resulting from the travel restrictions on westside roads within the park.

The nonmarket value of a trip to the parks of the Greater Yellowstone Area based on the winter visitor survey is $30 for residents of Montana, Idaho, and Wyoming and $145 for nonresidents. It is estimated that alternative 2 actions would lead to a reduction in park visitation of 26.9% for visitors from outside the three-state region and 12.2% for those from within the three-state region. Based on current winter visitation levels and the distribution of resident and nonresident visitors, this estimated reduction in visitation would translate into a $3,690,000 reduction in the aggregate nonmarket value of winter trips to the parks. This is a moderate negative impact.

These estimates are based on reduced use by current visitors. The extent to which this might be offset by visitation from individuals who do not currently visit the park in winter is unknown.

Conclusion

The impact on the regional economy of this alternative would likely be a moderate negative effect due to the estimated reductions in winter recreation use and the livestock industry. On the assumption that acquisition would occur, and from a social benefit-cost standpoint there would be moderate positive impacts to nonmarket existence values. There would be offsetting impacts on social values — for some this would be an adverse impact, for others a beneficial one. Some individual ranchers affected by this alternative might view this as a major adverse impact. Some residents across the country might be highly supportive of the actions in this alternative. A majority of current winter visitors would likely view this alternative as having major adverse impacts, while another substantial portion of the population would support the actions.

IMPACTS OF ALTERNATIVE 3

Analysis

Regional Economy. This alternative would have an economic impact on the local economy through expenditures made by hunters during their stay in the hunting area. This alternative would also generate revenues for the state of Montana through collection of application fees and awarding 75 tag permits beginning in 2000 (see table 54). A few more permits, up to 85, might be issued by 2005. However, the positive effect of the increased revenues would be offset by corresponding increases in costs to administer the bison hunting season.

It is clear from the sample of current hunts in the United States and current and past hunts in the Greater Yellowstone Area (see table 21) that the demand for bison hunting far exceeds the supply. A lottery for a limited number of permits to hunt the Yellowstone bison would receive a large number of applicants who would be willing to pay a substantial fee for the privilege to hunt a wild bison. The proposed bison hunt north of Yellowstone National Park should be very similar in hunter interest and willingness-to-pay to the 1996 hunt held in Wyoming just east of the park.

TABLE 54: ANNUAL ECONOMIC VALUES AND EXPENDITURES ASSOCIATED WITH BISON HUNTING OPPORTUNITIES IN THE YELLOWSTONE AREA UNDER ALTERNATIVE 3

	75 permits
Fees to Montana Department of Fish, Wildlife, and Parks[1]	$53,320
Hunter Expenditures[2]	$32,960
Net Economic Value[3]	$23,980

1. The applicant number, application fees, bison tag permits, and percent to residents and nonresidents were assumed to be the same as the 1996 Wyoming hunt (2,300 applicants, $5 nonrefundable application fee, $1,688 nonresident permit, $275 resident permit, and 80% of the permits reserved for state residents).
2. The average length of stay in the area was assumed to be 3 days per hunter: 2 days of hunting and 1 additional day in the area. Length of stay for a bison hunter was estimated at 3 days in the Jackson Bison Herd Draft Environmental Assessment (1994) based on communications with agency personnel. Average daily hunter expenditures are estimated to be $146.58. This number is based on elk hunters expenditures in Montana (Duffield 1988) and adjusted to 1996 price levels. Total hunter expenditures is (3 days) x (75 hunters) x ($146.48/hunter day).
3. Net economic value was assumed to be $106.58 per day based on the net economic value reported for elk hunting (Duffield 1988) and adjusted to 1996 price levels.

With regard to the livestock sector, the effects would be the same as alternative 2, with hunting as a potential additional source of income for those private holdings in the West Yellowstone area that charge for hunting on their land.

Minority and Low-Income Populations. Alternative 3 would primarily rely on hunting to control bison population growth. However, when hunting could not be used (such as when a large number of bison attempted to leave the park through the Reese Creek area), capture and quarantine or slaughter would be used as a back-up. On average, however, very few animals would likely be shot by agencies, slaughtered, or quarantined, and therefore be available to Native Americans or charitable organizations that provide food for the needy. It should be noted that any live bison completing quarantine would have a significantly higher value than bison carcasses (e.g., the average 1997 auction price for live bison from the Custer State Park was $1,700). Using the estimates in "Affected Environment" of the number of bison being quarantined under alternative 3, it is possible that live bison valued at approximately $826,000 could be released to tribes over the 15-year life of the plan.

Social Values. There would be only intermittent shipment of bison to slaughter associated with alternative 3, and thus any impacts on humanitarian and moral values would be minor. Social values of individuals who were opposed to hunting might be to a minor or moderate degree adversely affected by the hunting activities in this alternative. Some tribes might view the hunting program, quarantine, and capture, slaughter, and vaccination activities as disrespectful of tribal beliefs. Ranching lifestyles could be affected north of the park boundary, but land would be expected to be purchased from willing sellers; therefore, impacts on social values regarding changes in ranching lifestyles would be minimal (see "Affected Environment: Livestock Operations" for additional information regarding potential changes in ranching). Some residents across the country might not fully understand the science behind management of bison and perceive the animals as being an endangered species; therefore, some might oppose the management actions of this alternative.

Nonmarket Values. Alternative 3, like alternative 2, would use recently acquired land north of Yellowstone National Park for bison winter range. Because of this similarity to the alternative 2 proposals, it is estimated that the effect on existence values would be similar to or slightly less than those estimated under alternative 2. It is estimated that the nonmarket values accruing to hunters under this alternative would be approximately $24,000.

Conclusion

The impacts of alternative 3 on the regional economy would be minor and positive due to anticipated hunter expenditures. With respect to social values, this alternative could have minor to moderate adverse impacts depending on how the public viewed the fairness and appropriateness of the proposed hunt. The impacts from the standpoint of social benefits and costs would be similar to alternative 2 in that this alternative would have a considerable range from minor negative to major positive in levels of possible benefits to society.

IMPACTS OF ALTERNATIVE 4

Analysis

Regional Economy. The bison hunt would have a slight economic impact on the local economy through expenditures made by hunters during their stay in the area. This alternative would also generate revenues for the state of Montana through collection of application fees and the awarding of 35 tag permits (compared to 75 permits in alternative 3); see table 55.

TABLE 55: ANNUAL ECONOMIC VALUES AND EXPENDITURES ASSOCIATED WITH BISON HUNTING OPPORTUNITIES IN THE YELLOWSTONE AREA UNDER ALTERNATIVE 4

	35 permits
Fees to Montana Department of Fish, Wildlife and Parks[1]	$31,016
Hunter Expenditures[2]	$15,380
Net Economic Value[3]	$11,191

1. The applicant number, application fees, bison tag permits, and percent to residents and nonresidents were assumed to be the same as the 1996 Wyoming hunt (2,300 applicants, $5 nonrefundable application fee, $1,688 nonresident permit, $275 resident permit, and 80% of the permits reserved for state residents).
2. The average length of stay in the area was assumed to be 3 days per hunter: 2 days of hunting and 1 additional day in the area. Length of stay for a bison hunter was estimated at 3 days in the Jackson Bison Herd Draft Environmental Assessment (1994) based on communications with agency personnel. Average daily hunter expenditures are estimated to be $146.58. This number is based on elk hunters expenditures in Montana (Duffield 1988) and adjusted to 1996 price levels. Total hunter expenditures is (3 days) x (35 hunters) x ($146.48/hunter day).
3. Net economic value was assumed to be $106.58 per day based on the net economic value reported for elk hunting (Duffield 1988) and adjusted to 1996 price levels.

With regard to the livestock sector, the effects would be the same as alternative 1, with hunting potentially an additional source of income for those private holdings in the West Yellowstone area that charged for hunting on their land.

Minority and Low-Income Populations. Sixty-nine bison (56% of the 124 bison expected to be slaughtered or shot per year under alternative 4) would likely be donated to Indian tribes and charitable organizations per year. Based on percentages allotted during the interim management period, 13% of the bison would go to charities and 87% would go to Native Americans and affiliated organizations. The value of the donated carcasses was assumed to be equivalent to the value received in auction ($337/animal). The total annual value of the 69 donated carcasses would be $23,254. It should be noted that any live bison completing quarantine would have a significantly higher value than bison carcasses (e.g., the average 1997 auction price for live bison from Custer State Park was $1,700). Using the estimates in "Affected Environment" of the number of bison being quarantined under alternative 4, it is possible that live bison valued at approximately $1.17 million could be released to tribes over the 15-year life of the plan.

Social Values. Alternative 4 would have impacts similar to alternative 1. While total bison removals per year would be 20% higher under this alternative than under alternative 1, a number of these animals under alternative 4 would be quarantined and donated or sold live. The somewhat offsetting impacts of higher removals and lower slaughter would likely result in this alternative, having a similar impact on social values as alternative 1. Included in total bison removals under this alternative would be a hunting component at a lesser level than alternative 3. As noted above, some of the bison completing quarantine could be made available to tribes. The numbers of animals (and the availability of alternative sources) would be such that the positive impacts on tribal cultural values would likely be minor. Some tribes might view the management actions of this alternative to be in conflict with their beliefs and values. Ranching lifestyles and associated values would be similar to alternative 1.

Nonmarket Values. The estimated nonmarket benefits of alternative 4 are limited to hunting benefits of $11,000.

Conclusion

The overall impacts would be similar to alternative 1. Alternative 4 would have a negligible to positive minor impact (due to hunting) on the regional economy and on nonmarket benefit accounting, compared to alternative 1. There would be a minor to moderate adverse impact (due to the level of slaughter in this alternative, which would be about one-half the level of alternative 1) on social values associated with humanitarian and moral treatment of animals. Impacts on social values associated with ranching lifestyles would be similar to alternative 1. Some tribes might view the management actions of this alternative as being in conflict with their values and beliefs.

IMPACTS OF ALTERNATIVE 5

Analysis

Regional Economy. This alternative would have no impact on hunting. However, it would have an adverse impact on winter recreation through the plowing to pavement and accompanying loss of snowmobile access along all roads now groomed into the park from the west and east entrances, as well as access to Old Faithful from the north during the first three to five years of the management plan. It is assumed that the impacts of visitation and expenditure losses on the local annual economy would generally have the same magnitude as under alternative 2 ($13.7 million per year). Unlike alternative 2, these impacts would be limited to the three- to four-year period during the parkwide vaccination program.

The interim plan resulted in a level of slaughter in the winter of 1996–97 similar to that proposed for this alternative over the years parkwide capture and slaughter was in effect. Because of the major (50%) reduction in bison population relative to alternative 1, this alternative could have negative impacts on wildlife viewing-related visitation and expenditures. The probability and extent of such impacts, however, is unknown.

With regard to the livestock sector, aggressive brucellosis control could encourage increased livestock use of the affected areas, depending on their carrying capacities and public policies regarding land use. The affected areas could therefore become more economically important to their respective counties and the state.

Minority and Low-Income Populations. Of the 1,278 bison expected to be slaughtered or shot in four years under alternative 5, 720 (56%) would be donated to Indian tribes and charitable organizations that provided food for the needy. Based on percentages allotted during the interim management period, 13% of the bison would go to charities and 87% would go to Native Americans and affiliated organizations. The value of the donated carcasses would be equivalent to the value received in auction ($337/animal). The total value of the 720 donated carcasses would be $242,640, or $60,660 per year for four years.

Social Values. This alternative would have the highest level of slaughter of any of the proposed alternatives and would approximately equal the level of the slaughter in the winter of 1997 (but over the course of three to four years). The 1999 YNP summer visitor survey asked respondents whether they agreed or disagreed with the statement "All bison in Yellowstone National Park should be rounded up and tested for disease and then either slaughtered or vaccinated." Among the three-state residents in the summer visitor population, 52.7% disagreed with this statement and 21.5% agreed with it (the remaining 25.8% of respondents neither agreed nor disagreed or said they had no opinion). Among nonresident summer park visitors, 34.4% agreed with the statement and 28.4% disagreed. While there is a relatively large percentage of undecided respondents in both visitor populations, only one-fifth of resident and one-third of nonresident summer visitors support a parkwide test and slaughter operation as proposed under alternative 5. It appears that alternative 5 would have a moderate to major adverse impact on widely held humanitarian and moralistic attitudes in the population. For ranchers in the area, the management of brucellosis would have negligible to minor benefits on social values.

Nonmarket Values. This alternative would result in changes in the bison population that would be largest in the negative direction compared to all alternatives.

The quantifiable nonmarket benefits of alternative 5 are that there could be a nonmarket benefit for eradicating brucellosis from the Yellowstone bison herd and establishing a disease-free bison herd. The 1999 YNP visitor and resident surveys asked questions designed to gather the data necessary to estimate the net economic value associated with implementing a parkwide test, slaughter, and vaccination program as proposed under alternative 5. It was estimated that residents of the three-state region placed a nonmarket value on such a program of $14.70 per household (Duffield et al. 2000b). Multiplying this amount by the number of households in the region (944,800, U.S. Census Bureau) and applying a calibration factor that reflects the relationship between stated and actual willingness-to-pay, yields an estimated nonmarket value to residents of the three-state area of approximately $2.7 million.

The responses to the YNP summer visitor survey regarding willingness-to-pay for a parkwide test, slaughter, and vaccination program indicated that summer visitors from outside of the 3-state region placed a nonmarket value of $12.65 per visitor on the program. It was conservatively assumed that the $12.65 value was for visitor groups and not individual visitors. Given the total number of summer visitors to Yellowstone National Park, the percent of visitors that are from outside the three states of Idaho, Montana, and Wyoming, and the average size of visitor groups, it is estimated that nonresident summer visitors to the park place a nonmarket value on a parkwide test and slaughter program of $846,000 (This estimate includes a factor calibrating stated to actual willingness-to-pay). The total estimated nonmarket value placed on the program by resident and nonresident summer visitors is $3.57 million.

It must be noted that had a reliable estimate of nonmarket willingness-to-pay been estimated for the national resident population, the aggregate values associated with this population would be much larger than the $3.57 million estimate. This estimate would likely justify the alternative 5 actions on a benefit-cost basis.

The annual loss in nonmarket values for winter recreation under alternative 5 would likely be similar to alternative 2. Unlike alternative 2, the nonmarket losses would only occur over a three- to four-year period, so the overall impact on winter recreation of alternative 5 might not be as adverse as alternative 2. Alternative 5 would still have moderately adverse impacts on winter recreation.

Conclusion

Impacts on social values would be minor to major. There would be potentially minor to negligible benefits to ranchers when brucellosis in bison is eradicated. Placement of capture facilities throughout the park would have a major adverse impact on the social values of national park visitors and others who believe parks should not be degraded. Some tribes might view this alternative as having major impacts on their beliefs, given the high number of bison being captured, tested, and slaughtered.

IMPACTS OF ALTERNATIVE 6

Analysis

Regional Economy. The annual impacts on the regional economy from reductions in winter recreation use under alternative 6 would be similar to alternative 2 for the 15 years of the plan. Because the duration of the road closures under this alternative would be much greater than under alternative 5 (13–14 years of full or partial closures under alternative 6 compared to three to four years under alternative 5), the overall negative impact of alternative 6 on winter recreation is likely to be significantly larger than the impacts of alternative 5.

With regard to the livestock sector, the impacts would be similar to alternative 5, but slower control of brucellosis could result in increased livestock use of affected areas occurring later than alternative 5.

Minority and Low-Income Populations. Fifty-six bison (56% of the 99 bison expected to be slaughtered or shot under the first 12 years of management in alternative 6) would be donated to Indian tribes and charitable organizations per year. Based on percentages allotted during the interim management period, 13% of the bison would go to charities and 87% would go to Native Americans and affiliated organizations. The value of the donated carcasses would be equivalent to the value received in auction ($337/animal). The total annual value of the 56 donated carcasses would be $18,872. In the year 2010 there would be a one-year slaughter of approximately 826 bison, which might be similarly distributed.

Social Values. Throughout its first 12 years, this alternative has similar levels of annual slaughter as alternative 1 and is accordingly expected to have similar impacts on social values. In its 13th year, 826 bison would be slaughtered. This would be most similar to alternative 5, and would have similar impacts on social values for this short-term period. When compared to alternative 5, this alternative could also have additional negative impacts on humanitarian and moralistic values for the relatively intrusive management actions that would take place throughout the park for vaccination.

Nonmarket Values. The nonmarket benefits associated with the parkwide capture and vaccination of bison program under alternative 6 would be similar to those under alternative 5. Under alternative 6, however, the benefits would not accrue until much later (17 or more years from the implementation of the plan).

The annual impact on winter recreation under alternative 6 would be similar to alternative 2. In total, alternative 6 would have a significantly greater major negative impact on winter recreationists' nonmarket values than alternative 5.

Conclusion

Impacts on the regional economy, social values, regional economy, and nonmarket values under alternative 6 would be similar to those in alternative 1 for the first 12 years, and to alternative 5 for the second phase. Social impacts might be more adverse than alternative 1 but not as adverse as under alternative 5. Social impacts might be exacerbated due to the possible humanistic and moralistic reaction to vaccination and management activities throughout the park.

IMPACTS OF ALTERNATIVE 7

Analysis

Regional Economy. The bison hunt would have an economic impact on the local economy through expenditures made by hunters during their stay in the area. This alternative would also generate revenues for the state of Montana through collection of application fees and the awarding of 25 tag permits (15 beginning in 2000, and 10 more in 2002) compared to 75 permits in alternative 3 (see table 56). This would be offset by the costs of administering such a hunt.

Table 56: Annual Economic Values and Expenditures Associated with Bison Hunting Opportunities in the Yellowstone Area under Alternative 7

	25 permits
Fees to Montana Department of Fish, Wildlife and Parks[1]	$25,440
Hunter Expenditures[2]	$10,896
Net Economic Value[3]	$ 7,994

1. The applicant number, application fees, bison tag permits, and percent to residents and nonresidents were assumed to be the same as the 1996 Wyoming hunt (2,300 applicants, $5 nonrefundable application fee, $1,688 nonresident permit, $275 resident permit, and 80% of the permits reserved for state residents).
2. The average length of stay in the area was assumed to be 3 days per hunter: 2 days of hunting and 1 additional day in the area. Length of stay for a bison hunter was estimated at 3 days in the Jackson Bison Herd Draft Environmental Assessment (1994) based on communications with agency personnel. Average daily hunter expenditures are estimated to be $146.58. This number is based on elk hunters expenditures in Montana (Duffield 1988) and adjusted to 1996 price levels. Total hunter expenditures is (3 days) x (25 hunters) x ($146.48/hunter day).
3. Net economic value was assumed to be $106.58 per day based on the net economic value reported for elk hunting (Duffield 1988) and adjusted to 1996 price levels.

Phase 1 of the preferred alternative would enable current livestock operations to the north and west of Yellowstone National Park to continue as under the interim plan. No cattle producers in the Reese Creek area would be directly affected because the SMA would be restricted to the Eagle Creek/Bear Creek area and the Hellroaring and Slough Creek drainages. On the West Yellowstone side, producers in the Horse Butte area would manage their herds within the SMA using the same precautionary measures as now. Phase 2, by including expanded winter range for bison to the north of Yellowstone National Park, would require removal of cattle from one private holding and two public grazing allotments on the west side of the Yellowstone River. Cattle grazed on these lands total about 260 cow-calf pairs. Other smaller private holdings in the area, on which no cattle are currently grazed, would also be affected. Long-term potential changes in land use in the Reese Creek SMA would be of minor consequence for the region and state. Of more significance for producers locally and statewide would be regulations underlying the establishment of SMAs, whereby free-ranging bison would not compromise Montana's class-free status.

Minority and Low-Income Populations. Seventy-eight bison (56% of the 139 bison expected to be slaughtered or shot each year under alternative 7) would be donated to Indian tribes and charitable organizations per year. Based on percentages allotted during the interim management period, 13% of the bison would go to charities and 87% would go to Native Americans and affiliated organizations. The value of the donated carcasses would be equivalent to the value received in auction ($337/animal). The total annual value of the 78 donated carcasses is $26,286. It should be noted that any live bison that completed quarantine and were donated to tribes would have a significantly higher value that bison carcasses (e.g., the average 1997 auction price for live bison from the Custer State Park was $1,700). Using the estimates in "Affected Environment" of the number of bison being quarantined under alternative 7, it is possible that live bison valued at approximately $1.06 million could be released to tribes over the 15-year life of the plan.

Social Values. This alternative has similar but slightly higher levels of annual slaughter to alternative 4, and would likely have similar impacts on social values. However, some people, groups, and tribes might find this alternative to have a major impact on their social values, given the management of bison within specific population levels. Impacts on ranching lifestyles would be similar to alternative 3.

Nonmarket Values. Alternative 7, like alternatives 2 and 3, would also provide for the use of recently acquired bison winter range and, therefore, could have a significant impact on nonmarket bison existence values. It would be likely that the effect would be similar to that estimated under alternatives 2 and 3.

Conclusion

Alternative 7 would have a negligible to minor positive impact (due to hunting) on the regional economy compared to the status quo. There would be a minor to moderate adverse impact (due to the level of slaughter in this alternative, which is at about 25% higher than the level of alternative 1) on social values associated with humanitarian and moral treatment of animals. Some tribes, groups, and individuals might find this alternative to be a major impact on their social values and beliefs if they opposed the management of bison within specified population levels. The overall social benefit-cost impacts, like alternative 2, would range from a moderate negative to a major positive.

IMPACTS OF THE MODIFIED PREFERRED ALTERNATIVE

Analysis

Regional Economy. The impacts to the regional economy under the modified preferred alternative would be similar to those described under the impacts to alternative 7.

Minority and Low-Income Populations. Eighty-seven bison (56% of the 155 bison expected to be slaughtered or shot each year under the modified preferred alternative) would be donated to Native American tribes and charitable organizations per year. Based on percentages allotted during the interim management period, 13% of the bison would go to charities and 87% would go to Native Americans and affiliated organizations. The value of the donated carcasses would be equivalent to the value received in auction ($337/animal). The total annual value of the 78 donated carcasses is $26,286. It should be noted that any live bison that completed quarantine and were donated to tribes would have a significantly higher value than bison carcasses (e.g., the average 1997 auction price for live bison from the Custer State Park was $1,700). Using the estimates in "Affected Environment" of the number of bison being quarantined under the modified preferred alternative, it is possible that live bison valued at approximately $1.8 million could be released to tribes over the 15-year life of the plan.

Social Values. This alternative has similar, but slightly higher, levels of annual slaughter than under alternative 4, and would likely have similar impacts on social values. However, some people, groups, and tribes might find this alternative to have a major impact on their social values, given the management of bison within specific population levels. Impacts on ranching lifestyles would be similar to alternative 3.

Nonmarket Values. The modified preferred alternative, like alternatives 2 and 3, would also provide for the use of recently acquired bison winter range and, therefore, could have a significant impact on nonmarket bison existence values. It would be likely that the effect would be similar to that estimated under alternatives 2 and 3.

Conclusion

The modified preferred alternative would have a minor to moderate adverse impact (due to the level of slaughter) on social values associated with humanitarian and moral treatment of animals. There would be a minor to moderate positive impact to minority and low income populations from the donation of bison carcasses and live bison. There would also be a minor to moderate positive impact on nonmarket values associated with the use of acquired bison winter range in future years.

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

From an economic perspective there would be no irretrievable or irreversible commitments of resources affecting socioeconomics from any of the alternatives because reduced bison herds could be restored.

LOSS IN LONG-TERM AVAILABILITY OR PRODUCTIVITY OF THE RESOURCE TO ACHIEVE SHORT-TERM GAIN

While it is possible that the bison population reductions expected under alternative 7 could lead to a long-term decrease (15 years and beyond) in wildlife viewing related visitation, the probability and extent of any such decrease is unknown.

UNAVOIDABLE ADVERSE IMPACTS

Unavoidable adverse impacts on socioeconomics would include reductions in winter snowmobiling and certain other oversnow travel under alternatives 2, 5, and 6, and reductions in wildlife-viewing opportunities under alternatives 5 and 7.

SUMMARY OF BENEFITS AND COSTS

The following is a summary of benefits and costs and other socioeconomic impacts of each of the eight alternatives.

Economic impacts were estimated from the perspective of several accounting frameworks, including benefit-cost, regional economic impacts, and financial impacts. The first section on benefits and costs is organized as follows:

The direct benefits of achieving the plan objectives are described.

The cost-effectiveness of the specific proposed actions are described.

The direct benefits and costs of each alternative are discussed in turn, relative to the "without plan" case. The implications of nonmarket values for interpreting the direct benefits and costs are also discussed.

A summary table is presented that compares the net benefits and costs of each alternative with respect to the no-action alternative (alternative 1).

Net present-value calculations, as presented in tables 65 through 72, use year-specific costs and benefits and a discount rate to calculate the value today of a stream of annual costs and benefits over a specific time period. In the analysis presented here, the time period over which the net present value is calculated is the 15-year period, 2000–2014. A real 7% discount rate, required by the Office of Management and Budget (1997) for benefit-cost analysis, is used in these computations. The application of a discount rate puts value on costs or benefits realized today more highly than those realized in future years. The further into the future an impact is realized, the lower its net present value would be. In the development of the following tables, annual costs and benefits for each year from 2000 to 2014 were calculated and discounted to the year 2000. Annual values used are detailed in this chapter on each respective impact topic. The discounted annual values were then summed to arrive at a net present value for the entire planning period.

This summary of impacts assumes that the state of Montana does not experience a tourism boycott.

BENEFIT AND COST IMPACTS

Benefits of Satisfying the Objectives

Alternatives 1 through 7 and the modified preferred alternative are designed to satisfy the objectives identified in table 11 of "The Alternatives" part. This section describes the benefits and costs of meeting these objectives.

Background. Since the *Draft Environmental Impact Statement* was published, several studies have been completed that provide guidance and information related to socioeconomic impacts relevant to this environmental impact statement. In the report entitled "*Wildlife Management: Negotiations on a Long-term Plan for Managing Yellowstone Bison Still Ongoing*" (GAO 1999) a number of deficiencies concerning the economic analysis in the *Draft Environmental Impact Statement* are discussed:

> "Although the *Draft Environmental Impact Statement* states that a primary factor motivating the development of a bison management plan is the potential for widespread economic consequences to Montana if brucellosis is transmitted from bison to cattle, the draft EIS does not estimate the risk of such transmission or the economic consequences of an outbreak of the disease. Without this more comprehensive information, the public and, ultimately, interagency decision makers may have difficulty assessing whether the economic consequences of an outbreak justify the costs of undertaking a particular preventive management action."
>
> "..."If the risks were known or could be approximated, the expected value of the costs of any alternative could be estimated and incorporated into a benefit-cost analysis to assess whether the alternative is worth doing."
>
> "...time constraints were part of a settlement agreement. Consequently, the contractor was unable to collect original data and relied instead on published studies of grizzly bears and wolves to approximate some of the benefits that would result from various bison management plans."
>
> "...Typically, in conducting a benefit-cost analysis, an economist will provide information on the most likely (the mean) net benefit for each alternative."

To summarize, the GAO (1999) report suggested incorporating the following elements into the economic analysis:

Estimate economic consequences of an outbreak of brucellosis to Montana's cattle industry.

Estimate risk of a brucellosis outbreak.

Compute expected (probability-weighted) costs and incorporate in benefit-cost.

Collect original data related to bison values and management.

Report mean estimates (rather than a range) where possible.

A second study that recently focused on the relevant issues is NAS (1998) report entitled *Brucellosis in the Greater Yellowstone Area*. This report examined a number of topics, including the risk of brucellosis transmission. Findings from the NAS (1998) report are incorporated into the economic analysis.

For the purpose of economic analysis, the nine objectives listed in table 11 of "The Alternatives" are consolidated into five major objectives:

Protect livestock industry from risk of brucellosis.

Provide for public safety and prevent private property damage.

Commit to elimination of brucellosis in wildlife.

Maintain a viable population of wild bison.

Conduct research and coordination.

Benefits of Protecting Livestock Industry from Risk of Brucellosis. The benefits of protecting the livestock industry are measured by the avoided costs of an outbreak. The following tasks were added to the economic analysis and the results are discussed in the following sections:

Identify costs of an outbreak.

Estimate risk of transmission.

Compute expected costs.

Potential consequences for Montana livestock producers of losing class-free status or of sanctions imposed by other states

Introduction — Economic impacts of brucellosis in cattle are summarized in the "Purpose of and Need for Action: Background" chapter of this final environmental impact statement. Producers with herds directly affected would suffer production losses due to the disease, as well as disrupted incomes due to quarantine and probable depopulation.[3] Other Montana cattle producers could be indirectly affected by a change in the state's brucellosis status or by actions taken by other states, even if Montana were to maintain its class-free

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[3]The discovery of reactors in a producer's herd could be devastating. If the producer decided against depopulation, income losses would be prolonged by herd movement restrictions. If depopulation was chosen, indemnity payments would probably not fully compensate for lost productivity gains (lost future income) from years of selective breeding and culling. Owners of herds approved for depopulation can choose between two methods of indemnification: a fixed rate method and an appraisal method (9 CFR, Part 51). Under the fixed rate method, indemnity does not exceed $250 per animal for nonregistered cattle other than dairy cattle and $750 per animal for registered beef cattle and nonregistered dairy cattle. Under the second method, the producer is paid the appraised market value of the animal minus its salvage value, with appraisals conducted by an independent appraiser selected by APHIS.

status. On the supply side, brucellosis testing would mean increased costs for producers. On the demand side, any doubts in the minds of out-of-state buyers regarding the health of Montana's test-eligible cattle (despite their having been tested) could mean lower prices. Producers could lose sales if customers chose to purchase livestock from other states.

If all of Montana were reclassified as class A, testing costs to producers are estimated to total between $5.1 million and $16.3 million per year. If the state were to acquire a two-area classification, with most of Montana remaining class-free and only the affected area reclassified as class A, testing costs would be much less, depending on the area reclassified, however, there would also be costs of maintaining a two-area classification. In either case, it would be at least a year before class-free status was regained, but probably not more than two to four years, depending on how quickly all the known foci of brucellosis in domestic herds were brought under control.

Potential price impacts are difficult to assess. If demand for Montana's test-eligible cattle dropped following the state's reclassification as class A (i.e., the prices producers received were to fall by one to three percent), the decrease in income for Montana's producers could be from $4.7 million to $22.5 million per year. If Montana was reclassified as class-free/class A split status, estimated price impacts would be proportionally smaller. Overall, the extent of price impacts or to what levels they would occur is not known.

For the livestock industry statewide, the estimated effects of testing and price impacts would have a minimal impact. In areas reclassified as class A, however, testing costs and the potential fall in prices could have severe financial consequences to individual producers.

Testing impacts —

Testing requirements for test-eligible cattle depend on whether the state's status is class-free or class A and where the cattle are being shipped.

Class-free and class A testing requirements[4]

Test-eligible cattle from certified brucellosis-free herds, regardless of the status of the state, may move without testing if the identity of the herd of origin is maintained. Test-eligible cattle that are moved interstate from a class-free state

[4]Regulations concerning interstate movement are found in 9 CFR, Part 78, Subpart B. Minimum standards of the Cooperative State-Federal Brucellosis Eradication Program regarding movement of cattle within and from class-free states or areas and within and from class A states or areas are found in chapter 2, parts II and III, of the *Brucellosis Eradication: Uniform Rules and Methods* (USDA, APHIS).

such as Montana also do not require brucellosis testing, only certification that identifies them as originating in a class-free state.

Test-eligible cattle are all cattle 18 months of age and over, except steers, spayed heifers, official calfhood vaccinates of dairy breeds under 20 months of age, and official calfhood vaccinates of beef breeds under 24 months of age. An official calfhood vaccinate is a female that was inoculated as a calf subcutaneously with an approved *Brucella* vaccine within appropriate age limits by a state or federal representative or an accredited veterinarian using the approved vaccination procedure. Official calfhood vaccinates that are parturient or postparturient are test eligible regardless of age.

A change in the brucellosis status of a state from class-free to class A results in basically two testing impacts: a negative test becomes necessary for test-eligible cattle moved interstate, and testing requirements are increased for dairy herds in the state. In Montana, dairy cows comprise about 1.2% of Montana's cows (including heifers that have calved) and beef cows comprise about 98.8%. The discussion, therefore, is directed to possible impacts for cattle moved out-of-state.[5]

For class A states, test-eligible cattle originating in nonquarantined herds may move interstate from a farm of origin directly to a farm of destination if they have had a negative test during the 30 days previous to interstate movement and are accompanied by a certificate. Cattle and bison may be moved interstate from a farm of origin without a certificate directly to a specifically approved stockyard for the required negative test. A certificate is required for those test-negative cattle that subsequently move interstate from an approved stockyard. (A postmovement test at 45–120 days is strongly recommended.)

To allow for ranching operations that regularly cross jurisdiction boundaries, an exception to class A testing is made under certain circumstances.[6] However,

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[5]For dairy herds, the brucellosis ring test must be conducted in a class A state or area at least four times per year at approximately 90-day intervals, with all herds producing milk for sale in the state required to be included in at least three of the four brucellosis ring tests conducted each year. For a class-free state, the level of brucellosis ring test surveillance is lowered to two brucellosis ring tests per year at approximately 6-month intervals, and each herd producing milk for sale in the state must be included in both tests. Thus a change from class-free to class A status would mean that Montana's dairy producers would face added testing and handling costs associated with the higher level of brucellosis ring test surveillance. Given the very small number of dairy cows compared with beef cows in Montana (18,000 compared with 1,542,000 head) these costs are noted but not included in the analysis.

[6]Testing requirements for interstate movement are not required if all of the following conditions apply:

a) The cattle or bison being moved are from a herd that is not known to be affected.

b) The cattle or bison being moved have not changed ownership and are not changing ownership.

c) the cattle or bison are from herds that have had a complete negative herd blood test within 12 months.

d) any cattle or bison that were added to the herd after the herd test also tested negative.

e) the cattle or bison being moved have not come in contact with cattle or bison not meeting these requirements.

Idaho and Montana have their own testing agreement for Idaho cattle that are grazed in the Yellowstone vicinity even though both states are class-free.

For a state to acquire class-free status, all cattle herds in the state must remain free of the field strain *B. abortus* for 12 consecutive months (9 CFR, Part 78.1). In addition, the state must successfully complete epidemiologic investigations of at least 95% of the market cattle identification reactor cases traced to the farm of origin during the 12-month period. Adjacent herds and herds from which cattle were received by an affected herd must be placed under quarantine and have individual herd plans in effect within 15 days of locating the source herd or recipient herd. If Montana was reclassified as class A, it would need to remain free of the field strain *B. abortus* for at least a year following successful elimination of the disease before it could regain class-free status. California was reclassified class A in September 1994 and then regained class-free status in October 1987. Florida and Louisiana were both reclassified from class-free to class A in 1998 and have yet to regain class-free status.

A recent regulatory change enables a state to maintain its class-free status following the detection of an affected herd if the state meets certain conditions.[7] These conditions include testing, quarantine, and depopulating the affected herd and conducting an investigation to ensure that brucellosis has not spread. This provision will encourage the prompt resolution of any isolated cases of brucellosis, making the loss of class-free status less likely. However, a state may retain its status in this manner only once during any two-year period, and other states could still take action on their own.

Reclassification of Montana as class A

Test-eligible cattle moved to other states — Montana State statistics on out-of-state movement of cattle are not categorized by whether or not cattle are test eligible. If the cattle are not purchased at a market in Montana, they are listed by the state, Canadian province, or country of destination, and grouped according to whether the animal is being moved to a feedlot, a change of pasture, an out-of-state market, or a slaughter plant. Out-of-state movements for 1997 from private sales, shown in table 57, totaled about 1.3 million head, with about 80% either going to feedlots or a change of pasture.

Destinations of the 1.3 million Montana cattle moved out-of-state in 1997 following private transactions included 47 states, 7 Canadian provinces, Argentina, and Mexico. A large proportion of the total number were moved to a relatively small number of states, with two-thirds of the 1.3 million head

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[7]Federal Register, March 31, 1999 (Vol. 64, No. 61, pp. 15,296–15,298).

shipped to five states: Iowa, Kansas, Nebraska, South Dakota, and Wyoming. Ninety-five percent of all privately transacted out-of-state movements are accounted for when shipments to Colorado, Idaho, Minnesota, North Dakota, and Washington are included as well. Presumably, a similar concentration of movement exists for cattle moved out-of-state following market transactions. Of these 10 states, only South Dakota is not class-free.

Table 57: Number and Percentage of Montana Cattle Purchased Other Than at Markets and Moved Out-Of-State, by Type of Destination, in 1997

	Head Count	Percentage
Feedlots	566,544	43.5
Change of pasture	478,429	36.7
Out-of-state markets	159,820	12.3
Slaughter plants	98,745	7.5
Total	1,303,538	100.0

SOURCE: Montana Department of Livestock 1997.

Test-eligible cattle are included in all four of the destination categories shown in table 57, for private transactions but their numbers are not known. The out-of-state movement of steers and other cattle not test-eligible would not be affected by a change in Montana's status. For the purposes of general approximation, it is assumed that from one-third to two-thirds of privately purchased cattle leaving Montana are test-eligible. They probably make up a majority of cattle destined for a change of pasture, but a much smaller share of those are moved to feedlots. For the market and slaughter plant destinations, even general statements such as these about the proportion that are test-eligible cattle are difficult. The one-third to two-thirds range is very broad, but nonetheless instructive as to the potential costs Montana's producers could face.

In addition to the out-of-state movements shown (table 57), 454,662 head of Montana cattle purchased at markets in Montana in 1997 were also moved out-of-state. An estimated two-thirds of these cattle were test-eligible (Tierney, MDOL, pers. comm.).

Cattle moved to out-of-state slaughter plants are not included in the calculation of potential testing impacts. Test-eligible cattle from a class A state or area that are not brucellosis exposed and from a herd not known to be affected may be moved interstate from a farm of known origin to a recognized slaughtering establishment without restriction. Subtracting these cattle (7.5% or 98,745 head in table 57) from the total number moved out-of-state following private transactions, leaves 1,204,793 head. Assuming similarly that 7.5% of the 454,662 cattle purchased at markets and moved out-of-state were destined for slaughter, leaves 420,562 head.

Annual testing costs, based on 1,625,355 (1,204,793 + 420,562) head of nonslaughter Montana cattle moved out-of-state are calculated to range between $5.1 million and $16.3 million, assuming the following:

Testing costs per head range from $7.50 to $15.00

From one-third to two-thirds of nonslaughter cattle sold privately and moved out-of-state are test-eligible.

Two-thirds of nonslaughter cattle purchased at markets and moved out-of-state are test-eligible.[8]

The $7.50 to $15.00 range in testing costs is the same as assumed in the *Draft Environmental Impact Statement*, and includes all veterinary and handling expenses. It is a cost borne entirely by the producer.[9]

In the past, individual states have imposed or threatened to impose testing requirements on breeding stock originating in Montana due to perceived risks, despite Montana's class-free status (see "Purpose of and Need for Action: Background" in the DEIS, pp. 25 and 26). Potentially, some fraction of the $5.1 million to $16.3 million costs could be incurred by Montana producers, if other states decided that risks posed by cattle from Montana justified such action despite Montana's class-free status. The size of the impact would depend on which states sanctioned their own testing requirements, the portion of Montana test-eligible cattle moved to those states, and opportunities for those movements to be redirected elsewhere. Assuming the testing requirements of states would be no more stringent than those required of a class A state, the collective cost of testing imposed by individual states would not exceed the $5.1 million to $16.3 million range calculated above.

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[8]($\frac{1}{3}$ x 1,204,793 + $\frac{2}{3}$ x 420,562) x $7.50 = $5,114,800. ($\frac{2}{3}$ x 1,204,793 + $\frac{2}{3}$ x 420,562) x $15.00 = $16,253,600.

[9]In past rule changes that reclassify the brucellosis status of states, a testing cost of $4.00 per head has been assumed by APHIS for analyses of impacts on producers. This amount may be a reasonable estimate of the cost veterinary fees for administering the test, but it does not take into account handling costs that would also be incurred. These costs vary considerably depending on the labor and equipment available to a producer. In extreme cases, portable corrals and hired labor to gather and work the cattle may be required. There are also hidden costs, such as stress caused to the cattle tested. A range of $7.50 to $15.00 per tested animal is therefore considered a realistic approximation. (Peterson, MDOL, pers. comm. and Linfield, MDOL, pers. comm.)

Test-eligible cattle moved to Canada — Included in table 57 are 2,622 cattle moved to Canada (almost entirely split between feedlot and change of pasture destinations).[10] Canada's certification requirements for breeding cattle imported from the United States may be summarized as follows. Cattle must

originate from a certified brucellosis-free herd

originate from a class-free state

originate from a class A or B state and from an established herd in which no evidence of brucellosis has existed either clinically or serologically during the 24 months prior to export

originate from a class A or B state and from an assembled herd with a complete herd test within 12 months (except animals under 6 months of age, spayed heifers, steers, and official vaccinates under 18 months of age according to Canadian standards)

Canada's definition of test-eligible cattle is similar to that of the United States.[11] A test is not required for steers, spayed heifers, or official calfhood vaccinates under 18 months of age. However, Canada accepts only animals vaccinated with strain 19 as official calfhood vaccinates, and all official calfhood vaccinates in Montana are vaccinated with RB51. Therefore, they must be tested as well.

The additional testing requirements for Montana producers exporting breeding cattle to Canada if Montana were to be reclassified as class A would be the following:

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[10]Movement of 23 head to Argentina and 62 head to Mexico was also recorded.

[11]Negative testing requirements for breeding cattle exported to Canada from class-free and class A or B states depend on the status of the herd and state.

- Certified brucellosis-free herd, regardless of the status of the state:
  One standard tube test or standard plate test on exported animals within 30 days prior to export.

- Class-free states:
  Established herd — One standard tube test or standard plate test on exported animals within 30 days prior to export.
  Assembled herd — Two standard tube tests or standard plate tests on exported animals at least 30 days apart. The second test must be conducted within 30 days prior to export.

- Class A and B states:
  Established herd — One standard tube test or standard plate test within 30 days prior to export. (All additions to the herd, except natural increases, must be tested at least 60 days prior to the qualifying test for export.)
  Assembled herd — One standard tube test or standard plate test on the complete herd within 12 months of export except for calves under 6 months of age. One standard tube test or standard plate test on individual animals being exported regardless of age except for calves born after any testing commences. The second test must be conducted at least 60 days after the complete herd test but within 30 days prior to export.

for established herds, additional testing of cattle introduced into the original herd

for assembled herds, an initial, complete herd test (not only the cattle being exported)

The impact, therefore, would depend on whether movement were from established or assembled herds. Given the very small number of cattle exported to Canada (0.2% of all cattle moved out-of-state), this impact for Montana's producers, overall, would be minor.

Class-free/class A status — If brucellosis infection of cattle herds in the Greater Yellowstone Area vicinity caused reclassification, it is possible that not all of Montana would need to be reclassified class A. APHIS may approve a state's division into two classification areas upon finding that: (1) the state has legislative and regulatory authority for maintaining separate areas; (2) the state has committed resources to enforcing the different requirements in each area; (3) the state has an effective method for monitoring and controlling movement of cattle across the intrastate boundary; (4) the state has defined the intrastate boundary by county lines or by recognizable geographic features such as rivers and highways; and (5) each area of the state meets the standards for the brucellosis classification requested.[12]

If one or more affected cattle herds in the Greater Yellowstone Area vicinity resulted in conditions requiring reclassification from class-free status to class A status, Montana's fulfillment of the requirements stated above could allow reclassification to be restricted to the affected area. The division of Montana into two areas of classification would significantly reduce total potential costs. As a hypothetical example, if Gallatin and Park Counties were to comprise the area reclassified as class A and assumptions regarding out-of-state sales of test-eligible cattle matched those assumed for Montana as a whole, then estimated testing costs would range from $168,800 to $536,400 per year.[13] If the area reclassified as class A were restricted to that corresponding to the SMAs for alternative 2 of the *Draft Environmental Impact Statement,* estimated testing costs for affected producers could total between $7,500 to $15,000 per year. Costs could possibly be as low as $2,500 to $5,000 per year, if only areas in

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[12] 9 CFR, Part 78.40.

[13] Cattle and calves sold by producers in Gallatin and Park Counties in 1997 totaled 54,630 head (28,278 head and 26,352 head, respectively), which represented 3.3% of Montana's cattle and calf sales (1,654,014 head) [1977 Census of Agriculture, Volume 1, Part 26, Table 14]. Assuming the same proportion of cattle moved out-of-state from the two counties are test eligible as is assumed for the state as a whole, then testing costs would range from (0.033) x ($5,114,800) = $168,800 to (0.033) x ($16,253,600) = $536,400.

which bison normally move when outside of Yellowstone National Park were reclassified.[14]

The feasibility of any of these divisions would depend on Montana ensuring a secure boundary between the areas. In the past, Florida has been split into class B and class C areas and subsequently into class A and class B areas. There has not been an instance when a state has been split into class-free and class A areas. Division would enable the majority of Montana cattle producers to continue to operate under class-free conditions. While the state would bear area surveillance and enforcement costs of maintaining the split status, these costs would presumably be less than those that would be borne by Montana producers if the whole state were reclassified class A.

In Florida's experiences with a two-area classification, the division between the two areas gradually shifted southward, as herds met conditions for reclassification and the more restricted area progressively diminished in size. The cost to Florida of maintaining a two-area classification, including expenditures on inspection stations and other surveillance measures, cannot be separated from other federal and state cooperative brucellosis program costs that were incurred. Even if it were possible to do so, costs for Montana would depend on its own circumstances — the area reclassified class A, construction and staffing of inspection stations, and other surveillance activities for monitoring and controlling the movement of cattle.

Price impacts

Brucellosis testing, as described above, would permit Montana's producers to market test-negative breeding stock out-of-state. However, there could still be out-of-state buyers who would not perceive the cattle as brucellosis risk free, and this doubt would be reflected in the prices they would be willing to pay for Montana breeding stock.

The extent to which out-of-state demand would diminish cannot be readily estimated. To exemplify the potential size of the impact, it is assumed that a decrease in demand would result in a 1%–3% decline in prices paid for Montana cows and heifers.

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[14]Given that 80%–90% of the cattle grazed in the West Yellowstone area are already tested yearly because of seasonal movements to and from Idaho, testing required due to class A classification could affect cattle moved out-of-state from herds having a combined inventory of roughly 1,000 cow-calf pairs. Assuming, as an upper bound, that all of these cows are moved out-of-state, the total testing cost would range from $7,500 to $15,000 per year. Only about one-third of these 1,000 cow-calf pairs on the north side of Yellowstone Park are in areas normally traversed by bison when they move off the park, implying that testing costs for a very geographically restricted class A area could total from about $2,500 to $5,000 per year. In all cases, there would be additional costs of monitoring and controlling movement of cattle across the intrastate boundary.

The average value of Montana cattle over the 10-year period, 1989 to 1998, was $691 per head.[15] A 1% decline in price would mean a decrease of $6.91, and a 3% decline would mean a decrease of $20.73. Using these price discounts, the annual price impact for Montana producers would range from $4.7 million to $22.5 million, assuming

1,204,793 head as the number of privately purchased cattle moved out-of-state (other than to slaughter)

one-third to two-thirds as the proportion of those that are test eligible

420,562 as the number of head purchased at markets and moved out-of-state (other than to slaughter)

two-thirds as the proportion of those that are test-eligible[16]

Under a two-area classification, if only Gallatin and Park Counties were reclassified class A, annual price effects could range from $155,500 to $741,300. In the more restrictive examples, annual price effects could range from $7,000 to $21,000, if the reclassified area corresponded to the SMAs under alternative 2 of the *Draft Environmental Impact Statement* or as little as $2,300 to $7,000 if only the area where Yellowstone National Park bison normally move when outside the park was reclassified class A.[17]

These costs are illustrative only. The degree to which demand for test-eligible cattle from Montana would be affected by the loss of its class-free status or by sanctions imposed by individual states is not known. To determine a price effect econometrically would be extremely difficult because of the many variables affecting cattle prices and the lack of interstate movement data that is specific for test-eligible cattle.[18] Possible analyses might seek to determine whether there were price impacts for California producers during the three

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[15]Calculated from values shown in Montana Agricultural Statistics 1998, p.82.

[16]($\frac{1}{3}$ x 1,204,793 + $\frac{2}{3}$ x 420,562) x $6.91 = $4,712,400. ($\frac{2}{3}$ x 1,204,793 + $\frac{2}{3}$ x 420,562) x $20.73 = $22,462,400.

[17]Assuming the same proportion of cattle moved out-of-state from the two counties are test-eligible as is assumed for the state as a whole, a 1%–3% drop in prices paid for cattle moved out-of-state from the two counties due to reduced demand would mean an annual price impact ranging from (0.033) x ($4,712,400) = $155,510 to (0.033) x ($22,462,427) = $741,260. Assuming 1,000 cow-calf pairs would be affected by reclassification of the Yellowstone vicinity that corresponds to the SMAs under alternative 2 (since most of the cattle in West Yellowstone are tested annually when moved from Idaho), the 1%–3% decrease in prices received would mean a loss in annual income ranging from $6,910 to $20,730 ([1,000] x [0.01] x [$691] and [1,000] x [0.03] x [$691]). Annual income losses would be approximately one-third of this cost range, namely, $2,300 to $7,000, if only areas usually occupied by Yellowstone Park bison when they are outside park boundaries were reclassified.

[18]Aubrey Bordelon and Greg Thessen, livestock specialists with NASS, and Mark Ashcraft, California Department of Food and Agriculture, Animal Health, personal communications.

years after losing and before regaining class-free status or might compare prices paid for test-eligible cattle moved from the six class A states to prices received by producers in the 44 class-free states.[19] In either case, information on the number of cattle affected and the prices paid for them is not available. Price data on cattle moved interstate do not distinguish between test-eligible and nontest-eligible cattle; only cattle inventory data are categorized in this method. Even if the number of cattle of concern could be determined, the many factors affecting cattle prices, temporally and spatially, would make it very unlikely that the impact of class A status on prices could be specified with confidence.

Personal experiences of livestock producers offer some insight into the impact on demand resulting from the loss of class-free status, but it is difficult to generalize from their individual observations. A cattleman in Florida, for example, noted that all things being equal, buyers will make purchases from a class-free area rather than a class A area, if only because of the latter area's additional paperwork requirements or other regulatory inconveniences. Another Florida cattleman did not think that the change in Florida's status from class-free to class A had resulted in any shift in demand, especially since nearly all of the herds are certified brucellosis free and the state is in the process of regaining class-free status. With respect to the 3-year period, September 1994 to October 1997, when California was class A, one individual familiar with that state's cattle markets thought the change in status probably caused little noticeable effect in demand by other states for California's test-eligible beef cattle. He suggested one possible reason was that the affected cattle were dairy cows in a part of the state well removed from major beef cattle producing areas. On the other hand, this same individual thought that if a neighboring state such as Nevada or Arizona were to be reclassified class A, demand by California buyers for its test-eligible cattle would be affected.

These informed opinions would suggest that out-of-state movement of test-eligible cattle from California and Florida was not greatly affected by their loss of class-free status. While buyers may be disinclined from purchasing test-eligible cattle from a class A state or area, the circumstances of each transaction — from the proximity of affected herds to the herd from which cattle would be purchased, to whether or not the herd from which the cattle would be purchased is certified, to relative prices and other advantages and disadvantages of purchasing from alternative sources — may support or lessen

[19]The six class A states are Florida, Louisiana, Missouri, Oklahoma, South Dakota, and Texas.

this disinclination. In conclusion, the impact on demand if Montana or an area within Montana were to lose class-free status is far from clear.

Putting the impacts in perspective

The impacts on Montana producers if they lost class-free status may be large or small. From the perspective of Montana's cattle industry as a whole, the effects may be considered manageable, whereas for an affected producer the consequences could be extreme.

If Montana were reclassified as class A and a decrease in out-of-state demand for its test-eligible cattle was to cause a decline in price by 1% to 3%, the combined impact is estimated to range from $9.8 million to $38.8 million per year. In 1997, cash receipts of Montana producers of cattle and calves totaled $865.7 million.[20] The estimated impact would be from 1.1% to 4.5% of gross income when averaged over all sales by all producers. The average impact would be greater if only affected producers are considered, i.e., those producers that move test-eligible cattle out-of-state. However, the 1.1% to 4.5% range is a fair approximation since the major share of Montana's cattle are sold interstate.

If affected herds in the Greater Yellowstone Area were to lead to Montana acquiring two-area class-free/class A, and other states recognized a two-area classification, then the impact statewide for Montana producers would be appreciably smaller. Assuming only Gallatin and Park Counties were reclassified, for example, the testing and demand impacts are estimated to total from $324,300 to $1,277,700 per year, which represents only 0.04% to 0.15% of cattle and calf cash receipts statewide.[21] The statewide impact would be even smaller if the class A reclassification was restricted to only the Greater Yellowstone Area vicinity.

These hypothetical reclassifications include a price impact of approximately the same magnitude as the cost of testing. The extent to which price impacts would occur is not known, and if they did not reach the 1%–3% level assumed, impacts described above in relation to statewide cattle and calf cash receipts would be overstated.

An individual producer in the state or in an area of the state reclassified as class A could have a very different point of view. Depending on the producer's circumstances, testing costs and price effects could significantly affect net returns. An analysis of costs and returns on cow-calf enterprises in Montana

[20]USDA, NASS, Montana State statistics.

[21]Based on testing costs for the two counties ranging from $168,800 to $536,400 and price impacts ranging from $155,500 to $741,300.

offers insight.[22] The study was designed to provide both production and financial performance characteristics of Montana livestock producers. Using an approach called Standardized Performance Analysis, 31 commercial cow-calf operations were analyzed. The operations were not selected randomly, but they do portray a cross-section of the cattle industry in Montana. For example, the average investment per breeding cow based on costs actually incurred was found to range from about $342 to $6,083. The overall average for the 31 producers was $1,737 per breeding cow.

The study found that the net pretax income per cow, after withdrawals, ranged from a minimum of a negative $538 to a positive $134, with an average of a negative $35. The same values, in economic terms, ranged from a negative $538 to a positive $83, with an average pretax income of a negative $108. Economic costs include the financial costs (out-of-pocket costs, depreciation, and interest expenses) plus the opportunity cost for owned land, raised feed, and equity capital.[23] When economic net returns are negative, owned resources are not receiving their opportunity value (e.g., land is not earning its cash lease rate).

This analysis highlights the fact that testing costs and potential price declines due to reclassification could be the difference between a positive and a negative net return for an operation, a cattle producer's profit margin may be extremely narrow. Impacts that do not appear to be major on a statewide level, could be devastating for an individual producer.

Finally, the impacts associated with the length of time a class A reclassification would last should be considered. The regulatory requirements for regaining class-free status, together with California's experience, suggests that a class A reclassification of all or part of Montana would probably last for several years.

In addition to these costs, there would also be the costs associated with depopulating the infected herds. The average herd size for active cattle grazing allotments to the north and west of Yellowstone National Park (table 23 and 25) is 86 cow-calf pairs or 172 head. Valuing these animals at the $750 value APHIS uses for registered beef cattle and applying this to both cows and calves yields a cost per herd of $129,000. For two such incidents the cost would be $258,230. This estimate should provide an upper limit as costs may be lower if cattle are not registered and the lower value of calves is accounted for.

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[22] "Comparative Analysis: Measuring Beef Production and Financial Performance with SPA," Duane Griffith, Montana State University (last updated 3/6/97).

[23] The opportunity cost of owned grazing land is the lease equivalent the land could be rented for if it were rented out for grazing. The opportunity cost of the raised feed land (and raised feed) is the net market value of the raised feed that is fed to the cow-calf enterprise. The opportunity cost of the remaining equity capital is the equity position times the real rate of interest.

Risk of transmission from wildlife to cattle — The issue of the risk of transmission from bison to cattle is central to an evaluation of the benefits and costs of the proposed alternatives. The NAS (1998) report notes (p. 43) that

> One of the most contentious issues — because it is key to determining the need for control of the disease in Greater Yellowstone Area wildlife — is the probability of transmission of brucellosis between free-roaming bison and domestic livestock. Nearly all parties to the controversy agree that the risk of transmission of brucellosis from bison to cattle in the Greater Yellowstone Area is small, but not zero. Defining small depends on whether transmission has occurred in the past and, if so, how often. That is key to determining the need to control brucellosis in bison.

For purposes of the benefit-cost analysis regarding this issue, it is necessary to define the with- and without-plan risk of transmission. The reduction in risk is a benefit of the plan.

First, with regard to "with-plan" risk, it appears to be approximately zero. All of the alternatives rely on temporal and spatial separation of cattle and the definition of a boundary beyond which bison will not be tolerated. The judgement of the NAS (1998) report is that "There is no risk of *Brucella abortus* transmission to cattle from bison if bison do not leave Yellowstone National Park." Because bison are not permitted into areas with cattle or are removed from areas where cattle will graze following adequate temporal separation (approximately 45 days), the risk of transmission is near zero. All of the alternatives described here incorporate this spatial and temporal separation. For example, alternative 1 relies on strict border enforcement to keep bison and cattle separate. Sometimes in an environmental impact statement the "no-action" alternative provides for "no program." Benefits are measured for a given alternative by comparison to this "no-program " alternative. For this case the "no-action" alternative is the current interim plan which has been in place with some modification since 1996. Since the "no-action" alternative essentially reduces the risk of transmission to near zero, and all other alternatives do likewise, there are no measurable benefits with regard to reductions in the risk of transmission for any of the alternatives. This anomaly has been noted by some commenters who responded to the *Draft Environmental Impact Statement.*

To address the question of whether the proposed expenditures on protecting the Montana cattle industry from brucellosis are justified, it is necessary to identify some "without plan" situations that are possibly worth avoiding. The *Draft Environmental Impact Statement* identified factors that affect the risk of transmission (p. v):

degree of association between potentially infectious and susceptible animals

number and density of infectious animals

number of susceptible animals

environmental factors affecting viability of organism outside host

class of infectious animals (pregnant bison are higher risk)

vaccination and neutering

some animals are naturally resistant

It is noteworthy that the NAS report (1998) recognizes that "The risk of transmission is determined by the number of abortions that occur, the presence and survival of *Brucella abortus* in aborted tissues, and the exposure to a susceptible host."

For purposes of this analysis, the planning areas of interest for the "without-plan" setting are the SMAs north and west of Yellowstone National Park and the planning period is 2000 to 2015. Estimating the bison population that would be wintering outside the park in the absence of a plan is problematic. The closest estimate would be the results from the stochastic model under alternative 2, which shows bison populations growing to a total of 5,246 animals by 2014, with 1,643 animals wintering on lands north and west of the park. However, this scenario includes substantial bison removals. With no removals and using an 8.2% annual growth rate, the population would reach about 8,000 animals by 2015, with an average of 1,500 bison wintering outside the park during the planning period (bison population estimates from the new stochastic model results were used in this analysis). The NAS (1998) study suggests a constant incremental growth model might be appropriate, which would lead to lower populations. This projection also relies on the general findings from the NAS report that natural regulation does not appear to limit bison populations in Yellowstone National Park, at least at the historical levels observed. As the study notes (NAS 1998) "The lack of stabilization of bison population growth over time since the natural regulation policy was adopted suggests that bison have expanded like a wave front across suitable habitat in [Yellowstone National Park] with little diminution until now they are pressing against the borders of Yellowstone National Park in winter." An unanswered question is, "At what population level would some bison no longer return to the park in the summer?"

With regard to other "without-plan" factors, the seroprevalence in bison is 30%–40%, the cattle population is potentially as high as 2,224 pairs (698 on allotments), calfhood vaccination of cattle in the SMAs is 100%, and the bison abortion rate is unknown. The NAS (1998) report cites only two known bison abortions in the last decade, but the probability of observing an abortion is probably quite low. A complicating factor is the presence of seroprevalent elk, which can reinfect bison or directly infect cattle. For the planning area, elk potentially mixing with cattle during pregnancy and birthing numbers 2,000 to 6,000, seroprevalence is low (1%– 2%), and the Northern elk herd abortion rate is unknown. These parameters are summarized in table 58.

TABLE 58: FACTORS AFFECTING RISK OF BRUCELLOSIS TRANSMISSION FROM BISON TO CATTLE, BY AREA

Factor	Without-Plan Northwest of Yellowstone National Park 2000–2015	Historical Northwest of Yellowstone National Park 1917–1989	Historical Jackson, Wyoming, Region 1969–present	
Bison population in cattle range	0 to 4,500[1] Mean of 1,541	Few to 150[2] (1943–1967)	16 to 380[3] (1969 to present)	
Bison seroprevalence[3]	30%–40%	20%–73%	77%	
Bison abortion rate	Not known	-	4% to 6%[6]	
Cattle population on allotments			**Grand Teton National Park[4]**	**Bridger-Teton National Forest[4]**
Before 6/15	-	-	1,425	4,106
After 6/15	698[5]	-	2,100	7,885
Cattle on private	1,526[5]	-	-	-
Total cattle	2,224	-	9,985	
Elk population in cattle range	2,000–6,000	-	9,300[4]	
Elk seroprevalence	1%–2%[3]	-	37.5%[3]	
Elk abortion rate	-	-	7%–12.5%[3]	

1. Based on 1999–2000 population of 2470, 8.2% growth and bison wintering outside park are the excess of population over 3500.
2. Meagher 1973.
3. NAS 1998 — as a percent of pregnancies.
4. Smith and Robbins 1994.
5. Tables 22 through 25.
6. Howe 1997. This is a wholeherd rate apparently over a 4-year period, based on the estimated 9 to 15 aborted fetuses over the years 1992–96.

Given the description of the "without-plan" setting, there are several ways to estimate the risk of transmission. One approach would be to develop a formal risk assessment model. Another approach is to estimate an approximate bound to the risk by examining the epidemiological record for the area in question or a similar area.

Brucellosis was first found in Yellowstone National Park bison in 1917. The border was controlled beginning in 1968. For the period 1942 to 1967, there were 22 instances where bison were known to have moved beyond west and north park boundaries (Meagher 1973). A number of bison were also outside the park in 1988 and 1989. It has not been possible to determine whether or not brucellosis transmission from wildlife to cattle has occurred from 1917 to present in this area, although no documented cases of such transmission are known. Several of the risk factors for the planning area in the historical period since 1917 and prior to formal control plans are also summarized in table 58. While many of the variables may be at the same or nearly the same level as for the planning period, bison populations in the past were much lower and occasions when bison were outside the park were limited compared with what is projected for the "without-plan" case. Given the much higher bison populations projected for future years, the historical epidemiological record for the planning area does not provide an upper bound to the future risk of transmission. In any case, the observed risk is zero.

A second possible source is to examine the epidemiological record for the Jackson, Wyoming, area — specifically Grand Teton National Park and the Gros Ventre drainage area of the Bridger-Teton National Forest to the west of the park. The Jackson bison herd became freeranging in 1969 and is thought to have acquired brucellosis from feeding with elk on the National Elk Refuge (in the mid-1970s. This herd has numbered from 16 to 380 (its current population level). The seroprevalence is estimated to be 77% and one study (Howe 1997) used an abortion rate of 4% to 6% (apparently as the number of estimated aborted fetuses over a four year period as a percent of the total herd size) for modelling purposes. The number of cattle on allotments in the area prior to June 15 include 1,425 in Grand Teton National Park and 4,106 on the adjacent Gros Ventre drainage area of the Bridger-Teton National Forest. Total cattle on the summer range are 9,985 pairs (Smith and Robbins 1994). The elk population wintering on the National Elk Refuge and Gros Ventre feeding grounds averages 9,300. The seroprevalence in these elk is 37% and the elk abortion rate is estimated to be 7%–12.5%.

In comparing the "without-plan" case and the historical Jackson area case, it appears that accounting for both population and seroprevalence and other things equal, the risk associated with the Yellowstone National Park bison population alone is about five times higher in the "without-plan." (This ratio is calculated from the data in table 58 using a mean of 1,541 bison for the "without plan" and an average seroprevalence of 35% in Yellowstone bison; and a mean of 150 bison and a seroprevalence rate of 77% for bison in the Jackson area.) However, this difference may be more than offset by the much greater association of cattle with wildlife in the Jackson area and the approximately five times higher cattle population at risk. North and west of Yellowstone National Park, bison are generally off the winter range and back in the park well before the first cattle come onto the allotments — and none of these are before June 15. (Of course, this could change if bison populations continued to grow unabated.) In contrast, most of the Grand Teton National Park cattle are on pasture by mid-May and about half the cattle on the Bridger-Teton National Forest are moved in before June 15. The NAS (1998) report notes "Bison are in contact with cattle as they cross private lands during migration and cattle trail driveways in spring and fall and on grazing allotments on Grand Teton National Park and U.S. Forest Service lands in summer (Smith and Robbins 1994). Another factor is the percentage of cattle that are calfhood vaccinated against brucellosis. This is known to be 100% at present in the planning area. The vaccination rate in the Jackson area during the historical period is not known, but at least one ranch in the near vicinity (the Parker Ranch at Dubois) is known to have had vaccination rates of only 20% to 40% for several herd samples in 1989 (based on court records for Parker v. United States).

In interpreting the epidemiological record for the Jackson area, it is noteworthy that the risk factor associated with elk in the Jackson area appears to be much greater than for elk in the planning area. There are large numbers of elk, the seroprevalence is relatively high, and the elk share late spring and summer range with large numbers of cattle. As the NAS (1998)reports "..the sheer numbers of elk, their proximity to grazing allotments, cattle trailing areas, and private ranches, and their relatively higher seropositive rates means that the relative risk of transmission of *Brucella abortus* from elk to cattle is greater than for the northern herd elk." However, in comparison to bison, elk are less gregarious and are less likely to associate with cattle.

As noted, the risk of transmission is largely a function of the number of abortions and exposure to a susceptible host. There is, unfortunately, considerable uncertainty about both seroprevalence rates and abortion rates. Nonetheless, it is instructive to roughly compare the approximate number of abortions for both bison and elk from the number of abortions published estimates listed in table 58. Although abortion rates for Yellowstone area elk and bison are unknown, they can be estimated based on rates for Grand Teton animals and adjusted for relative seroprevalence. Using these adjusted estimates of abortion rates, seroprevalence and populations, it is likely that the average number of combined bison and elk abortions through the planning period in the Jackson area herds would be about five to ten times higher than for Yellowstone area elk and bison. This is primarily due to the large number of serprevalent elk in and around the National Elk Refuge. Considering the much higher numbers of cattle in the Jackson area and the greater degree of association, the epidemiological record for brucellosis transmissions from wildlife to cattle for the Jackson area might provide an upper bound for an estimate for the planning area in the "without-plan" case. A key uncertainty is how the distribution and seasonal movements of the Yellowstone National Park bison herd would change as the population doubles from the previous maximum levels of nearly 4,000 bison.

The next section summarizes the epidemiological evidence on wildlife to cattle transmissions in Wyoming. This data is used to approximate an upper bound for the annual risk of transmission from bison to cattle north and west of Yellowstone National Park in the planning period. Following this, a statistical model is presented to estimate (given the probability of an occurrence in any given year) the probability of two occurrences in any given year or an occurrence in each of two consecutive years over the next 15 years (the planning horizon for this environmental impact statement). The occurrence of two brucellosis outbreaks within two years corresponds to the APHIS standard for changing a state or sub-state area from class-free to class A status, as noted in the preceding section.

Jackson area epidemiological record

The NAS (1998) report summarizes the controversy over the epidemiological record in the Greater Yellowstone Area:

> Advocates of no control maintain adamantly that no case of transmission of brucellosis from bison to cattle in the free-roaming state in the Greater Yellowstone Area has ever been documented. Advocates of the need to control the disease in bison to protect livestock in the surrounding areas maintain equally stoutly that there is clear epidemiologic evidence that transmission from wildlife has occurred at least six times in the recent past, two of which might have been due to bison.

The report then goes on to note that the epidemiological evidence is

> summarized in a field report submitted to APHIS in December 1966. Between 1961 and 1989, cattle on six ranches in the Greater Yellowstone

> Area became seropositive for brucellosis after testing brucellosis-free...In four of the cases, anecdotal evidence was provided that elk were adjacent to or moving onto the property; the other two cases included anecdotal evidence of elk and bison presence...Those six cases of purported transmission of brucellosis from wildlife to cattle are based on circumstantial evidence.

After considering the lack of documentation and record retention and noting the possibility that the disease might not have been entirely eliminated in cattle initially, the NAS (1998) report concludes that "Given the ambiguity allowed by epidemiological evidence in this situation, wildlife cannot be determined to be the source of brucellosis infection in these six cases."

The NAS (1998) report also notes that one of these outbreaks led to court cases (Parker vs. United States 1992; Peck vs. United States 1992). The Wyoming Supreme Court upheld the factual findings of the Wyoming Game and Fish Commission that Parker (a rancher) had failed to establish a causal connection between the presence of brucellosis in his cattle herd and the alleged presence of brucellosis in nearby elk or bison. Several of the justices assessed the evidence themselves and concluded that the probability of disease transmission from elk or bison to one or more of Parker's cattle was remote.

To conclude, the finding of both the NAS (1998) report (with regard to all six alleged wildlife transmissions) and the court case (with regard to just the Parker case) is that there is no solid evidence of a wildlife transmission to cattle in the Jackson area. A review of the APHIS report concerning these six cases show them all to be in Wyoming. Four of the cases were on ranches located a good distance (40 to 60 miles southwest and southeast) from Jackson near the towns of Alpine Junction, Wyoming (in 1961 and again in 1969 at the same ranch), Bondurant, Wyoming (in 1982), Cora, Wyoming (in 1983), and Etna, Wyoming (in 1985). In all of these cases, the alleged transmission was from elk, and in two of the cases, the ranches were in close proximity to state elk feeding grounds (Alpine Elk Feedground and Black Butte Elk Feedground). In any event, these four cases are well removed from the range of the Jackson elk herd and the Jackson bison herd. Of the two remaining cases, the only one in Teton County was at a ranch 6.5 miles north of Jackson — apparently in the Gros Ventre Junction area near the border of the National Elk Refuge and Grand Teton National Park. This transmission is alleged to have been from bison or elk, which certainly seems plausible given the location. However, Smith and Robbins (1994, p. 40) "Doubt remains whether this was an actual field-strain brucellosis infection or a vaccination phenomenon (e.g., inadvertent revaccination or infection with vaccine strain

Brucella abortus. Attempts to culture organisms from tissues of reactors were unsuccessful..." The only other case allegedly involving wildlife that could conceivably be from the Jackson herds was the previously mentioned Parker case (1989). However, this ranch is located on the other side of the continental divide about 60 miles east of Jackson and Moran Junction. The evidence in this case linking wildlife to the transmission is anecdote, e.g., "There was a bull bison sighting in one of Parker's allotments and several bison sightings on an adjacent allotment during late July and early August of 1988. It is unknown whether there was any commingling with cattle" (GYIBC 1997). As noted in the related court case, it was concluded that transmission from wildlife was not established.

To summarize, the NAS (1998) concludes there are no well-documented cases of wildlife transmission to cattle in the Greater Yellowstone Area. A more generous interpretation is that there might be, at most, two cases that could conceivably be traced to the Jackson bison and elk herds during the historic period.

Estimated risk of brucellosis transmission and loss of class-free status

Given the uncertainty of the epidemiological record, a range of probabilities were examined to approximate the annual risk of brucellosis transmission from bison to cattle north and west of Yellowstone National Park. The data can be interpreted in more than one way. The number of cases in Teton County from 1951 to the present is, at most, one Smith and Robbins (1994). This would imply about a 1 in 50 chance or an annual probability of 0.02. Given the uncertainty in the data, sensitivity of estimates to an even lower probability, such as 1 in 100 or 0.010, might be of interest. Another interpretation would be to consider only the record since Grand Teton National Park bison were free ranging (beginning in 1969) This would imply a 1 in 31 chance or a 0.032 annual probability. The most generous possible interpretation is that there have been two cases in the last 31 years or a 0.065 annual probability.

If the annual probability of an occurrence is known, the associated probability of a loss of class-free status for the Montana livestock industry can be computed. As noted, under APHIS regulations, two occurrences within a two years period if certain conditions are met. Per APHIS regulations, if only one affected herd is disclosed, but that herd cannot be depopulated within 60 days, (the owner will not allow it due to genetics, or if the herd is too large and funding is not available) or the associated required epidemiologic investigation and/or testing is not completed within 60 days, the state may still lose its class-free status. What is required then is to compute the probability of incidents in at least two consecutive years out of the next 15 years of the planning period. This problem can be approached using a Bernoulli model and a Poisson model.

It should be noted that it is also possible for a loss of class-free status to occur if there is an incident of brucellosis occurrence and the associated investigation discloses that the infection has spread to an associated herd. The APHIS report (summarized in GYIBC 1997) indicates that no reactors caused by contact with the infected herd were found in any of the associated or contact herds in any of the six cases. Although the probability of infection spreading is clearly not zero, this data suggests the probability is quite small and has not been modelled here. It is noteworthy that the investigations did disclose one reactor in the 1982 case near Bondurant, Wyoming. However, the infected cow was a 1981 import from another state that was kept at the home place and did not associate with the infected herd.

Bernoulli Model — Let n be the total number of years in the analysis and p be the probability of an incident in a given year. The Bernoulli model assumes that years are independent and that the probability of an incident is constant from year to year. Let X be the number of years with an incident in the n years. Then X has a binomial distribution with parameters n and p. Therefore,

$$\Pr(X=x) = \binom{n}{x} p^x(1-p)^{n-x}$$

Table 59 gives the values of these probabilities for n=15 and various values of x and p. The probability of at least one incident in 15 years is then one minus the probability of no incidents (x=0).

TABLE 59: PROBABILITY OF INCIDENTS IN *X* YEARS OUT OF 15 WITH PROBABILITY *P* OF AN INCIDENT IN ANY ONE YEAR (BERNOULLI MODEL)

p	*x*				
	0	1	2	3	≥4
.010	.8601	.1303	.0092	.00040	.00001
.020	.7386	.2261	.0323	.00286	.00018
.025	.6840	.2631	.0472	.00525	.00043
.032	.6139	.3044	.0704	.01009	.00108
.065	.3649	.3805	.1852	.05578	.01364

The probability of incidents in at least two consecutive years out of n years is more complicated to compute. It is easier to look at the probability of the complement of this event, i.e., the probability of no run of at least two years with incidents over n years. Let A_i be the event that there is no run of at least two years with incidents over a period of i years. Then $\Pr(A_i)$ can be calculated recursively:

$$\Pr(A_i) = (1-p)\Pr(A_{i-1})+p(1-p)\Pr(A_{i-2})$$

The probability of no run of two incidents in i years can be broken down into two cases: either there isn't an incident in the i^{th} year or there is an incident. If there isn't an incident in the i^{th} year (probability $1-p$), then the probability of no run of two incidents for all i years is the probability of no run of two in the first i-1 years. This is represented by the first term on the right-hand side of the equation. If there is an incident in the i^{th} year (probability p), then the probability of no run of two incidents is the probability of no incident in the (i-1)th year times the probability of no run of two in the first i-2 years. This is the second term on the right-hand side of the equation. Need to note that

$$\Pr(A_0) = \Pr(A_1)=1$$

Table 60 gives the probability of incidents in at least two consecutive years out of 15, i.e., $1-\Pr(A_{15})$, for various values of p.

Table 60: Probability of Incidents in At Least Two Consecutive Years Out of 15 Years with Probability p of an Incident in Any One Year (Bernoulli Model)

p	Probability of Incidents in Two Consecutive Years out of 15
.010	.00139
.020	.00549
.025	.00852
.032	.01384
.065	.05455

Poisson model — The Bernoulli model does not take into account the possibility of two or more incidents in one year. Since the empirical data does not allow the direct estimation of two or more incidents in one year, it is necessary to build a model. A reasonable starting model would be the Poisson model, which assumes incidents happen randomly over time. The parameter of the Poisson is the mean number of incidents per unit of time (one year, in this case). If X is the number of incidents in one year, then the probability of x incidents in one year is given by

$$\Pr(X=x) = \left(\frac{e^{-\lambda}\lambda^{x}}{x!}\right), \text{ where } x=0, 1, 2\ldots$$

The probability of either two or more incidents in one year or one incident in each of two consecutive years is of primary interest. To calculate this probability, this set of outcomes is divided into two disjoint subsets: B_1 — two or more incidents in at least one year out of n, and B_2 — no more than one incident in any one year but incidents in at least one run of two consecutive years. Then

$$\begin{aligned}\Pr(B_1) &= 1\text{-}\Pr(0 \text{ or } 1 \text{ incident in each of } n \text{ years})\\ &= 1\text{-}[\Pr(X=0)+\Pr(X=1)]^{n}\\ &= 1\text{-}[e^{-\lambda}+\lambda e^{-\lambda}]^{n}\\ &= 1\text{-}[(1+\lambda)e^{-\lambda}]^{n}\end{aligned}$$

The probability of B_2 is the probability of no more than one incident in any one year times the conditional probability of incidents in at least one run of two years, given no more than one incident in any of the years, i.e.,

$$\begin{aligned}\Pr(B_2) = 1\text{-}&\Pr(0 \text{ or } 1 \text{ incident in every year}) \times\\ &\Pr(\text{incidents in at least 2 consecutive years} \mid 0 \text{ or}\\ &1 \text{ incident in every year})\end{aligned}$$

The first of these probabilities is simply 1-$\Pr(B_1)$; the second is computed just as 1-$\Pr(A_i)$ was computed in the previous section, except that the probability of an incident in any one year is now the conditional probability of one incident given there were 0 or 1 incidents:

$$\begin{aligned}p &= \Pr(X=1 \mid X=0 \text{ or } X=1)\\ &= \frac{\Pr(X=1)}{\Pr(X=0 \text{ or } X=1)}\\ &= \frac{\lambda e^{-\lambda}}{e^{-\lambda}+\lambda e^{-\lambda}} = \frac{\lambda}{1+\lambda}\end{aligned}$$

The probability of either two or more incidents in one year or incidents in two consecutive years is $\Pr(B_1) + \Pr(B_2)$ since B_1 and B_2 are disjoint. This probability is calculated for several values of λ in table 61, where λ represents the mean number of incidents per year. This would normally be estimated from sample data by the total number of incidents observed over some number of years divided by the number of years.

Table 61: Probability of Two or More Incidents Either in One Year or Over Two Consecutive Years

λ	r(B_1)	Pr(B_2)	Probability of Either Two Incidents in One Year or Incidents in Two or More Consecutive Years = $\Pr(B_1)+\Pr(B_2)$
.010	.00074	.00136	.00210
.020	.00296	.00526	.00822
.025	.00460	.00808	.01268
.032	.00749	.01292	.02041
.065	.02992	.04694	.07686

Violation of the model assumptions — The models in previous sections assume that the probability of an incident is constant from year to year. This assumption would not be valid if incidents are more likely to occur under certain environmental conditions than others. It is likely that the probabilities computed for the Bernoulli model would not be overly affected if the yearly probability of an incident varied randomly by a relatively small amount over time and that probabilities from year to year were independent. However, if the yearly probabilities were positively correlated over time, then the probability of incidents in two consecutive years would be higher than those calculated for the Bernoulli model. The same is true for the Poisson model if λ (the mean number of incidents per year) varied from year to year. The probability of two or more incidents in one year would also be increased in the Poisson model if λ varied, even if the λs were not serially correlated.

Although the Bernoulli and Poisson models could be modified to incorporate varying p or λ, there is not enough information available to quantify how much these parameters should vary and whether there is serial correlation and how much variation exists. Even experts in the field would have difficulty quantifying these parameters since knowledge is limited and little information exists in the literature.

The general finding of these models is that the Poisson model generally provides a more conservative result (higher risk of loss of class-free status, given any specific annual probability). Table 62 provides a summary of the plausible range of annual probabilities and the associated estimates of the probability of a loss of class-free status. This table also shows the probability weighted expected costs of a loss of class-free status in Montana over the next 15 years. This is computed using the economic costs associated with the loss of class-free status outlined in a previous section. For example, if the class-free status changes to a class A area for the entire state of Montana, additional testing costs per year are estimated to be $5.1 million to $16.3 million with a mean of $10.7 million. The loss of class-free status is assumed to last for three years. Since the loss could occur beginning in any of the next 15 years, an average present value factor (0.607) is used for each of the 15 years. Including depopulation costs of two herds (see notes to table 62), the total present value is $19.63 million. If the probability of a loss of class-free status is 0.00210 (corresponding to an annual probability of occurrence of 0.01, then the expected cost is $41,223. However, if the annual probability is 2 in 31 years or 0.065, the expected cost over the life of the plan has a present value of $1.5 million. This would correspond to an annual expected cost of $166,000 each year over the life of the plan.

This latter value provides an approximate upper bound for the expected costs of losing class-free status in the "without-plan" case and accordingly, is also a measure of the upper bound, for the benefits associated with controlling the risk of transmitting brucellosis from bison to cattle in any of the alternatives. This is an upper bound based on the interpretation of the epidemiological record for the Jackson area where, at most, no more than two cases of transmission of brucellosis actually occurred in this area from 1969 to present.

Table 62 also shows the range of costs for alternative institutional responses to the loss of class-free status. As noted, APHIS regulations allow a state to choose a two-area classification; a class A area smaller than the entire state can be established if necessary. By establishing a class A area equal to just Park and Gallatin Counties or even just the SMAs, Montana could greatly reduce the expected cost and risk to its cattle industry associated with a possible loss of class-free status. The enforcement costs and most plausible boundaries for such an area are beyond the scope of this investigation. However, given that the potential areas are in a corner of the state and bounded on several sides by Yellowstone National Park and by the Idaho state line on another side, the costs of monitoring and enforcement could be comparatively low. For example, there are only three roads leading out of the SMAs and into

Montana (U.S. Highway 89 passing through Yankee Jim Canyon north of Gardiner, U.S. Highway 287 west into the Madison Valley, and U.S. Highway 191 north through the Gallatin Valley).

The probabilities in table 62 can also be used to compute the regional economic impacts to the state of Montana that could arise from a statewide or smaller area loss of class-free status. For example, for the statewide case, the effect of a price reduction could be a loss of $4.7 million to $22.5 million to Montana producers per year. Note that from a national benefit-cost standpoint, this price reduction is a cost to producers but has an equivalent benefit to buyers and so has a zero net impact on benefit-cost. From the standpoint of regional economics, however, the loss is only partially offset by compensation for herd reductions.

Table 62: Expected Costs of Loss of Montana, Two-County, or SMA Class-Free Status as a Function of Observed Annual Probability of Brucellosis Infection in Cattle

Odds of Infection[1]	Annual Probability of Infection	Probability of Loss of Class-Free Status[2]	Expected Costs of Loss of Class-Free Status		
			State[3]	Two County[4]	SMA[5]
1/100	.010	.00210	41,223	1,678	372
1/50	.020	.00822	161,359	6,566	1,457
1/31	.032	.02041	400,648	16,304	3,617
2/31	.065	.07686	1,508,762	61,398	13,622

1. For example, observed infection of cattle in 100 years.
2. Based on Poisson model of probability of 2 or more incidents in any 1 year or 2 or more consecutive years out of 15 years.
3. Present value for state of Montana loss of class-free status in mean annual testing costs of $10.7 million for 3 years, present value factor for average of any year in 15 is .607, herd size at 172 head and per head value of $750, depopulation per herd is $129,115 for 2 herds, total present value is $19.63 million.
4. Present value for Park and Gallatin County testing costs annual means of $352,600, other parameters same as the state, present value of $798,830 plus unknown costs of maintaining and defining the boundary.
5. Present values for SMAs north and west of Yellowstone National Park and average testing costs of $4,250, other parameters same as state, total present value of $177,231 plus unknown costs of maintaining and defining the boundary.

Given the considerable uncertainties involved in estimating the risk of transmission, table 63 is provided to offer decision makers another way of viewing the problem. The costs of the alternatives are known with greater certainty than the benefits of controlling the risk of an outbreak. Given the costs of achieving the objective of protecting Montana's livestock industry from brucellosis for any given alternative, one can compute the associated break-even probability of an occurrence. The latter is the probability level that would make the benefits of risk reduction (the expected costs of avoiding a loss of class-free status) just equal to the cost of implementing an alternative. For example, if an alternative would cost $216,000 per year over the life of the plan to reduce brucellosis infection risk to near zero, the probability of an occurrence necessary to justify this level of expenditure is one in 13.3 year (or 0.0753). (Recall that the highest probability associated with the Jackson area epidemiological record is 2 in 31 years or 0.0645.) This assumes that the state of Montana does not choose to economize on the cost of a loss of class-free status and the entire state is reclassified. If the state chose to split out a separate class A area, it would need to be known with certainty (probability 1.00) that not only would class-free status be lost in the next 15 years, but also that it would occur more than once.

TABLE 63: BREAKEVEN PRESENT VALUE AND ANNUAL COSTS TO CONTROL BRUCELLOSIS RISK GIVEN PROBABILITY OF OCCURRENCE

Frequency of One Occurrence Per Year	If Probability of an Event is:	Probability of Loss of Class-Free Status[1]	Breakeven Expected Costs[2] (millions $)	Breakeven Annual Costs (millions $)
1/13.3	.0753	.1000	1.963	0.216
1/8.8	.1131	.1999	3.924	0.431
1/6.8	.1468	.2999	5.887	0.646
1/5.6	.1801	.4001	7.854	0.862
1/4.7	.2148	.4999	9.813	1.077
1/3.9	.2532	.5999	11.776	1.293
1/3.4	.2983	.7000	13.741	1.509
1/2.8	.3564	.8000	15.704	1.724
1/2.2	.4464	.9000	17.667	1.940

1. Poisson model of 2 or more incidents in any 1 year or incidence in 2 or more consecutive years out of 15 years.
2. Assume state loss of level class A status for three years, cost of testing and herd depopulation present value is $19.63 million.

As another example, if the annual costs of reducing the risk of brucellosis were around $1.5 million, and assuming the entire state goes to class A status, a brucellosis outbreak would be expected every 3.4 years.

Benefits of Public Safety and Avoided Private Property Damages. Based on the discussion in "Affected Environment," the benefits associated with protecting public safety and preventing private property damage are relatively small and have not been quantified.

Commit to Eliminating Brucellosis in Wildlife. The NAS (1998) report characterizes this objective as "Total eradication of brucellosis as a goal is more a statement of principle than a workable program at present: neither sufficient information nor technical capability is available to implement a brucellosis-eradication program in the Greater Yellowstone Area." As a statement of principle, it is difficult to identify any direct benefits for this objective. Possible nonmarket benefits are discussed below.

Viable Population of Wild Bison. The "without plan" would result in a larger bison population than any of the listed alternatives. Accordingly, the "benefits" associated with this objective for the various alternatives are, if anything, negative. More pragmatically, the direct benefits of changes in the bison population are related to the direct use visitors make of these animals on their visits to Yellowstone National Park. This use is limited to observation and photography. While these direct-use values are in aggregate probably very large, the marginal values associated with the range of populations proposed could be quite small. In any case, the only available empirical estimates (discussed in "Affected Environment") are not significantly different from zero.

Research. While there is considerable ongoing research related to the bison-brucellosis issue (see appendix D), almost all of this work is ongoing outside the context of this environmental impact statement. The only action item related to this objective is a relatively low-cost item, wildlife/winter-use monitoring. The separate benefits of this objective would be difficult to estimate and to date, have not been estimated.

Cost-Effectiveness of the Alternative Actions and Objectives

A number of comments on the *Draft Environmental Impact Statement* suggested a need to provide a cost-effectiveness evaluation of the various alternatives. This type of analysis requires an evaluation of the costs and benefits of the specific proposed actions.

Table 64 provides a list of the many different specific proposed actions organized by the objectives they are intended to fulfill. This list draws on all of the alternatives and is intended to represent the full set of more-or-less generic possible actions that the different alternatives draw upon.

Protecting Livestock from Risk of Brucellosis. Most of the actions fall under the objective of protecting livestock and the livestock industry from brucellosis. An approximate upper bound to the direct benefits of achieving this objective was previously discussed and is estimated at $1.5 million (present value) or an annual value through the life of the plan of about $163,000 per year. This value is predicated on a loss of class-free status for the state of Montana. If a loss of class-free status could be restricted to a smaller area, such as Park and Gallatin Counties or the SMAs proposed in this plan, the costs are much lower. Implicitly, the development of a contingency plan for defining a smaller potential class A area is one specific cost-effective action that has not been included in the plan.

With respect to the general objective, the NAS (1998) report emphasizes that the separation of cattle and bison is a plausible first step to lowering the risk of brucellosis infection. This step is related to the objectives of defining and controlling a border beyond which bison are not tolerated and controlling bison populations. The major actions proposed for achieving these objectives are monitoring bison; agency shooting; bison hunting; capture, test, and slaughter operations; and quarantine. Monitoring bison is low cost ($44,000 annual) and is a necessary part of any of the other actions. Bison hunting has action-specific benefits (license fee revenues and nonmarket benefits to hunters) that potentially offset the direct costs — making this a low cost and cost-effective possible action. Hunters alone could not be relied on to maintain a border, which creates more of a population control action. There is additional uncertainty associated with this action in that it requires approval by the Montana legislature and eventually, acceptance by the public.

Table 64: Benefit-Cost of Bison Management Objectives and Actions — Summary of Range of Alternatives

Objective/Action[7]	Direct Benefits and Costs: Annual Costs[9]	Direct Benefits and Costs: Present-Value Costs	Direct Benefits and Costs: Present-Value Benefits	Present Value of Nonmarket Costs or Benefits	Net
(A) Protect Livestock from Risk of Brucellosis[1]					
1. Monitoring of bison	44,000[10]	400,700	≤1,514,000[2]	-	-
2. Agency shooting	[11]	-	≤1,514,000[2]	-	-
3. Calfhood vaccination of cattle with RB51	-	[13]	≤1,514,000[2]	-	-
4. Surveillance testing of cattle	-	-	-	-	-
5. Other cattle management actions[3]	-	-	-	-	-
6. Modify national forest grazing allotments	-	88,000[18]	-	-	-
7. Bison hunting	66,000[16] 389,200	481,000 175,100	185,700–	58,400–	-
8a. Capture, test, and slaughter operations at boundaries	264,000– 963,500	2,471,294– 8,829,400[12]	128,500– 475,400[19]	-	-
9. Vaccination of bison	330,500– 338,000	2,145,000– 2,321,100	-	-	-
10. Quarantine bison 4,372,600[15]	447,500[14] 1,796,300	4,282,100–	825,800–	-	-
11. Winter road grooming	55,000– 575,960[21]	401,500– 1,511,500	[22]	-	-
(B) Public Safety, Private Property Damage					
12. Remove bison at landowner request[4]	-	-	-	-	-
(C) Commit to Eliminating Brucellosis in Wildlife					
8b. Herd-wide capture, test, and slaughter operations — alternative 5[5]	2,636,760	11,292,000	376,400	1,695,150[5]	-

Table 64: Benefit-Cost of Bison Management Objectives and Actions — Summary of Range of Alternatives *(continued)*

Objective/Action[7]	Direct Benefits and Costs			Present Value of Nonmarket Costs or Benefits	Net
	Annual Costs[9]	Present-Value Costs	Present-Value Benefits		
8c. Herd-wide capture, test, and slaughter — alternative 6[23]	2,132,560–2,678,160	9,931,357	411,600	-	-
(D) Viable Population of Wild Bison[6]					
13. Bison population range[8]	-	0[17]	-	-	-
14. Bison management on public lands	-	-	-	-	-
15. Acquire additional wildlife habitat	-	15,100,000[17]	-	4,177,700–4,177,727	-
(E) Research					
16. Wildlife/winter-use monitoring	5,500–27,500[20]	50,100–200,747	-	-	-
TOTALS	-	5,705,241–15,822,800	1,642,500–3,785,700	81,700–4,203,100	(8,768,700) -81,959

1. Includes objectives 1,2,5, and 6 in table 11.
2. Benefit to satisfaction of all four objectives is the expected present value of loss of class-free status for the entire state, if based on a risk of brucellosis infection, is 2 in 31 years. For Gallatin and Park Counties, the corresponding estimate is $61,398. For the SMAs it is $13,622.
3. Other cattle management actions are listed under the same objective/alternative in table 11, but are not line items in table 12 or line items in alternative-specific cost tables, including: 1) test/vaccinate adult cattle and 2) conversion to steer/spayed heifer operations.
4. Bison hunting could also contribute to this objective, but is not sufficient to accomplish it.
5. Vaccination of bison may also contribute to this objective, but is not sufficient to accomplish it.
6. Also includes elements of objective 1.
7. List of actions based on table 11, except for addition of "other cattle management actions." Contingency plans not listed as a separate action may modify timing or extent of many actions listed here.
8. This is more of an outcome than an action.
9. Costs are derived from alternative specific cost tables to the extent possible. Costs are often not broken out at the action/objective level.

Table 64: Benefit-Cost of Bison Management Objectives and Actions — Summary of Range of Alternatives *(continued)*

10. Based on alternative 2.
11. Based on alternative 2.
12. Alternatives 7 and the modified preferred alternative etc. assume capture facility costs are sunk costs (total of $379,000, modified preferred alternative). Includes equipment repair and replacement.
13. No specific costs were broken out in the "Alternatives" cost tables for this action.
14. Based on the modified preferred alternative.
15. Includes average of range of costs $550,000 to $880,000, (alternatives 7 and 8) for quarantine facility.
16. Alternative 7.
17. $29.1 million to acquire level 1 (exp. alternatives 7 and 8) are sunk costs (lands already acquired). Cost for level 2 is based on alternative 2 less $29.1 million.
18. Based on alternative 2.
19. Revenue from sale of hides, horns, and meat is based on average $337 value per animal.
20. Alternative 2.
21. Snowmobile enforcement, alternative 2.
22. Savings from not plowing roads in alternative 2.
23. Alternative 6.

The actions remaining that would actually control bison population are the alternative actions, including agency shooting, capture, test, and slaughter operations, and quarantine. Only agency shooting is justified within the range of estimated direct benefits — costs of about $200,000 per year are somewhat more than estimated benefits. Capture, test, and slaughter operations include facility costs and costs vary across alternatives from $2.5 million to $8.8 million (present value). This is only partially offset by revenues from the sale of slaughtered animals. There is an additional unquantified benefit of reducing seroprevalence in bison, but this benefit is likely to be small, given the remaining risk to be controlled once spatial and temporal separation is ensured. Another perspective on the benefit of reducing seroprevalence, e.g., by about one-half, is that this has about the same effect on risk as reducing the number of cattle at risk by one-half. Accordingly, there are more cost-effective ways of achieving similar reductions in risk, such as modification of national forest grazing allotments. The value of the past grazing resources is relatively low (around $2 to $12 per animal unit month) and the one-time administrative costs are also low.

Quarantine costs are around $4.3 million, but costs can be offset by $0.8 to $1.8 million when live bison are either sold or distributed. These live bison will leave the park and could be used for commercial or tribal livestock operations. Accordingly, their value is based on the auction value for live bison. Quarantine cannot be justified based on the cost relative to the total benefits for this objective. It is also not a cost-effective way to produce disease-free bison for commercial herds, since each bison will cost two to four times as much as it will return. These costs are high because of facility and operating costs and the amount of time bison will have to be in quarantine.

The lowest cost actions listed in the table are for the management of cattle. These include calfhood vaccination, surveillance testing, testing/vaccination of adult contact cattle, and conversion to steer/spayed heifer operations. All of these actions are likely to be cost-effective. Some of these are already being undertaken but exact costs (conversion to steer/spayed-heifer operations) have not been computed. The latter costs are likely to be low since the potential number of livestock involved is small and the costs are bounded by the net economic returns to these herds.

With respect to winter road grooming, the costs are within the range of the direct benefits for this objective. However, the NAS (1998) report suggests that in the long-term, the contribution of this action to the objectives at issue may be low or negligible. The report (NAS 1998) notes that bison movement seems to be mostly correlated to bison populations and secondly to snow depths and concludes "The suggestion that discontinuing winter road grooming will contain bison better within [Yellowstone National Park] and that starvation and other natural factors will relieve the need for artificial control outside the park appears optimistic." To date, the research to test this hypothesis by closing roads has not been undertaken. Given a possibly low probability of contributing to the objective, the known costs of road grooming likely outweigh the expected possible benefits.

Public Safety and Private Property Damage. The only specific action mentioned to satisfy this objective is removal of bison at landowners request. The costs for this action have not been separately calculated but the costs are likely to be low, as are the benefits of the avoided costs of damage.

Commit to Eliminating Brucellosis in Wildlife. The NAS (1998) study suggests that this objective can be interpreted as a statement of principle. The direct benefits of committing to a statement of principle would be difficult to quantify. Vaccination could be listed as an action under this objective as evidence of a commitment. However, vaccination is included in the first set of objectives related to protecting livestock from brucellosis. Accordingly, vaccination as an action is examined under the first set of objectives relating to protecting livestock from brucellosis.

Herd-wide capture, test, and slaughter operations is a specific action that could be used to aggressively lower seroprevalence, as it has been in alternatives 5 and 6. The difference is that in alternative 6, the herd-wide capture, test, and slaughter operation is preceded by efforts to reduce seroprevalence through vaccination. Given the already low risk levels of brucellosis infection achievable by separation of bison and cattle and by cattle management actions, the direct benefits of these actions relative to the first set of objectives are small relative to the costs. The only quantifiable benefits are nonmarket, in that some individuals may value knowing that bison are brucellosis free. These values have been estimated as discussed in "Affected Environment."

The present value of these benefits depends on when they are realized (when zero seroprevalence is achieved). The NAS (1998) report suggests that not enough is known at present to achieve this in bison and the disease would also have to be controlled in elk. The NAS (1998) report provides some specific management examples from Custer State Park and Wind Cave National Park where a herd-wide capture, test, and slaughter operations was used to control brucellosis in bison. This data suggests that achieving zero seroprevalence would take 10 and 20 years under alternatives 5 and 6 respectively, even where the number of bison and the setting were similar to a commercial ranching operation. These estimates have been used to compute a present value to benefits — implicitly discounting for both time and risk. A herd-wide capture, test, and slaughter operation similar to alternative 6 does not achieve zero prevalence in the planning period. The finding is that the direct benefits of these actions are quite small relative to costs, and the costs are also about double the estimated nonmarket benefits. The estimated nonmarket benefits are only based on the values attributable to Yellowstone National Park visitors and regional (Idaho, Montana, and Wyoming) residents. If reliable estimates were developed for the national population, the estimated nonmarket benefits would likely exceed costs. However, given that most survey respondents opposed herd-wide vaccination and slaughter, there are likely also considerable values associated with not having such a vaccination program. Information related to nonmarket benefits for vaccination would require further research.

Viable Population of Wild Bison. Three actions have been proposed related to this objective. The bison population size and range is less of an action than an outcome measure or constraint. The other two actions, bison management on public lands and acquiring additional wildlife habitat, in themselves have only a small impact on total bison populations. The upper limit to the number of bison allowed outside the park between, for example, alternative 1 and the modified preferred alternative, is only 150 to 300 versus 400. Most of the acquired habitat is north of Reese Creek, which is expected to support an additional 100 bison. None of the alternatives considered allows for bison populations approaching levels that would threaten herd viability. Accordingly, the direct benefits of achieving this objective have not been quantified.

Nonmarket benefits for acquiring winter range have been estimated, as discussed in "Affected Environment." Acquisition is proposed at several levels that vary with each alternative. The first level uses a total budget of $29 million in the *Draft Environmental Impact Statement* and was primarily intended to purchase the Royal Teton Ranch and possibly other lands north of Reese Creek. The lands targeted in this budget have now been acquired; these costs are sunk costs and do not appear as costs in tables 64–72. The nonmarket present value of benefits of this action is estimated at $4.2 million, assuming that the lands begin to serve their purpose as winter range in the year 2002. A higher level of acquisition has also been proposed (total budget of $43 million or $15 million net of the sunk costs). The benefits of this increment of winter range has not been estimated. It appears that neither of these levels of acquisition would be justified based on nonmarket values attributable to Yellowstone National Park visitors and regional (Idaho, Montana, and Wyoming) residents. However, if reliable estimates were developed for the national population, the estimated nonmarket benefits would likely exceed costs.

Research. An extensive research agenda is described in appendix D. However, the only action related to research listed in any of the alternatives is wildlife/winter-use monitoring related to winter road grooming. The costs of this monitoring is relatively low. The benefits have not been quantified.

Direct Benefits and Costs of the Objectives Under Each Alternative

The set of actions listed in table 64 and table 12 could be combined in a nearly endless number of permutations. The eight alternatives identified in this environmental impact statement are a subset of the possible combinations. In tables 65 through 72, benefits and costs for each of the eight alternatives are identified relative to the "without plan" case. (In a following section, net costs and benefits are summarized with reference to the "no-action" case, alternative 1). The overall benefit-cost evaluation of the various alternatives depends on whether the specific actions included in the alternative are, in themselves cost-effective.

The benefits and costs of alternative 1 are shown in table 65. This alternative relies on two of the more expensive approaches for protecting livestock from brucellosis (capture, test, and slaughter operations and vaccination programs for bison). Some of the costs shown also contribute to other objectives such as public safety and maintaining a viable population of wild bison, but have not been broken out. The basic finding is that the costs of this alternative ($7.5 million, present value) greatly exceed the net benefits — by an amount of about $5.5 million. This result is most sensitive to the benefit level of protecting livestock from brucellosis, which are estimated to be less than $1.5 million. Given the uncertainty in the latter estimate (which is dependent on the risk of an infection from bison to cattle), one can also note the required break-even level of risk needed to justify this level of expenditure. As can be noted in table 63, one would have to expect an occurrence of the disease every six years to have a break-even of direct costs and benefits.

Table 65: Benefit-Cost of Bison Management Objectives and Actions — Alternative 1

	Direct Benefits and Costs				
Objective/Action	Annual Costs	Present-Value Costs	Present-Value Benefits	Present Value of Nonmarket Costs or Benefits	Net of Costs and Benefits
(A) Protect Livestock from Risk of Brucellosis					
1. Monitoring of bison	[1]	-	≤1,514,000	-	-
2. Agency shooting	[1]	-	≤1,514,000	-	-
3. Calfhood vaccination of cattle with RB51	N/A	-	≤1,514,000	-	-
4. Surveillance testing of cattle	N/A	-	-	-	-
5. Other cattle management actions	N/A	-	-	-	-
6. Modify national forest grazing allotments	N/A	-	-	-	-
7. Bison hunting	N/A	-	-	-	-

Table 65: Benefit-Cost of Bison Management Objectives and Actions — Alternative 1 *(continued)*

	Direct Benefits and Costs				
Objective/Action	Annual Costs	Present-Value Costs	Present-Value Benefits	Present Value of Nonmarket Costs or Benefits	Net of Costs and Benefits
8a. Capture, test, and slaughter operations at boundaries	525,800–657,800	5,310,000[2]	316,000	-	-
9. Vaccination of bison	330,500	2,143,000	-	-	-
10. Quarantine bison	N/A	-	-	-	-
11. Winter road grooming	N/A	-	-	-	-
(B) Public Safety, Private Property Damage					
12. Remove bison at landowner request	[1]	-	-	-	-
(C) Commit to Eliminating Brucellosis in Wildlife					
8b. Herd-wide capture, test, and slaughter operations — alternative 5	N/A	-	-	-	-
8c. Herd-wide capture, test, and slaughter operations — alternative 6	N/A	-	-	-	-
(D) Viable Population of Wild Bison					
13. Bison population range	N/A	-	-	-	-
14. Bison management on public lands	[1]	-	-	-	-
15. Acquire additional wildlife habitat	N/A	-	-	-	-
(E) Research					
16. Wildlife/winter-use monitoring	N/A	-	-	-	-
Totals	-	**7,532,900**	**1,991,900**	-	**(5,541,000)**

1. Not estimated or costs included in action 8a.

2. Net present value estimated using average of range of cost estimates. Capture facility cost of $359,500 are sunk costs and are not included.

Table 66: Benefit-Cost of Bison Management Objectives and Actions — Alternative 2

Objective/Action	Direct Benefits and Costs: Annual Costs	Direct Benefits and Costs: Present-Value Costs	Direct Benefits and Costs: Present-Value Benefits	Present Value of Nonmarket Costs or Benefits	Net of Costs and Benefits
(A) Protect Livestock from Risk of Brucellosis					
1. Monitoring of bison	44,000	400,700	≤ 1,514,000	-	-
2. Agency shooting	[1]	-	≤ 1,514,000	-	-
3. Calfhood vaccination of cattle with RB51	N/A	-	≤ 1,514,000	-	-
4. Surveillance testing of cattle	N/A	-	-	-	-
5. Other cattle management actions	N/A	-	-	-	-
6. Modify national forest grazing allotments	N/A	88,000	-	-	-
7. Bison hunting	N/A	-	-	-	-
8a. Capture, test, and slaughter operations at boundaries	264,000	2,471,294[2]	128,500	-	-
9. Vaccination of bison	330,500	2,143,000	-	-	-
10. Quarantine bison	N/A	-	-	-	-
11. Winter road grooming	55,000[3]	401,500	-	-	-
(B) Public Safety, Private Property Damage					
12. Remove bison at landowner request	[1]	-	-	-	-
(C) Commit to Eliminating Brucellosis in Wildlife					
8b. Herd-wide capture, test, and slaughter — alternative 5	N/A	-	-	-	-
8c. Herd-wide capture, test, and slaughter — alternative 6	N/A	-	-	-	-
(D) Viable Population of Wild Bison					
13. Bison population range	N/A	-	-	-	-

Table 66: Benefit-Cost of Bison Management Objectives and Actions — Alternative 2 *(continued)*

	Direct Benefits and Costs			Present Value of	
Objective/Action	Annual Costs	Present-Value Costs	Present-Value Benefits	Nonmarket Costs or Benefits	Net of Costs and Benefits
14. Bison management on public lands	[1]	-	-	-	-
15. Acquire additional wildlife habitat	N/A	15,100,000[4]		4,144,700	
(E) Research					
16. Wildlife/winter-use monitoring	27,500	200,747	-	-	-
Totals	-	**20,805,241**	**1,642,500**	**4,144,700**	**(15,018,041)**

1. Not estimated or costs included in action 8a.
2. Includes relocating capture facility cost of $71,500.
3. Increased snowmobile enforcement in park.
4. $29.1 million to acquire level 1 winter range are sunk costs (lands already acquired). Cost for level 2 is based on alternative 2 total land acquisition cost estimate minus $29.1 million.

Table 67: Benefit-Cost of Bison Management Objectives and Actions — Alternative 3

	Direct Benefits and Costs			Present Value of	
Objective/Action	Annual Costs	Present-Value Costs	Present-Value Benefits	Nonmarket Costs or Benefits	Net of Costs and Benefits
(A) Protect Livestock from Risk of Brucellosis					
1. Monitoring of bison	[1]	-	≤1,514,000	-	-
2. Agency shooting	[1]	-	≤1,514,000	-	-
3. Calfhood vaccination of cattle with RB51	N/A	-	≤1,514,000	-	-
4. Surveillance testing of cattle	N/A	-	-	-	-
5. Other cattle management actions	N/A	-	-	-	-

Table 67: Benefit-Cost of Bison Management Objectives and Actions — Alternative 3 *(continued)*

Objective/Action	Direct Benefits and Costs: Annual Costs	Direct Benefits and Costs: Present-Value Costs	Direct Benefits and Costs: Present-Value Benefits	Present Value of Nonmarket Costs or Benefits	Net of Costs and Benefits
6. Modify national forest grazing allotments	N/A	-	-	-	-
7. Bison hunting	66,000	481,800	389,200	175,100	-
8a. Capture, test, and slaughter operations at boundaries	419,100	3,878,800[2]	215,800	-	-
9. Vaccination of bison	330,500	2,143,000	-	-	-
10. Quarantine bison	447,500	4,282,100[3]	825,800	-	-
11. Winter road grooming	N/A	-	-	-	-
(B) Public Safety, Private Property Damage					
12. Remove bison at landowner request	[1]	-	-	-	-
(C) Commit to Eliminating Brucellosis in Wildlife					
8b. Herd-wide capture, test, and slaughter — alternative 5	N/A	-	-	-	-
8c. Herd-wide capture, test, and slaughter — alternative 6	N/A	-	-	-	-
(D) Viable Population of Wild Bison					
13. Bison population range	N/A	-	-	-	-
14. Bison management on public lands	[1]	-	-	-	-
15. Acquire additional wildlife habitat	N/A	-	-	4,144,727	-
(E) Research					
16. Wildlife/winter-use monitoring	N/A				
Totals	-	**10,785,700**	**2,944,800**	**4,319,827**	**(3,521,073)**

1. Not estimated or costs included in action 8a.

2. Includes cost to relocate capture facility of $66,000. Sunk facility cost of $132,000 is not included.

3. Includes one-time cost of quarantine facility of $715,000.

Table 68: Benefit-Cost of Bison Management Objectives and Actions — Alternative 4

Objective/Action	Direct Benefits and Costs: Annual Costs	Direct Benefits and Costs: Present-Value Costs	Direct Benefits and Costs: Present-Value Benefits	Present Value of Nonmarket Costs or Benefits	Net of Costs and Benefits
(A) Protect Livestock from Risk of Brucellosis					
1. Monitoring of bison	[1]	-	≤1,514,000	-	-
2. Agency shooting	[1]	-	≤1,514,000	-	-
3. Calfhood vaccination of cattle with RB51	N/A	-	≤1,514,000	-	-
4. Surveillance testing of cattle	N/A	-	-	-	-
5. Other cattle management actions	N/A	-	-	-	-
6. Modify national forest grazing allotments	N/A	-	-	-	-
7. Bison hunting	66,000	481,800	226,400	81,700	-
8a. Capture, test, and slaughter operations at boundaries	578,600	5,269,800[3]	419,600	-	-
9. Vaccination of bison	330,500	2,143,000	-	-	-
10. Quarantine bison	447,500	4,282,100[2]	1,166,300	-	-
11. Winter road grooming	N/A	-	-	-	-
(B) Public Safety, Private Property Damage					
12. Remove bison at landowner request	[1]	-	-	-	-
(C) Commit to Eliminating Brucellosis in Wildlife					
8b. Herd-wide capture, test, and slaughter operations — alternative 5	N/A	-	-	-	-
8c. Herd-wide capture, test, and slaughter operations — alternative 6	N/A	-	-	-	-

Table 68: Benefit-Cost of Bison Management Objectives and Actions — Alternative 4 *(continued)*

Objective/Action	Direct Benefits and Costs: Annual Costs	Direct Benefits and Costs: Present-Value Costs	Direct Benefits and Costs: Present-Value Benefits	Present Value of Nonmarket Costs or Benefits	Net of Costs and Benefits
(D) Viable Population of Wild Bison					
13. Bison population range	N/A	-	-	-	-
14. Bison management on public lands	[1]	-	-	-	-
15. Acquire additional wildlife habitat	N/A	-	-	-	-
(E) Research					
16. Wildlife/winter-use monitoring	N/A	-	-	-	-
Totals	-	**12,176,700**	**3,326,300**	**81,700**	**(8,768,700)**

1. Not estimated or costs included in action 8a.
2. Includes one-time cost of quarantine facility of $715,000.
3. Sunk facility cost of $379,500 are not included.

Table 69: Benefit-Cost of Bison Management Objectives and Actions — Alternative 5

Objective/Action	Direct Benefits and Costs: Annual Costs	Direct Benefits and Costs: Present-Value Costs	Direct Benefits and Costs: Present-Value Benefits	Present Value of Nonmarket Costs or Benefits	Net of Costs and Benefits
(A) Protect Livestock from Risk of Brucellosis					
1. Monitoring of bison	[1]	-	≤1,514,000	-	-
2. Agency shooting	[1]	-	≤1,514,000	-	-
3. Calfhood vaccination of cattle with RB51	N/A	-	≤1,514,000	-	-
4. Surveillance testing of cattle	N/A	-	-	-	-
5. Other cattle management actions	N/A	-	-	-	-
6. Modify national forest grazing allotments	N/A	-	-	-	-

Table 69: Benefit-Cost of Bison Management Objectives and Actions — Alternative 5 (*continued*)

Objective/Action	Direct Benefits and Costs: Annual Costs	Direct Benefits and Costs: Present-Value Costs	Direct Benefits and Costs: Present-Value Benefits	Present Value of Nonmarket Costs or Benefits	Net of Costs and Benefits
7. Bison hunting	N/A	-	-	-	-
8a. Capture, test, and slaughter operations at boundaries	N/A	-	-	-	-
9. Vaccination of bison	N/A	-	-	-	-
10. Quarantine bison	N/A	-	-	-	-
11. Winter road grooming	N/A	-	-	-	-
(B) Public Safety, Private Property Damage					
12. Remove bison at landowner request	[1]	-	-	-	-
(C) Commit to Eliminating Brucellosis in Wildlife					
8b. Herd-wide capture, test, and slaughter operations — alternative 5	2,636,760[3]	11,292,000[2]	376,400	1,695,150	-
8c. Herd-wide capture, test, and slaughter operations — alternative 6	N/A	-	-	-	-
(D) Viable Population of Wild Bison					
13. Bison population range	N/A	-	-	-	-
14. Bison management on public lands	[1]	-	-	-	-
15. Acquire additional wildlife habitat	N/A	-	-	-	-
(E) Research					
16. Wildlife/winter-use monitoring	N/A	-	-	-	-
Totals	-	**11,292,000**	**1,890,400**	**1,695,150**	**(7,706,450)**

1. Not estimated or costs included in action 8a.

2. Includes one-time capture facility cost of $1,056,000. Sunk capture facility cost of $132,000 not included.

3. Includes plowing of roads during first three years of plan at $575,960 per year.

Table 70: Benefit-Cost of Bison Management Objectives and Actions — Alternative 6

	Direct Benefits and Costs			Present Value of	
Objective/Action	Annual Costs	Present-Value Costs	Present-Value Benefits	Nonmarket Costs or Benefits	Net of Costs and Benefits
(A) Protect Livestock from Risk of Brucellosis					
1. Monitoring of bison	[1]	-	≤1,514,000	-	-
2. Agency shooting	[1]	-	≤1,514,000	-	-
3. Calfhood Vaccination of cattle with RB51	N/A	-	≤1,514,000	-	-
4. Surveillance testing of cattle	N/A	-	-	-	-
5. Other cattle management actions	N/A	-	-	-	-
6. Modify national forest grazing allotments	N/A	-	-	-	-
7. Bison hunting	N/A	-	-	-	-
8a. Capture, test, and slaughter operations at boundaries	N/A	-	-	-	-
9. Vaccination of bison	N/A	-	-	-	-
10. Quarantine bison	N/A	-	-	-	-
11. Winter road grooming	N/A	-	-	-	-
(B) Public Safety, Private Property Damage					
12. Remove bison at landowner request	[1]	-	-	-	-
(C) Commit to Eliminating Brucellosis in Wildlife					
8b. Herd-wide capture, test, and slaughter operations — alternative 5	N/A	-	-	-	-
8c. Herd-wide capture, test, and slaughter operations — alternative 6	2,132,560–2,678,160	9,931,357[2]	411,600	0[3]	-

Table 70: Benefit-Cost of Bison Management Objectives and Actions — Alternative 6 (*continued*)

Objective/Action	Direct Benefits and Costs: Annual Costs	Direct Benefits and Costs: Present-Value Costs	Direct Benefits and Costs: Present-Value Benefits	Present Value of Nonmarket Costs or Benefits	Net of Costs and Benefits
(D) Viable Population of Wild Bison					
13. Bison population range	N/A	-	-	-	-
14. Bison management on public lands	[1]	-	-	-	-
15. Acquire additional wildlife habitat	N/A	-	-	-	-
(E) Research					
16. Wildlife/winter-use monitoring	N/A	-	-	-	-
Totals	-	**9,931,357**	**1,925,600**	**0**	**(8,005,757)**

1. Not estimated or costs included in action 8a.
2. Includes one-time capture facility cost of $165,000 during phase 1 and $792,000 during phase 2. Sunk capture facility cost of $132,000 is not included.
3. A one-time nonmarket benefit of $3,568,039 would be realized 22 years after initiation of the plan, but this would be beyond the 15-year horizon of the cost/benefit analysis.

Table 71: Benefit-Cost of Bison Management Objectives and Actions — Alternative 7

Objective/Action	Direct Benefits and Costs: Annual Costs	Direct Benefits and Costs: Present-Value Costs	Direct Benefits and Costs: Present-Value Benefits	Present Value of Nonmarket Costs or Benefits	Net of Costs and Benefits
(A) Protect Livestock from Risk of Brucellosis					
1. Monitoring of bison	[1]	-	≤1,514,000	-	-
2. Agency shooting	[1]	-	≤1,514,000	-	-
3. Calfhood vaccination of cattle with RB51	-	-	≤1,514,000	-	-
4. Surveillance testing of cattle	-	-	-	-	-
5. Other cattle management actions	Unknown	-	-	-	-
6. Modify national forest grazing allotments	N/A	-	-	-	-

Table 71: Benefit-Cost of Bison Management Objectives and Actions — Alternative 7 *(continued)*

Objective/Action	Direct Benefits and Costs: Annual Costs	Direct Benefits and Costs: Present-Value Costs	Direct Benefits and Costs: Present-Value Benefits	Present Value of Nonmarket Costs or Benefits	Net of Costs and Benefits
7. Bison hunting	66,000	481,800	185,700	58,400	-
8a. Capture, test, and slaughter operations at boundaries	963,500	8,829,400[4]	475,400	-	-
9. Vaccination of bison	330,500	2,142,800	-	-	-
10. Quarantine bison	447,500	4,372,600[3]	1,064,140	-	-
11. Winter road grooming	N/A	-	-	-	-
(B) Public Safety, Private Property Damage					
12. Remove bison at landowner request	[1]	-	-	-	-
(C) Commit to Eliminating Brucellosis in Wildlife					
8b. Herd-wide capture, test, and slaughter operations — alternative 5	N/A	-	-	-	-
8c. Herd-wide capture, test, and slaughter operations — alternative 6	N/A	-	-	-	-
(D) Viable Population of Wild Bison					
13. Bison population range	N/A	-	-	-	-
14. Bison management on public lands	[1]	-	-	-	-
15. Acquire additional wildlife habitat	Not estimated	[2]	4,144,700	-	-
(E) Research					
16. Wildlife/winter-use monitoring	5,500	50,100	-	-	-
Totals	-	**15,822,800**	**3,239,240**	**4,203,100**	**(8,380,460)**

1. Not estimated or costs included in action 8a.
2. Sunk costs of 27.1 million have already been spent.
3. Includes one-time cost of quarantine facility of $715,000.
4. Includes one-time cost of relocating capture facility of $66,000. Sunk facility costs of $132,000 not included.

Table 72: Benefit-Cost of Bison Management Objectives and Actions — the Modified Preferred Alternative

	Direct Benefits and Costs			Present Value of	
Objective/Action	Annual Costs	Present-Value Costs	Present-Value Benefits	Nonmarket Costs or Benefits	Net of Costs and Benefits
(A) Protect Livestock from Risk of Brucellosis					
1. Monitoring of bison	[1]	-	≤1,514,000	-	-
2. Agency shooting	[1]	-	≤1,514,000	-	-
3. Calfhood vaccination of cattle with RB51	N/A	-	≤1,514,000	-	-
4. Surveillance testing of cattle	N/A	-	-	-	-
5. Other cattle management actions	Unknown	-	-	-	-
6. Modify national forest grazing allotments	N/A	-	-	-	-
7. Bison hunting	N/A	-	-	-	-
8a. Capture, test, and slaughter operations at boundaries	963,500	8,775,500[3]	475,400	-	-
9. Vaccination of bison	330,500	2,142,800	-	-	-
10. Quarantine bison	447,500	4,372,600	1,796,300	-	-
11. Winter road grooming	N/A	-	-	-	-
(B) Public Safety, Private Property Damage					
12. Remove bison at landowner request	[1]	-	-	-	-
(C) Commit to Eliminating Brucellosis in Wildlife					
8b. Herd-wide capture, test, and slaughter operations — alternative 5	N/A	-	-	-	-
8c. Herd-wide capture, test, and slaughter operations — alternative 6	N/A	-	-	-	-

Table 72: Benefit-Cost of Bison Management Objectives and Actions — the Modified Preferred Alternative *(continued)*

Objective/Action	Direct Benefits and Costs: Annual Costs	Direct Benefits and Costs: Present-Value Costs	Direct Benefits and Costs: Present-Value Benefits	Present Value of Nonmarket Costs or Benefits	Net of Costs and Benefits
(D) Viable Population of Wild Bison					
13. Bison population range	N/A	-	-	-	-
14. Bison management on public lands	[1]	-	-	-	-
15. Acquire additional wildlife habitat	Not estimated	[2]	4,144,700	-	-
(E) Research					
16. Wildlife/winter-use monitoring	5,500	50,100	-	-	-
Totals	-	**15,341,000**	**3,785,700**	**4,144,700**	**(7,410,600)**

1. Not estimated or costs included in action 8a.
2. Sunk costs of 27.1 million have already been spent.
3. Sunk capture facility costs of $379,000 are not included.

Alternative 2 (table 66) has lower costs for direct bison management than any other alternative, reflecting that in later years border and population control is by agency shooting. However, the alternative does include vaccination program(s). The alternative also includes a large budget for additional winter range acquisition. Costs again exceed benefits. If this alternative did not include vaccination and acquisition of additional winter range, it would be the closest to being justified on the grounds of benefit-cost than any of the other alternatives.

Alternatives 3 and 4 include hunting, which is an approximately a break-even operation, but also includes expensive capture, test, slaughter, vaccination, and quarantine operations. Direct benefits of reducing the risk of brucellosis infection would have to be on the order of $8 million per year to justify the proposed costs. This would imply a brucellosis infection rate of about one every five years.

Alternatives 5 and 6 both have large costs associated with herd-wide capture, test, slaughter, and related vaccination operations. Costs greatly exceed direct benefits.

Alternative 7 has a high cost of capture, test, and slaughter operations, as well as vaccination and quarantine programs. The net of direct costs over direct benefits is about $12 million. One would have to expect an occurrence of brucellosis from bison infecting cattle at a rate of almost once every three years for benefits to equal costs.

The modified preferred alternative is similar to alternative 7 with respect to benefits and costs, but is just slightly less expensive. The small difference is due to the assumed greater number of bison coming out of quarantine (which affects the revenues or benefits from live disease-free bison available for distribution). However, the modified preferred alternative does add some modifications compared with alternative 7 that have not added to estimated costs and may cost-effectively contribute to the objectives. The modified preferred alternative adopts some management concepts from the NAS (1998) report, including adaptive management with respect to bison distribution and numbers and the concept of a buffer zone or management zone (comprised of the SMAs) on the perimeter of Yellowstone National Park. Other changes are responsive to many comments on the *Draft Environmental Impact Statement* suggesting that it is cost-effective to more actively manage cattle. The modified preferred alternative includes several such actions, including more surveillance testing of cattle, 100% voluntary (in its absence, mandatory) calfhood vaccination, and modification of turn-on dates on national forest allotments, as necessary, to ensure a 45-day separation of bison and cattle. Perceived risk is also addressed though the commitment of APHIS to consult with states threatening sanctions and convince those states that sanctions are unwarranted. With respect to the wild and free-roaming bison objective, the modified preferred alternative also has a somewhat higher population target (3,000) based on NAS (1998) findings regarding the level at which bison movement outside the park will most likely begin to occur.

The basic finding is that none of the alternatives is justified on direct benefit-cost grounds. These findings are not changed if one also incorporates nonmarket values. To justify the most expensive alternatives, one would have to assume risk levels for brucellosis infection in cattle from Yellowstone National Park bison that are implausible — on the order of once every three to five years. While the NAS (1998) report does not identify the risk of transmission, it does say that "it is too small to measure with accuracy." It is difficult to view a probability of occurrence of 20% to 33% as being "too small to measure."

Except for the "commit to eliminate brucellosis in wildlife" objective, it appears that it would be possible to construct a permutation of the listed actions that would satisfy the objectives and be at least close to passing a benefit-cost test. This would consist of something similar to the alternative 2 approach (controlling bison populations and distribution and the risk of brucellosis — except the vaccination of bison action) and the alternative 7 or the modified preferred alternative approach to actively managing cattle with regard to additional winter range. The cost-effective strategy is to make use of already acquired lands but not acquiring more, except possibly through easements.

Summary of Costs and Benefits by Alternative. Table 64 presents a summary of the action-specific costs and benefits detailed in tables 65–72. Table 73 shows a comparison of the net present value of costs and benefits by objective for each of the eight alternatives relative to the "without-plan" case. As discussed previously, objective B, "Public Safety, Private Property Damage," is not estimated as impacts to this objective are uncertain and likely to be minor.

A comparison of total net present value of costs and benefits, shown in table 73, shows that based on available data, none of the alternatives is justified on a benefit-cost basis. Alternative 3 comes the closest to being justified with a net present value of minus $3,521,073. Alternative 2 is the least attractive on a benefit-cost basis with an expected net cost over the life of the plan of $15,018,041 (This large loss is largely due to the proposed acquisition of additional bison winter range for $15.1 million).

Table 74 shows the information presented in table 73, but with reference to the costs and benefits of the "no-action" alternative of the current interim plan (alternative 1). Table 74 shows that among the seven action alternatives only alternative 3 is less costly (on a net benefit-cost basis) than the alternative 1 program. Alternative 2, with its large additional purchase of winter range, is the most costly relative to alternative 1, unless the additional winter range purchase is excluded.

Table 73: Net Present Value of Costs and Benefits by Alternative and Objective

Objective	Alt 1 (current)	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7	Modified Preferred Alternative
(A) Protect Livestock from Risk of Brucellosis	(5,541,000)	(3,861,994)	(7,665,800)	(8,768,700)	-	-	(12,535,160)	(11,505,200)
(B) Public Safety, Private Property Damage	-	-	-	-	-	-	-	-
(C) Commit to Eliminating Brucellosis in Wildlife	-	-	-	-	(7,706,450)	(8,005,757)	-	-
(D) Viable Population of Wild Bison	-	(10,955,300)	4,144,727	-	-	-	4,144,700	4,144,700
(E) Research	-	(200,747)	-	-	-	-	-	50,100
TOTALS	(5,541,000)	(15,018,041)	(3,521,073)	(8,758,700)	(7,706,450)	(8,005,757)	(8,380,460)	(7,410,600)

Table 74: Net Present Value of Costs and Benefits by Alternative and Objective — Differences from Alternative 1

Objective	Alt 1 (current)	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7	Modified Preferred Alternative
(A) Protect Livestock from Risk of Brucellosis	0	1,679,006	(2,124,800)	(2,227,700)	5,541,000	5,541,000	(6,994,160)	(5,964,200)
(B) Public Safety, Private Property Damage	0	-	-	-	-	-	-	-
(C) Commit to Eliminating Brucellosis in Wildlife	0	-	-	-	(7,706,450)	(8,005,757)	-	-
(D) Viable Population of Wild Bison	0	(10,955,300)	4,144,727	-	-	-	4,144,700	4,144,700
(E) Research	0	(200,747)	-	-	-	-	-	(50,100)
TOTALS	0	5,622,959	2,019,927	(3,217,700)	(2,165,450)	(2,464,757)	(2,839,460)	(1,869,600)

Social Value Impacts of Achieving the Objectives.

Surveys of Yellowstone National Park visitors and residents of the Greater Yellowstone Area, the three-state region (Idaho, Montana, and Wyoming), and national residents provide information on public acceptance of and attitudes toward some of the proposed actions. This information is detailed in "Affected Environment." Table 75 provides a summary.

Table 75: Social Values — For Those with an Opinion, Ratio of Agree: Disagree or Disagree: Agree on Attitude Statements

	Phone			Summer Visitor		Winter Visitor	
	Local	Regional	National	Resident	Nonresident	Resident	Nonresident
Access	2:1 agree	2:1 agree	1.3:1 agree	1.5:1 agree	1.4:1 agree	2.4:1 agree	4.7:1 agree
Disturb	2:1 agree	3:1 agree	9:1 agree	4.4:1 agree	6.4:1 agree	2.6:1 agree	3:1 agree
Graze	2:1 agree	2:1 agree	1.5:1 agree	1.6:1 agree	1.1:1 agree	1.2:1 agree	1.2:1 agree
Kill	1.7:1 agree	1.8:1 agree	1.6:1 agree	1:1 divided	1.2:1 agree	1.3:1 disagree	1.3:1 agree
Range	1:1 divided	1:1 divided	1:1 divided	1.4:1 agree	1.2:1 agree	2.2:1 agree	1.4:1 agree
Don't vaccinate	1.8:1 agree	2.2:1 agree	3:1 agree	-	-	-	-
Vaccinate	-	-	-	2.5:1 disagree	1.2:1 agree	2.7:1 disagree	1.3:1 disagree
Close road for bison	1.3:1 open	1.2:1 close	2.1:1 close	1:1 divided	1.4:1 close	-	2.2:1 open

Access: Visitors should have the opportunity to mechanized winter access into Yellowstone National Park.
Disturb: I am concerned about the possible disturbance of Yellowstone wildlife in the winter.
Grazing: Livestock grazing is an appropriate use of national forest lands around Yellowstone National Park.
Kill: It is appropriate to kill bison at park boundaries as necessary to protect domestic livestock.
Range: Yellowstone bison should be allowed to range onto public lands outside Yellowstone National Park.
Vaccinate: All bison in Yellowstone National Park should be rounded up and tested for disease then either slaughtered or vaccinated.
Don't vaccinate: All bison should be rounded up and tested for the disease rather then either slaughtered or vaccinated.
Close road for bison: Grooming the roads into Yellowstone National Park from West Yellowstone and Mammoth for over snow vehicles provides an easier winter route out of the park for bison. If roads were not groomed, more bison might remain in the park. Given this possibility, which of the following policies would you prefer?

One of the most challenging aspects of bison management is the issue of controlling animal numbers. All alternatives incorporate some form of lethal control; it is possible that even animals that are quarantined bison would be transferred to commercial operations and eventually slaughtered, although the details of how live bison are dispersed would be part of a future planning and NEPA process. Agency shooting is judged by the American Veterinary Medical Association to be an acceptable method of euthanasia (appendix F). Among the general public (Greater Yellowstone Area residents, regional residents, and national residents) and for those respondents who had an opinion, a majority (in a 1.6:1 to 1.8:1 ratio) agree "It is appropriate to kill bison at park boundaries as necessary to protect domestic livestock." Nonresident summer and winter visitors are less accepting of the notion (1.2:1 to 1.3:1) agree, while resident summer visitors are divided on the notion and winter resident visitors disagree in a 1.3:1 ratio.

On the issue of whether "Yellowstone bison should be allowed to range onto public lands outside Yellowstone NP [National Park]," the general public is divided across all subsamples. Park visitors, on the other hand, agree with this concept, with residents being more supportive of the idea (1.4:1 to 2.2:1) than nonresidents (1.2:1 to 1.4:1). However, all populations sampled agreed that "Livestock grazing is an appropriate use of national forest lands around Yellowstone NP [National Park]" The general public was strongly supportive of this statement, with the visitor population being less supportive, but still agreeing.

The visitor population surveys included a statement intended to test support for herd-wide capture, test, and slaughter operations such as proposed in alternative 5 and 6. With respect to the statement "All bison in Yellowstone NP [National Park] should be rounded up and tested for the disease then either slaughtered or vaccinated," resident summer and winter visitors were in strong disagreement (2.5:1 to 2.7:1) as were winter nonresident visitors (1.3:1 disagree). Summer nonresident visitors provided mild support for the concept (1.2:1) but the percentage agreeing (35.4%) was less than the percentage who were neutral or did not know (36.4%). In the general public surveys, a slightly different statement was used: "All bison in Yellowstone National Park should be rounded up and tested for the disease rather than either slaughtered or vaccinated." A strong majority of respondents agreed with this statement (1.8:1 to 3:1). These findings are generally consistent with the opinion offered in the NAS (1998) report that "Neither depopulation nor a test-and-slaughter program alone is likely to be publicly acceptable," although the NAS report does suggest an approach similar to alternative 6 (vaccination first) may be acceptable. On this issue the NAS report also suggests that administering a brucellosis-elimination program similar to that used for domestic livestock could be inconsistent with the wild free-ranging objective "..rounding up has the consequence of some artificial selection for domestication because wildness and intractability, salient traits in wild bison, are not disfavored. Those are important traits to retain in YNP [Yellowstone National Park] bison, one of the few herds where it is feasible to maintain natural behavior, so rounding up is not likely to be acceptable."

Public attitudes were also examined with regard to the issue of mechanized access to Yellowstone National Park in the winter. All subsamples agreed (particularly winter visitors) with the statement "Visitors should have the opportunity for mechanized winter access into Yellowstone NP [National Park]." Nonetheless, all subsamples also agreed to an even greater extent (table 75) that: "I am concerned about the possible disturbance of Yellowstone wildlife in the winter." Respondents were faced with the specific choice of trading off access with concern for wildlife, as expressed in the following question, "Grooming the roads into Yellowstone National Park from West Yellowstone and Mammoth for over snow vehicles provides an easier winter route out of the park for bison. If roads were not groomed, more bison might remain in the park. Given this possibility, which of the following policies would you prefer?" The choices were "the currant policy that allows for winter access" and "to close motorized winter access" or "not sure." Summer nonresident visitors favored closing roads (1.4:1) as did regional and national residents (1.2:1 and 2.1:1, respectively). Summer resident visitors were evenly divided on the issue, while winter visitors favored having access (2.2:1) as did local phone respondents (1.3:1).

REGIONAL ECONOMIC IMPACTS OF ACHIEVING THE OBJECTIVES

Changes in sales of goods and services for export outside the affected area or sales to nonresident tourism would have an economic impact on the regional economy. In addition to the direct change in expenditures in an export-base framework, there would be multiplier effects on other area businesses.

With regard to livestock lease operations that would be converted to other uses, there would be a reduction in the lease payments coming into the region. There would also be multiplier effects of lost revenue to the local economy, for example, through equipment and ranch supply purchases. With regard to tourism, changes in the number of nonresident tourists coming to the affected area would also result in expenditure changes and multiplier effects on the regional economy. Similarly, expenditures by hunters would impact the regional economy. Table 76 details those regional economic impacts that have been estimated under each of the alternatives.

Changes in expenditures in the region by governmental agencies would also impact the overall level of economic activity in the regional economy. For this reason, table 76 includes changes in bison management costs, as well as changes in road grooming costs.

FINANCIAL IMPACTS

The various alternatives would have financial impacts on a number of governmental entities, including changes in county and state tax revenues, changes in entry fees to Yellowstone National Park, changes in hunter fees to the Montana Department of Fish, Wildlife, and Parks, and changes in grazing fees to the U.S. Forest Service. These changes would all likely be relatively small in the context of the overall impacts of the alternatives and in general, have not been quantified. However, as an example, changes in county tax payments due to changes in livestock operations might be estimated by multiplying the per capita tax rate by the number of livestock grazed in the SMAs. Even if the livestock were put elsewhere in the county and state, they would displace other livestock, assuming all available animal unit months in the county and state were currently being used. There would be no loss in property taxes on private land if the land was acquired and managed by the Montana Department of Fish, Wildlife, and Parks or an easement was placed on the property. However, if the land was acquired by a federal agency, there would be potential for losses in property taxes.

Hunter fees to the Montana Department of Fish, Wildlife, and Parks were quantified. These are estimated to be $53,320 for alternative 3, $31,016 for alternative 4, and $25,440 for alternative 7.

TABLE 76: DIFFERENCES BETWEEN CURRENT AND ALTERNATIVE-SPECIFIC ANNUAL EXPENDITURE IMPACTS

	Current Values	Alt 1[1]	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7	Modified Preferred Alternative
Winter tourism expenditures[2]	Not estimated	0	13,750,000	0	0	13,750,000	13,750,000	0	0
Hunter expenditures	0	0	0	32,900	15,380	0	0	10,896	0
Livestock operations	$150,851	0	(150,851)	(36,627)	0	0	0	(36,627)	(36,627)
Bison management expenses[4]	$922,300	0	(201,300)	340,800	500,300	1,714,460	1,483,060	890,700	824,700
Trail grooming expenses[3]	$17,250	0	17,250	0	0	0	0	0	0

1. Alternative 1 assumes continuation of current values.
2. Alternatives 5 and 6 winter tourism expenditure losses are for years with highest impact and are not constant across the 15 years of the plan. Alternative 5 winter expenditure reductions are for years 1–4. Alternative 6 would have winter expenditure reductions similar to those under alternative 2 in the years 1–10 and similar to alternative 5 in years 11–14.
3. Assumes average of high and low estimates for winter road grooming.
4. Assumes years of highest spending impact.

DEFINITIONS OF LINE ITEMS

Winter tourism expenditures: Spending by winter visitors from outside the area on goods and services within the area.

Hunter expenditures: Spending in the Greater Yellowstone Area by hunters hunting bison in the area

Livestock operations: Lost value of grazing leases on public and private land.

Bison management expenses: The direct expenditures by federal and state agencies to implement bison management under the alternatives.

Trail grooming expenses: The cost to the Yellowstone National Park of grooming winter snowmobile and snowcoach trails.

IMPACTS ON THREATENED, ENDANGERED, AND SENSITIVE SPECIES

SUMMARY OF REGULATIONS AND POLICIES

The Endangered Species Act mandates that all federal agencies consider the potential effects of their actions on species listed as threatened or endangered. The U.S. Forest Service must also consider the potential effects of its actions on sensitive species in the national forests. NPS policy also requires consideration of state and locally listed species.

The Endangered Species Act mandates that all federal agencies consider the potential effects of their actions on species listed as threatened or endangered.

The Endangered Species Act directs federal agencies to assess the effects of their proposed actions on threatened and endangered species and critical habitat for these species, to write biological assessments for these proposed actions, and consult with the U.S. Fish and Wildlife Service if any effect is anticipated. The threatened and endangered species occurring in the project area for this environmental impact statement that have the potential to be affected are the grizzly bear (threatened), gray wolf (nonessential, experimental), bald eagle (threatened), and Canada lynx (threatened); also see appendix H. Due to its unique nature as a nonessential, experimental population, the wolf is required to be treated as threatened within national parks and national wildlife refuges and proposed for listing outside them (e.g., on the national forests). Formal consultation with the U.S. Fish and Wildlife Service is required if a "may affect-likely to adversely affect" determination is made for one or more of the threatened or endangered species. The only action alternatives with this determination are alternative 5, which has this anticipated effect on the grizzly bear, and alternative 6, which has a "may affect-likely to adversely affect" determination on bald eagles. As part of the consultation process with the U.S. Fish and Wildlife Service, a biological assessment was conducted to determine the effects of the modified preferred alternative on threatened and endangered species and those proposed for federal listing. The biological assessment was sent on to the U.S. Fish and Wildlife Service, Helena, Montana, office on March 23, 2000. The biological assessment determined that the modified preferred alternative may affect bald eagles and grizzly bears in the area, but would not likely adversely affect them. The modified preferred alternative would not likely adversely affect the gray wolf in Yellowstone National Park and would not likely jeopardize the continued existence of the gray wolf in the Gallatin National Forest. The modified preferred alternative would not likely adversely affect the Canada lynx. (See appendix J for U.S. Fish and Wildlife Service concurrance letter.)

Sensitive species consist of both plants and animals (see appendix H) and are listed as sensitive by the regional forester for national forests in their region.

Sensitive species are those for which there are viability or habitat concerns but they are not currently federally listed as threatened or endangered. For the Gallatin National Forest in Region 1 of the U.S. Forest Service, a number of vertebrate species are listed as sensitive, of which the wolverine, and trumpeter swan have the potential to be affected by bison management activities. In addition, 23 species of plants are listed as sensitive on the Gallatin National Forest. Some of these sensitive species also have the status of state species of special concern.

METHODOLOGIES FOR ANALYZING IMPACTS

The primary steps in assessing impacts on species of special concern were to determine (1) which species are found in areas likely to be affected by management actions described in the alternatives in this environmental impact statement, (2) habitat loss or alteration caused by the alternatives, (3) displacement and disturbance potential of the actions and the species' potential to be affected by activities, and (4) relative population levels and distribution of bison under the alternatives. The information contained in this analysis was obtained through best professional judgment of team members, experts not on the team (but cited in the document), and by conducting a literature review. Because quantitative information on affected species is rarely available, impacts are usually assessed qualitatively.

Bison mortality is not density-dependent (Meagher, pers. comm.) but is largely influenced by weather (density-independent); therefore, one cannot assume that a high bison population necessarily means more bison carrion for carnivores unless there is the weather event that leads to mortality. The link between high bison numbers being better for carnivores and low numbers being worse is somewhat tenuous due to the influence of weather on bison mortality. What could be of more importance than projected bison numbers when assessing the impact of the alternatives on grizzly bears (and other carnivores) is the distribution of bison carcasses in relation to the bears that appear to be most dependent on this food source in the spring (i.e., those bears that den in and near Pelican and Hayden Valleys in the interior of the park). The analysis of impacts on threatened, endangered, and sensitive species under alternatives 1 through 7 was based on the deterministic model of bison population, and analysis of the impacts associated with the modified preferred alternative was based on the enhanced stochastic model.

The Yellowstone area is a dynamic system in which stochastic processes operate and many factors are interconnected; therefore, it is difficult to quantify or predict outcomes with great accuracy. Whether or not something is beneficial or detrimental to bears appears to be relatively easy to assess, but the degree to which it is beneficial or detrimental is difficult to determine. See "Environmental Consequences: Impacts on Bison Population" for updated information regarding changes in the bison population under each alternative using the enhanced stochastic model.

IMPACTS COMMON TO ALL ALTERNATIVES

The actions described in this environmental impact statement could affect species of special concern in three ways — through management actions such as hazing or shooting; by removing habitat to build and operate capture or quarantine facilities; and indirectly by influencing the number of bison available as a food source for wildlife. The latter could further influence habitat quality for predators and carrion eaters by changing the availability, location, and timing, as well as the abundance of the food source. Human activity associated with bison management (e.g., hazing, construction of quarantine or capture facilities, and operation of quarantine or capture facilities) could also affect threatened and endangered species through disturbance leading to displacement and energy expenditure.

Construction of facilities associated with bison management could directly affect sensitive plants if these species were located on the construction site. Because capture and quarantine facilities would be sited using site-specific criteria described in "The Alternatives," including surveys and redesign or relocations of the proposed facilities if conflicts with threatened or endangered species would be likely, the impacts of these facilities will only be discussed in general terms in this environmental impact statement.

Management activities, including hazing, shooting, capture facility operation, quarantine operation, and public hunting, generally would have impacts on species of special concern that are minor, or that could be mitigated so they would be negligible. Other factors that would likely a more acute impact on threatened and endangered species, in particular the grizzly bear, would include those resulting in larger population increases or decreases such as slaughter, changes in grooming or plowing of roads, and the potential acquisition of additional winter range for bison through purchase or easement from willing sellers.

All alternatives call for brucellosis vaccination of calves or yearling bison. The likely brucellosis vaccine candidate, RB51, is a live bacterial vaccine. A bison vaccination program may inadvertently expose nontarget species to the bacteria. Nontarget species are species for which the vaccine was not intended and exposure may occur. For example, target animals with a vaccine infection may expose nontarget species through predation, scavenging, or by shedding the vaccine into the environment in other ways. Threatened and endangered species such as eagles, bears, wolves, and lynx may come in contact with carrion or shed materials and could be exposed to RB51.

Before bison vaccination begins, safety of the vaccine in nontarget species or surrogates (such as coyotes as surrogates for wolves) must be proven. Research is ongoing to determine the safety of RB51 in nontarget species. Research results on several nontarget species suggest RB51 does not cause morbidity, mortality, or significant clinical pathology in the species tested (see "The Alternatives: Actions Common to All Alternatives — Vaccination"). Based on these results, the known habitat and feeding habits of nontarget animals, and a favorable outcome from the remaining safety studies, it is expected that brucellosis vaccination of bison calves and yearlings would not affect bald eagles, wolves, grizzly bears, or lynx.

Acquisition of approximately 6,000 acres of land plus proposed additional land through purchase, exchange, and conservation easements north of Yellowstone National Park in the Gardiner Valley would result in more habitat available to threatened and endangered species. This increase in habitat is considered a positive impact on threatened and endangered species.

The impact sections that follow focus on the threatened grizzly bear, bald eagle, and lynx; the gray wolf, classified as non-essential, experimental in the Yellowstone area; and the U.S. Forest Service sensitive species wolverine and trumpeter swan (see "Affected Environment" for more information).

Endangered Species

FEIS Note: At the time the *Draft Environmental Impact Statement* was published, the peregrine falcon was listed as an endangered species. However, on August 26, 1999, the U.S. Fish and Wildlife Service delisted the peregrine falcon.

Threatened Species

Bald Eagle. Bald eagles would occasionally scavenge on large mammal carcasses; however, this would not be a large proportion of their diet. Bald eagles could be affected if management activities occurred or capture facilities were constructed near an active nest or foraging area.

In West Yellowstone, the potential to disturb nesting and foraging bald eagles through noise and human activity from hazing, shooting, and capture, and slaughter operations exists. The capture facility on public land in West Yellowstone has bald eagle mitigation measures included in its operation.

Canada Lynx. Recently the U.S. Fish and Wildlife Service listed the Canada lynx as a threatened species in the contiguous United States under the Endangered Species Act. The listing rule was filed with the *Federal Register* on March 23, 2000.

Bison management activities are expected to have negligible impact on the Canada lynx. Lynx do not rely on areas for hunting snowshoe hares where existing capture facilities are located. These areas are used only sporadically, if at all, by lynx. However, if lynx were present in bison habitat and bison carrion was available, lynx might opportunistically feed on the carrion. US Highway 191/287 is a source of numerous roadkill carcasses, and lynx might opportunistically feed on those carcasses and expose themselves to traffic conflicts. This situation is not expected to change.

Sensitive Wildlife Species

Although wolverine exist in the study area and might rarely feed on bison carrion, management operations or changes in bison population numbers proposed in the alternatives would have only negligible impacts on this specie, except for alternative 2, in which a change in snowmobile use in the national forest would be expected. Although no known general impacts from siting facilities would be anticipated, site-specific impacts would be avoided.

Sensitive Plant Species

The alternatives would have no impacts on sensitive plant species from management operations or changes in bison population numbers. No known general impacts from siting facilities would be anticipated; site-specific impacts would be avoided through compliance with national forest and park policies protecting sensitive species.

CUMULATIVE IMPACTS COMMON TO ALL ALTERNATIVES

Cumulative impacts are past, present, and future (reasonable and foreseeable) actions of federal, state, and private entities. For this analysis, the maps of the different alternatives were used to bound the analysis area for the effects of activities on threatened, endangered, and sensitive species. In order to be considered, the effects of actions must overlap temporally or spatially with bison distribution and management activities. Most bison management activities would be limited to relatively small areas due to the fairly limited area in which bison would likely occur outside Yellowstone National Park (stippled areas on the alternative maps), or the limited areas within the park where activities might occur under alternatives 5 and 6.

To set the context for cumulative impacts, there are numerous naturally or seminaturally occurring factors of interest in relation to the grizzly bear in particular. Whitebark pine seeds are a meaningful source of fall food for grizzly bears. In the Greater Yellowstone Area, this tree species is experiencing the beginning of an outbreak of blister rust. The disease will result in the eventual decline and potential loss of this important food. Also, grizzly bears have fed extensively on spawning trout in the spring around Yellowstone Lake. Due to the introduction of lake trout into Yellowstone Lake, native cutthroat trout populations are likely to decline, and the bear could lose an important spring food in this area of the park (R. Knight, pers. comm.). Other factors influencing grizzly bears include fluctuations in sizes of ungulate herds in and around the park, weather influences on winter kill of ungulates and the number of carcasses available in the spring to bears, and competition for carrion with other scavengers and carnivores including wolves.

The use of pesticides on army cutworm moths in agricultural areas could affect moth recruitment and reduce the availability of this high-quality food for bears. Food shortages may result in lower cub production, higher numbers of bear-human conflicts, and higher human-caused grizzly bear mortalities. In addition, pesticide-laden moths could carry pesticide residues from agricultural fields to high-elevation moth aggregation sites. Resulting pesticide bio-magnification in grizzly bears could cause detrimental physiological effects on moth-foraging bears. At this time, army cutworm moths are known to be used only by bears in the eastern part of the Greater Yellowstone Area.

Within the potential areas of bison management, on public lands several kinds of activities occur that may have cumulative effects on threatened and endangered species. There are several proposed timber sales on the Gallatin National Forest within the analysis area for bison, that may have a short-term displacement effect on some threatened and endangered species. These sales include the Darroch-Eagle timber sale, the Taylor Fork timber sale, and the West Lake timber sale. More information is available from the U.S. Forest Service on these timber sales. NEPA analysis has been completed on the first two sales that are now in litigation. The West Lake Sale is undergoing NEPA analysis at this time (2000). Most other public projects are fairly small in size and of limited duration and should have insignificant effects on threatened and endangered species.

Wildfire activities have not been extensive or frequent, but cover for wildlife has been temporarily reduced in burned areas. Prescribed fires have been proposed for the Horse Butte area, but final proposals and environmental assessments have not been completed. The Fall River Rural Electric Cooperative has proposed reconstruction and new construction of overhead power lines for the Madison substation to Hebgen Lake project. New roads necessary for the project would not exceed the number of roads previously closed in the area and would result in no net increase in open motorized route density (Gallatin National Forest 1998).

Gray wolf.

Mattson and Knight (1992) concluded that the reintroduction of wolves to the area would likely have both positive and negative effects on grizzly bears. Slight reductions in populations of elk and bison would be probable, and interior herds may be most affected. Big game populations could become more stable allowing for a more stable supply of carrion. Elk would likely be more affected by wolves than bison. Interactions among predators would be likely, with wolves perhaps reducing coyote populations and perhaps reducing competition for carcasses. Bears should be able to displace individual wolves from kills, but might not be able to displace larger groups of wolves. Overall, the issue of how wolves and grizzly bears would interact on the biomass available in terms of prey and carrion would be uncertain. Competition for carrion in the spring between bears and wolves is likely (Servheen and Knight 1990).

Public hunting has the potential to disturb and displace grizzly bears and gray wolves. Although the majority of hunting activities would occur when grizzly bears were in their dens, bears may be out of their dens during the beginning of hunting season. During this period, the potential for contacts between hunters and grizzly bears would exist, and may result in an increased bear mortality risk.

Wolves might also experience a minor increase in the risk of mortality from hunters on public lands. Hunter education on species identification for grizzly bears and wolves should be conducted as a mitigating measure to ensure that hunters do not kill these species while hunting elk or deer. The impacts on either grizzly bears or wolves as a result of human interactions during hunting would be expected to be minor.

The most serious threat to threatened and endangered species would be private land development and the concomitant increase in interactions between humans and these species. In the last 5 to 10 years, development has increased dramatically on private land near Yellowstone National Park. The particular areas experiencing this increase are the Yellowstone River valley (or Paradise Valley) north of Gardiner, the area in and around Gardiner, and the West Yellowstone area, particularly around Hebgen Lake. The increases in development to accommodate human habitation would decrease habitat for important wildlife species, such as grizzly bear and wolves, and also displace animals due to increased recreational activities, such as hiking, fishing, hunting, and skiing, in what was formerly high-quality land for wildlife near this development. It would be expected that this trend toward development and loss of habitat would continue indefinitely.

IMPACTS OF ALTERNATIVE 1: NO ACTION

Analysis

The continued operation of the 13-acre capture facility at Stephens Creek and the two facilities at West Yellowstone affects threatened and endangered species' habitat directly by removing acreage from potential habitat, and indirectly by disturbance and displacement of threatened and endangered species from management activities, such as shooting, hazing, and capture operations. This would most likely affect the grizzly bear and gray wolf that could normally use the area. However, the total acreage occupied by the facilities or over which bison management operations occurred would be small compared to habitat available for the wolf population, and the impact on the wolves would be negligible. Also, capture facilities would be most heavily used from December to February, a time of year when grizzly bears were denning and would not be disturbed; therefore, the impacts on grizzly bears from operation of the capture facilities would also be expected to be negligible.

Hazing activity near Reese Creek and West Yellowstone to return bison to the park would have the potential to disturb and displace any threatened and endangered species in the area near the hazing operation. Hazing would most likely occur in April and May, but might occur throughout the winter at the SMA boundaries. This would most likely affect the grizzly bear and gray wolf that could be using the area. Although individual animals may be affected, impacts of hazing on the population of either species would be short term and negligible. At this time, no grizzly bears or their sign have been observed prior to hazing operations at West Yellowstone (USFS, Inman, pers. comm.). Currently, hazing operations would cease if there was evidence of grizzlies being active in the area.

The management activity of agency personnel shooting bison that crossed the boundaries of tolerance under this alternative could disturb and displace individual wolves or grizzly bears. This would likely be a short-term, negligible impact, limited to the time shooters were actually in place and firing. Bears and wolves would be expected to reoccupy the area once agency personnel were gone.

Shooting bison at West Yellowstone and Reese Creek, and leaving bison viscera or other body parts in these areas would increase the chance grizzlies would occupy the area and encounter humans. Under such conditions, the possibility would increase that bears would be shot. Mitigation requiring agencies to remove bison parts from these areas between March 1, when bears begin to emerge from their dens, and the time boundary control operations ceased (usually in May, but possibly throughout the summer as well), is already in place under this alternative. This mitigating measure would continue under this and any other alternative involving shooting bison, and would reduce any potential impact from grizzly bear-human conflicts as a result of agency or private individual shooting to negligible.

Mitigating measures currently in place to avoid disturbance to bald eagles during bison hazing or removal operations would continue if this alternative (with management actions in the Horse Butte area) was selected. The measures include (1) no bison removal activity that would disturb eagles would occur within 1/4 mile of any active bald eagle nest from February 1 through May 15 (after which time bison have not been allowed in this area), and (2) activities associated with bison management within 1/4 mile of open water of the South Fork of the Madison River and the Madison River and Madison Arm of Hebgen Lake are limited to 10:00 A.M. to 3:00 P.M. (when eagles are not foraging). If one or more bison capture facilities were proposed, the site-specific effects of these facilities on bald eagles would have to be analyzed and mitigation applied, if needed, to prevent negative impacts on bald eagles. Because of these measures, the impacts on bald eagles would be negligible in all alternatives except alternatives 5 and 6. In alternative 5, a capture facility is proposed inside the park along the Madison River corridor. In alternative 6 a proposed capture facility could be located anywhere including Seven-Mile Bridge. Either alternative could have adverse impacts on bald eagles.

Under this alternative, bison could range outside the park into the West Yellowstone area (until April 30) and Eagle Creek/Bear Creek SMA. This would add about 35,000 acres to the available winter range (stippled area on the Alternative 1 map).

Alternative 1 is the baseline to which others can be compared. Under this alternative, the bison herd was modeled to increase from 2,200 animals at present to 3,100 bison in 10 years (2006), and the population would continue to increase to 3,500 in the year 2010, which would be the maximum population allowed under the model. Because of the relative slower increase (4% per year) in bison population, this alternative would have a short-term, negligible impact on grizzly bears.

Under this alternative, snowmobile grooming and use would continue as it has in the past. As discussed in the "Affected Environment: Threatened, Endangered, and Sensitive Species" chapter, compaction of snow makes oversnow travel relatively energy-efficient for bison, allowing them to move long distances after the snow has fallen. This allows bison to exit the park to the west in the fall and winter. If an average number of bison exited the park and were captured and slaughtered as dictated under the interim management plan, enough bison would remain in the park to die over the winter and provide grizzly bears with a source of spring carrion. However, when periodic environmental events such as a severe winter occurred, bison could be reduced to low levels, and some segments of the bison herd could be seriously reduced. This would result in a similar reduction in bison carrion, which could have a temporary, minor adverse impact on grizzly bears (Meagher, pers. comm.).

Alternative 1 has no specific measures to ensure that the bison population would remain within a given range. For this reason, and because bison would be able to exit the park on groomed trails and leave the system rather than remain as carrion, this alternative would have a potential negative impact on grizzly bears, particularly on those bears that den in the park interior where winter carrion other than bison was uncommon.

Although grizzly bears are omnivorous, (i.e., they will eat almost any plant and animal matter; see Affected Environment: Threatened, Endangered, and Sensitive Species"), some individual bears that den in the interior of the park depend on bison carrion in the spring, as little other food is available upon den emergence (male grizzly bears emerge earliest in the spring). These bears would likely be adversely affected if bison were reduced or disappeared from this area. As long as bison continued to winter and die in the interior of the park, this alternative would have only a negligible impact on the grizzly bear.

Cumulative Impacts

The additive effects of actions proposed in alternative 1, including hazing, shooting, and other human disturbances, the ongoing operation of capture facilities at Stephens Creek and in West Yellowstone, and the expected losses of bison resulting from these actions combined with potential adverse impacts from timber sales and development, would not be expected to have more than a negligible impact on any threatened, endangered, or sensitive species in the study area. Continued grooming within the park could assist bison in leaving the interior of the park, but it has not yet resulted in a loss of wintering bison in these areas (Pelican and Hayden Valleys).

Conclusion

Alternative 1, in combination with other known impacts on threatened and endangered species, would have no effect on the bald eagle (with mitigation, if needed) would not likely adversely affect the grizzly bear (as defined by the Endangered Species Act), and would not likely adversely affect (National Park Service) or jeopardize (U.S. Forest Service) the gray wolf. Due to the status of the wolf as a nonessential, experimental population, the terminology for the determination differs between the National Park Service and the U.S. Forest Service. All impacts from this alternative on threatened or endangered species in the study area would be negligible.

IMPACTS OF ALTERNATIVE 2

Analysis

No capture, quarantine, or hunting operations, and minimal hazing would be allowed under this alternative. It would include the largest area outside the park for bison to roam, and include the modification of winter grooming activities inside Yellowstone National Park to help control bison movements.

Hazing would only be used to keep bison off private land, and it would be unlikely any wolves or grizzly bear would be disturbed.

Shooting to enforce boundaries at Buffalo Horn Creek and Yankee Jim Canyon could displace grizzly bears or wolves in the short term, although the bears would be denning for some of the time shooting would take place. This activity would most likely occur from December through May, and the average emergence date for bears is in March, so there could be some displacement. At this time, wolves have rarely ventured into the areas where shooting would likely occur at the SMA boundaries. It is possible that wolves could be displaced due to this activity in the future if wolves began to inhabit these areas. Displacement impacts on bears and wolves due to shooting operations would probably be negligible. Carcasses and viscera outside the park would likely be removed, reducing the risk of human/grizzly bear interaction.

Under alternative 2 bison would be allowed to roam more widely outside the park (see Alternative 2 map). According to the model, this alternative would have the highest average growth rate of the bison population (7% per year) and number of bison for most years the plan would be in effect. The bison population was modeled to reach 3,500 by the year 2006. It should be noted that weather events causing a major movement of bison out of the park and beyond the outer SMA boundaries would likely lead to bison removal at the boundaries of the SMAs. This could keep the bison population below 3,500. It would also include the largest area over which bison were allowed to range, thereby increasing distribution of a possible food source. This alternative would have a moderately beneficial impact on the gray wolf and grizzly bear compared to alternative 1.

Under alternative 2, snowmobile trail grooming from the west entrance would cease. This could affect bison movements out of the park in the winter, making bison less efficient in leaving the park in the winter, and perhaps resulting in more bison carrion being available within the interior of the park in the spring. Grizzly bears in the park interior are known to use bison carrion, and bison carrion can be an especially important component of the spring diet for bears in the Hayden and Pelican Valleys emerging from their dens (Meagher, pers. comm.; see “Affected Environment: Threatened, Endangered, and Sensitive Species”). For this reason, alternative 2 would have the potential for an additional minor to moderate beneficial impact on grizzly bears, particularly on those bears denning in portions of the park interior where winter carrion other than bison was uncommon.

Under this alternative, it would be expected that at least a portion of the snowmobile use that would have occurred in Yellowstone National Park would shift to Gallatin National Forest, particularly in the West Yellowstone area. Concerns have recently arisen regarding susceptibility of wolverines (Copeland 1996) and lynx (USFS 1994) to disturbance. In addition, lynx are especially adapted to deep snow conditions and specialized to prey upon snowshoe hare (Weaver, pers. comm.). It has been suggested that snowmobile or other packed routes into lynx habitats might allow generalist predators (e.g., coyotes and bobcats) to compete with lynx for a limited food source (Idaho Fish and Game et al. 1995). If alternative 2 was selected, which would be expected to increase winter use on the Gallatin National Forest, the increase in activities and locations would be monitored, and if needed, mitigating measures would be designed and implemented for the protection of lynx and wolverine. With mitigation, impacts would be negligible.

Cumulative Impacts

The additive effects of actions proposed in alternative 2, including the expansion of bison winter range and proposed changes in park winter road grooming would improve conditions for threatened species feeding on bison, particularly grizzly bears. It would also help offset any potential displacement impacts from timber sales and natural changes in the bears' food supply. Overall, under alternative 2, the cumulative impacts would be moderately beneficial to grizzly bears, would have a minor benefit for wolves, and would have no impact on bald eagles.

Conclusion

In comparison with alternative 1 (the baseline), alternative 2 would have a minor to moderate benefit on grizzly bears, particularly those denning in the Hayden and Pelican Valleys, by concentrating some bison in the park interior through the modification of winter grooming practices on park roads. It would also have a moderately beneficial impact on grizzly bear and gray wolf populations throughout the study area by increasing the number of bison and their distribution. If grizzly bears and wolves were drawn outside the park to feed on bison carcasses due to increased distribution and numbers of bison, they might be subjected to a slightly higher human-caused mortality rate. This should have a negligible effect on these species and could partially offset the benefit of the potential increased distribution of bison. This alternative would have no effect on the bald eagle and is not likely to adversely affect or jeopardize the gray wolf.

Alternative 2 would have negligible impacts on wolverine and lynx with the addition of mitigating measures, if needed, by the U.S. Forest Service.

IMPACTS OF ALTERNATIVE 3

Analysis

In the short term, alternative 3 would differ from alternative 1 in that there would not be a capture facility at West Yellowstone, seronegative bison captured at Stephens Creek would be quarantined, and public hunting would play a role. In the long term, the Stephens Creek facility would likely be dismantled and a new, smaller facility constructed north of the park in a newly established SMA.

The construction, operation, and maintenance of capture and quarantine facilities would directly affect threatened and endangered species by removing acreage from potential habitat, and would indirectly affect threatened and endangered species by disturbance and displacement due to management activities, including hazing, shooting, and other operations. Although capture facilities would only operate during the winter (short term) or early spring (March 1 to April 30 in the long term), quarantine facilities would operate year-round. Locations for the quarantine facilities have not been determined and would undergo MEPA/NEPA analyses and surveys and mitigation in compliance with the Endangered Species Act if this alternative was selected. Because of this, the impact of quarantine facilities to species of special concern would be negligible.

Public hunting would be allowed if approved by the Montana Legislature. Bison would be allowed outside the park and hunted on public land. Hunting has the potential to disturb and displace the grizzly bear and the gray wolf. Although most of the hunting season (October 1 to February 28) would occur when grizzly bears were denning, bears might still be out in the fall when hunting begins. During this period, grizzly bears and armed persons might come in contact with one another with a potential result of increased bear mortality risk. However, compared with the regular season elk hunt (which runs from late October to late November), the risk would be fairly low of bison hunters and grizzly bears coming in contact. This would happen because many more elk permits would be issued than the proposed number of permits to hunt bison, elk more typically use habitats used by grizzly bears, and hunter techniques would be different for hunting elk versus hunting bison, making elk hunters more subject to contact with grizzly bears. Hunter education on species identification for grizzly bears and wolves should be conducted as a mitigating measure to ensure hunters did not kill these species while hunting bison. The impacts on either grizzly bears or wolves as a result of human interactions during bison hunting would be negligible.

Bison would be allowed to roam over a large area outside the park (see stippled areas on Alternative 3 map), and the distribution of bison as prey or carcasses would also be larger than all other alternatives except alternative 2. Bison populations would increase nearly as quickly in this alternative (6%) as in alternative 2 (7%), and modelling predicts they would reach 3,500 bison by the year 2006. Implementation of alternative 3 would have negligible impacts on the grizzly bear compared to alternative 2. Compared to the no-action alternative (alternative 1), the bison population would increase quicker, carrion would be more readily available, and grizzly bears and wolves would experience a minor beneficial impact. The effects of snowmobile trail grooming on grizzly bears would be the same as in alternative 1.

Cumulative Impacts

The additive effects of actions proposed in alternative 3, including hazing, shooting, and other human disturbances; the ongoing operation of capture facilities at Stephens Creek and possibly in the future in Yankee Jim Canyon; the construction and operation of a quarantine facility; hunting; and displacement impacts from timber sales and development, would not be expected to have more than a minor combined impact on any threatened, endangered, or sensitive species in the study area. Potential acquisition of additional winter range and resulting predicted increases in the number of bison would have a minor beneficial impact on grizzly bears and wolves. There would be potential adverse impacts on grizzly bears from the continued grooming of roads and possible loss of bison from the interior of the park. Bison numbers were much lower before the time that winter grooming began; thus, the effects of discontinuing grooming on park interior bison at their present population would not be known.

Conclusion

Alternative 3 would have no effect on the bald eagle, is not likely to adversely affect the grizzly bear or lynx, and is not likely to adversely affect or jeopardize the gray wolf. Although this alternative would allow for public hunting of bison, it would not significantly increase the mortality risk to bears or wolves given the likely number of permits issued, the locations where bison would be present, and the fact that the grizzly bears would be denning during most of the hunting season. Therefore, impacts from hunting would be negligible. However, impacts from increases in the number of bison and the area over which they would range would be a minor benefit to grizzly bears and wolves.

IMPACTS OF ALTERNATIVE 4

Analysis

The impacts of bison management actions proposed as part of alternative 4 (capture and quarantine facilities and associated habitat removal and the hazing, shooting, and other capture and quarantine operations as a disturbing and dislocating force for threatened or endangered wildlife) have been discussed in other alternatives, although the combination of public hunting and quarantine inside the SMAs described in alternative 1 would result in different population estimates discussed below.

Bison, and hence carrion, would be removed from the ecosystem in alternative 4 either by quarantine, capture, and slaughter or hunting — the method would not affect the degree of impact on grizzly bears. According to the bison population model, this alternative would result in approximately 2,800 bison by the year 2006, about 250 or 8% lower than in alternative 1. The bison population would run an average 8% to 9% lower than under the model for alternative 1. As mentioned earlier, the uncertainty in the model estimates might be fairly large due to the deterministic nature of the model. Thus, 8% to 9% would not be biologically different from alternative 1, and thus alternative 4 would have a negligible impact on grizzly bears. In the 15-year life of the management plan, bison population numbers would remain 8%–9% lower than if the no-action alternative was adopted, primarily due to the added influence of hunting.

The impacts of a capture facility located near Horse Butte on the bald eagle are described in alternative 1.

The impacts of snowmobile grooming on grizzly bears would be the same as in alternative 1, as would be the potential mitigating measures.

Cumulative Impacts

Alternative 4 would include the combination of quarantine facilities and public hunting in the future. Under alternative 4, the SMAs would be fairly large but exclude the area west of the Yellowstone River. There would be negligible cumulative impacts on the bald eagle or lynx by implementation of alternative 4. Implementation of this alternative would have a negligible to minor adverse impact on grizzly bears and wolves.

Conclusion

Alternative 4, in combination with other known impacts on threatened and endangered species, would have no effect on the bald eagle (with mitigation, if needed), is not likely to adversely affect the grizzly bear, and is not likely to adversely affect or jeopardize the gray wolf. Although this alternative would allow public hunting of bison, it would not significantly increase the mortality risk to bears or wolves given the likely number of permits issued, the locations where bison would be present, and the fact that the grizzly bears would be denning during most of the hunting season. Impacts on grizzly bears and wolves from human interactions as a result of hunting would be negligible. Hunter education on species identification for grizzly bears and wolves should be conducted as a mitigating measure to ensure hunters did not kill these species while hunting bison. The effect on grizzly bears from the slightly smaller bison population would be negligible.

IMPACTS OF ALTERNATIVE 5

Analysis

Alternative 5 would differ from alternative 1 in that the capture facilities would be located throughout the park and bison would not be tolerated outside the park.

The construction and operation of nine capture facilities at several locations would affect threatened and endangered species' habitat directly by removing acreage from potential habitat, and indirectly by disturbance and displacement due to management activities. However, capture operations would be heaviest at a time of year when grizzly bears are denning and would not be disturbed. There could be potential problems for other species of concern depending on exact facility location. Any proposed capture facility in the vicinity of Madison River would have the potential to directly affect wintering bald eagles through disturbance. See analysis of alternative 6 for impacts to threatened and endangered species should a capture facility be located in the vicinity of Seven-Mile Bridge on the Madison River.

The primary impact on grizzly bears and wolves in this alternative would be the reduction in the number of bison these species would have available as food. Bison would not be allowed to roam outside the park, and an aggressive parkwide capture and slaughter program to control brucellosis would significantly decrease the number of bison available as prey or carcasses for grizzly bears or wolves.

Modelling alternative 5 showed a bison population of approximately 1,300 in the year 2000, a bison population of 1,982 in 2006, and a population of 3,188 in 2011. The initial decrease in bison numbers for the first 10 years of implementation of the alternative would have the bison population at approximately 50%–65% of what it is modeled to be under alternative 1 (no action). In the year 2011 the bison population would reach approximately 85% of the population modeled under alternative 1. In the first 10 years or more bison numbers would be substantially lower than under the no-action alternative and would biologically important with potential moderate to major negative impacts on the grizzly bear, even given the limitations of the model to deal with stochastic events such as weather.

Although some roads would be plowed to transport bison under this alternative, the effects of snowmobile grooming and road plowing would be similar on bison movements; therefore, this alternative would have the same general effect on grizzly bears as alternative 1 in promoting efficient travel for bison to the park boundaries where they would be removed from the system. However, alternative 5 would also result in major decreases in the bison population, which would have an added effect on the carrion supply available to grizzly bears. The combination of these factors would likely have a moderate to major adverse impact on grizzly bears, particularly those in the park's interior. It would also have a moderate to major adverse impact on wolves.

Cumulative Impacts

The additive effects of actions proposed in alternative 5, including capture, shooting, and other human disturbances, and the expected losses of bison resulting from these actions combined with displacement impacts from timber sales and development, would be expected to have a negligible effect on the bald eagle, and gray wolf. The grizzly bear would experience a moderate to major adverse impact from this alternative due to a rapid decrease in bison numbers projected and the reduced area where bison were allowed to roam (park only).

Conclusion

Alternative 5, in combination with other known impacts on threatened and endangered species, may affect the grizzly bear, is not likely to adversely affect or jeopardize the gray wolf and is not likely to adversely affect the lynx. The grizzly bear would experience a moderate to major adverse impact from this alternative. This alternative could have a major adverse impact on one pair of bald eagles that nest near the Seven-Mile Bridge if one of the potential capture facilities were to be constructed in the vicinity of this site. Any of the capture facilities constructed along the Madison River would have an adverse effect on other eagles that winter along the river corridor.

IMPACTS OF ALTERNATIVE 6

Analysis

Alternative 6 would differ from alternative 1 in that a capture facility would be located at Seven-Mile Bridge within the park rather than outside the park at West Yellowstone. The capture facility at Stephens Creek would remain the same. There would also be a quarantine facility, public hunting (as in alternative 3), and bison would not allowed outside the park except in the Eagle Creek area.

The impacts of capture facilities on grizzly bears and wolves have been discussed in other alternatives. They could affect these species directly by removing acreage from potential habitat and indirectly by disturbing and displacing individual species from management activities such as hazing, shooting, and other operations. The facility at Stephens Creek and the facility proposed for the Seven-Mile Bridge area would be most heavily used during a time of year when grizzly bears were denning and would not be disturbed. Wolves could be displaced from either area. The impacts on either species would be negligible.

The capture facility at Seven-Mile Bridge in alternative 6 would have the potential to directly affect wintering bald eagles through disturbance. This facility, located at the bridge, would have a major adverse impact on one pair of nesting bald eagles and other bald eagles that winter in this area (McEneany, pers. comm.).

Unlike other alternatives, the capture facility at Seven-Mile Bridge in alternative 6 would have the potential to directly affect trumpeter swans. This species is one of concern in the park, a class 2 species of special concern for the state of Wyoming, and considered a sensitive species by neighboring national forests. The Seven-Mile Bridge location is an important area year-round for a breeding pair of trumpeter swans, who occupy slow-moving water of the Madison River (crossed by Seven-Mile Bridge). This pair is one of only four attempting to breed inside the park. The park has closed the area during breeding season for a quarter-mile around the nest to prevent human disturbance. Habitat along the Madison River near the area where this pair breeds supports up to about 110 trumpeter swans during migration. It would be unlikely that a capture facility could be built and operated without disturbing some migrating birds and the nesting pair.

This alternative would include aggressive brucellosis management actions, but numbers of bison would not fall as quickly as alternative 5, since capture and slaughter would not begin until vaccination has had its maximum effect on the bison population. Bison would also be restricted to the park and the Eagle Creek/Bear Creek area and Horse Butte (in West Yellowstone).

The model predicts that there would be approximately 3,100 bison by the year 2006 and 3,500 by the year 2010. The model used to predict population was run using two different vaccine efficacy rates, and the resulting numbers differed depending on which rate was assumed. Bison numbers increases until the year 2010, when capture and slaughter of all remaining seropositive bison began. A large drop occurred and was followed by growth at the intrinsic rate of increase (about 8%) when brucellosis was eradicated. Under the two vaccine efficacy rates, the bison population declined in the year 2011 and dropped to an estimated 79 to 82% of what it was under alternative 1. The bison population increased again after 2011, and in 2015 was between approximately 2,900 and 3,500 depending on the vaccine efficacy. Up until 2011, this alternative was modeled to be almost exactly the same as alternative 1. Because of the assumptions inherent in the model and the inability to account for stochastic events such as weather, it was predicted that alternative 6 would have a negligible impact on grizzly bears.

Some roads would be plowed under this alternative, but the effects of snowmobile grooming and road plowing on bison movements would be similar, and therefore this alternative would not change winter bison movements (see alternative 1) from those that currently exist.

Cumulative Impacts

The additive effects of actions proposed in alternative 6, including capture, shooting, and other human disturbances, and the expected losses of bison resulting from these actions combined with potential displacement impacts from timber sales and development, would be expected to have a negligible impact on any threatened, endangered, or sensitive species in the study area except for the bald eagle. The capture facility at Seven-Mile Bridge in alternative 6 would have the potential to directly affect wintering bald eagles and a nesting pair of bald eagles through disturbance. This would be a major adverse effect.

Conclusion

Alternative 6, in combination with other known impacts on threatened and endangered species, is not likely to adversely affect the grizzly bear or lynx, and is not likely to adversely affect or jeopardize the gray wolf. The numbers of bison and distribution are not very different from alternative 1; therefore, this alternative would be expected to have a negligible impact on grizzly bears. This alternative would have a major adverse impact on one pair of bald eagles that nest near the Seven-Mile Bridge and would have an impact on other eagles that winter in this area.

Alternative 6 would have the potential to have a major impact on one breeding pair of trumpeter swans and a minor to moderate impact on other trumpeter swans, a species of concern in the park and a sensitive species in neighboring national forests, that use the area around Seven-Mile Bridge where a capture facility is proposed.

IMPACTS OF ALTERNATIVE 7

Analysis

Alternative 7 would differ from the other alternatives in that it would attempt to hold the bison population between 1,700 and 2,500. Differences in management would occur as the population approached either end of the range with more lethal controls employed outside the park as the population approached 2,500 and less lethal means as the population approached 1,700 animals. Bison numbers would be held to an upper limit of approximately 2,500 animals rather than the 3,500 animals in the other alternatives; however, removal actions would only occur outside the park, thus potentially allowing the population to exceed 2,500 if bison remained in the park.

Alternative 7 would include three capture facilities, a quarantine facility, public hunting, and the potential acquisition of additional winter range north of the park's Reese Creek boundary. Hazing and shooting would occur at or near SMA boundaries. As described in other alternatives, the construction, operation, and maintenance of capture and quarantine facilities would affect threatened and endangered habitat directly by removing acreage from potential habitat, and would indirectly affect threatened and endangered species by disturbance and displacement due to management activities, including hazing, shooting, and other operations.

The impacts of a capture facility near Horse Butte on the bald eagle and potential mitigating measures needed to avoid negative impacts are described in alternative 1.

Although capture facilities would only operate during the winter or early spring, quarantine facilities would operate year-round. The effects on threatened or endangered species of the capture facilities, hazing, and shooting would be short term, while the effects of the quarantine facility would likely be long term. The location of the quarantine facility has not been determined and would undergo additional analysis if located on public land, with necessary surveys and mitigation in compliance with the Endangered Species Act if this alternative was selected. Thus, the impact of quarantine facilities on species of special concern should be negligible.

Public hunting would be allowed under this alternative if approved by the Montana Legislature. Bison would be hunted on public land outside the park. Hunting would have the potential to disturb and displace grizzly bears, lynx, and gray wolves. Although most of the hunting would occur when grizzly bears were in their dens, bears might be out of their dens in the fall when hunting commences. During this period the potential for contacts between hunters and grizzly bears would exist with a result in an increased bear mortality risk. However, compared with the regular season elk, the risk that bison hunters and grizzly bears would come into contact with one another would be fairly low. This would be because many more elk permits would be issued than the proposed number of bison permits, elk would more often be found in habitats used by grizzlies, and hunter techniques would be different for elk and bison. Wolves might also experience a minor increase in the risk of mortality from hunters in the area. Hunter education on species identification for grizzly bears and wolves should be conducted as a mitigating measure to ensure that hunters did not kill these species while hunting bison. The impacts on either grizzly bears or wolves as a result of human interactions during bison hunting would be expected to be minor. Mitigating measures requiring agencies to remove bison viscera and remains from the areas on the national forest where bears might occur after March 1 would be required. This would reduce the potential impact of grizzly-human conflicts to negligible.

Under alternative 7, the bison population was modelled to increase fairly rapidly to 2,705 animals (by the year 2003) and remain at this level due to the management actions employed in this alternative. In the year 2006, alternative 7 has an estimated 88% of the bison population predicted by the model for alternative 1. In the year 2011, alternative 7 has an estimated 77% of the bison in alternative 1. The bison population might exceed 2,500 under alternative 7 because if bison stayed within the park boundaries, no bison management actions would be proposed (except for use of the Reese Creek capture facility in the short term). Because of the assumptions inherent in the model and the inability to account for stochastic events such as weather, alternative 7 would not be biologically different from alternative 1, and therefore would have a negligible impact on grizzly bears. In addition, the segments of the bear population that would be of concern in relation to losing their spring food supply would be the bears that denned in the vicinity of Pelican and Hayden Valleys. As long as bison continued to winter and die in these areas in the interior of the park, the impact on grizzly bears would be negligible. There has been concern that all bison would exit the interior of the park, and no bison or bison carrion would be left for grizzly bears emerging in the spring in these areas. Conditions that would cause this to occur would be unknown. Bison populations and movements relative to the park's interior, especially Pelican and Hayden Valleys, should be monitored to attempt to determine how many bison would be left in the park's interior each winter. If insufficient numbers of bison were deemed to be remaining in the interior, mitigation should be considered. In conclusion, alternative 7 would have a negligible impact on grizzly bears.

Cumulative Impacts

The additive effects of actions proposed under this alternative, including hazing, shooting, and other human disturbances related to bison management, the construction and operation of three capture facilities and one quarantine facility, and public bison hunting, would not likely have more than a negligible impact on grizzly bears. This would be because grizzly bears were denning during the period of much of the bison management activity with a possibility for some overlap in fall and March when bears were not in dens. Mitigating measures in the form of bison viscera removal on the national forest after March 1 to reduce the potential for conflict with grizzly bears in and near areas of human habitation and use, and hunter education for bison hunters to also help avoid bear-human conflict would enable these activities to have a negligible impact on grizzly bears.

Gray wolves might experience a negligible effect due to the slightly reduced potential availability of bison carrion under this alternative. Activities related to bison management might have some temporary disturbance and displacement effects on wolves. As a measure, hunter education for bison hunters on the identification of grizzly bears and wolves would mitigate the potential misidentification by bison hunters and reduce the risk of mortality during the bison hunting season.

The operation of the capture facility in the Hebgen Lake area of West Yellowstone would have the potential to affect the bald eagle. Mitigating measures for the bald eagle are in place to ensure that this alternative would have no impact on this species. Measures currently in place to avoid disturbance to bald eagles during bison hazing or removal operations would continue. These would include (1) no bison removal activity that would disturb bald eagles would be permitted within 1/4 mile of any active bald eagle nest from February 1 through May 15 (after which time bison have not been allowed in this area), and (2) activities associated with bison management within 1/4 mile of open water of the south Fork of the Madison River and the Madison River and Madison Arm of Hebgen Lake would be limited to 10:00 A.M. to 3:00 P.M.

Trumpeter swan numbers have been decreasing in the Greater Yellowstone Area over the past several years. Inside the park, only 21 adults were counted in spring 1997 (NPS, McEneany, pers. comm.). Although the reasons for the decline are unknown, it is speculated that snowmobiling and loss of habitat in the Yellowstone region might be a contributors.

Conclusion

Alternative 7 would have negligible impacts on lynx, and negligible impacts on the bald eagle with required mitigating measures. Alternative 7 would have a negligible effect on the gray wolf but is not likely to adversely affect or jeopardize this species.

Alternative 7 would have negligible effects on the grizzly bear from the displacement and disturbance caused by bison management activities, and from the potential availability of slightly less bison carrion under this alternative than alternative 1. However, based on modelling and comparison of alternatives above, alternative 7 is not likely to adversely affect the grizzly bear because the bison population and potential amount of bison carrion available under this alternative was not believed to be measurably different from that available under alternative 1 given the inherent natural variability in populations and mortality. If one could model the natural variability in the bison population and carrion on an annual basis, the bison numbers under all alternatives except alternative 5 would be very likely to overlap, meaning that no real or measurable difference would exist among the effects of these alternatives.

Public hunting would not significantly increase the mortality risk to bears or wolves given the likely number of bison permits issued, the locations where bison would be present, and the fact that the grizzly bears would be denning during most of the hunting season. The impact of hunting on grizzly bears and wolves as a result of human contact would be minor. Hunting education on species identification for grizzly bears and wolves should be conducted as a mitigating measure to ensure that hunters did not kill these species while hunting bison.

IMPACTS OF THE MODIFIED PREFERRED ALTERNATIVE

Analysis

The modified preferred alternative would employ an adaptive management approach that allows the agencies to gain experience and knowledge before proceeding to the next management step, particularly with regard to managing bison on winter range outside Yellowstone National Park. The alternative uses many tools to address the risk of brucellosis transmission, but primarily relies on the spatial and temporal separation of potentially infectious bison (including their birth products) and susceptible cattle. Bison would not be allowed to intermingle with cattle and would be hazed back into the park, captured, or shot (if they could not be hazed) at least 45 days before cattle return to graze in the summer.

This time period would ensure all bacteria are destroyed by the heat and light of a typical Montana spring. An overall herd size of approximately 3,000 bison, as well as manageable limits to the number of bison outside the park, would be enforced. As with other alternatives, vaccination of eligible bison, including remote vaccination of those inside the park, is anticipated.

For the most part, when bison are allowed to exit the park to access winter range, they would be managed in zones, where management becomes increasingly intense as bison approach the edge of the zone boundaries. As with most of the other alternatives, untested bison would be allowed to occupy the Eagle Creek/Bear Creek area, the Cabin Creek Recreation and Wildlife Management Area, and the Monument Mountain Unit of the Lee Metcalf Wilderness year-round, without agency interference. This alternative would differ from the other alternatives in that it would attempt to maintain a bison population of around 3,000. However, as in alternative 7, removal actions would occur only outside Yellowstone National Park, thus potentially allowing the population to exceed 3,000 if bison remained inside park boundaries.

The modified preferred alternative would include three capture facilities, a potential quarantine facility, and the use of acquired additional winter range north of the park's Reese Creek boundary. Hazing and shooting by agency personnel would occur at or near boundaries of the different management zones. As described in other alternatives, the operation and maintenance of capture and quarantine facilities would affect threatened and endangered habitat directly, by removing acreage from potential habitat and would indirectly affect threatened and endangered species by disturbance and displacement due to management activities, including hazing, shooting, and vehicular travel.

Although capture facilities would operate only during the winter or early spring, the quarantine facility would operate year-round. The effects of the capture facilities on threatened or endangered species, hazing, and shooting would be short-term, while the effects of the quarantine facility would likely be long-term. The location of the quarantine facility has not been determined and would undergo additional analysis if located on public land, with the necessary surveys and mitigation in compliance with the Endangered Species Act if this alternative was selected. Thus, the impact of quarantine facilities on species of special concern should be negligible.

Under the modified preferred alternative, the enhanced stochastic model projected a mean total population increasing from 2,108 in 1997 to 3,117 in 2001 (year 5 of the model) and then stabilizing between 2008 and 2014 at approximately 3,700 animals. The mean estimated bison population for the modified preferred alternative is similar to the mean population of 3,700 for alternative 1.

For the life of the plan after 2002, when cattle grazing stops north of the park boundary at Reese Creek (year 6 of modelled plan), up to 100 seronegative bison would be allowed in that area in the winter. Unlike alternative 1, which requires that management actions be taken when any bison attempt to cross the northern boundary, the modified preferred alternative may provide for less capture and handling of bison when the tolerance limits outside the park are not exceeded.

Similarly, management objectives would allow up to 100 bison within the prescribed West Yellowstone management area during winter. The modified preferred alternative would allow for management flexibility and potentially less hazing, capture, and handling of bison when the tolerance limits outside of the park are not exceeded.

The modified preferred alternative may affect grizzly bears by slightly altering the distribution of bison during the winter. Because bison would be allowed to winter in portions of the winter range from which they were previously hazed back into the park, a limited increase in the number of carcasses of winter-killed bison is expected in these zone management areas. Although implementation of the modified preferred alternative may slightly alter the distribution of bison carcasses, it is not expected to negatively alter the overall availability of bison carcasses for grizzly bears. As in alternative 1, the modified preferred alternative ultimately would result in a similar overall number of bison carcasses available in the analysis area. There has been concern that a large-scale migration from the park would result in no bison or bison carrion being left in the interior of the park for grizzly bears emerging in the spring. As stated in alternative 7, if insufficient numbers of bison were deemed to be remaining in the interior of the park after monitoring their population and movements, mitigation should be considered.

Bison carcasses that remain in the zone management areas, which are important sources of food for grizzly bears upon leaving their wintering dens, may attract the attention of some opportunistic bears and entice them into these areas more often than would occur under alternative 1. However, mitigating measures would require agencies to remove bison viscera or carcasses after March 1 from areas on public lands at or surrounding capture facilities or on public lands where human use might occur. This would reduce the potential impact of grizzly-human conflicts to a negligible level.

Allowing up to 100 bison to winter-over outside the park in both the north and west boundary areas might mean more winterkilled bison carcasses outside the park for wolves that range in these areas. The modified preferred alternative would likely have negligible to undetectable effects on wolf distribution and prey consumption. This potential effect on the wolf population would be expected to be minor to negligible.

Continued operation of the three capture facilities and the associated human activities (hazing, agency shooting, and vehicular travel) may displace wolves from the area during winter operations. However, wolf activity in these areas is nonexistent to extremely limited. It is also possible wolves may already be acclimated to the presence of these facilities and have modified their behavior. The grassland and steppe communities do not offer as much cover for wolves as do forested areas, and this area may be less attractive to wolves. Therefore, potential effects on wolves from continued human activities would be considered negligible to nonexistent.

Facilities in the Horse Butte area of West Yellowstone would have the potential to affect the bald eagle. Mitigating measures currently in place under the Special Use Permit authority of the Gallatin National Forest to avoid disturbance of bald eagles during bison hazing or removal operations would continue. If any additional facilities were proposed, the site-specific impacts of these facilities on bald eagles would have to be analyzed, and mitigating measures would be applied, if needed. The operation of a capture facility in the Reese Creek area would not affect bald eagle nesting, but may have a negligible effect on foraging by eagles along the Yellowstone River in that area. Because of the implementation of mitigation measures, the impacts on bald eagles would be negligible. The modified preferred alternative would allow for potentially less hazing, capture, and handling of bison when tolerance limits outside the park are not exceeded and therefore would have less negative impacts on eagles compared with alternative 1.

The modified preferred alternative may also positively affect bald eagles by slightly altering the availability, location, time, and, to some extent, the abundance of winterkilled bison north and west of the park. Because bison would be allowed to winter in these portions of the winter range from which they were previously hazed back into the park (as in alternative 1), a limited increase in the number carcasses of winterkilled bison is expected. These carcasses, which are potential sources of food for wintering bald eagles, may attract opportunistic eagles into these areas more often than would occur under existing management practices.

Cumulative Impacts

Grizzly bears in the analysis area are likely to continue to be affected cumulatively by actions and activities occurring in the area. Bison management activities such as hazing, shooting, and other human disturbances related to capture facilities and the construction of a quarantine facility would not have more than a negligible impact on grizzly bears. Although there is the possibility of overlap in the fall and spring when bears are not in dens, during the majority of bison management activities, bears would be in their dens. Bison carcasses that remain in the zone management areas, which are important sources of food for grizzly bears upon leaving their wintering dens, may attract the attention of some opportunistic bears and entice them into these areas more often than would occur under alternative 1. However, mitigating measures requiring agencies to remove bison viscera or carcasses from areas in the national forest after March 1 to avoid conflict with bears in and around human habitation would be required. This and hunter education for bison hunters, to help avoid bear-human conflict, would ensure that these activities would have negligible impacts on grizzly bears.

Although the Horse Butte area is not regarded as winter range for elk, elk may be present, especially during the early spring. The continued operation of the capture facility would add to the level of human activity during the winter/early spring period and could cause a temporary change in the distribution of elk in the area. However, elk observed on Horse Butte appear to occupy habitat with more cover (trees). Because elk are a major prey species of wolves, if elk are attracted to the capture facility due to the presence of hay (used to bait bison), wolves may possibly increase their use of the area (U.S. Forest Service 1998). Also, the Horse Butte area is used only sporadically by wolves (usually in the summer); it appears they do not rely on this area for winter-killed elk or bison carcasses. The potential change in the distribution of bison (and bison winter-killed carcasses) and elk from the park to the Horse Butte area would not be expected to negatively affect the wolf (U.S. Forest Service 1998).

Recreational activities are popular in the analysis area and the number of participants is increasing. Popular activities include snowmobiling, cross-country skiing, dog sledding, snow shoeing, hunting, and fishing. Recognizing the increasing popularity of winter recreation, the National Park Service is developing a new winter use plan to manage winter use in Yellowstone and Grand Teton national parks. However, this analysis is not yet complete. Thus, within Yellowstone National Park, some roads are plowed, other roads are groomed for use by motorized oversnow vehicles, and nonmotorized uses occur on groomed routes, on ungroomed routes, and in the backcountry.

Generally, increases in winter recreational activities in combination with implementation of the modified preferred alternative are not likely to result in more than negligible cumulative effects on the grizzly bear. Most bears are in hibernation during the winter use season. Furthermore, denning habitats are generally away from the sites of winter use (NPS 1999a). Consequently, the opportunity for winter use to affect grizzly bears is minimal.

Development and increases in recreational activities would continue to affect wolves, lynx, and bald eagles cumulatively as these activities, in effect, fragment existing habitats. The primary location where cumulative effects would be expressed is on Horse Butte, where recreational activities on the system of national forest lands are pursued year-round because of close proximity to the community of West Yellowstone, Montana. The potential effects on wolves from current winter recreational activities were considered negligible and short-term with mitigation and administration measures (NPS 1999a). The primary location where cumulative effects would be expressed concerning bald eagles is around the Horse Butte nest site and foraging areas along the Madison Arm, particularly when open water on the lakes is limited. In particular, ongoing development and increases in recreational activities, in combination with operation of the Horse Butte capture facility, appear to have the greatest potential to affect bald eagles. However, with the permit restrictions on public land activities imposed on the operation of the Horse Butte facility, it is not expected to contribute significantly to the cumulative effects.

Cumulatively, increases in recreational activities and development may make a limited number of bison carcasses unavailable to grizzly bears. As discussed in the Biological Assessment for the Horse Butte capture facility (U.S. Forest Service 1998), bison have been observed in and around private lands and homes and do not appear to be displaced by existing human activities associated with these areas. In contrast, grizzly bears tend to avoid carcasses in close proximity to roads, buildings, and other areas of human activity. Thus, carcasses of bison located near roads and sites of other human activity may go unused by grizzly bears.

Conclusion

The modified preferred alternative would have negligible effects on the bald eagle with the required mitigating measures. The modified preferred alternative may have a minor positive effect on bald eagles, particularly those nesting on Horse Butte, as a result of the potential for less hazing, capture, and handling of bison. The modified preferred alternative would have some slight, but negligible, effects on the lynx and gray wolf but is not likely to adversely affect these species.

The modified preferred alternative would have indirect effects on the grizzly bear from the displacement and disturbance caused by bison management activities and from the potential alteration in distribution of available bison carrion. However, based on modelling and comparison of the bison population, the modified preferred alternative is not likely to adversely affect the grizzly bear. The bison population and potential amount of bison carrion available under this alternative is expected to be similar to alternative 1.

Public hunting of elk and deer would not significantly increase the mortality risk to bears or wolves, given the locations where bison would be present and that grizzly bears would be denning during most of the hunting season. The impact of hunting on grizzly bears and wolves as a result of human contact would be minor.

The areas of potential habitat for threatened or endangered species that would be occupied by facilities or where displacement would also occur are only a small percentage of the total potential habitat available in the Greater Yellowstone Area.

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

There would be no irreversible (long-term or permanent) commitments of resources for any of the alternatives.

There would be some irretrievable (short-term or reversible) commitments of resources under several alternatives.

Implementation of alternative 5 might have a moderate to major adverse impact on the grizzly bear. This would be because the bison numbers would be low during the first 10 years of implementation and would climb slowly. The initial decrease in bison numbers and slow increase for the first 10 years of implementation of the alternative would have the bison population at approximately 50%–65% of what it was modeled to be under alternative 1 (the no-action alternative). In the year 2011 the bison population would reach approximately 85% of the population modeled under alternative 1. In the first 10 years or more bison numbers would likely be substantially lower than under alternative 1, and this difference between alternatives 5 and 1 would likely be biologically important, even given the limitations of the model to deal with stochastic events such as weather. Planned management activities would significantly lower bison population numbers. This would be most important if bison numbers and distributions declined and/or altered to the point that few bison would no longer winter (and die) in the interior of the park, particularly in Pelican and Hayden Valleys. This would affect bears that depended on bison carcasses in the spring when they emerged from their dens.

Mitigating measures for bald eagles, wolverine, and lynx would prevent the irreversible or irretrievable commitments of resources as related to these species. Wolverine and lynx have the most potential to be affected by alternative 2 in which snowmobile use would decrease in the national park and likely increase in the national forest. Bald eagles that nest and winter in the vicinity of the Seven-Mile Bridge would suffer a major negative impact under alternative 6.

Operation of a capture facility in the Seven-Mile Bridge area (alternative 6) would likely result in the loss of at least one breeding pair of trumpeter swans.

Sensitive plant surveys prior to facility location would ensure that sensitive plants would not be affected.

LOSS IN LONG-TERM AVAILABILITY OR PRODUCTIVITY OF THE RESOURCE TO ACHIEVE SHORT-TERM GAIN

Under alternative 5 grizzly bear productivity could be affected in the long term. Under alternative 6 the loss of productivity of one pair of nesting bald eagles would occur, and bald eagles wintering in the Seven-Mile Bridge area would also be negatively affected.

Loss of a breeding pair of trumpeter swans at Seven-Mile Bridge (alternative 6) and the creation of an area unsuitable for nesting could contribute to a decline in the overall productivity of the local swan population in the long term. Implementation of mitigating measures, where needed, would ensure no loss in long-term availability or productivity of other threatened, endangered, and sensitive species.

UNAVOIDABLE ADVERSE IMPACTS

Under alternative 5, there may be unavoidable adverse impacts on the grizzly bears. Under alternatives 5 and 6, the only possible location for the Seven-Mile Bridge capture facility would have an impact on nesting and wintering bald eagles.

Operation of a capture facility at Seven-Mile Bridge (alternative 6) would result in a major adverse impact on at least one pair of breeding trumpeter swans, and could have a moderate adverse impact on the local swan population by removing several acres from availability for nesting sites.

IMPACTS ON OTHER WILDLIFE SPECIES

SUMMARY OF REGULATIONS AND POLICIES

Several planning and policy documents, including the *Yellowstone National Park Master Plan* (NPS 1974), the *Yellowstone National Park Statement for Management* (NPS 1991), and the *National Park Service Management Policies* (NPS 1988) require the protection of ecological processes and native species in a relatively undisturbed setting, and require that park planning be accomplished in a regional context. The goals outlined in the *Resource Management Plan* (NPS 1995) are to "preserve the natural and cultural resources of Yellowstone and to allow natural process and interactions between resources to occur with a minimum of human influence."

The wildlife-related goals of the Gallatin National Forest as stated in the *Gallatin National Forest Plan* (1987) include the following: (1) provide habitat for viable populations of all indigenous wildlife species and for increasing populations of big game animals, (2) provide sufficient habitat for recovered populations of threatened and endangered species, and (3) strive to prevent any human-caused grizzly bear losses. The U.S. Forest Service is a multiple use agency, and in the area closest to the park that lies in the grizzly bear recovery zone, the *Forest Plan* allows for resource use (e.g., timber harvest, recreation) compatible with the recovery of the grizzly bear.

The method used to identify impacts on other wildlife species was to initially identify which species might occupy habitat in areas where bison management activities might occur or otherwise be affected by them.

METHODOLOGIES FOR ANALYZING IMPACTS

The method used to identify impacts on other wildlife species was to initially identify which species might occupy habitat in areas where bison management activities might occur or otherwise be affected by them. A review of the available literature was conducted, to determine whether the ecological niche of bison might overlap with these species as well. This includes food choices as well as the geographical area each species occupies. Potential effects were then analyzed based on information obtained from the literature review and from accumulated knowledge about the particular species and the location and nature of bison management activities. Impacts are assessed qualitatively, due to a lack of quantitative data and quantitative methods for predicting effects.

IMPACTS COMMON TO ALL ALTERNATIVES

The acquisition of approximately 6,000 acres of land that has taken place or has been proposed through purchase, exchange, and conservation easements north of the park in the Gardiner Valley would result in more winter habitat available to elk, mule deer, and, to a lesser extent, bighorn sheep. This increase in winter habitat might result in a negligible or minor increase in the population size of these ungulates. Acquisition of access to winter range in the Gardiner Valley would also make more winter habitat available to pronghorn. Although some pronghorn currently use private lands north of the park boundary, a hunt has been conducted for the past 10 years on those lands. The purpose of the hunt has been to remove, through hunting and associated displacement, pronghorn from agricultural land in that area. Acquisition of additional winter range in the north boundary area could remove the need for the hunt, and could lead to a moderate, or possibly major, increase in the population.

Elk

Hazing activities directed at moving bison into capture facilities or inside the SMA boundary might disturb and displace elk using those areas. Displacement and disturbance could increase energy expenditures and result in increased chance of mortality for some individual elk. Hazing would likely be infrequent, however, and displacement and stress would be local and temporary and would have only minor effects on the elk population. Shooting activities to control bison in boundary areas would likely have the same effect on elk as hazing.

Although elk and bison share habitat and eat similar foods, these species do not have to compete for either in the analysis area (Singer and Norland 1994). Therefore, increases or decreases in bison population numbers would not expected to affect elk through competition for food or habitat.

Pronghorn

Pronghorn winter range in the analysis area is limited, and is restricted to approximately 7,000 acres, 75% of which is within the park. This area is located between Mammoth Hot Springs and Cinnabar Mountain, with the core use area in the open grasslands near the Stephens Creek area. A bison capture facility currently exists at Stephens Creek, and would continue to operate in all alternatives (for the short term only in alternatives 3 and 7) except alternative 2. The facility occupies 13 acres of this core use area, and removes it from winter range available to the pronghorn.

Hazing and shooting activities to manage bison in this area might have also had an adverse effect on the herd. Pronghorn could be particularly vulnerable to stress caused by human disturbance (Autenrieth 1983), and observations made during bison captures and associated activities in the winter of 1996–97 indicated that pronghorn were displaced from the area extending at least 1/2 mile outward from the Stephens Creek capture facility (Caslick and Caslick 1997). In addition to displacement, hazing and shooting activities could increase energy expenditures and could result in increased risk of mortality of some individuals. Because of the small size and vulnerability of this population, the loss of a few individuals could have moderate to major impacts on the population as a whole.

Hazing and shooting activities in areas other than the Gardiner Valley/Stephens Creek area would be expected to have minimal impact, if any, on pronghorn.

Yellowstone bison and pronghorn are separated by habitat selection, food habits, snow tolerance, and seasonal distribution. Therefore, increases or decreases in the number of bison would not be expected to affect pronghorn through competition for food or habitat.

Deer

Hazing and shooting activities would have a similar effect on deer as that described for elk. Fewer deer than elk would likely be affected, due to lower numbers of deer in the area and different distribution of deer on the winter range.

Although bison and mule deer experience some degree of overlap in habitat use, there appears to be little or no competition between these two species because of differing diet preferences (Singer and Norland 1994). Competition may also be precluded by seasonal distribution differences and by the limited ability of deer to deal with deep snow. Bison and white-tailed deer also appear to avoid competition through food choices. Therefore, no impacts on deer from increases or decreases in bison population sizes would be expected.

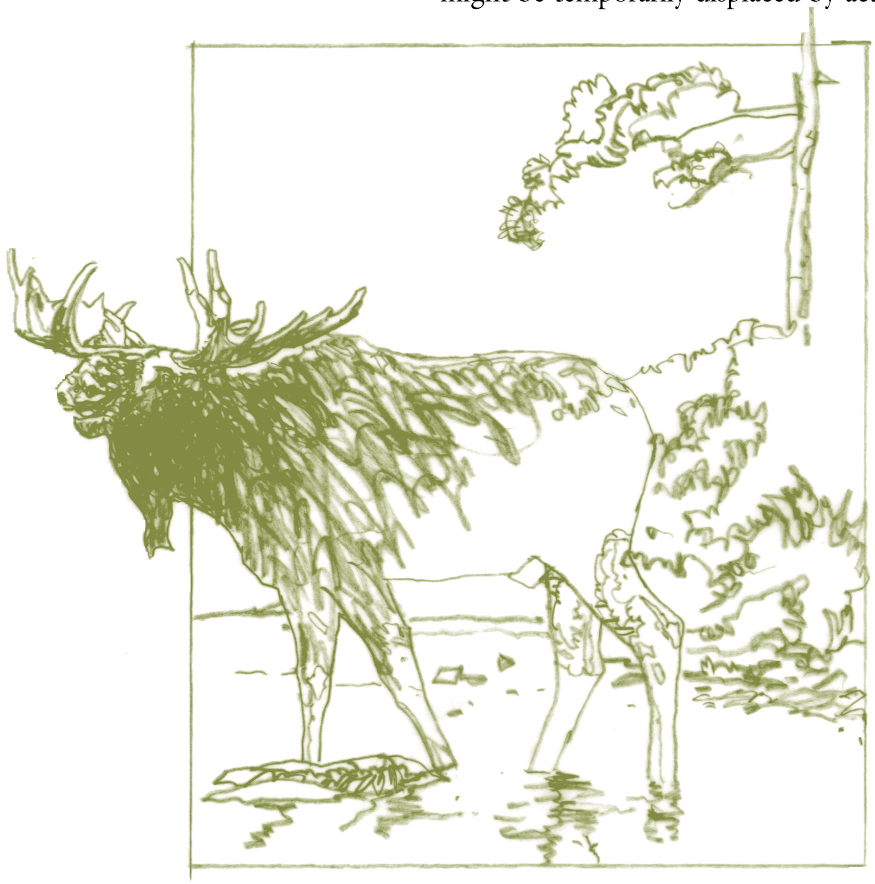
Bighorn Sheep

Hazing and shooting activities could temporarily affect a small number of sheep in the vicinity of those activities. Hazing and shooting activities would likely be very infrequent in areas used by bighorn sheep and would not have any effect on the population.

While there has been some increase in habitat overlap between bighorn sheep and bison in recent years (Singer and Norland 1994), the two species are separated ecologically by differences in distribution, diet, and tolerance of snow. During spring, bison increasingly select habitats with characteristics important to bighorn sheep, but there does not appear to be appreciable overlap or competition for the use of those areas from bison. Therefore, increases or decreases in the bison population size would not be expected to affect bighorn sheep through competition for food or habitat.

Moose

Hazing and shooting activities would be expected to have no detectable impact on the moose population. A few moose in the West Yellowstone area might be temporarily displaced by activities in that area.



Bull moose.

Moose tend to use riparian habitats, and are not likely to compete with bison for forage or habitat. Increases or decreases in the bison population size would not be expected to have an impact on moose through competition for either forage or habitat.

One study (Forbes et al. 1996) has indicated that infection with *Brucella abortus* might be fatal to moose, while another study (Zarnke 1983) suggested that brucellosis might not be a threat to moose. Because only small numbers of moose inhabit the analysis area and they do not occupy the same habitat as bison, and because bison in the area might have few or no brucellosis-related abortions (the route of disease transmission in other ungulates), the risk of transmission would be remote (e.g., less than negligible). In addition, in all alternatives, vaccination would be used to reduce seroprevalence rates in bison. Vaccination would accomplish this in part by further reducing abortions and therefore reducing the amount of bacteria available in the environment. The selection of any alternative analyzed in this environmental impact statement would therefore further reduce the risk of transmission to moose.

Predators and Scavengers

Hazing activities directed at moving bison into capture facilities or inside the SMA boundary might disturb and displace predator and scavenger species using those areas. Hazing would likely be infrequent, however, and displacement and stress would be local and temporary and have only minor effects on those populations. Shooting activities could provide an additional food source (gut piles) for scavengers in areas where such food was not previously available. However, this would not likely represent a significant addition to the food supply for these animals, and therefore would not have more than a negligible impact on scavenger populations. Measures requiring removal of gut piles or carcasses from areas near human habitation might prevent conflicts between humans and scavengers using the additional food source.

IMPACTS OF ALTERNATIVE 1: NO ACTION

Analysis

Ungulates. Elk and other ungulates could be captured unintentionally in temporary enclosures designed to hold bison. Some animals might be unable to escape the enclosures on their own. Animals unable to escape would be separated from the bison and released. Although unlikely, bison could physically injure other ungulates that are captured with bison in the capture facilities. The additional stress might affect individual ungulates, but this should not significantly affect ungulate populations using winter range in the Stephens Creek and West Yellowstone areas.

Capture operations and associated capture facilities and wing fences would occur on critical pronghorn winter range in the Stephens Creek area. Pronghorn winter range is restricted to approximately 7,000 (7,168) acres (Houston 1982) in south end of the Gardiner Valley, west of the Yellowstone River. Wing fences and increased human activity might cause displacement of pronghorn from a portion of their winter range, and increase stress on animals. Caslick and Caslick (1997) reported that pronghorn avoided the area within about 1/2 mile of the Stephens Creek facility when bison management activities were occurring during the winter of 1996–97. They also reported that the center of pronghorn activity apparently shifted away from the Stephens Creek service road junction with the County Road, possibly in response to increased traffic associated with bison management activities. At least one adult pronghorn was killed by a coyote along the wing fence (Caslick and Caslick 1997). The wing fence design included a 24-inch gap under the bottom wire to facilitate pronghorn movement, but presence of the fence in a previously open area might have confused pronghorn, which rely on rapid flight over long distances to escape predators.

Species Associated with Bison Grazing and Behavior. Habitat disturbances such as tree rubbing, trails, and wallowing occur in certain locations favored by bison, and would likely be unaffected by all but the most dramatic reductions of bison numbers (NPS, Meagher 1973). Therefore, species associated with these features would not be affected by this alternative.

Predators and Scavengers. Some bison that might otherwise have died within the park would be removed through capture and shipment to slaughter in this alternative. This removal should not be of great enough magnitude to affect the food supply of scavengers.

Impacts Associated with Snowmobiling. Currently, some segments of road inside the park are groomed during the winter, and are used by winter recreationists including snowmobilers. The use of snowmobiles likely affects a wide range of wildlife species, including big game, furbearers, and small mammals. In general, snowmobiling is believed to lead to displacement and increased energetic costs of wildlife (Caslick and Caslick 1997). Winter recreation can result in harvest, habitat modification, pollution, and disturbance. These results have a number of potential impacts on wildlife species, including altered behavior, altered vigor, altered productivity, or death in the long term. The abundance, distribution, and demographics of populations could be affected, and this could result in a change in species composition and interactions among species (Knight and Cole 1995). These could include alteration of wildlife movement or displacement from normal wintering areas and higher energy costs for stressed wildlife, potentially resulting in decreased production of young, and occasionally, in the case of snowmobile/wildlife collisions, direct mortality. Use of snowmobiles in thermal areas, which are of great value to wintering wildlife, would be of special concern inside the park (Caslick and Caslick 1997).

Grooming for snowmobiles, which compacts the snow, can benefit wildlife species that use these groomed trails for energy-efficient travel (Aune 1981). The presence of groomed (compacted) trails also allows species to venture into areas where they do not normally winter (Copeland 1996). This might result in adverse impacts when it allows generalist predators, such as coyotes and bobcats, to enter the winter foraging areas of specialized predators such as the lynx. The extent to which animals other than bison use groomed snowmobile roads within the park to facilitate movement in winter is not well known. The degree of impact is also unknown.

Cumulative Impacts

Human development of winter range adjacent to the Yellowstone National Park boundary, in combination with increased human activity both inside and outside the park could be causing increased disturbance and displacement of elk, mule deer, and bighorn sheep from important habitat. These activities would occur on winter range that would be critical for the pronghorn population. The current pronghorn population of approximately 220 animals is considered to be at an unacceptably high risk of extinction due to chance events such as weather, predation, and disease (Goodman 1996). Winter range available to pronghorn is limited in size and could be of suboptimal quality due in part to invasion by nonnative vegetation into the Stephens Creek area. Predation by coyotes might be causing a very low level of fawn survival, and might also be affecting adult survival. Hunting would remove a small but possibly significant number of pronghorn from the population annually. These factors, in combination with disturbance and displacement resulting from the presence and operation of the Stephens Creek capture facility, could result in a cumulative adverse impact, particularly for pronghorn.

There would be no actions proposed or now being taken that might mitigate the impacts of the capture facility. The impact of coyote predation on the pronghorn population would be unknown; therefore, the potential effect of coyote control would also be unknown. Currently, only five permits are offered for pronghorn in the hunting district adjacent to Yellowstone National Park, in part because of concern over the low population size. The potential effect of ceasing the hunt altogether would be unknown except that 2–10 additional pronghorn might survive in the population each year. Ceasing the hunt would require action on the part of the Montana Department of Fish, Wildlife and Parks. Rehabilitation of habitat on the winter range could provide some benefit, the degree of which is unknown, but plans to do so have not been fully developed. Purchase or easement of additional winter range that would expand the area currently available to pronghorn might mitigate the effects of the capture facility at Stephens Creek.

Conclusion

The impacts of hazing and capture operations on elk, bighorn sheep, mule deer, and moose would likely be negligible. Operation of the capture facility at Stephens Creek could potentially contribute to a moderate to major decrease in the pronghorn population, through displacement of pronghorn from a portion of critical and limited winter range, through creation of a barrier to movement (wing fences), and through disturbance-related increases in energy expenditure during the critical winter period. Impacts on wildlife from the continuation of snowmobile use would not be well known, but would likely be minor as it would be confined to groomed trails. Wildlife would tend to habituate to snowmobile traffic and would use packed snowmobile routes for energy-efficient travel. No impacts on predators, scavengers, or other species associated with bison grazing and behavior from increases or decreases in bison population size would be expected as a result of this alternative.

IMPACTS OF ALTERNATIVE 2

Analysis

Ungulates. The presence and operation of a capture facility at Stephens Creek during the first phase of this alternative would have impacts similar to those described under alternative 1, although they could be less severe because they would be of shorter duration (five years compared to 15 years).

Increased bison distribution and numbers outside the park under this alternative would not likely affect other ungulate species. Singer and Norland (1994) indicated that at bison population levels at or higher than that anticipated under this alternative, no competitive effects would be detectable in other ungulate species.

Species Associated with Bison Grazing and Behavior. Habitat disturbances such as tree rubbing, trails, and wallowing occur in certain locations favored by bison and would likely be unaffected by all but the most dramatic reductions or increases of bison numbers (NPS, Meagher 1973). Therefore, species associated with these features would not be affected by this alternative.

Predators and Scavengers. Increased distribution of bison outside Yellowstone National Park might result in increased distribution of carcasses, providing food for scavengers in areas where this food source was not previously available. This would have the potential to create both positive and negative impacts on certain scavenger species. The additional food source would be beneficial but could be offset by bringing those scavengers, particularly bears and coyotes, into conflict with humans. Measures requiring removal of gut piles or carcasses from areas near human habitation might mitigate these effects.

Impacts Associated with Snowmobiling. In this alternative, roads currently groomed and used by snowmobiles in the winter might be closed to help keep bison from easily migrating outside the park. The cessation of winter road grooming from the west entrance under alternative 2 would have the effect of discontinuing snowmobile use from West Yellowstone into the park, and displacing it onto adjacent public lands outside the park. On the Gallatin National Forest, many parts of the forest, excluding wilderness areas and generally big game winter ranges, would be open to snowmobiling on or off groomed routes. The technology of snowmobiles has improved to the point that the machines are capable of going up very steep slopes and entering areas of the forest where they have not been able to travel in the past. As more snowmachines used the national forest and entered areas away from roads and trails, some species of wildlife would have the potential to be affected, and the effects could potentially be major as snowmobile use increased in areas where it had either not occurred or occurred in small amounts in the past.

Where snowmobiles were permitted over a wide-ranging area in and near big game winter ranges, as they were in the Gallatin National Forest, potentially major impacts on already stressed ungulates in the form of increased energy expenditures could occur (Caslick 1997). Predators that normally feed on these ungulates would also suffer adverse impacts from displacement. Extensive literature is now available on the effects of various forms of winter recreation on wildlife. In general, snowmobiling could lead to displacement and increased energetic costs of wildlife (Caslick and Caslick 1997).

The cessation of snowmobile grooming and snowmobile activity in the park would probably have some beneficial effects on wildlife in the park, such as reducing displacement away from groomed roads and snowmobile activity. It might also change the way in which wildlife move within the park in the winter, or at least cause animal movement to be less energy-efficient.

Grooming for snowmobiles, which compacts the snow, could benefit wildlife species that use these groomed trails for energy-efficient travel (Aune 1981). The presence of groomed (compacted) trails would allow species to venture into areas where they did not normally winter (Copeland 1996). However, it might also have major adverse impacts through competition with specialized predators such as lynx when it would allow generalized predators such as coyotes and bobcats to enter their winter foraging areas.

The extent to which animals other than bison would use groomed snowmobile roads within the park to facilitate movement in winter would be unknown. It would be likely that many species use them, and these animals would find those movements restricted by closure of roads to grooming and snowmobiling. Restricted movement could result in increased cost of movement between foraging areas and consequently decreased survival and reproduction. Conversely, the removal of a major disturbance and displacement factor (snowmobiles) could benefit some species by reducing stress and associated energy expenditure. Although the degree of impact would vary among species, restricting travel and removing snowmobiles could generally be offsetting to park wildlife.

Without mitigation, impacts of increased snowmobile uses on wildlife on the national forest would be moderately negative. With mitigation, such as confining snowmobile use to existing trails, these impacts might be reduced to minor, although the degree of impact would be unknown. Specifically, snowmobiles may be restricted in big game habitat or other wildlife habitat during critical times of the year, such as when winters were particularly harsh or food supplies were low.

Cumulative Impacts

Cumulative impacts would be expected to be similar in the first phase of this alternative to those described under alternative 1, but less severe because the presence and operation of a capture facility at Stephens Creek was assumed to last about five years until 2002 and not 15 years as under alternative 1. Acquisition of winter habitat in the Gardiner Valley could offset the negative impacts of human development and increased human activity. Although more than one factor has likely contributed to the decline in the pronghorn population, availability of more winter range might help offset some of those influences.

Conclusion

During phase 1 of this alternative, the presence and operation of a capture facility at Stephens Creek might result in a moderate adverse impact on the pronghorn population through displacement of pronghorn from portions of critical winter habitat and creation of a barrier to movement (wing fences) in the midst of critical winter habitat.

Acquisition of additional winter range in the Gardiner Valley might slightly increase populations of elk and mule deer, by increasing the amount of winter forage available and reducing stress associated with current displacement from those areas. Acquisition of winter range in the Gardiner Valley could contribute to at least a moderate and possibly a major increase in the pronghorn population, by greatly expanding the limited winter range available to them. The degree of impact on wildlife of displaced snowmobile use to public lands outside the park would be unknown, but would likely be more adverse than under existing conditions as snowmobiles would not be restricted to trails outside the park. No impacts on predators, scavengers, or other species associated with bison grazing and behavior from increases or decreases in bison population size would be expected under this alternative.

IMPACTS OF ALTERNATIVE 3

Analysis

Ungulates. Operation of capture facilities during the first phase of this alternative would have the same impacts as those described for alternative 1. Movement of the capture facility out of the Stephens Creek area in phase two of this alternative would likely have a beneficial effect on the pronghorn population, by allowing them to again use that part of their winter range and by removing disturbances associated with operation of the facility.

The beneficial effects of habitat acquisition discussed under "Impacts Common to All Alternatives" might be slightly offset for all ungulate species by bison hunting activities conducted within the acquired area. Hunting might create temporary and localized displacement or stress of individuals or small groups of elk, bighorn sheep, mule deer, and pronghorn.

Species Associated with Bison Grazing and Behavior. Habitat disturbances such as tree rubbing, trails, and wallowing would occur in certain locations favored by bison and would likely be unaffected by all but the most dramatic reductions or increases in bison numbers (NPS, Meagher 1973). Therefore, species associated with these features would not be affected by this alternative.

Predators and Scavengers. Viscera associated with hunting in the acquired area, in addition to winterkilled carcasses distributed over a larger area, could draw scavenger species, such as coyotes and bears, into the area and potentially into conflict with humans. Measures requiring removal of viscera or carcasses from areas near human habitation might mitigate these effects.

Impacts Associated with Snowmobiling. No changes in existing winter road grooming would be anticipated in this alternative. Bison movements along groomed trails would be monitored, and options for restricting bison movement through blocking or closing roads researched. Any closures resulting from amendments to the park's winter use plan that restrict bison movement might also restrict the movement of other wildlife species, and research on bison movement would continue. Otherwise, impacts on wildlife from snowmobiling would be similar to those described in alternative 1.

Cumulative Impacts

Cumulative impacts would be expected to be the same as those described under alternative 1 in the short term, and the same as those described under alternative 2 in the long term.

Conclusion

The impacts of hazing and capture operations on elk, pronghorn, mule deer, and moose would not be major. During the period in which the capture facility at Stephens Creek was in operation, there would be the potential for a moderate to major impact on the pronghorn population through their displacement from portions of critical winter habitat and creation of a barrier to movement (wing fences) in the midst of critical winter habitat. Acquisition of wildlife habitat in the Gardiner Valley would have a moderate to major beneficial impact on elk, mule deer, pronghorn, and bighorn sheep by providing additional winter range that would be of limited availability. No impacts on predators, scavengers, or other species associated with bison grazing and behavior from increases or decreases in bison population size would be expected as a result of this alternative. Impacts on wildlife from the continuation of snowmobile use would be unknown, but would likely be minor as it was confined to groomed trails.

IMPACTS OF ALTERNATIVE 4

Analysis

Ungulates. Operation of capture facilities under this alternative would have the same impacts as those described under alternative 1. Hunting activities conducted under this alternative would likely have little to no effect on other ungulate species because hunting would be limited to areas in which extensive elk hunting already occurred. Bison hunting would not be conducted within pronghorn winter range.

Species Associated with Bison Grazing and Behavior. Habitat disturbances such as tree rubbing, trails, and wallowing occur in certain locations favored by bison, and would likely be unaffected by all but the most dramatic reductions or increases of bison numbers (NPS, Meagher 1973). Therefore, species associated with these features would not be affected by this alternative.

Predators and Scavengers. Scavengers feeding on gut piles would not likely come into conflict with humans any more than they currently do as a result of feeding on offal from the elk hunting season.

Impacts Associated with Snowmobiling. No changes in existing road grooming practices would be anticipated under this alternative. Therefore, impacts from snowmobiling would be the same as those described for alternative 1.

Cumulative Impacts

Cumulative impacts would be expected to be the same as those described under alternative 1. The degree to which land acquisition or easement might offset other impacts on wildlife would be dependent on whether additional winter range was acquired by purchase or easement, on the terms of easement, on the land use and management of the acquired area, and on whether the capture facility would be moved into the acquired area and where it would be located.

Conclusion

Impacts on all wildlife species would be expected to be the same as those described under alternative 1.

IMPACTS OF ALTERNATIVE 5

Analysis

Ungulates. Capture facilities would be constructed and operated at up to nine locations within and adjacent to the park. These facilities would occupy several acres each, in areas previously available to a variety of wildlife species. Activity associated with capture operations would likely temporarily displace most wildlife from the area immediately surrounding each facility. Capture operations in the Lamar and Blacktail Plateau areas could displace elk, mule deer, pronghorn, and a variety of predators and scavengers (see below). Capture operations in the Madison River, Firehole River, and Hayden and Pelican Valley areas could displace elk. During the fall and spring elk would be present in Pelican and Hayden Valleys; they would not be present in the winter. The temporary displacement and disturbance to elk and mule deer would be expected to affect individuals but would have no effect on those populations as a whole. Little is known about the habits and habitat use of pronghorn in the Blacktail Plateau and Lamar Valley areas, but it would be unlikely that capture facilities in these locations would have a major impact on the population. As in alternative 1, operation of a capture facility at Stephens Creek could contribute to a moderate to major decline in the pronghorn population.

Species Associated with Bison Grazing and Behavior. Removal of more than half the bison population could have ecological consequences that would be difficult to assess. There is some overlap in habitat use and diets of bison, elk, and bighorn sheep, but there has been no measurable degree of interspecific competition among these species (Singer and Norland 1994). Removal of a large number of bison from Yellowstone Park could result in increased habitat and forage species available for elk and bighorn sheep. Conversely, there is evidence that bison grazing contributes to increased production and nutritional content of grasses as well as to the stability of grassland systems (Frank and McNaughton 1993; Singer 1995; Wallace 1996). Removal of large numbers of grazers (i.e., bison) could actually reduce the productivity of grasslands, at least temporarily, for other species.

Absence of bison from some areas where they previously existed could result in some minor habitat changes. Some wallows could grow in, depending on the duration of absence of bison from those areas, and result in microsite changes affecting individual mammals, birds, and insects. Absence of tree rubbing and grazing in some areas could contribute to the promotion of forest invasion into open areas, although continued grazing by large numbers of elk might offset these effects. It would be likely that the continued presence of other grazers combined with climate and fire events would contribute more to maintaining landscape characteristics than the presence or absence of bison alone.

Predators and Scavengers. Removal of more than 40% of the bison population would result in a substantial reduction in the number of winterkilled bison carcasses available to scavengers. Black bears, grizzly bears, wolves, coyotes, foxes, ravens, magpies, and many other bird and insect species rely on bison carcasses as an important food source in late winter and spring. Although elk and other ungulate carcasses would still be available, the major reduction in biomass associated with removal of so many bison from the system would likely have a moderate adverse effect on scavenger species.

Grizzly bears would be the most likely scavenger species to be affected by the reduction in availability of bison carcasses in spring. A large reduction in the number of winterkilled bison carcasses, in combination with low availability of other natural foods, could also contribute to increased bear-human conflicts both inside and outside Yellowstone National Park. Impacts on grizzly bears are discussed in detail under "Impacts on Threatened, Endangered, and Sensitive Species."

Some scavengers might have learned to rely on carcasses available at predictable locations. Removal of such a large portion of the bison population might result in complete removal of bison from some localities within the analysis area where they previously existed. Carcasses might therefore be absent from areas where they had been predictably found. The absence of these carcasses might adversely affect individual scavengers or localized portions of scavenger populations. The impact on scavenger populations overall would likely be minor to moderately adverse.

A significant reduction in the amount of carrion available to scavengers might increase competition for the remaining carrion (e.g., elk carcasses). This competition could adversely affect some scavenger species, such as foxes, coyotes, and black bears, that might not be able to compete against larger scavengers (grizzly bears and wolves). The extent of this impact, or species that might be affected, would be unknown.

Impacts Associated with Snowmobiling. This alternative would require the plowing to pavement of some sections of road inside the park for short periods of time to facilitate transport of seropositive bison to slaughter. This would mean snowmobiles and other winter recreationists who have traditionally used the groomed roads as winter trails would be temporarily displaced, and the roads would be used intermittently by trucks and other vehicles associated with the capture operations in the park.

The extent to which animals other than bison use groomed snowmobile roads within the park to facilitate movement in winter would be unknown. Plowing of roads to access capture facilities would allow for continued use of those travel routes. The removal of a major disturbance and displacement factor (snowmobiles) could benefit some species by reducing stress and associated energy expenditure.

Unlike alternative 2, the adverse impact of prohibiting the use of travel corridors and associated increases in energy expenditure would not take place in alternative 5. However, to the extent snowmobile use was displaced from the park onto public lands in the adjacent Gallatin National Forest, impacts on wildlife as described in alternative 2 would occur. The degree of impact on forest wildlife within the Gallatin National Forest would be similar to that in alternative 2.

Cumulative Impacts

The effects of operation of capture facilities at Stephens Creek, combined with increased development outside the park, increased human activity both inside and outside the park, predation, and hunting could have a moderate to major negative effect on the pronghorn population, resulting in decreased numbers.

Increases in development and activity outside the park, combined with loss of a significant portion of their food source inside the park, might have a moderate impact on scavenger populations.

Conclusion

Operation of capture facilities throughout Yellowstone National Park would likely have minor temporary and local adverse impacts on ungulates and other species. Impacts on pronghorn of the capture operation at Stephens Creek could potentially contribute to a moderate to major decline in numbers. Although most scavengers rely on elk carcasses in addition to bison carcasses, the reduction in availability of an important late winter and early spring food source would likely create a moderate reduction in scavenger populations in specific areas.

The removal of 40% of the bison herd could result in ecological changes affecting other ungulates and minor microsite changes affecting individual mammals, birds, and insects. The degree of these impacts and species affected would be unknown.

Impacts as a result of snowmobile displacement from plowed roads might occur as snowmobile use would be expected to increase in the adjacent national forest. The impact would likely be moderately negative on wildlife for the first few years as this alternative was implemented and roads were plowed in the park.

IMPACTS OF ALTERNATIVE 6

Analysis

Ungulates. Impacts on ungulates during the first phase of this alternative would likely be similar to those described under alternative 1. The types of impacts described under alternative 5 would be the same that wildlife would experience during the second phase of this alternative, although the magnitude would not be as great as the bison population size would be much larger before the areawide capture, test, and slaughter phase began.

Species Associated with Bison Grazing and Behavior. Habitat disturbances such as tree rubbing, trails, and wallowing would occur in certain locations favored by bison, and are likely to be unaffected by all but the most dramatic reductions of bison numbers (NPS, Meagher 1973). Therefore, species associated with these features would not be affected by this alternative.

Predators and Scavengers. Some bison that might otherwise have died within the park would be removed through capture and shipment to slaughter in this alternative. Removal of a significant portion of the bison population during the capture, test, and slaughter phase could temporarily have a minor to moderate effect on scavenger species. The magnitude of this effect would be less than in alternative 5 because the bison population would be higher in alternative 6 and fewer bison would be removed.

Impacts Associated with Snowmobiling. The impacts from plowing roads for a short period of time during the winter for the years capture and slaughter operations took place would have impacts on wildlife comparable to those described in alternative 5.

Cumulative Impacts

Cumulative impacts on ungulates (pronghorn in particular) would likely be the same as those described under alternative 1 in the short term, and as those described under alternative 5 in the long term.

Conclusion

As in alternative 5, operation of capture facilities throughout Yellowstone National Park during phase 2 of this alternative might locally and temporarily affect a variety of wildlife species. Adverse impacts on scavenger populations would be less intense than in alternative 5, but similar in that they would involve the loss in a single year of several hundred bison from the ecosystem. Operation of capture facilities at Stephens Creek could contribute to a moderate to major decline in the pronghorn population. Impacts as a result of snowmobile displacement from plowed roads might occur, although the degree of impact would be unknown.

IMPACTS OF ALTERNATIVE 7

Analysis

Ungulates. Operation of capture facilities during phase 1 of this alternative would have impacts similar to those described under alternative 1. Movement of the capture facility out of the Stephens Creek area in phase 2 would likely have a beneficial effect on the pronghorn population, by allowing pronghorn to use that part of their winter range and by removing disturbance associated with operation of the facility. Operation of the capture facility at Horse Butte would not be likely to have a measurable effect on any wildlife species because this area would not be used by other ungulates for winter range.

Acquisition or easement of additional winter range would have impacts similar to those described under "Impacts Common to All Alternatives." The degree to which acquisition or easement of additional winter range might benefit wildlife would be dependent on whether habitat was purchased or easement acquired, and on the terms of easement. The beneficial effects of habitat acquisition or easement might be slightly offset for all ungulate species by bison hunting activities conducted within the acquired area. Hunting might create temporary and localized displacement or stress of individuals or small groups of elk, bighorn sheep, mule deer, and pronghorn.

Species Associated with Bison Grazing and Behavior. Habitat disturbances such as tree rubbing, trails, and wallowing would occur in certain locations favored by bison, and would likely be unaffected by all but the most dramatic reductions of bison numbers (NPS, Meagher 1973). Therefore, species associated with these features would not be affected by alternative 7.

Predators and Scavengers. Viscera associated with hunting in the acquired area, in addition to winterkilled carcasses distributed over a larger area, could draw scavenger species, such as coyotes and bears, into the area and potentially into conflict with humans. Measures requiring removal of gut piles or carcasses from areas near human habitation might mitigate these effects.

Maintenance of the bison population at or below 2,500 animals would remove, through capture and shipment to slaughter or quarantine, some bison that might otherwise have died within the park. The overall reduction in the bison population as compared to alternative 1 might have a minor negative impact on scavenger populations.

Impacts Associated with Snowmobiling. The impacts associated with snowmobiling under alternative 7 would be the same as those described for alternative 1.

Cumulative Impacts

Cumulative impacts would be expected to be similar to those described under alternative 1. Easement or acquisition of additional winter range in the

Gardiner Valley might be a mitigating measure for the cumulative impacts on ungulate populations as described under alternative 2. The degree to which land acquisition or easement could offset other impacts would depend on whether additional winter range was acquired by purchase or easement, on the terms of easement, on the land use and management of the acquired area, and on whether the capture facility would be moved into the acquired area and where it would be located.

Conclusion

During the period in which the capture facility at Stephens Creek would be in operation, there would be potential for moderate to major adverse impact on the pronghorn population as described under alternative 1. Acquisition of wildlife habitat in the Gardiner Valley would likely have a moderately beneficial impact on elk, mule deer, pronghorn, and bighorn sheep, depending on the terms of acquisition or easement. Removal of bison for the purpose of maintaining the population at about 2,500 animals might have a minor negative impact on predators and scavengers. No impacts on species associated with bison grazing and behavior from increases or decreases in bison population size would be expected under this alternative.

IMPACTS OF THE MODIFIED PREFERRED ALTERNATIVE

Analysis

Ungulates. The presence and operation of a capture facility at Stephens Creek during the first step of this alternative would have impacts on ungulates similar to those described under alternative 1. During steps 2 and 3 of this alternative, up to 100 bison may occupy lands north of Yellowstone National Park (unlike alternative 1) that require management actions when bison attempt to cross the northern boundary. The modified preferred alternative may provide for less capture and handling of bison when the bison population is around 3,000 animals and tolerance levels outside the park are not exceeded. Therefore, during steps 2 and 3 of this alternative, the impacts on ungulates in the Stephens Creek and Reese Creek areas would be similar to those described under alternative 2, with a moderate to major benefit for pronghorn and a minor benefit for other ungulates. Operation of the capture facility at Horse Butte would not be likely to have a measurable effect on any wildlife species because this area would not be used by other ungulates for winter range. Management of bison in the management zones under this alternative may disturb and displace other wildlife species, but the impact is considered to be short-term and minor.

Species Associated with Bison Grazing and Behavior. Habitat disturbances such as tree rubbing, trails, and wallowing occur in certain locations favored by bison and would likely be unaffected by all but the most dramatic reductions of bison numbers (NPS, Meagher 1973).

Under this alternative, it is expected that grazing and the behaviors cited above would not be modified and conditions in these areas would be similar to what exists under alternative 1. Therefore, it is unlikely that other wildlife species associated with areas of bison grazing and bison-disturbed habitats would be affected by the implementation of this alternative.

Predators and Scavengers. During step 1 of this alternative, impacts on predators and scavengers would be similar to those described under alternative 1. Tolerance of bison outside Yellowstone National Park, particularly in the Reese Creek area, associated with steps 2 and 3 of this alternative, might result in increased distribution of winterkilled carcasses, providing food for scavengers in areas where this food source was not previously available. This would have the potential to create both positive and negative impacts on certain scavenger species. The additional food source would be beneficial, but in some areas scavengers such as bears and coyotes may come into conflict with humans. Mitigation measures requiring removal of carcasses from areas near human habitation might minimize these effects.

Impacts Associated with Snowmobiling. No changes in existing road grooming practices would be anticipated under this alternative. Therefore, impacts from snowmobiling would be the same as those described for alternative 1.

Cumulative Impacts

Cumulative impacts would be expected to be the same as those described under alternative 1.

Conclusion

During step 1, when bison would be captured and tested throughout the winter, there would be the potential for moderate to major impacts on the pronghorn population in the Stephens Creek and Reese Creek areas as described under alternative 1. Operation of the Horse Butte capture facility is not expected to have any impacts on other wildlife species. During steps 2 and 3, this alternative may provide for less capture and handling of bison when the population size is around 3,000 animals and tolerance limits outside the park have not been exceeded. The reduction in use of the Stephens Creek capture facility is expected to result in a moderate to major beneficial impact on pronghorns and a minor benefit to other wildlife. No impacts on species associated with bison grazing and behavior from changes in bison population size would be expected under this alternative. The increased tolerance of bison north of the park may result in an increase in winterkilled carcasses in the area, which would be a minor benefit to scavengers.

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

The effects of the Stephens Creek capture facility and associated structures and activities (in all alternatives except alternative 2) in critical pronghorn winter range could result in an irretrievable loss of individual pronghorn antelope. The cumulative effects of the capture operation combined with predation, restricted winter range, increasing human development and activity, and other factors (see discussion on pronghorn ecology, habitat use, and food habits in "Affected Environment: Other Wildlife Species") could result in eventual irreversible loss of this pronghorn population. These impacts might be mitigated or reversed by acquisition of additional wildlife winter range in the Gardiner Valley and associated cessation of capture operations at Stephens Creek (alternatives 3, 7, and the modified preferred alternative).

Removal of more than 40% of the bison population (alternative 5) and the consequent reduction in the number of bison carcasses available to scavengers could result in the irretrievable loss of individual scavengers. Mortality of individual scavengers might also result from increased conflicts with humans or from competition with other scavengers for a reduced food supply.

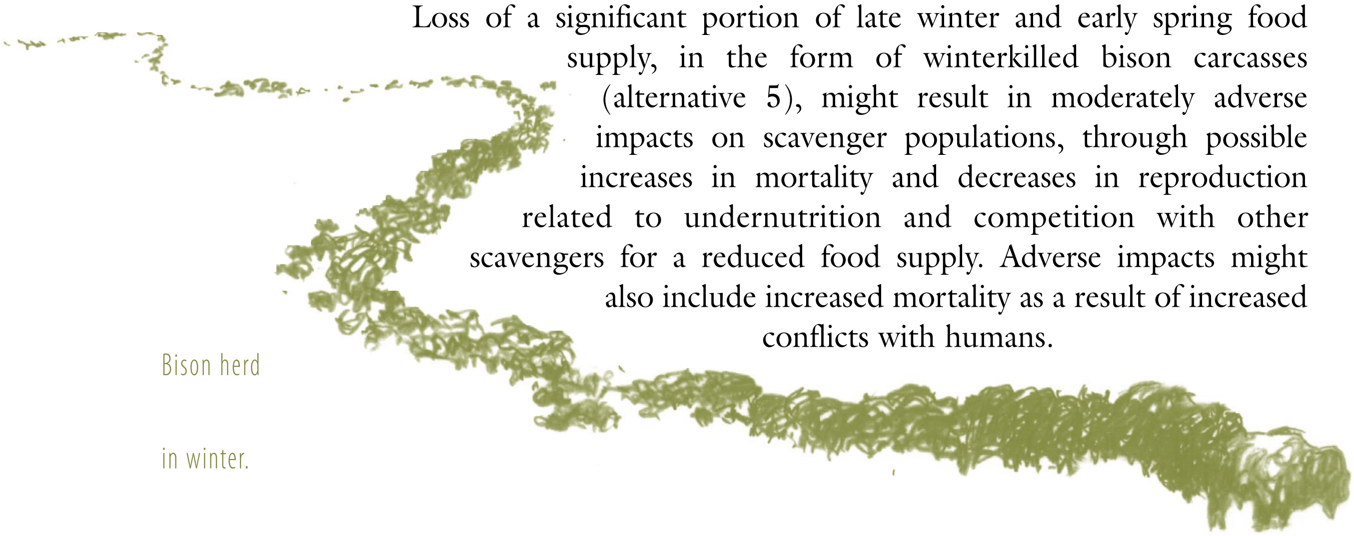
LOSS IN LONG-TERM AVAILABILITY OR PRODUCTIVITY OF THE RESOURCE TO ACHIEVE SHORT-TERM GAIN

The impacts on the pronghorn population from bison management activities in alternatives 1, 4, 5, 6, and 7 could contribute to a long-term decline or, combined with other factors, eventual loss of the pronghorn population (see discussion on pronghorn ecology, habitat use, and food habits in "Affected Environment: Other Wildlife Species").

UNAVOIDABLE ADVERSE IMPACTS

The capture facility and associated structures and activities in the Stephens Creek area (alternatives 1, 3, 4, 5, 6, 7, and the modified preferred alternative) could have a moderate to major adverse impact on the pronghorn population, by displacing pronghorn from a portion of their limited, critical winter range, by increasing stress and energy expenditures related to disturbance by humans, and by increasing vulnerability to predation.

Loss of a significant portion of late winter and early spring food supply, in the form of winterkilled bison carcasses (alternative 5), might result in moderately adverse impacts on scavenger populations, through possible increases in mortality and decreases in reproduction related to undernutrition and competition with other scavengers for a reduced food supply. Adverse impacts might also include increased mortality as a result of increased conflicts with humans.



Bison herd in winter.

IMPACTS ON HUMAN HEALTH

SUMMARY OF REGULATIONS AND POLICIES

Under authority of public laws, executive order, regulations, and APHIS directive, APHIS has a brucellosis health monitoring program that provides educational information concerning the disease and assists in the prevention of brucellosis for APHIS employees. No regulations or policies regarding the protection of human health from brucellosis exist, although standard measures such as those described in the impacts section for protection from disease would apply.

METHODOLOGIES FOR ANALYZING IMPACTS

The agencies reviewed information about human brucellosis in the literature to qualitatively evaluate the risks to human health that might result from bison management.

Based on information about transmission of brucellosis from livestock to people, bison management would not be a health risk to the general public.

IMPACTS COMMON TO ALL ALTERNATIVES

Based on information about transmission of brucellosis from livestock to people, bison management would not be a health risk to the general public. However, brucellosis transmission from bison to people responsible for various management actions, e.g., hunters or those dressing bison carcasses, might occur.

Transmission to people might result from contact with infectious tissues by people responsible for eviscerating or processing bison carcasses or otherwise handling infectious materials. Contact infection might occur either directly through the skin on the hands; the infection could be carried from the hands to the eyes or mouth; or, infection could occur through the splattering of uterine fluids or blood into the eye or mouth. In particular, veterinarians, lab workers or others working with carcasses or reproductive tissues of infected bison (for instance, females with placental lesions or who have aborted fetuses, or males with testicular abscesses or other lesions of the external genitalia) might be subject to higher risks of contracting the disease. Infection would also be possible as a result of inhalation of the organism by people working with bison or bison tissues, especially in poorly ventilated areas. People who ingested contaminated raw organ tissue would be at risk for infection. Also, persons responsible for vaccinating bison are at risk for accidental injection and subsequent infection with the vaccine strain of the *brucella* organism.

Although the risk of brucellosis transmission from bison to people could not eliminated, the potential could be significantly reduced by employing reasonable precautionary measures. These would include the following:

- Those who assist with capture operations and load live bison for shipment to slaughter would be warned to avoid direct contact with vaginal discharges; birth membranes; or, blood from animals that might have been injured during capture.
- Those who collect blood or tissue, conduct field blood tests, or give vaccinations would have to have the necessary training and skills to safely conduct these procedures, and would have to wear gloves, masks, and protective eyewear.
- Laboratory work on potentially infected tissues and fluids would be done by trained professionals using appropriate safety measures.
- Slaughterhouse workers should wear appropriate clothing and eyewear, and use standard sanitation procedures. In addition, slaughterhouses should include proper ventilation and provide safety training for their employees.
- Hunters would complete orientation, including instruction on safe procedures for field dressing bison and safe handling of meat. Instruction would emphasize avoiding contact with the uterus and the udder, with strong advice against opening the uterus of pregnant cows.
- Qualified agency officials would supervise field dressing and the removal of pregnant uteri, male external genitalia, or the entire offal from the field.

In addition to the risk of transmission of brucellosis from bison to people, there would be low to moderate risks of human injury in all actions that include handling of live bison. These injuries could occur during hazing, capture, testing, vaccination, or loading bison.

CUMULATIVE IMPACTS COMMON TO ALL ALTERNATIVES

No cumulative impacts related to the transmission of brucellosis to humans would occur in the study area.

IMPACTS OF ALTERNATIVE 1: NO ACTION

Analysis

Alternative 1 would include capture, testing, and slaughter of bison. As described above under "Impacts Common to all Alternatives," agency personnel who collect blood samples and administer blood tests would be at risk of contracting the disease. The degree of risk to these personnel would be considered moderate. However, with the addition of precautionary measures, such as training and implementation of safe handling procedures, the risk would be negligible to minor.

People assisting with capture and loading of live seropositive bison in trucks for slaughter might be exposed to the disease through discharged fluids, birth membranes, or blood from infected animals. The risk of infection would be negligible to minor.

Personnel in charge of vaccinating would also be at minor risk from accidental injection because the available brucellosis vaccines would consist of live organisms.

Tribal representatives or those staff who assist agency personnel in cleaning and loading carcasses might also be exposed. With proper precautions, the risk would be negligible to minor.

Conclusion

The risk of transmission to people responsible for bison management would be negligible to minor if safe handling practices were employed. If safe handling practices were not used, the risk might be moderate to those who worked with fluids or birth materials from infected animals.

IMPACTS OF ALTERNATIVE 2

Analysis

Under alternative, the risk of brucellosis transmission to humans would be the lowest of all alternatives. This would be because bison would not be captured, slaughtered, tested, or vaccinated with hand injection.

Conclusion

The risk of brucellosis transmission to any bison management personnel would be negligible to minor.

IMPACTS OF ALTERNATIVE 3

Analysis

Many of the impacts described for alternative 1 would also apply to alternative 3. An additional group of people at moderate risk includes hunters, who would come in contact with tissues during field dressing, and might handle pregnant females or their fetuses. With training, which would be considered mandatory, the risk of transmission of brucellosis to hunters would be minor.

Conclusion

The risk of transmission to people responsible for bison management and to hunters would be negligible to minor if safe handling practices and training were employed. If safe handling practices and training were not used, the risk to either hunters or to those who work with fluids or birth materials from infected animals could be moderate.

IMPACTS OF ALTERNATIVE 4

Analysis

Populations at risk in this alternative would include agency personnel involved with capture, slaughter, testing, vaccination, loading for shipment, and shooting as described above, and would be similar to alternative 1. In addition, hunters, tribal representatives, or those staff who would assist agency personnel in cleaning and loading carcasses could be exposed.

Conclusion

The risk of transmission to people responsible for bison management and to hunters would be minor if safe handling practices and training were employed. If safe handling practices and training were not used, the risk to either hunters or to those who work with fluids or birth materials from infected animals might be moderate.

IMPACTS OF ALTERNATIVE 5

Analysis

In this alternative, nine capture facilities would run simultaneously and bison would be shipped to slaughter if they tested seropositive. Given that about one-half of the population typically tests seropositive, more bison would be transported to slaughterhouses than in any other alternative. Even with safe handling practices, the increased volume of processed bison and resulting increased contact with infected body fluids or fetuses could lead to a moderate risk to veterinarians, laboratory workers, and slaughterhouse workers (e.g., those actually in contact with fluids, birth materials, or fetuses). When the test and slaughter phase ended, risk of transmission would be expected to decline markedly because the vast majority of seropositive bison would have been removed from the herd. During the succeeding monitoring phase, the risk of transmission would be negligible as there would be few if any seropositive bison remaining in the herd.

Conclusion

The risk of transmission to people responsible for bison management would be moderate, even when safe handling practices were used during the first phase of this alternative. When the test and slaughter phase ended, the risk of transmission would be negligible.

IMPACTS OF ALTERNATIVE 6

Analysis

During the vaccination phase, impacts of alternative 6 would be the same as alternative 1. During the test and slaughter phase, impacts would be the same as alternative 5.

Conclusion

The risk of transmission to people responsible for bison management would be minor to moderate, but more likely to be moderate. When the test and slaughter phase is completed, the risk of transmission would likely be negligible.

IMPACTS OF ALTERNATIVE 7

Analysis

Populations at risk in this alternative would include agency personnel involved with capture, slaughter, testing, vaccination, loading for shipment, and shooting as described above, and would be similar to alternative 1. In addition, hunters, tribal representatives, or those staff who assisted agency personnel in cleaning and loading carcasses might be exposed to brucellosis.

Conclusion

The risk of transmission to people responsible for bison management and to hunters would be negligible to minor if safe handling practices and training were employed. If safe handling practices and training were not used, the risk to either hunters or to those who work with fluids or birth materials from infected animals might be moderate.

IMPACTS OF MODIFIED PREFERRED ALTERNATIVE

Analysis

Individuals responsible for bison management would include agency personnel involved with the capture, slaughter, testing, vaccination, loading for shipment, and shooting, as described above. The degree of impact on each of these groups would be similar in steps 1 and 2 of this alternative to that described for alternative 1. In step 3, bison would not be captured or tested unless the early spring population was greater than 3,000 animals, more than 100 bison occupied the management zones outside of the park, or bison could not be hazed back into Yellowstone National Park in the spring before cattle return to graze. It is likely that step 3 would pose fewer health risks to personnel involved with the capture, slaughter, testing, loading for shipment to slaughter, and in-chute vaccination than alternative 1. Impacts on these groups would be close to those in phase 2 of alternative 3. Some risk to staff performing remote vaccination on bison calves during step 3 is possible, as bison may charge or otherwise threaten those delivering such a vaccine. Such risk is likely to be fully mitigated by the use of vehicles, although vehicles may not be used except on established roads within the park. Remote vaccination may occur off roads and trails and risks would likely be negligible to minor.

Bison in holding pens at Stephens Creek capture facility, 1997.

Conclusions

The risk of transmission to people responsible for bison management would be negligible to minor if safe handling practices and training were employed. The degree of risk would decrease to bison-handling personnel in step 3 compared with earlier steps, but may increase relative to these steps and pose a minor risk to those conducting remote vaccination of bison calves.

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

There would be no irreversible or irretrievable commitments of resources under any of the alternatives.

LOSS IN LONG-TERM AVAILABILITY OR PRODUCTIVITY OF THE RESOURCE TO ACHIEVE SHORT-TERM GAIN

There would be no loss in long-term availability or productivity of the resource to achieve short-term gain under any of the alternatives.

UNAVOIDABLE ADVERSE IMPACTS

Direct contact with fluids and reproductive materials from infected bison would present some risk of transmission of the disease to bison management personnel.

IMPACTS ON CULTURAL RESOURCES

SUMMARY OF REGULATIONS AND POLICIES

The National Park Service Management Policies state that cultural resources are to be preserved and appreciation of the resources should be fostered through appropriate programs of research, treatment, protection, and interpretation.

All federal actions affecting cultural resources are subject to the provisions of the National Historic Preservation Act of 1966, as amended; the National Environmental Policy Act; the Native American Graves Repatriation Act; the American Indian Religious Freedom Act; the Advisory Council on Historic Preservation's Implementing Regulations Protection of Historic Properties (36 CFR 800); The Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation (FR 48:44716-40); and federal agency responsibilities under section 110 of the National Historic Preservation Act (FR 53:4727-46). Other applicable legislation, regulations and specific management procedures are detailed in the Cultural Resources Management Guideline (NPS-28).

The National Park Service Management Policies state that cultural resources are to be preserved and appreciation of the resources should be fostered through appropriate programs of research, treatment, protection, and interpretation.

Gallatin National Forest standards require that cultural resources are to be inventoried, evaluated, and preserved for enhancement and protection purposes (*Gallatin National Forest Plan*, II-17).

Section 106 of the National Historic Preservation Act requires a federal agency to take into account the effects of its undertaking on properties included in, or eligible for inclusion in, the National Register of Historic Places. This also applies to properties not formally determined eligible, but which meet eligibility criteria. Section 110 of the act requires that federal agencies establish a program to identify, evaluate, and nominate properties to the national register. It also requires agencies to act as necessary to minimize harm to historic properties adversely affected by a federal proposal, requires consultation with the state's historic preservation officer when historic resources are potentially affected, and gives the Advisory Council on Historic Preservation an opportunity to comment. In summary, the section 106 process requires the identification of resources that would be affected by a federal proposal, their evaluation under national register criteria, an assessment of proposed impacts on those resources, and consideration of ways to avoid, reduce, or mitigate adverse impacts.

METHODOLOGIES FOR ANALYZING IMPACTS

In this environmental impact statement various bison management options would be explored, including the building of quarantine and capture facilities that would not only affect archeological sites, but also the bison and the landscape they inhabit. Effects on cultural resources primarily would result from the construction of facilities to support various bison management options. For example, construction of corrals and fences would have the potential to affect prehistoric and historic resources. The number of facilities would vary among alternatives.

It should be noted that the cultural landscape(s) of the Yellowstone area have not been evaluated under national register criteria. However, these resources must be treated as eligible until otherwise documented. Under National Register of Historic Places criteria, historic properties retain integrity through their ability to convey historical significance. This concept is comprised of the seven aspects of integrity, which include location, design, setting, materials, workmanship, feeling, and association. For example, the presence of bison contributes to the location, setting, feeling, and association aspects of the integrity and significance of the cultural landscape of Yellowstone National Park. The presence of bison also constitutes a significant resource. The management of these resources might in turn have effects on other resources. In preparing for any ground-disturbing activities, the project area would be assessed for cultural landscapes.

Assessment of impacts on cultural resources followed a four-step process outlined in the advisory council's revised regulations: (1) identify the area of potential effect of the proposed action, (2) compare that location with that of resources listed in or eligible for listing in the National Register of Historic Places, (3) identify the extent and type of impact of the proposed action on national register properties, and (4) assess these effects according to procedures established in the regulations.

An effect on a historic property would occur if an undertaking had the potential of changing in any way the characteristics that qualify that property for inclusion in the national register. If the proposed action diminished the integrity of such characteristics, it would be considered to have an adverse effect. Effects that might occur later than or at a distance from the location of the undertaking would also have potential impacts of the action. These would be indirect effects.

IMPACTS COMMON TO ALL ALTERNATIVES

Bison are significant to the cultural and spiritual lives of many Native American tribes. The specific significance of bison in tribal life varies from tribe to tribe. To adequately assess the impacts, it is important that representatives of each tribe articulate the specific impacts on their tribe of the alternatives.

In all alternatives proposing construction of bison management facilities, site-specific surveys would be conducted prior to ground-disturbing activities. Any resources uncovered in the surveys would be evaluated under national register criteria in consultation with the state historic preservation officer. Every effort would be made to avoid known archeological resources. Should avoidance prove impossible, the National Park Service, Gallatin National Forest, and state agencies would develop mitigating measures in consultation with the state historic preservation officer and the advisory council Government-to-government consultations with affected tribes would be conducted as required. Should unknown resources be uncovered during construction, work would be stopped in the project area, and the agencies would consult according to 36 CFR 800.11 and as appropriate, provisions of the Native American Graves Protection and Repatriation Act.

Each alternative would seek to retain the presence of bison within varying areas of their historic range; however, bison would be killed while occupying historic range if they are outside Yellowstone National Park or the SMAs. This management action would have a moderate to major negative impact on the cultural resource the bison herd represented.

Based on current information, the physical appearance of bison does not appear to be affected by the presence of the *Brucella* organism. In all alternatives except alternative 2, the process of monitoring and vaccinating bison would change their appearance. Bison would be identified by a small metal ear tag and visual marker to indicate that they had tested negative for the *Brucella* organism. These actions would alter the historic image of the bison and would have a negligible impact on the landscape.

CUMULATIVE IMPACTS COMMON TO ALL ALTERNATIVES

Archeological resources can be at risk from development, natural occurrences, and human activity. Proposed construction of facilities could add to this loss, although the losses of any proposal could be mitigated through avoidance and data recovery. Similarly, the cumulative effect of construction of facilities could add to the loss of undisturbed historic landscapes in specified locations in the Greater Yellowstone Area.

IMPACTS OF ALTERNATIVE 1: NO ACTION

Analysis

Sketch of Indian and buffalo, by American naturalist Titian Ramsey Peale, 1832. (NPS photo)

Capture facilities at Stephens Creek, Horse Butte, and Duck Creek already exist, and there would be no additional impact on archeological resources beyond what has already occurred. Capture facilities at Stephens Creek, Horse Butte, and Duck Creek would continue to have an impact on the landscape of those areas. Because the facilities at Horse Butte and Duck Creek would be temporary and those at Stephens Creek would be compatible with nearby Yellowstone National Park wrangling facilities, the effect would be negligible. Some bison, depending on age, sex, and pregnancy status, would occupy historic ranges in Yellowstone National Park and would be allowed to inhabit some other historic foraging areas in the Eagle Creek/Bear Creek area, along Hellroaring and Slough Creek, near Silver Gate and, during the winter, in the West Yellowstone area, including public lands on Horse Butte and in the Cabin Creek Recreation and Wildlife Management Area. This would ensure the presence of bison on segments of historically occupied range. However, bison would not be allowed to occupy winter range inside Yellowstone National Park in the Stephens Creek area north about 2 miles to the Reese Creek boundary. Some tribes may view continuing the status quo as a major impact to the cultural importance of bison.

Cumulative Impacts

This alternative would not add to the loss of archeological resources nor would it add to the loss of undisturbed landscapes. Thus, it would protect and maintain a remnant herd of free-ranging bison on the landscape, although the amount of available habitat would be limited.

Conclusion

There would be no impacts on archeological resources, nor additional impacts on landscapes. Bison would exist on historic ranges within most areas of Yellowstone National Park and limited historic winter range outside the park. Some tribes may view continuing the status quo as a major impact to the cultural importance of bison.

IMPACTS OF ALTERNATIVE 2

Analysis

Removal of capture facilities at Stephens Creek, Horse Butte, and Duck Creek near the western boundary of Yellowstone National Park could result in disturbance of unknown archeological resources. Because any impact would be mitigated through procedures described above in "Impacts Common to All Alternatives," the loss of archeological resources would be minor. Removal of structures would have a beneficial impact on the landscapes; however, the degree of benefit could not be determined until a cultural landscape study was completed.

If alternative 2 was implemented, bison could inhabit the largest portion of their historic ranges inside and outside Yellowstone National Park of any of the alternatives. This would ensure the presence of bison on historically occupied range and would promote a greater understanding of the historic Great Plains and seasonal movement of bison in and around the northern Yellowstone area range, a minor to major positive impact to tribes who view free ranging bison as culturally important.

Cumulative Impacts

Removal of capture facilities on Stephens Creek and near the western boundary of Yellowstone National Park could add to the loss of archeological resources but would have a beneficial impact on the historic landscapes of the area. The cumulative effect on free-ranging bison and the landscape would be the same as alternative 1, except that bison could range over a larger area.

Conclusion

Any potential loss of archeological resources associated with removal of bison management facilities at Stephens Creek and near the western boundary of the park could be mitigated. The removal of these structures would have a beneficial impact on the historic landscape. Free-ranging bison would be protected and maintained on historic landscapes inside and outside Yellowstone National Park, a minor to major positive impact to tribes viewing free-ranging bison as culturally important.

IMPACTS OF ALTERNATIVE 3

Analysis

The construction of a quarantine facility and relocation of the Stephens Creek capture facility north of the park boundary could result in the disturbance of as yet unknown archeological resources. Because any impacts would be mitigated through procedures described in "Impacts Common to all Alternatives," the loss of archeological resources would be negligible or minor.

Relocation of the Stephens Creek capture facility would have a beneficial impact on the landscape at Stephens Creek, but would introduce new elements into the landscapes outside Yellowstone National Park. The degree of impact on the landscape would depend on location and design and results of a cultural landscape assessment. Construction of a quarantine facility may result in impacts to cultural landscapes outside of the park, depending upon the location selected for the facility. This would be assessed in subsequent environmental analyses and cultural resources compliance measures.

Implementation of alternative 3 would ensure the presence of free-ranging bison in a larger portion of their historic range than alternative 1, but a smaller portion than alternative 2. This would be a minor to major positive impact to some tribes viewing bison as culturally important.

Cumulative Impacts

Construction of facilities could add to the loss of archeological resources, although the loss could be mitigated. Construction/relocation of facilities would have a beneficial impact at Stephens Creek, but might add to the loss of undisturbed landscapes in new areas. The cumulative effect of maintaining free-ranging bison on the landscape would be the same as in alternative 1.

Conclusion

Construction and/or relocation of facilities could disturb archeological resources; however, with mitigation the impacts would be minor. Construction and/or relocation of facilities would have beneficial impacts on the landscape in Yellowstone National Park and might have negative impacts in other new areas. The presence of bison on a portion of their historic ranges in Yellowstone National Park and land outside the park would be ensured, a minor to major positive impact to some tribes viewing bison as culturally important.

IMPACTS OF ALTERNATIVE 4

Analysis

Capture facilities at Stephens Creek, Horse Butte, and Duck Creek already exist and there would be no additional impact on archeological resources beyond what has already occurred. Construction of a quarantine facility could disturb unknown archeological resources. Because impacts would be mitigated using procedures described in the previous section, "Impacts Common to All Alternatives," the loss of resources would be minor, depending upon where the facility is sited. These impacts would be addressed in subsequent environmental analyses and cultural resources compliance measures.

Capture facilities at Stephens Creek, Horse Butte, and Duck Creek would continue to have an impact on the landscape of those areas. Those at Stephens Creek would be compatible with nearby Yellowstone National Park wrangling facilities; therefore, the effect would be negligible.

Bison would inhabit historic ranges in most areas of Yellowstone National Park, except Stephens Creek. As in all other alternatives except alternative 5, some bison would be allowed to inhabit historic foraging areas outside of the park in the Eagle Creek/Bear Creek area, along Hellroaring and Slough Creek, near Silver Gate and, during the winter, in West Yellowstone. This would ensure the presence of bison on a limited portion of their historic ranges.

Cumulative Impacts

Construction of facilities could disturb as yet unknown archeological resources. However, the impact could be mitigated. Construction of facilities would also affect the landscape, depending on location and design. The cumulative impact on free-ranging bison on the landscape would be the same as in alternative 1.

Conclusion

Archeological resources could be affected by construction of facilities, although with mitigation the impacts would be minor. The effect of construction on the landscape would depend on location and design. Bison would continue to inhabit historic ranges within Yellowstone National Park, and might inhabit historic rangeland outside the park.

IMPACTS OF ALTERNATIVE 5

Analysis

The construction of temporary capture and testing facilities at Lamar/Crystal Bench, Blacktail Plateau, Madison River, West Yellowstone boundary area, Old Faithful/Firehole River, and Hayden and Pelican Valleys could disturb as yet unknown archeological resources. Because any impacts could be mitigated using procedures in "Impacts Common to all Alternatives," the loss of archeological resources would be minor, however, the cost would be expensive. There would be no new impacts from the existing Stephens Creek facility.

A site specific analysis of a capture facility proposed in alternative 6 at the Seven-Mile Bridge area was conducted to determine the range of impacts to cultural resources. This area would be representative of impacts to other potential facility sites proposed in alternative 5 in the vicinity of the Madison River corridor. While the impacts to archeological resources of siting a facility along the river corridor could be mitigated, the costs would be major (see alternative 6).

The landscape would be temporarily affected by the proposed bison management facilities in the areas mentioned above. The landscapes of these areas are highly sensitive. While the facilities would be temporary and every effort would be made to minimize the intrusion through design, the impact on the landscape would be significant in the short term.

In addition, fewer bison would inhabit historic ranges within Yellowstone National Park while none could range outside the park. This would be a major impact on the cultural importance the bison herd represents.

Cumulative Impacts

Construction of facilities would add to the loss of archeological resources, although impacts would be mitigated. The impacts on the landscape would be major in the short term. Available habitat for free-ranging bison would be restricted and their numbers greatly reduced.

Conclusion

Archeological resources could be disturbed by construction of facilities, although the effect would be mitigated, although possibly at a high cost. The loss of undisturbed landscapes would be temporary but major. Limited available habitat (none outside the park) would be available to free-ranging bison and their numbers would be reduced. Bison would also not likely inhabit areas where they were previously found because of reduced numbers. This is a short term, major impact on the cultural resource the bison herd represents.

IMPACTS OF ALTERNATIVE 6

Analysis

In order to better understand impacts on archeological and other cultural resources from the construction of capture and testing facilities at Seven-Mile Bridge, further research was conducted by the environmental impact statement team. A summary of results of this investigation follows.

History of the Seven-Mile Bridge Area. The first road systems into Yellowstone National Park entered on the western boundary where West Yellowstone, Montana, is now located. A stagecoach route ran along the Madison River from the West Yellowstone area to what is now Madison Junction and then south to the lower geyser basin. Two companies, the Basett Brothers and Gilmer and Salisbury, ran stagecoaches into the park before the Northern Pacific Railroad arrived at the north entrance of the park, after 1883 (Lee Whittlesey, Park Archivist, pers. comm.). Maps dating back to 1878 through 1904 show the route of the stagecoach adjacent to the Madison River. Remnants of the stagecoach road are still visible today in the area southwest and adjacent to Seven-Mile Bridge. Any construction and operations associated with a capture facility in this area adjacent to Seven-Mile Bridge would result in a loss of this historic evidence.

Archeology of the Seven-Mile Bridge Area. An archeological site inventory was conducted in the Madison Valley at the potential capture facility sites and surrounding areas in the summer of 1999. A total of seven Precontact Native American archeological sites were recorded during field studies (Shortt and Johnson 1999). The location nearest Seven-Mile Bridge also contains Non-Native Postcontact archeological materials. All sites, except for one, are recommended as potentially eligible for the National Register of Historic Places under Criterion D based on the presence or probability of buried deposits (Cite — criterion D).

Materials found at sites located south of the highway included Precontact Native American artifacts and Non-Native Postcontact specimens. At the site closest to the bridge, non-Native Postcontact specimens were discovered, which suggests that there may have been a Non-Native camp sometime around or prior to World War I. Although the historic component of the site may have lost its integrity, additional study would help to better understand the Non-Native use of the Madison River Valley. The second site south of the highway is located 1.1 kilometer northwest of the bridge. Precontact Native American artifacts found at this site include 30 pieces of debitage (debris resulting from tool making) and a buried fire-cracked rock feature. Radiocarbon dates can be derived from charcoal removed from the fire-cracked rock feature. This is of special significance in light of the general paucity of dated archeological components in Yellowstone National Park. The importance of this site is underscored by the fact that it provides the first recorded occurrence of a subsurface hearth in the Madison River valley in Yellowstone National Park and could establish the first radiocarbon date for the valley.

The five sites north of the river revealed numerous Precontact Native American artifacts. All sites contained remnants of lithic derbitage of materials such as obsidian, various charts, white chalcedony, and quartzite. Three of the sites north of the river revealed lithic tools such as obsidian projectile points, which date to the Middle Precontact Period (circa 3,000–1,700 years before present). Additionally, Precontact archeological materials collected from another site revealed a projectile point that resembles late Precontact Period specimens, possibly deriving from the Intermountain Tradition of circa. 500–200 years before present. Additional test excavations would be required to further assess the research/interpretive value of the five sites north of the river and to broaden understanding of the depth, age, cultural affiliations, and geological associations of the cultural deposits.

Cost of Cultural Resources Mitigation. Should alternative 5 or 6 be implemented and include a capture facility at or near Seven-Mile Bridge, cultural resource impacts would require additional mitigation. Cost estimates to mitigate adverse impacts to prehistoric archeological sites was calculated using several scenarios involving alternate locations for the capture facility and access to it in the Madison valley near Seven-Mile Bridge. The two scenarios (scenario 1 has two alternatives) assume construction of a bridge across the Madison River from the existing highway to access the area referred to as the “high terrace.” This high terrace is typically used by bison as they travel along the Madison River to reach the higher plateau in the vicinity of the Gneiss Creek trail.

Scenario 1

The first capture location scenario involves a bridge crossing the Madison River to the low terrace on the north side of the river. This scenario has two alternatives that depend upon the angle of a new access road required to reach the upper terrace. One alternative assumes the access road would be more or less a right angle (south to north) and the other assumes the new road would be diagonal (southwest to northeast) as it rises to the top of the upper terrace somewhere near where the existing Gneiss Creek trail reaches the high terrace now.

The low terrace was a campsite/occupation site of some duration and investigations here would concentrate upon identification of activity areas and block excavations to expose them. This campsite would be impacted by construction of a ramp for the new road and by the construction zone.

The low terrace on the north side of the river nearest Seven-Mile Bridge is 100 meters wide and extends 1 kilometer along the river. Cultural material covers the entire surface and cannot be avoided. The material is in part up to 60 centimeters deep, at least where it was observed eroding into the river.

The capture facility and placement of wing fences on the high terrace and plateau would require additional surveys and mitigation. Archeologists are aware of at least two prehistoric sites and there may be more. One of these sites may have up to 50-centimeter deposits. There is every indication, in the form of tools, that the high terrace and plateau sites have higher integrity than the low terrace site and thus a significant amount of mitigation would be required.

A summary of mitigation costs for scenario 1, with both potential access road alternatives, is presented in table 77.

Scenario 2

In this scenario, it is assumed that the bridge across the Madison River would begin 2.5–3 kilometers farther to the west, where the upper terrace has tapered gradually downward towards the west and would pose less of a challenge for road access. The archeological inventory did not extend this far but there is every reason to believe archeological resources are present in similar patterns as represented by the Federal Highway Administration West Entrance road right-of-way cultural inventory and by the inventory for the proposed bison capture facility.

A summary of mitigation costs for scenario 2 is presented in table 77.

Table 77: Summary of Cost Estimates for Proposed Bison Capture Facility North of the Madison River

Scenario 1	Low Terrace	High Terrace	Plateau
Alternative 1	$825,000 mitigation	$225,750 mitigation	$8,600 inventory
			$5,375,000–$10,000,000 mitigation
Alternative 2	$1,100,000 mitigation	$225,750 mitigation	$8,600 inventory
			$5,375,000–$10,000,000 mitigation
Scenario 2		$10,750 inventory	$8,600 inventory
		$513,700 mitigation	$5,375,000–$10,000,000 mitigation

Cultural Landscapes. Construction of capture and testing facilities at Seven-Mile Bridge (phase one) and temporary facilities at Lamar/Crystal Bench, Blacktail Plateau, Madison River, West Yellowstone boundary area, Old Faithful/Firehole River, and Hayden and Pelican Valleys (phase two) would affect the landscape of those areas. The landscapes of these areas would be highly sensitive. Phase two facilities would be temporary, and while every effort would be made to minimize the effect through design, the impact would be major as long as the structures existed.

In phase two, the numbers of bison on historic ranges in Yellowstone National Park would be reduced and the herd would be limited to the portion of their historic ranges inside the park, and outside the park at the Eagle Creek/Bear Creek SMA, the West Yellowstone area of the western SMA, and along Hellroaring Creek and Slough Creek drainages. Impacts to the cultural importance represented by the herd would be similar, but less severe, to those in alternative 5.

Cumulative Impacts

Archeological resources could be disturbed by construction of facilities, although the impacts could be mitigated. The proposal would add to the loss of undisturbed landscapes in Yellowstone National Park in phase one and eight more in phase two. Limited numbers of bison would occupy historic rangelands in Yellowstone National Park and available habitat (outside the park) would be reduced.

Conclusion

Archeological surveys of the proposed bison capture facility in the Seven-Mile Bridge area revealed that most sites discovered would be eligible for listing on the National Register of Historic Places. Prior to any construction, additional surveys and mitigation would be required through procedures discussed in the previous section, "Cumulative Impacts Common to all Alternatives." The cost of mitigation would be major, ranging from $1 million to $10 million depending upon how and where the facility and access roads are sited. In addition, the potential impact to historic features, such as the existing route of the stagecoach road in the Seven-Mile Bridge area, would be major.

Construction of bison capture facilities would have a major impact on the landscapes in the short and long term. Bison would be present on historic ranges in the park and in limited areas outside the park, a moderate to major adverse impact on the cultural importance the herd represents.

IMPACTS OF ALTERNATIVE 7

Analysis

Dismantling the Stephens Creek capture facility (phase two) and moving it to a new site north of the park boundary and construction of a quarantine facility could result in the disturbance of unknown archeological resources. Because impacts could be mitigated through procedures described in "Impacts Common to All Alternatives," the impact would be minor.

Continued operation of the Horse Butte bison capture facility and the state of Montana capture facility on private land at Duck Creek would not have an additional impact on archeological resources.

Construction of facilities north of the park boundary would intrude on the landscapes. The degree of impact of constructing facilities in a previously undisturbed landscape would depend on location and design and results of a cultural landscape assessment. Removal of the facilities at Stephens Creek would have a beneficial impact on the historic landscape.

Bison would be present on historic rangeland in Yellowstone National Park as well as on limited historic foraging areas outside the park. In phase two, some bison might also be allowed to occupy lowlands between the park boundary and Yankee Jim Canyon, although the number of bison may be somewhat less than under alternative 1. These impacts may be offsetting on the cultural importance represented by the herd and similar to alternatives 1 or 4.

Cumulative Impacts

Grading, digging, and other earth-moving activities associated with building in the Greater Yellowstone Area and park have already disturbed archeological resources of the area. To the extent these actions are part of the proposed action, the effect would be additive on these resources. Construction of bison management facilities would affect the cultural landscape, but the extent of this impact would be directly related to location and design of these facilities and thus would be unknown at this time.

Conclusion

Cultural resources could be affected from a negligible to minor degree by removal of existing facilities and construction of new ones. This alternative would ensure the presence of bison on historic rangelands in Yellowstone National Park as well as on some lands outside the park, although the number of bison would be reduced. A minor to moderate reduction in bison population numbers compared to alternative 1 would adversely impact the cultural importance the bison herd represents. However, this may be partially offset by the presence of bison occupying lands outside the park.

IMPACTS OF THE MODIFIED PREFERRED ALTERNATIVE

Analysis

Capture facilities at Stephens Creek, Horse Butte, and Duck Creek currently exist and there would be no additional impact on archeological resources beyond what has already occurred. Should an additional capture facility be located north of the park boundary, disturbance of as yet unknown archeological resources may occur. Because any impacts would be mitigated through procedures described in the previous section, "Impacts Common to all Alternatives," the loss of archeological resources would be negligible or minor. Construction of a quarantine facility may also result in impacts to archeological resources. Prior to construction, additional environmental analyses and cultural resource compliance would be required.

The existing capture facilities at Horse Butte and Duck Creek would continue to impact the cultural landscape in these areas. The existing Stephens Creek facility would not add impacts to the cultural landscape since it is compatible with the nearby Yellowstone National Park wrangling facility. Impacts would therefore be negligible. Should an additional capture facility be located north of the park boundary, the cultural landscape of that area would be impacted.

A cultural landscape inventory of the area would be conducted prior to construction. Depending on its location, construction of a quarantine facility may also impact cultural landscapes, which would be assessed in subsequent environmental analyses.

The modified preferred alternative is based upon an increased tolerance of bison outside of the park under certain management prescriptions and conditions. As such, an adaptive management approach as called for in this alternative may decrease, over time, the need for extensive use of capture facilities throughout the fall and winter season. This would allow for bison migration in and out of the park up to specified limits within certain zones. The increased tolerance of bison outside of the park to occupy winter range within these limits and zones would be a major positive impact to the cultural significance of preserving a wild and free-ranging bison herd.

Cumulative Impacts

Construction of facilities could add to the loss of archeological resources, although the loss could be mitigated. This construction activity may also have cumulative impacts on cultural landscapes depending upon the ultimate location of the quarantine facility. The increased tolerance of bison under certain management prescriptions and conditions would have a major beneficial cumulative impact in preserving the cultural significance of a wild and free-ranging bison herd.

Conclusion

Construction of an additional capture facility north of the Yellowstone National Park boundary and a quarantine facility at some location may disturb archeological resources; however, with mitigation measures, the impacts would be negligible or minor. There would be no new impacts on cultural landscapes from the continued operation of the Stephens Creek, Horse Butte, and Duck Creek bison capture facilities. Cultural landscapes may be impacted adversely if an additional capture facility is located north of the park and may also be impacted depending upon the ultimate location of a quarantine facility. The increased tolerance of bison under certain management prescriptions and conditions would have a major beneficial impact on the cultural significance of a wild and free-ranging bison herd.

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

Loss of archeological resources would be an irretrievable commitment of cultural resources. However, information that would be obtained through data recovery would mitigate the loss.

LOSS IN LONG-TERM AVAILABILITY OR PRODUCTIVITY OF THE RESOURCE TO ACHIEVE SHORT-TERM GAIN

There is a potential loss of archeological resources in any construction, removal, or relocation of facilities. However, the information would be retained through data recovery.

UNAVOIDABLE ADVERSE IMPACTS

Alternatives 5 and 7 and step 2 of alternative 6 would result in major reductions in the number of free-ranging bison and adversely affect the cultural resource the herd represented.

IMPACTS ON VISUAL RESOURCES

SUMMARY OF REGULATIONS AND POLICIES

The National Park Service has not developed a visual resource management system for public lands under its jurisdiction; however, the overriding management purpose in a park is preservation of all significant resources, including the scenery. The National Park Service organic act states that one of the fundamental purposes of a national park is "to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such a manner and by such means as would leave them unimpaired for the enjoyment of future generations."

Visual quality objectives within the Gallatin National Forest project areas range from preservation, retention, and partial retention to modification and maximum modification of existing visual qualities. The U.S. Forest Service would require all activities proposed on public lands to meet visual quality objectives for a specific area based on suitability within a given landscape and visibility from critical viewpoints.

Visual resource changes are analyzed by comparing the existing visual character of the landscape and the degree to which the actions contrast or conform with that character.

METHODOLOGIES FOR ANALYZING IMPACTS

Impacts on visual resources and landscapes have both a physical component and a viewer component. Visual resource changes are analyzed by comparing the existing visual character of the landscape and the degree to which the actions contrast or conform with that character.

The opportunity to observe bison was assumed to vary with population size. Therefore, numbers of bison calculated via the deterministic, or averaging, model explained in "Impacts to Bison Population" were used to predict impact from availability of bison to those trying to view them. For those finding increases in the bison herd size problematic, a wide range of social values was assumed and applied to determine impact.

Actions described in the alternatives that could have an impact on visual resources were the focus of this analysis. These include capture, test, slaughter, quarantine, hazing, agency shooting, and hunting.

IMPACTS COMMON TO ALL ALTERNATIVES

The process of monitoring and vaccinating bison would temporarily change their "wild" appearance. Bison would be visibly marked with tags and stripes due to vaccination and testing procedures. These processing marks would detract from the natural appearance of the animal. This would be a short-term, moderately adverse impact on the viewer, photographer, and others interested in seeing bison.

Agency shooting of bison and some hazing operations would be visible if bison venture beyond delineated SMAs. These bison management actions would have a minor to major visual impact on the landscape and for some viewers who might be opposed to shooting or hazing bison or to those viewers sensitive to these activities.

IMPACTS OF ALTERNATIVE 1: NO ACTION

Analysis

The existing capture and test facility would continue to intrude on the viewshed at Stephens Creek. Because this facility is of a compatible design with the nearby Yellowstone National Park wrangling facilities, the impact on visual resources would be minimal. Also, this facility would not be readily visible to the majority of visitors to the park and surrounding areas.

Capture and test facilities within the viewshed on the western boundary of Yellowstone National Park would continue to adversely impact visual resources. The facility is on forest service lands that are managed for “partial retention” and “modification” of visual quality objectives and allow for some evidence of human activity. The continued visual impact of this facility and the facility located on private lands at West Yellowstone would be minor to moderate. These facilities would not be visible in major viewsheds, but some park visitors, national forest users, and local residents would see them. Bison management actions, such as hazing, shooting, and gutting, could be a major adverse visual impact for some of these viewers.

The bison population would likely increase over time if alternative 1 were implemented. This would be a minor benefit to those seeking to view bison.

Cumulative Impacts

Continued operation of bison management facilities during winter and activities in addition to other ongoing changes to the scenery, such as the wrangling facilities at Stephens Creek, would constitute additional impacts on visual resources of the Greater Yellowstone area. The impact would range from minor to moderate depending on the extent of these cumulative changes in the landscape.

Conclusion

Capture and test facilities and associated bison management actions would intrude on the visual scene and have minor to moderate impacts during winter. Facilities would be located in areas where park visitation was minimal compared to other more popular areas of the park and surrounding forest lands. Activities such as hazing, shooting, and gutting of bison would be a major impact for some viewers. Increases in the bison population would have minor positive impacts for visitors seeking to view them.

IMPACTS OF ALTERNATIVE 2

Analysis

Removal of capture facilities from the viewshed at Stephens Creek and West Yellowstone would restore the visual scene to more natural conditions. This would be a beneficial impact.

Grazing allotments might be modified as part of alternative 2. Private grazing operations might be changed to run nonbreeding cattle. Either could result in negligible to minor changes in the rural/ranching landscape near park boundaries. The change in the type of cattle operations would be a change in the scenery, but most viewers would not likely be aware of this; therefore, this would be a negligible impact. In the long term, cattle grazing and ranching could be modified in some allotments on lands adjacent to Yellowstone National Park, and the scenery might change to views of bison and wildlife habitat.

Through time, larger numbers of bison would be present on the landscape both inside and outside Yellowstone National Park. This would be a minor to moderate benefit to those seeking to view bison.

Alternative 2 would include closing some roads now groomed for snowmobiles and other winter recreationists. The winter visual scene in some areas of Yellowstone National Park would be beneficially affected as a result of this reduction or elimination of snowmobile and oversnow activities. However, access to the interior of the park would be restricted from West Yellowstone, adversely affecting visitors and their viewing opportunities. Some portion of the snowmobile activity would likely move to the adjacent Gallatin National Forest and other public lands near the park. There would be indeterminant adverse visual impacts on public lands from displaced recreational use. The degree of visual impact would depend on the number of snowmachines displaced and the visual quality objectives of forest lands affected.

Cumulative Impacts

The primary cumulative impact of this alternative to visual resources is the effect on winter landscapes. Additional snowmachines displaced from the park onto forest lands would be a minor to major cumulative impact in some areas. Forest lands are experiencing increasing numbers of winter visitors. Additional winter use by snowmachines affecting the visual quality of these areas might be adverse and long term. Reduction or elimination of snowmachine use in certain areas of the park would be a beneficial cumulative impact as these areas would return to a more natural scene.

Conclusion

The impact of removal of the Stephens Creek and West Yellowstone facilities would be beneficial to visual resources within the park and on the Gallatin National Forest. A wider distribution of bison and increased herd size would have minor to moderate beneficial impacts on those seeking to view bison. Changes in cattle grazing operations would not be noticeable to most viewers, but for others this impact might be adverse. Reduction in snowmachine use in some areas of the park would return these areas to a more natural visual scene; however, increased snowmachine use displaced onto public lands might have a minor to major cumulative impact on visual resources, depending on the visual quality objectives of those areas.

IMPACTS OF ALTERNATIVE 3

Analysis

Capture and test facilities would continue to intrude on the viewshed at Stephens Creek and would be the same as alternative 1 over the short term. Over the long term, this facility would be moved north of the park. Although the location or design of a quarantine facility for bison has not been determined, the facility would probably appear as large scaled corrals and pens within which bison would be visible. Siting of a relocated capture facility and a new quarantine facility would be sensitive to views and features of the viewshed; therefore, impacts would likely be minor.

The existing facilities at West Yellowstone would be dismantled. Removal of these facilities would be a beneficial impact on visual resources as the areas would be returned to more natural conditions.

Impacts from modified grazing allotments and uses on visual resources would be similar to that described in alternative 2.

A moderate increase in the size of the bison population over time compared with alternative 1 would result in a minor to moderate benefit similar to alternative 2 for those seeking to view bison.

Hunters and hunting activities might be visible within viewsheds of surrounding areas. This would be a short-term impact through the winter hunting season and a minor impact in the viewshed because most viewers would not readily see these activities. However, to some viewers sensitive to killing of bison, this would be a major impact.

Cumulative Impacts

The addition of a quarantine facility and the relocation of the Stephens Creek facility would impact visual resources, when added to other changes in the landscape occurring throughout the Greater Yellowstone Area. However, given the siting objectives of these facilities to avoid sensitive areas, these impacts would likely be minor. Additional hunting activities would be a cumulative impact, but given the extent of big game hunting in the region, impacts on visual resources would be minor for most, but major for some viewers.

Conclusion

Removal of the facilities at West Yellowstone would be a minor to moderate benefit to visual resources. Impacts of hunting on the visual quality of hunting areas would be minor; however, some viewers opposed to hunting bison who happen to see this activity would consider this to be a major impact on the scenery. Increased herd movements and bison numbers in and near the park would result in minor to moderate benefits for those seeking to view bison. Impacts of relocation of the Stephens Creek facility and construction of a quarantine facility would be a minor impact on visual resources because siting would avoid sensitive visual resources. Changes in grazing allotment use and cattle operations would not be readily noticeable to most viewers; therefore, the impact would be negligible.

IMPACTS OF ALTERNATIVE 4

Analysis

The existing capture facilities at West Yellowstone and at Stephens Creek would have the same impacts on visual resources as described in alternative 1. Impacts of the quarantine facility would the same as alternative 3 as described above. Impacts on viewers from changes in the bison population size would be minor and similar to identical to those in alternative 1. Impacts on visual resources from hunting would be the same as in alternative 3, although somewhat reduced as the number of hunting permits and the range over which hunting was allowed would be less than alternative 3.

Cumulative Impacts

Impacts would be the similar to alternative 3, except that grazing allotments and operations in the western SMA would not change.

Conclusion

Impacts would be similar to those described for alternatives 1 and 3; the primary difference would be that changes in grazing allotments in the western SMA and operations in either the western or northern boundary areas would not occur. Thus, the impacts on visual resources would be minor.

IMPACTS OF ALTERNATIVE 5

Analysis

Construction of capture and test facilities within Yellowstone National Park at Lamar/Crystal Bench, Blacktail Plateau, Madison River, West Yellowstone boundary area, Old Faithful/Firehole River, and Hayden and Pelican Valleys would have a major impact on visual resources. These areas would be highly sensitive to visual intrusions, and while measures would be taken to minimize impacts, the presence of these facilities would be highly noticeable.

In order to assess the magnitude and intensity of impacts on visual resources, a site specific analysis was conducted for the Seven-Mile Bridge area and Lamar Valley (see alternative 6 for visual simulation representative of the two areas). These two areas would be representative of most areas proposed for bison capture facilities throughout the park in alternative 5. Similar to the findings under "Impacts on Recreation," alternative 5 would have moderate to major short and long-term impacts on visual resources.

The capture and test facility at Stephens Creek would continue to have a minimal impact on visual resources.

Implementing this alternative would result in reduced numbers of bison which could have temporary minor to moderate adverse impacts on the ability to view bison.

Snowmobiling inside the park would be temporarily eliminated on some segments of roads plowed to pavement to access capture facilities. These winter recreation activities would be displaced onto surrounding U.S. Forest

Service lands, especially near West Yellowstone. This would be a beneficial visual impact within the park, but would constitute a minor to major negative visual impact similar to that described in alternative 2 for neighboring public lands outside the park where activities would be displaced. Road closures needed to facilitate transport of seropositive bison would also prevent visitors from viewing features of the park. Some of those who are able to access areas where capture operations were ongoing might experience moderate to major adverse impacts to the winter scene.

Cumulative Impacts

The primary cumulative impact would be construction of eight additional capture facilities within the park, when added to other changes in the landscape throughout the Greater Yellowstone Area. This would be a major impact on visual resources; however, once these facilities were removed, the impact would be negated. Cumulative impacts from displaced snowmachine use would be similar to that described in alternative 2.

Conclusion

Construction of facilities in sensitive areas and decreasing numbers of bison throughout the park would have major negative impacts on visual resources. Displacement of snowmobiling would have beneficial impacts on visual resources in Yellowstone National Park and minor to major impacts on visual resources outside. Implementation of this alternative would result in significantly reduced numbers of bison. This would be a minor to moderate adverse impact on the ability of those seeking bison to view them.

IMPACTS OF ALTERNATIVE 6

Analysis

Construction of capture and testing facilities in the Seven-Mile Bridge viewshed would be a major impact on visual resources. The visual scene would continue to be minimally affected at Stephens Creek. In phase two of this alternative, portions of the Yellowstone National Park landscape would be affected to a major degree because additional capture and test facilities would be constructed throughout the park. Impacts on visual resources would be similar to those described in alternative 5.

In order to assess the magnitude and intensity of impacts on visual resources, a site-specific analysis was conducted for the Seven-Mile Bridge area and Lamar Valley. Visual simulations, provided in figures 3 through 9 of the Seven-Mile Bridge area and figures 10 and 11 of the Lamar Valley, illustrate the existing scene compared to what visitors would see and experience with the capture facilities in place. The Seven-Mile Bridge area is traveled extensively throughout the peak summer and winter use seasons. Between 1994 and 1998, an average of 896,000 visitors crossed the Seven-Mile Bridge during the peak summer season; an average of 60,000 visitors crossed during the winter season.

The bridge area is also used extensively by hikers using the Gneiss Creek trail, anglers, and photographers. The visual impacts would remain beyond the life of the plan until full reclamation of the site is completed.

Should a bridge be required to cross the Madison River to access a bison facility on the high terrace, visual impacts would be permanent, long-term, major, and adverse to the existing scene.

The simulation of a potential site at Lamar Valley would have similar, but less pronounced, impacts than that at Seven-Mile Bridge area. Assuming a facility would be located close to the main road, the viewshed would be impacted by scenes of equipment, operations, and activities throughout the year. The Lamar Valley is a popular wildlife viewing area for a variety of wildlife species. Activities from a bison capture facility located there would have a major impact on the viewshed.

Badger.

Implementing this alternative would result in some short term reductions in the bison population in phase two. During this time, visitors attempting to view bison may experience minor to moderate impacts as a result.

Figure 3:

Existing Conditions at Proposed Capture Facility Site Looking Southwest from the Gneiss Creek Hiking Trail near Seven-Mile Bridge

Figure 4:

Visual Simulation near Seven-Mile Bridge from Gneiss Creek Hiking Trail with Proposed Roads, Pens and Buildings

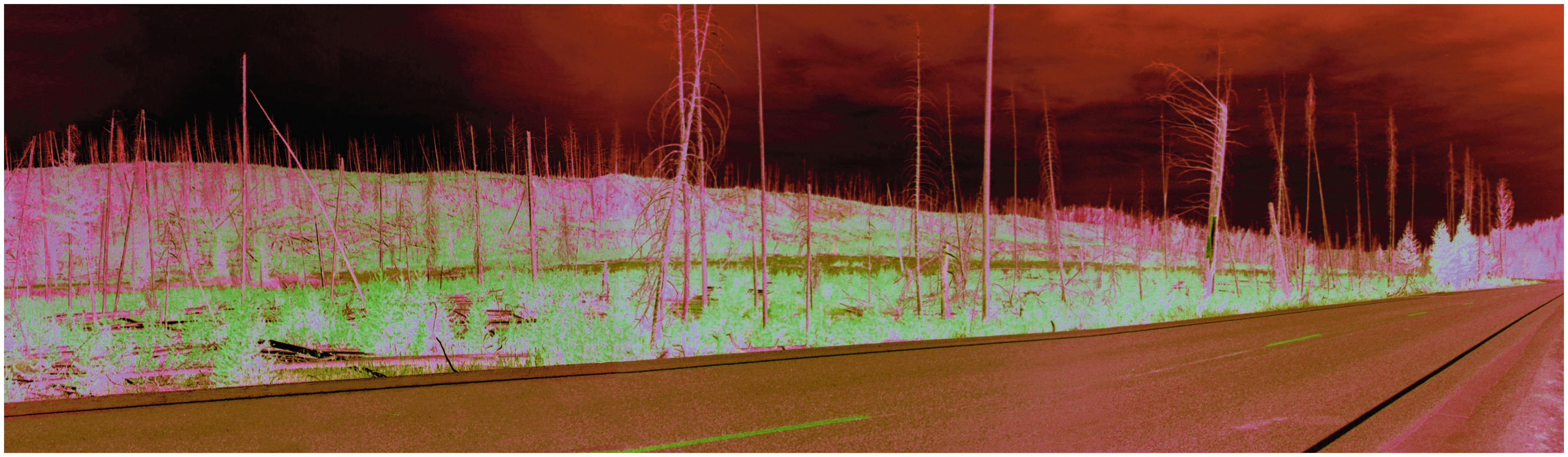


Figure 5:

Existing Conditions at Proposed Capture Facility Site Looking Southwest from Road near Seven-Mile Bridge

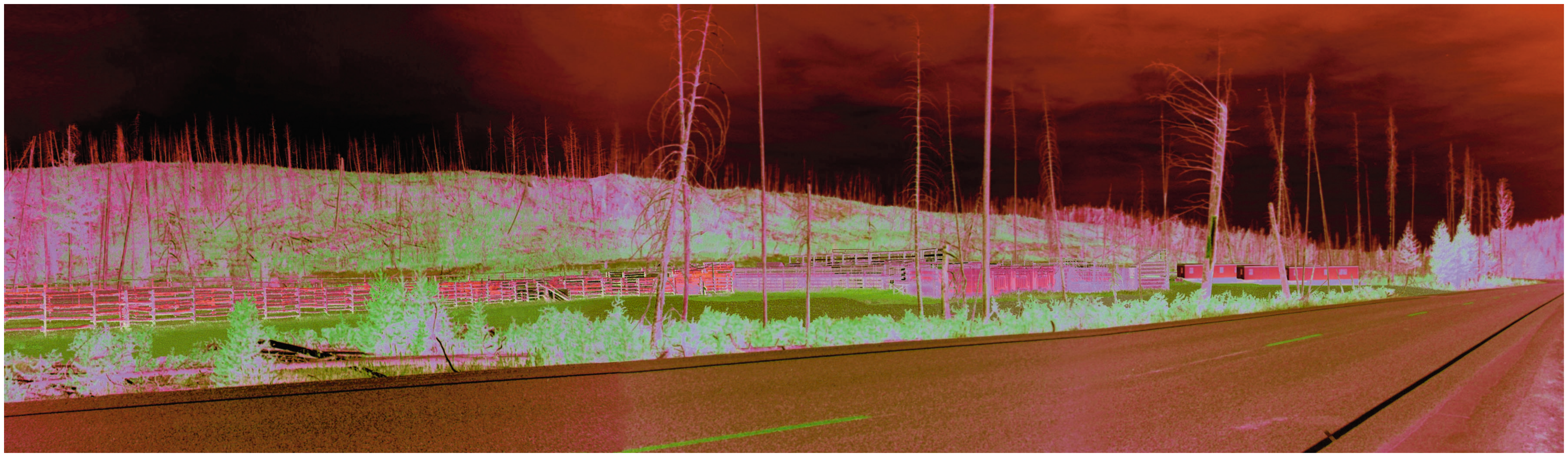
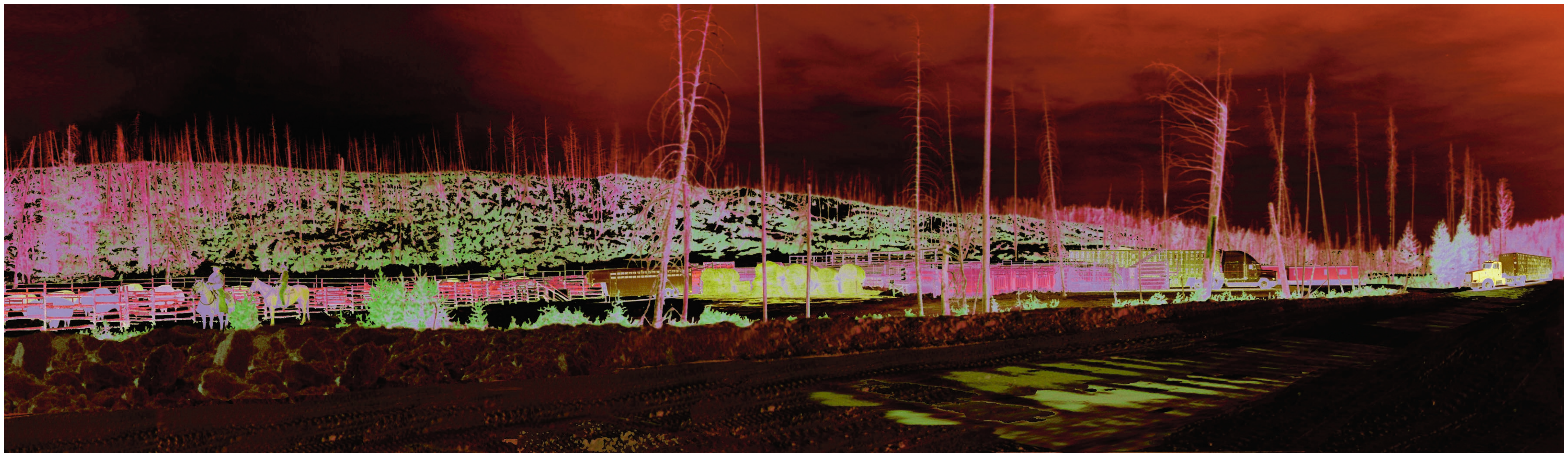


Figure 6:

Visual Simulation from Road with Proposed Pens and Buildings near Seven-Mile Bridge

Figure 7:

Visual Simulation from Road in Winter with Proposed Pens and Buildings near Seven-Mile Bridge



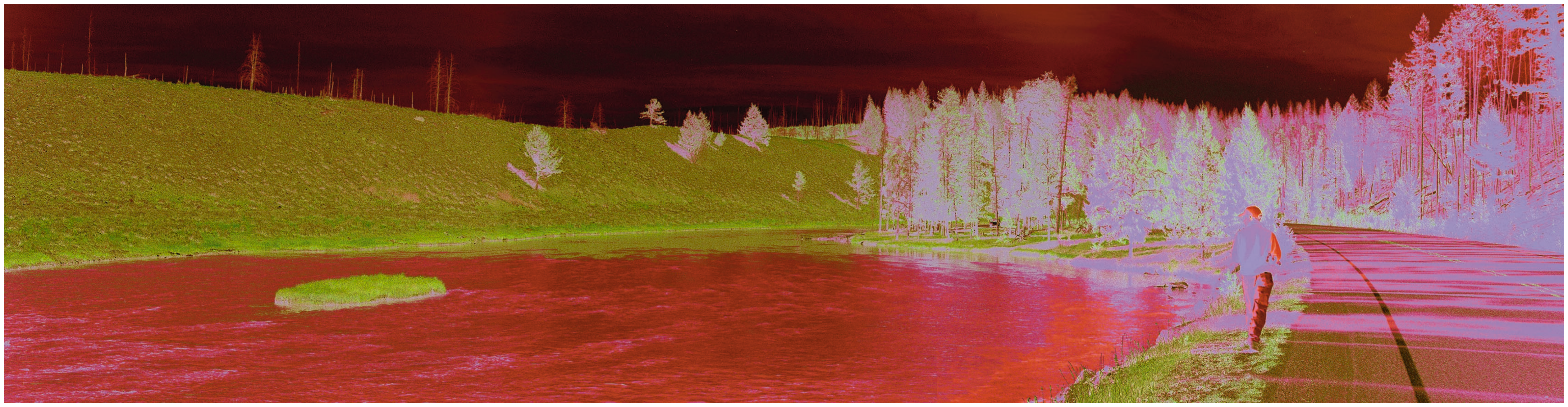


Figure 8:

Existing Conditions at Madison River Looking Northeast from Road near Seven-Mile Bridge

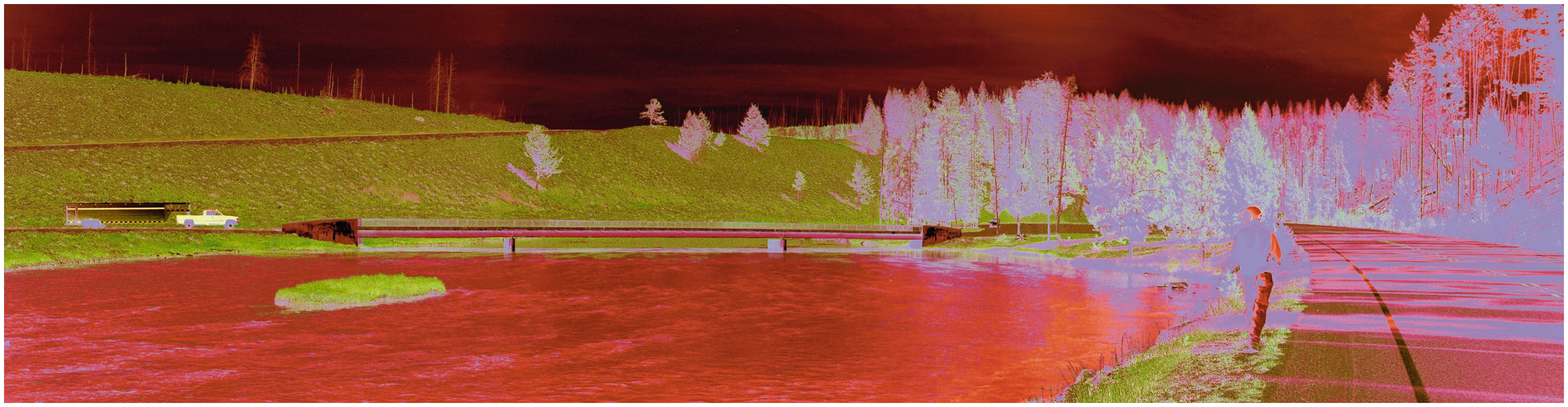


Figure 9:

Visual Simulation of Potential Bridge and Road to Access Proposed Capture Facility on High Terrace above Madison River near Seven-Mile Bridge

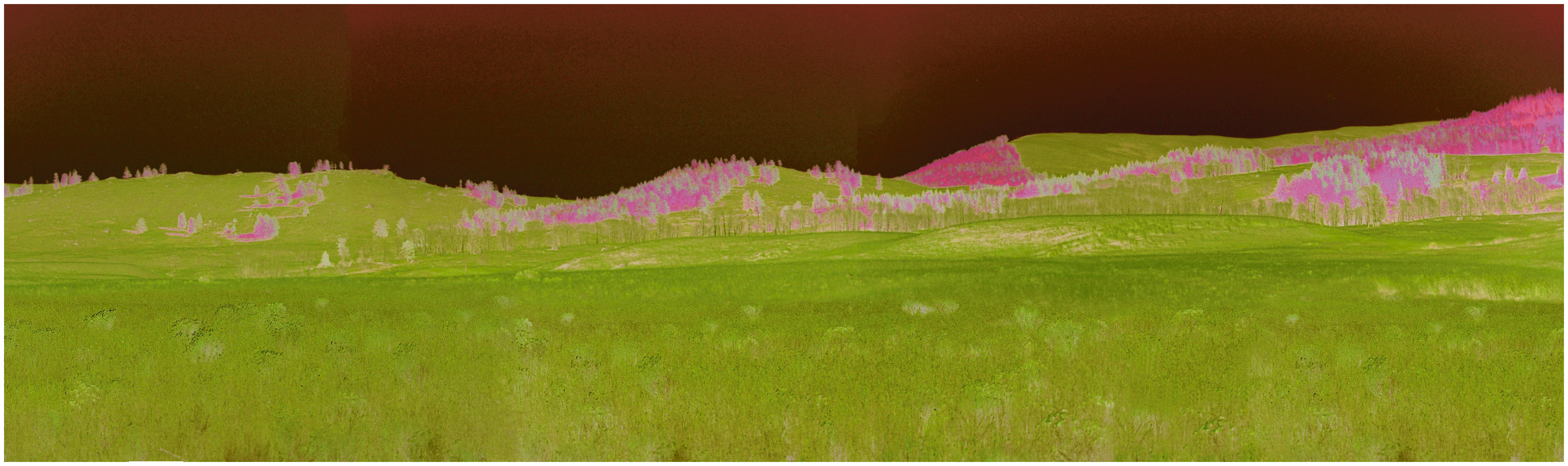


Figure 10:

Existing Conditions at Site in Lamar Valley Looking South from Road Near Crystal Creek

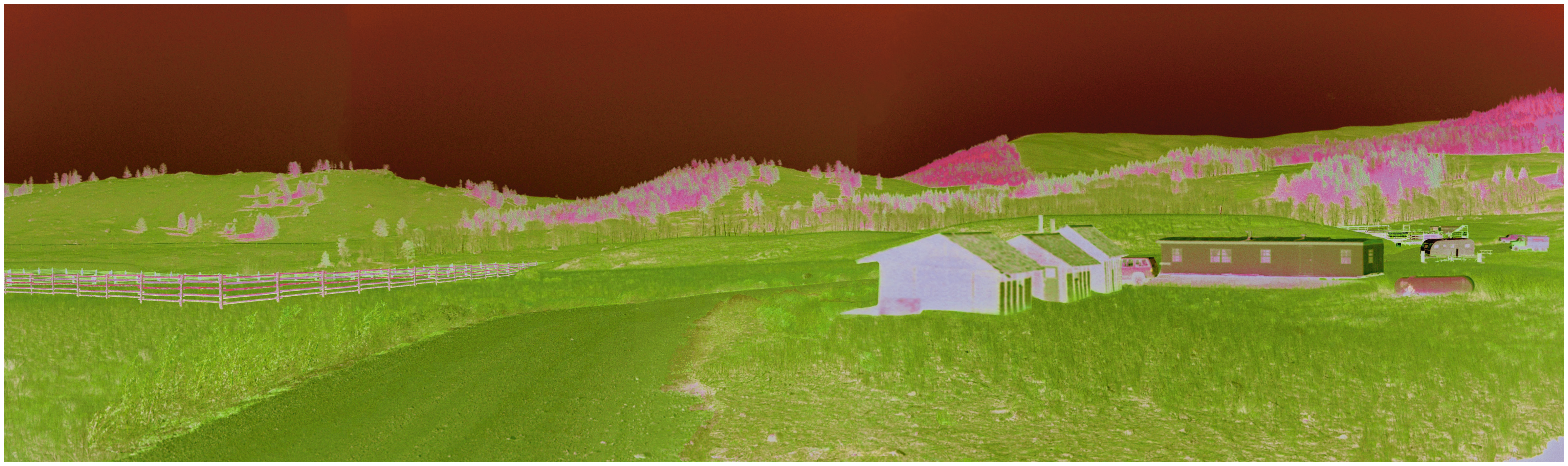


Figure 11:

Visual Simulation of Proposed Capture Facility, Lamar Valley

In the long term, snowmobiling and winter recreation within the winter landscape would be modified or eliminated on certain park roads and would be a beneficial impact on the visual scene for three to four years. Displaced oversnow recreational activities would constitute a moderate to major negative visual impact on surrounding U.S. Forest Service lands, especially near West Yellowstone. Impacts on neighboring public lands from displaced snowmobiles would be slightly higher in this alternative than alternative 5, as the Seven-Mile Bridge capture facility would be maintained throughout the life of the management plan, resulting in the closure of roads to snowmobiles from West Yellowstone into the park. However, for those visitors able to access the park interior, capture operations might have a moderate to major adverse impact to the winter scene.

Cumulative Impacts

Impacts would be similar to alternative 5.

Conclusion

Impacts would be similar to visual resources as described in alternative 5 with the primary difference being the permanent location of the capture facility at Seven-Mile Bridge, which would be a major adverse impact on visual resources. Implementing this alternative would result in some short term reductions in the bison population in phase two. During this time, visitors attempting to view bison may experience minor to moderate impacts as a result.

IMPACTS OF ALTERNATIVE 7

Analysis

Impacts of the Stephens Creek facility and its relocation north of the park boundary would be similar to that described in alternative 3. Continued use of the Horse Butte and Duck Creek facilities would have the same impact as in alternative 4.

Hunting activities would have similar impacts on visual resources as described for alternative 4.

The primary impact would be the reduction of numbers of bison to no more than 2,500, which would reduce viewing opportunities for those seeking to view bison. However, this adverse impact would be partially offset by the presence of bison outside the park in phase 2. Overall, the impact of this combination may be to make this alternative similar to alternatives 1 or 4.

Cumulative Impacts

Bison management facilities would constitute an intrusion on the visual scene. The bison management facilities would add to the number of aboveground structures , wherever the quarantine facility is located, and north of the park where the Stephens Creek capture facility would be relocated in the long term. However, impacts on visual resources as a result of these facilities would likely be minor to moderate, as siting would be sensitive to visual resources. The primary cumulative impact would be the reduction of the number of bison on the landscape. As changes occurred throughout the Greater Yellowstone Area to wildlife populations and scenery, the reduced number of bison on the landscape would be considered by some to be a major adverse impact, but to others a major beneficial impact.

Conclusion

Impacts on visual resources would be similar to alternative 3; the primary exception would be the capture facility at Horse Butte. This would be a minor to moderate impact. The displacement of snowmachines onto U.S. Forest Service lands would be similar to alternative 5 in the types of impacts on visual resources, but it would be minor in degree. Impacts from hunting on visual resources would be similar to alternative 3. The primary impact would be the reduction of numbers of bison to no more than 2,500, which would reduce viewing opportunities for those seeking to view bison. However, this adverse impact would be partially offset by the presence of bison outside the park in phase 2. Overall, the impact of this combination may be to make this alternative similar to alternatives 1 or 4.

IMPACTS OF THE MODIFIED PREFERRED ALTERNATIVE

Analysis

The existing capture facilities at West Yellowstone and at Stephens Creek would continue to intrude on the viewshed with a minor to moderate negative impact. The location and design of the quarantine facility has not been determined, and the facility would probably appear similar to a large corral with pens for holding bison. The siting of the facility would be sensitive to views and features of the viewshed; therefore, impacts would likely be minor.

The modified preferred alternative may provide for less capture and handling of bison when the population is around 3,000 animals and tolerance levels outside Yellowstone National Park are not exceeded. During step 3 of the modified preferred alternative, when a reduction in management activities is expected, there may be a minor positive visual impact for some viewers opposed to activities such as hazing and shooting compared with alternative 1.

Under the modified preferred alternative, during step 3, untested bison would be permitted to occupy designated areas to the west and north of the park when the population level is not above 3,000 animals and tolerance levels outside of the park have not been exceeded. Therefore, there is a potential for less marking and tagging of bison under this alternative. Reduction in the marking of bison could be considered a moderate to major positive impact on visual resources for those viewers opposed to such markings, compared with alternative 1.

Under the modified preferred alternative, the bison population would be expected to increase from current levels and be maintained at a level of 3,000 animals. Compared with alternative 1, the bison population would increase slightly in the first 10 years and decrease slightly in the next five. The impacts to bison viewing would be negligible. However, bison would be more widely distributed than in alternative 1, a minor to moderate positive impact.

Cumulative Impacts

The addition of a quarantine facility and the continued operation of the capture facilities, particularly during step 1 of this alternative, would impact visual resources, when added to other changes in the landscape occurring throughout the Greater Yellowstone Area. The impact would range from minor to moderate, as siting would be sensitive to visual resources.

Conclusion

The operation of capture facilities during the first step of this alternative would result in minimal impacts to visual resources. Although the location is unknown, the addition of a quarantine facility is expected to have a minor impact on visual resources because of siting objectives to avoid sensitive areas. With a reduction in capture and handling of bison associated with step 3, there may be a minor benefit to the visual resources for some viewers opposed to such activities. The modified preferred alternative may potentially result in less marking of bison, which is considered a moderate to major beneficial impact to visual resources. The potential for increased numbers of bison outside of the park to the north may be considered a minor to moderate positive impact on visual resources for those seeking to view bison.

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

There would be no irreversible or irretrievable commitments of resources under the alternatives.

LOSS IN LONG-TERM AVAILABILITY OR PRODUCTIVITY OF THE RESOURCE TO ACHIEVE SHORT-TERM GAIN

Under all alternatives, except alternative 2, appearance, environmental adaptations, and seasonal distribution of bison on landscapes could vary from a greater to a lesser degree depending on the number removed.

Grizzly.

Under alternative 2, there would be a change in some allotments' rural/ranching landscapes near park boundaries. This range land might be visibly occupied by bison and other wildlife.

UNAVOIDABLE ADVERSE IMPACTS

The management activities proposed under alternatives 5 and 6 would result in an unavoidable short-term loss of some of the bison population. Alternative 7 would result in the long-term loss of a portion of the population. Either would affect the visual resources the wild and free-ranging herd represented to viewers.

Consultation and coordination

PUBLIC INVOLVEMENT

A summary of the environmental impact statement planning process and public participation, including that conducted for the 1996 *Interim Bison Management Plan and Environmental Assessment*, can be found in part 1, "Purpose of and Need for Action," in the "Scoping Process and Public Participation" chapter. A summary of the major concerns identified throughout the past several years by the public on the issues of bison management are also provided in the "Purpose of and Need for Action."

In addition to public scoping activities, agencies and tribes have been consulted throughout the preparation of the environmental impact statement. In particular, the agencies consulted with the U.S. Fish and Wildlife Service (USFWS) and prepared a Biological Assessment for its review and concurrence. The response from the U.S. Fish and Wildlife Service can be found in Appendix x.

The public comment period on the *Draft Environmental Impact Statement* was initiated on June 16, 1998, and was to run for 120 days. In response to requests for an extension, the comment period was adjusted to receive comments through November 3, 1998. The comment period generated a large volume of responses from the public; 67,520 documents were received containing 212,249 individual comments.

A content analysis of comments was conducted to identify substantive issues for response and determine the overall theme of public concerns about the plan. The report, "Content Analysis of Public Comment for the Interagency Bison Management Plan for the State of Montana and Yellowstone National Park," (NPS 1999b) was made available for public review in March 1999.

A content analysis of comments was conducted to identify substantive issues for response and determine the overall theme of public concerns about the plan.

Volume 2 of this final environmental impact statement provides a summary of the substantive issues and concerns expressed during the public comment period, as well as responses to those comments.

Native American tribes have been involved throughout the planning process. The 1996 *Interim Bison Management Plan/Environmental Assessment* was distributed for comment to the Crow, Northern Cheyenne, Northern Arapaho, Arapaho, Shoshone, Confederated Salish and Kootenai Tribes, Blackfeet, Nez Perce, Shoshone and Bannock, Gros Ventre and Assiniboine Tribes. Consultation with the tribes for the assessment was done both verbally and in writing. The National Park Service has consulted periodically with the Inter-Tribal Bison Cooperative regarding its interest in a quarantine facility on tribal lands (see discussion of quarantine facility in "The Alternatives" part of the environmental impact statement). Other tribes that have expressed interest have been contacted periodically and will receive copies of this environmental impact statement (see the following "Agencies and Organizations that Received Copies of the Final Environmental Impact Statement").

Tribes contacted from November 1995 until March 1997 for the purposes of this environmental impact statement include the following: Blackfeet, Choctaw, Crow, Eastern Shoshone, Gros Ventre-Assiniboine, Nez Perce, Northern Arapaho, Northern Cheyenne, Rosebud Lakota, Salish and Kootenai, and Shoshone-Bannock. The Crow Nation also commented on the archeological surveys conducted for the siting of possible bison management facilities both inside and outside Yellowstone National Park in 1995. Other tribes were contacted per written request, specifically the Sissiton-Wahpeton Sioux, Loyal Shawnee, Flandreay Santee Sioux, Lower Brule Sioux, Picuris Pueblo, Native Village of Mekoryuk, Round Valley Tribal Council, Modoc of Oklahoma, and Nambe Pueblo.

In addition to consultation with tribes through the preparation of the *Draft Environmental Impact Statement*, meetings and discussions were held during and after the public comment period with various tribal representatives. Appendix I provides a summary of the consultation history and the major concerns expressed by tribes during meetings, through written correspondence, and oral testimony.

This final environmental impact statement will be released to the public for a minimum of 30 days prior to action on approving the records of decision necessary to implement the plan.

LIST OF THOSE ENTITIES RECEIVING
THE FINAL ENVIRONMENTAL IMPACT STATEMENT

BUSINESSES

Abrahams, Loewenstein, Bushman and Kauffman
Adams Ranch
Adventurer Tours
Al Bellotto Incorporated
All Aboard Travel
Allen, Jack, Attorney at Law
Allied Correctional Services
Alpine Environmental Incorporated
Alta Ranch
American Sales Associates
Amfac Parks and Resorts
Andersons Arsenal
Angus Associates
Animal Health Center
Annenberg Rural Challenge
Aquarian Systems Incorporated
Architectural Illustration
Armadillo World
Arrowhead Ranch
Artistic Features Art Studio
Aspen Trading Post
Audio Press
Aurora Animal Behaviour
Ayers Northwest
Ayurvedic Rehabilitation Center
B&L Selective Logging
Backyard Designs
Baker Animal Hospital
Baldwin Realty
Baltimore Zoo
Battele-Columbus
Bell and Associates
Berthel Fisher & Company
Betty Brite Dry Cleaners
Biological Services
Biota Research and Consulting
Blaise Hayward Studio
Blue Water Publishing Incorporated
Boesche, McDermott & Eskridge
Boocks Farm
Bracer Consulting
Bray Ranch
Broken Arrow Ranch
Bruce Jackson Photography
Buffalo Bill Historical Center
Buffalo Jump
Busch Gardens
C J Properties
C. W. Roders Enterprises
Calvary Cemetery
Cambata Aviation Inc.
Cargill Pork
Cefali & Cefali Attorneys at Law
Circle CG Farm
City Living Realty
CNG Mexico
Coastal Consultants
Coffee Shaman
Compassionate Creations
Coyote Creek Photography
Crabtree Chiropractic Center
Crabtree Ridge Farm
D. Lindsay Pettus Real Estate
Daniel C. Hughes, Jr. Investment Properties
David L. Bourgoin Law Offices
David Spagat, Ltd.
Dawnland Center
Dawson Medical Group
Deseret Ranches of Florida
Deutsche Bank
Diachemix Corporation
Diamond 88 Ranch

Diamond K Outfitters
Direct Response
Don Devine's Studio
Donnadane Great Danes
Doubletree Incorporated
Double Spear Ranch
Dundee's Place
EB3 Ranch
Ecological Consulting Services
Elephant Head Lodge
Elk Run Ranch
Fable Incorporated
Family Medicine
Farm Bureau Insurance
FaunaWest Wildlife Consultants
First Alabama Bank of Birmingham
Flagg Ranch Resort
Fletcher's Wildlife Designs
Florida Museum of Natural History
Floyd Fisher-Buffalo Caretaker
Fort Worth Nature Center and Refuge
Georgia Surgical Associates, P.C.
Geyser Gazette
Golden Heart Photography
Goldstar Jewellery Pvt. Ltd.
Good Machine Incorporated
Gray Wolf Ranch
Great Earth Vitamins
Greenway Travel Service Incorporated
Grimsley Ranch
H. F. Magnuson Company
Hagenbarth Livestock
Hakansson, Carl G., Attorney at Law
Hamilton Stores Incorporated
Haney Truck Line, Inc.
Hawk Inn & Mountain Resort
Heartland Realty Investors, Inc.
Hebgen Lake Lodge and Cabins
Herbert L. Staples Insurance
Herbst Lazy TY Cattle Company
Hogue's Ravenoak
Holmhaven
Hubbinettee-Cowell Associates Incorporated
Humanistic Psychology Center
IBM Global Services
Indigo Girls
IXL Glass & Trim
Jack Atcheson and Sons Incorporated
Jessie M. Harris, Flower and Nature Photography
Joel J. Bickler D.D.S.
Keenan Ranch
Kelley, Hart, & Hallman
Kiefer Home Pet Care
King Ranch
Kokopelli Books
KVM Beefmasters
LaCrosse Associates
Lake Area Hamilton Stores
Lance W. Holter, Real Estate & Construction
Lee Jackson Motel
Lee Ranch
Leonard, Street and Deinard
Lichtenfeld, Mark A., Attorney at Law
Light Touch Chiropractic
Lockwood Properties Trust
Lonsdale Concepts
Lortz Manufacturing Company
Louis Berger International Incorporated
Marmon/Keystone Corporation
Marquis Art and Frame
McCoy Meadows Ranch
Meagher County News
Meat Marketing & Technology
Medicine Lodge Ranch
Metrics Unlimited Incorporated
Meyers and Alterman
Microban Products Company
Mills, Sherman, Gilliam, & Goodwin, P.S.C.
Minnesota Zoo

Modern Dance Studio
Montana International Incorporated
Montana Livestock Ag Credit Incorporated
Moon Rising Ranch
Moore and McFadden, Chartered
Morgan, Franich, Fredkin, and Marsh
Morningstar Mini Storage
Morris, Manning, & Martin
Moseley Outdoor Advertising
Multi-Pure Water Systems
Mundt & Associates
Naturally Curious Incorporated
Nelsen Electronics
Networks
New Jersey Veteran Memorial Home
Northfork Ranch
Northwest Build Net
NovelTech Incorporated
Oklahoma National Stockyards Company
Outdoor Life Network
Owl Ranch
Pain Relief Center
Painted Rose Ranch
Patagonia
Patino-Treat and Rosen, Attorneys at Law
Pediatric and Handicapped Dentistry
Peleau Investments
Peoria Union Stockyards
Peter H. Dierlich Associates
Peterson Buffalo Ranch
Philips County Veterinary Clinic
Pippin's Shire
Planetary Productions, Ltd.
Producers Livestock Auction
Purdy Ranches
PVA Travel Planning
Quality Transportation Services
R Lazy S Ranch
Rachel Rosenthal Company
Rancho San Benito
Raven Trails
Regency at Smithtown
Resource Concepts Incorporated
Rio Puerco
Richard Raymond Associates
River Bend Ranch
Rocking T Stables
Rockmoore Ranch
Rolyboh International, Inc.
Rushmore Farms
Russel Lamb Photography
Sagar-Mexico
Santee Cooper
Saturday Night and Sunday Morning, Ltd.
Saxtons River Professional Center
Schubert & Associates
Selah Bamberger Ranch
Sentinel Home Inspections
Shell Knob Real Estate
Signal Mountain Lodge
Silver Cloud Farm
Silver Spring Ranch
Smith and Doherty, PLLC
Snavely Forest Products
Snider Hardwoods
Spiriti Heart Productions
Springfield Veterinary
Sprout House Farm
St. Louis Zoological Park
Star B Ranch
Star Watcher Productions
Steele Veterinary Clinic
Stone Orchards
Stormont Labs
Sunswept Farm
Taylor, John A., Attorney at Law
Techna Tech
Teton Medical Specialty Center
Tetra Technology Inc., Virginia
Tetra Technology Nus Incorporated

Thunder Herd Buffalo
Tierra Linda Ranch
TMR Incorporated
Trout Creek Ranch
Turner Ranches
Upstream Anglers and Outdoor Adventures
Van Hyning & Associates Incorporated
Veterinary Consultants Incorporated
Wade Gallery
We Care Chiropractic
Weatherwax
Wellness Enterprises
Wesley Granger, M.D.
Western Beef Producer
Wild Birds Unlimited
Wildlife Damage Control
Wildlife Veterinary Research
William P. Cook & Associates, PLLC
Windswept Farm
Wired Digital
Wisdom House
Woodsong Ranch
World Book Publishers
WPKR and WPCK Radio
Yeates, J. William, Attorney at Law
Yellowstone Arctic Yamaha
Yellowstone Park Medical Services
Yellowstone Park Service Stations
Yellowstone Tour and Travel
Zoological Research Service
Zoological Society of San Diego

ORGANIZATIONS AND EDUCATIONAL INSTITUTIONS

Advocates for Animals
Advocates of Nature
Alabama Audubon Council
Alabama Cattlemen's Association
Alabama Cooperative Extension System
Alabama Environmental Council
Alabama Farmers Federation
Alabama Ornithological Society
Alabama Veterinary Medical Association
Alliance for the Prevention of Animal Abuses
Alliance for the Wild Rockies
Alpaca Owners and Breeders Association
  Michigan
  Oregon
  South Dakota
American Association of Equine Practitioners
American Association of Wildlife Veterinarians
American Association of Zoological Veterinarians
    Florida
    Pennsylvania
American Bison
American Buffalo Foundation
American Council of Snowmobile Associations
American Farm Bureau Federation
American Feed Industry Association
American Horse Council/AQHA
American Indian Science and Engineering Society
American Lands Alliance
American Legion-Miami Beach Post No. 85
American Reform Party-CA
American Sheep Industry Association
American Veterinary Medical Association
American Wildlands, Northern Rockies Office
Animal Advocates of Lake County
Animal Assistance League of Orange County
Animal Health Information
Animal People
Animal Protection Institute
Animal Rights Alliance
Animal Welfare Institute
Anti-Vivisection Society of America
Appalachian Voices
Apple Country Snowmobile Club
Arkansas Farm Bureau

- Arlington Conservation Council
- Associated Milk Producers Incorporated
- Association of Veterinarians for Animal Rights
- Audubon Society
  - Arkansas Valley
  - Bexar
  - Bighorn
  - Boulder County
  - Central Oklahoma
  - Cheyenne High Plains
  - Conococheague
  - Evergreen Naturalists
  - Last Chance
  - Montana
  - Montana Audubon Council
  - Prairie Woods
  - Rocky Mountain Region
  - Sacajawea
  - Snake River
  - Travis
  - Upper Missouri Breaks
  - Utah
  - Yellowstone Valley
- Ball State University Medical University
- Banff Environmental Action and Research Society
- Bear Creek Council
- Beartooth Alliance
- Behman Academy
- Berlin United Methodist Church
- Bighorn Livestock Association
- Billings Rod and Gun Club
- Biodiversity Legal Foundation
- Bison Sportsman Club
- Blackfeet Community College
- Blue Ribbon Coalition, Inc.
- Boise State University
- Boulevard School
- Bridging the Gap
- Brushy Bottom Bison Basin
- Buffalo Field Archery Club
- Buffalo Field Campaign (formerly Buffalo Nations)
- Buffalo Gap Land Rescue
- Butte Busters Snowmobile Club Incorporated
- Cabinet Resource Group
- California Farm Bureau Federation
- California Federation for Animal Legislation
- Cascade Public Schools
- Cascadia Forest Alliance
- Cascadia Wildland Project
- Casper College
- Central Wyoming College
- Chambers of Commerce
  - Billings, Montana
  - Bozeman, Montana
  - Cody Country, Wyoming
  - Cooke City/Silver Gate, Montana
  - Gardiner, Montana
  - Idaho Falls, Idaho
  - Jackson Hole, Wyoming
  - Lander, Wyoming
  - Livingston, Montana
  - Pinedale, Wyoming
  - Red Lodge, Montana
  - Riverton, Wyoming
  - Thermopolis, Wyoming
  - West Yellowstone, Montana
- Chipeta Elementary
- Church Universal Triumphant
- Civitas-Citizens for Planetary Health
- Clemson University, Department of Livestock and Poultry Health Programs
- Coal Creek Education Institute
- Coalition for Louisiana Advocates
- Cold Mountain, Cold Rivers
- College of Great Falls
- Colorado Farm Bureau
- Colorado Grizzly Project

- Colorado State University-Natural Resource Ecology Laboratory
- Colorado Wildlife Alliance
- Colorado Wildlife Federation
- Committee for Children
- Committee for Responsible Growth
- Committee to Abolish the Fur Trade
- Compassionate People for Animals
- Concerned People for Animals Incorporated
- Connecticut Animal Reachout
- Conservation Advocacy
- Conservation Council for Hawaii
- Converse County School District #2-9th Grade
- Cornelia Connelly School
- Cornell University-Veterinary Diagnostic Laboratory
- Dawson Community College
- Deerlodge Forest Defense Fund
- Defenders of Wildlife
  - Montana
  - New Jersey
  - Washington D.C.
- Delaware Farm Bureau
- Delaware Valley Basenji
- Doing Things for Animals
- Doris Day Animal League
- Earth Island Institute
- Earthwalk Spiritual Ministry
- East Ascension Sportmanís League Incorporated
- Eastern Michigan University-Recreation and Parks Department
- Eastern Montana College
- Eastern Wyoming College
- Ecology Center
- Ecology Center of Southern California
- EcoSys Alert
- Eco-watch Sonoma
- Edmonds Institute
- Eilat Loves Animals
- Elsa Wild Animal Appeal
- Emory University
- Environmental Council of Rhode Island
- Environmental Defense Fund
- Environmental Protection Information Center
- Environmental Rangers
- Ethics Outreach
- Exotic Wildlife Association
- Eye Openers
- Farm Sanctuary
- Finger Lakes Community College
- First Congregational Church
- Flathead Valley Community College
- Flathead Wildlife Incorporated
- Florida Biodiversity Project
- Florida Farm Bureau
- Florida Wildlife Organization
- Forest Lake Minnesota Snowmobile Group
- Framingham State College
- Frente Zapatista
- Friends of Animals
- Friends of Animals and Their Environment and Faith
- Friends of Native Americans
- Friends of the Bitterroot
- Friends of the Uintas
- Friends of the West
- Friends of the Wild Swan
- Fund for Animals
  - California
  - Illinois
  - Maryland
  - New York
  - Wyoming
- Gallatin Beef Producers
- Gallatin Valley Snowmobile Association
- Gallatin Wildlife Association
- Georgia Farm Bureau Federation
- Girl Scout Troop 395

Girl Scouts of the USA
Glasgow Area Chamber of Commerce
Grassland Heritage Foundation
Grassroot for Multiple Use
Great Bear Foundation
Great Plains Restoration Council
Greater Yellowstone Coalition
Habitat and Endangered Species
Harmony Middle School
Harvard University-Mammal Department
Heartwood
Heritage Community Sons of Confederated Veterans
Heroes Alliance
Holstein Association of America
Honor the Earth
Humane Education Network
Humane Legislative Network
Humane Society
- Corsicana, Texas
- Golden State
- Marion County
- Peoria
- Seneca County
- Tampa Bay
- United States
- Utah

Hunter of Bison
Idaho Cattle Association
Idaho Conservation League
Idaho Farm Bureau Federation
Idaho Mythweaver
Idaho State Snowmobile Association
Idaho State University
Idaho Watersheds Project
Idaho Wildlife Federation of Boise
In Defense of Animals
- California

Indiana University-Department of Geography
Indiana Wildlife Federation
Indigenous Support Coalition of Oregon
Inherit the Earth
Institute of Political Economics
International Defenders of Animals Incorporated
International Llama Association
- Arizona
- California
- Kentucky
- Minnesota
- Oregon
- Pennsylvania

International Lutheran Women's Missionary League
Iowa Farm Bureau Issue Strategies Group
Iowa State University-Department of MIPM
Iowa State University-Department of Veterinary Pathology
Iowa Wildlife Federation
Ithaca College
Izaak Walton League
- Minnesota Division
- Walter J. Breckenridge Chapter

Jackson Hole Alliance for Responsible Planning
Jackson Hole Conservation Alliance
Jerabek Elementary School-5th Grade
Johnson State College-Department of Environmental Science
Kaniksu Bioregional Council
Kansas State University-College of Veterinary Medicine
Kerr Center
Kettle Range Conservation Group
Kyle Rzewnicki Memorial Wildlife Trust
Las Colinas Polo Club
Last Chance for Animals
League for Animal Protection Incorporated
League in Support of Animals
League of Kentucky Sportsmen Incorporated

Lemon Bay High School
Little Missouri Grazing Association
Little Wound School-3rd Grade
Livestock Conservation Institute
  Kentucky
  Wisconsin
Livestock Marketing Association
Llama Association of North America
Louisiana Farm Bureau Federation
Louisiana State University
Louisiana State University-Department of Veterinary Medicine
Madison Gallatin Alliance
Maine Farm Bureau
Manitoba Animal Alliance
Mariposa Mobile Veterinary Service
Marshall Elementary School-4th Grade
Maryland Coalition for Animal Rights
Maryland Farm Bureau
Meagher County Sportsman Association
Medicine Wheel Alliance
Medora Grazing Association
Mennen Environmental Foundation
Michigan Farm Bureau
Michigan State University-College of Veterinary Medicine
Michigan United Conservation Clubs
Mid-America Dairymen
  Illinois
  Missouri
Miles Community College
Minnesota Conservation Federation
Mira Mesa High School Ecology Club
Mississippi Farm Bureau
Mississippi Wildlife Federation
Missouri Farm Bureau
Montana Alternative Livestock Producers
Montana Association of Livestock Auction Markets
Montana Beef Council
Montana Cattlemen's Association
Montana Cattlewomen's Association
Montana Coalition for Appropriate Management of State Land
Montana College of Mineral Science and Technology
Montana Ecosystems Defense Council
Montana Farm Bureau Federation
Montana Farmers Union
Montana Pork Producers Council
Montana Power
Montana Snowmobile Association
Montana State University
Montana State University Billings-Department of English
Montana State University-Biology Department
Montana State University-Extension Range Management
Montana Stockgrowers Association
Montana Stockgrowers Cattle Health Committee
Montana Veterinary Medical Association
Montana Wilderness Association
Montana Wildlife Federation
Montana Wool Growers Association
Moravian College-Biology Department
Mt Shasta Snowmobilers Incorporated
National Academy of Sciences
National Association of State Recreation Planners
National Bison Association
National Cattle and Feed Association
National Cattlemen's Beef Association
National Coalition for Public Lands and Natural Resources
National Farm Organization
National Milk Producers Association
National Parks and Conservation Association
  Colorado
  Massachusetts

Minnesota
North Carolina
Rocky Mountain Region
Utah
Washington D.C.
National Pork Producers Council
National Rifle Association of America
National Wildlife Federation
Northern Rockies Project Office
Native Action
Native American Rainbow Network
Native Forest Network
Natural Resources Defense Council
California
Washington, D.C.
Nature Conservancy
Montana
Nebraska Farm Bureau
Nebraska Veterinary Medical Association
Nevada Farm Bureau
New Jersey Animal Rights Alliance
New Jersey Environmental Lobby
New Jersey Farm Bureau
New Mexico Farm Bureau
New York Farm Bureau
New York State College of Veterinary Medicine
No Excuse for Animal Abuse
North American Bison Society
North American Deer Farmers
California
Maryland
North American Elk Breeders
Colorado
Minnesota
North American Independent Indigenous Community
North Carolina Farm Bureau
North Carolina State University
North Carolina Wildlife Federation
North Central Ohio Nature Preservation League
North Coast Environmental Center
North Dakota Farm Bureau
North Fork Preservation Association
Northern Agricultural Network
Northern Montana College
Northern Plains Resource Council
Northern Rockies Preservation Project
Northland College
Northwest College
Northwest Indiana Association of Wholistic Healers
Ohio Environmental Council
Ohio Farm Bureau
Oklahoma Cattlemen's Association
Oklahoma Farm Bureau
Oklahoma State University-Veterinary Medicine
One People, One Nation
Orange County People for Animals
Oregon Cattlemen's Association
Oregon Dairy Farmers Association
Oregon Farm Bureau
Oregon Natural Resources Council
Oregon State University-College of Veterinary Medicine
Parish Community of Saint Bernard
Park County (Montana) Environmental Council
Park County (Wyoming) Travel Council
Park County Ranchers Marketing Association
Parkview Elementary School
Pegasus Foundation
People for the USA
Pet Rescue Incorporated
Portneuf Environmental Council
Pray for Peace Foundation
Predator Education Fund
Predator Project

Preserve Appalachian Wilderness
Providence College-Biology Department
Puerto Rico Farm Bureau
Quebec Pork Producers
Real Environmentalists
Republicans for Environmental Protection
Respect for Life Society
Ricks College
Riverway Consensus Standard Foundation
Rock Springs 4-H Center
Rocky Mountain Animal Defense
Rocky Mountain College
Rocky Mountain Elk Foundation
Ross School
Sacred Earth Network
Sacred Heart Convent
Safari Club International
Salish-Kootenai College
San Francisco State University
Sand Creek Arabians
Sarasota In Defense of Animals
Save Our Earth
Schuylerville Central School
Seeley Lake Driftriders
Seventh Generation Fund
Sheridan College
Sierra Club
  Berks Group
  Big River Group
  Bitterroot Mission Group
  Black Hills Group
  Central Florida Group
  Columbia Group-Oregon Chapter
  Delta Group of San Francisco
  East Idaho Group
  Grizzly Bear Ecosystems Project
  Montana Chapter
  Mount Evans Group
  Northern Plains Regional Office
  Northern Rockies Chapter
  North Star Chapter
  Placer Group
  Rocky Mountain Chapter
  Santa Lucia Chapter
  Teton Group
  Texas Lone Star Chapter
  Upper Columbia River Group
  Utah Chapter
  Wyoming Chapter
Sierra Club Legal Defense Fund
Sierra Club Yellowstone Ecosystem Task Force
Sinapu
Sitting Bull College
SKUNKS
Skyline Sportsmen's Association Incorporated
Society for Range Management
Society for the Prevention of Cruelty to Animals
South Carolina Farm Bureau
South Carolina Pork Board
South Carolina Wildlife Federation
South Dakota Farm Bureau
Southeast Idaho Environmental Network (SEIEN)
Southeastern Livestock Association
Southeastern Montana Livestock Association
Southeastern Montana Sportsman Association
Southern Rockies Ecosystem Project
SPCA, Animal Care and Welfare
SPCA, League for Animal Protection, Inc.
SPEAK
St. Edward's University
St. Labre
St. Labre Volunteers
State University of New York-Cobleskill
State University of New York-Cortland
Station Middle School
Stop Animal Exploitation

Students for Environmental Action and Animals
Stuyvesant High School-American Habitat Club
Sun City Friends of Animals
Sweetgrass Hills Cattlewomen
Teen Animal Protectors
Tennessee Farm Bureau
Teton Science School
Texas A&M University-College of Veterinary Medicine
Texas A&M University-Department of Anatomy and Neurobiology
Texas and Southwestern Cattle Raisers Association
Texas Animals
Texas Bison Association
Texas Committee on Natural Resources
Texas Establishment for Animal Rights
Texas Farm Bureau
Texas Tech University
Trimbelle Rod and Gun Club
Trout Unlimited Rio Grande Chapter
Turner Foundation Incorporated
Union Furnace Elementary School-3rd Grade
United States Animal Health Association
Universidad De Jaen-Dept. De Biologia
University of California Davis-Section of Evolution and Ecology
University of California Davis-Veterinary Medicine Extension
University of California San Diego
University of Chicago
University of Colorado
University of Connecticut-Environmental Research Institute
University of Florida
University of Georgia-School of Veterinary Medicine
University of Idaho
University of Illinois-Department of Geography
University of Kentucky
University of Massachusetts-Department of Forestry
University of Michigan-School of Natural Resources
University of Montana
University of Nebraska-Department of Veterinary Science and Biomedical Science
University of Nevada Las Vegas
University of New Hampshire-Department of Entomology
University of Northern Colorado
University of Oxford-Department of Zoology
University of Pennsylvania
University of Pennsylvania-Biology Department
University of Richmond-Department of Speech
University of Texas-Philosophy Department
University of Washington
University of Wisconsin-College of Natural Resources
University of Wyoming
University of Wyoming-Department of Geology and Recreation
US WEST
Utah Farm Bureau Federation
Utah Snowmobile Association
Utah State University
Utah Wildlife Federation
Valley Middle School
Valley Snodrifters
Ventura Out
Virginia Tech-College of Veterinary Medicine
Virginia Tenth District Environmental Council
Virginia Wildlife Federation
Voice for Wildlife
W.I.F.E.

Warren Schools
Wasatch Mountain Club
Washington Cattlemen's Association
Washington Elementary School-6th Grade
Washington State Snowmobile Association
Washington Wildlife Federation
West Yellowstone Chamber of Commerce
Westchester School District
Western Dairymen Cooperative Incorporated
Western Montana College
Western Wildlife Health Cooperative
Western Wyoming Community College
Whitesburg Home Schoolers
Wild Rockies Infonet
Wilderness Resource Center
Wilderness Society
  Idaho Chapter
  Montana Chapter
Wildlands Center for Preventing Roads
Wildlife Conservation Society
  Montana
  New York
Wildlife Damage Review
Wildlife Information Center
Wildlife Management Institute
  Oregon
  Washington D.C.
Wildlife Rehabilitation and Refuge Center
Wildlife Society
  Maryland
  Montana
Wisconsin Farm Bureau
Wisconsin Wildlife Federation
Wolf Alliance
Wyoming Bears
Wyoming Farm Bureau Federation
Wyoming Heritage Society
Wyoming Outdoor Council
Wyoming Stockgrowers Association
Wyoming Travel Commission
Wyoming Wildlife Federation
Wyoming Woolgrowers Association
Yell County Wildlife Federation
Yellowstone Association
Yellowstone Park Foundation

PUBLIC AGENCIES

FEDERAL AGENCIES

Advisory Council on Historic Preservation
American Embassy-Vienna
Department of Agriculture
  Animal & Plant Health Inspection Service-
    Agricultural Research Service and
    National Animal Disease Center
      Ames, Iowa Office
  Roman L. Hruska U.S. Meat
    Animal Research Center
  Animal & Plant Health Inspection Service-
    Animal Care
      Rockville, Maryland Office
  Animal & Plant Health Inspection Service-
    Food Safety and Inspection Service
      Washington, D.C. Office
  Animal & Plant Health Inspection Service-
    Legislative and Public Affairs
      Riverdale, Maryland Office
  Animal & Plant Health Inspection Service-
    National Wildlife Research Center
      Fort Collins, Colorado Office
  Animal & Plant Health Inspection Service-
    Veterinary Services
      Albany, New York Office
      Arlington, Texas Office
      Atlanta, Georgia Office
      Auburn, Kansas Office
      Boise, Idaho Office
      Bozeman, Montana Office
      Bowie, Maryland Office
      Cheyenne, Wyoming Office
      Desoto, Kansas Office

Englewood, Colorado Office
Fort Collins, Colorado Office
Lakewood, Colorado Office
Little Rock, Arkansas Office
Oklahoma City, Oklahoma Office
Riverdale, Maryland Office
Sacramento, California Office
Shelbyville, Kentucky Office
Sykesville, Maryland Office
Thomaston, Georgia Office
Washington, D.C. Office
Western Field Office-Denver, Colorado
Bureau of Land Management
Colorado Office
Idaho Office
Cheyenne, Wyoming Office
Cody, Wyoming Office
Pinedale, Wyoming Office
National Applied Resource Sciences Center
Forest Service
Beaverhead National Forest
Bridger-Teton National Forest
Custer National Forest
Gallatin National Forest
Shoshone National Forest
Targhee National Forest
Tongass National Forest
Wasatch-Cache National Forest
Wildlife and Fisheries Office, Washington, D.C.
Omaha, Nebraska Office
Natural Resources Conservation Service
Department of the Army
Corps of Engineers
Department of Energy
Idaho Falls, Idaho Office
Department of Housing and Urban Development
Department of the Interior
Bureau of Indian Affairs
Billings, Montana Office
Lower Brule, South Dakota Office
Natural Resources Office-Aberdeen, South Dakota
Fish and Wildlife Service
Montana Office
Wyoming Office
Division of Refuges
National Elk Refuge
National Wildlife Health Center
Office of External Affairs
Office of International Conservation
Red Rock Lakes National Wildlife Refuge
Wichita Mountain Wildlife Refuge
General Accounting Office
National Park Service
Acadia National Park
Alaska Area Regional Director's Office
American Indian Liaison Office
Badlands National Park
Bering Land Bridge National Park
Bighole National Battlefield
Big South Fork National Recreation Area
C & O Canal National Historic Place
Canyonlands National Park
Catoctin Mountain Park
Cuyahoga Valley National Recreation Area
Death Valley National Park
George Washington Birthplace National Monument
Gettysburg National Military Park
Glacier National Park
Grand Teton National Park
Grant-Kohrs Ranch National Historic Site
Little Bighorn National Battlefield

Midwest Archaeological Office
Midwest Field Area Great Lakes SSO
Mojave National Preserve
Olympic National Park
Rocky Mountain National Park
Valley Forge National Historic Park
Wind Cave National Park
Wrangell St. Elias National Park and Preserve
Yellowstone National Park
Intermountain Regional Office
Office of the Secretary
U.S. Geological Survey-Biological Resources Division
Central Regional Office
Interagency Grizzly Bear Study Team
Mid-Continent Ecological Science Center
Department of Justice-Environmental and Natural Resource Division
Embassy of Australia
Environmental Protection Agency
Montana Office
Office of the Director, Washington, D.C.
Region VIII Office
Region VIX Office

FEDERAL ELECTED OFFICIALS

U.S. House of Representatives, Idaho
Honorable Helen Chenoweth
U.S. Senate, Idaho
Honorable Larry Craig
U.S. House of Representatives, Montana
Honorable Rick Hill
U.S. Senate, Montana
Honorable Max Baucus
Honorable Conrad Burns
U.S. Senate, South Dakota
Honorable Tim Johnson
U.S. House of Representatives, Wyoming
Honorable Barbara Cubin
U.S. Senate, Wyoming
Honorable Mike Enzi
Honorable Craig Thomas
U.S. House of Representatives, Committee on Resources

INTERNATIONAL AGENCIES

Wood Buffalo National Park

COUNTY AND LOCAL GOVERNMENTS AND AGENCIES

City Council of Steamboat Springs
City of West Yellowstone
Cody Conservation District Board, Wyoming
Fremont County, Idaho
Gallatin County Commissioners, Montana
Park County Commissioners, Montana
Park County Commissioners, Wyoming
Sacramento County Board of Supervisors
Teton County Commissioners, Wyoming
Yellowstone County Public Defenderís Office

STATE AGENCIES

Alabama Department of Agriculture and Industries
Alaska Department of Fish and Game
Arizona Department of Agriculture
California Department of Food and Agriculture
Georgia Department of Agriculture
Idaho
Department of Agriculture
Department of Commerce
Department of Livestock
Fish and Game Department
Illinois Department of Agriculture
Indiana State Board of Animal Health
Kansas Animal Health Department

Louisiana Department of Agriculture and Forestry
Michigan Department of Agriculture
Minnesota Board of Animal Health
Montana
- Department of Agriculture
- Department of Commerce
- Department of Fish, Wildlife and Parks
- Department of Livestock

Montana State Library
Montana State University Libraries
State Historic Preservation Office
Nevada Department of Business and Industry, Division of Agriculture
North Carolina Department of Agriculture and Consumer Services
North Dakota Department of Agriculture Board of Animal Health
Oregon Department of Agriculture
South Dakota Animal Industry Board
Texas Animal Health Commission
Utah Department of Agriculture and Food
Vermont Department of Agriculture, Food and Markets
Washington Department of Agriculture
Wisconsin Department of Agriculture, Trade and Consumer Protection
Wyoming
- Department of Agriculture
- Department of Environmental Quality
- Division of Cultural Resources
- Division of Tourism
- Game and Fish Department
- Livestock Board
- State Historic Preservation Office

STATE ELECTED OFFICIALS

Governor, Idaho
- Honorable Dirk Kempthorne

Governor, Montana
- Honorable Marc Racicot

Governor, Wyoming
- Honorable Jim Geringer

State House of Representatives, Montana
- Honorable Shiell W. Anderson
- Honorable Marian W. Hanson
- Honorable Bob Raney
- Honorable Alvin Ellis, Sr.

State Senate, Montana
- Honorable Lorents Grosfield
- Honorable Ken Mesaros

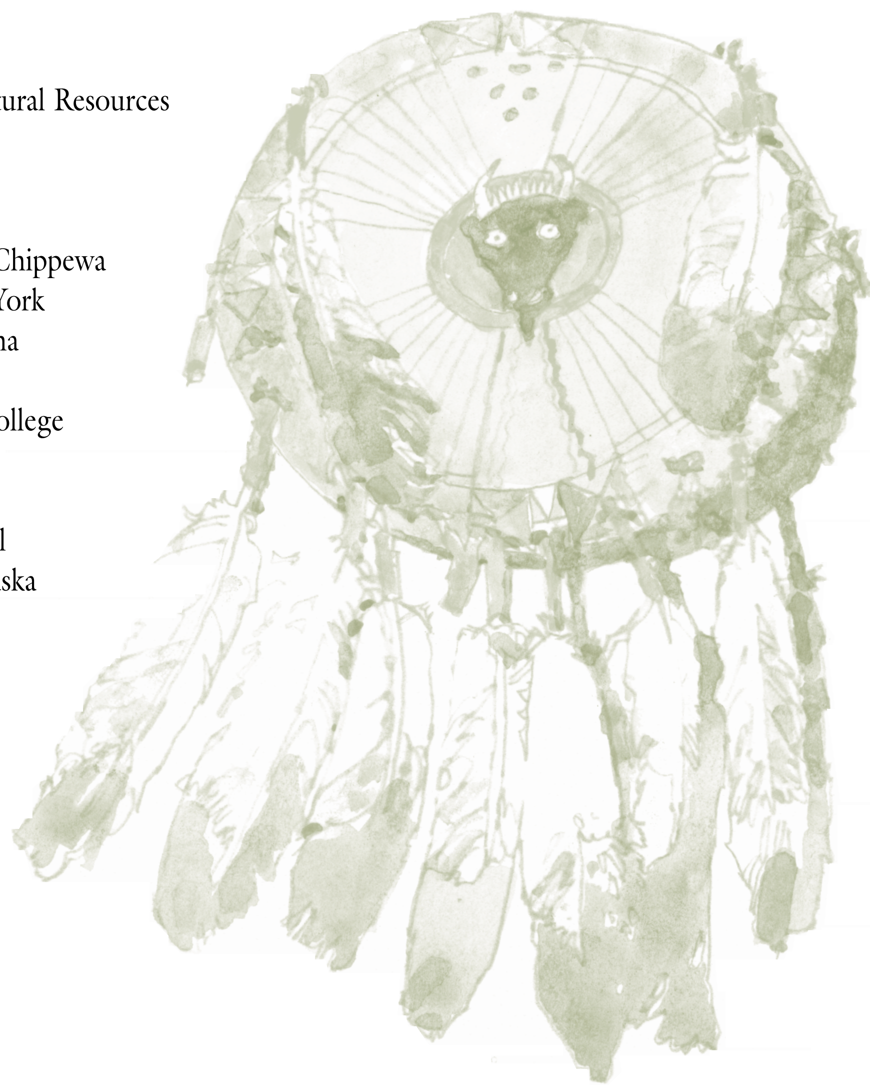
TRIBES AND TRIBAL ORGANIZATIONS

American Indian Friends
American Indian Movement
Assiniboine and Sioux Fort Peck
Assiniboine Treaty Committee
Bad River Band Chippewa
Blackfeet Tribe
Bois Forte Chippewa Tribe
Cheyenne River Community College
Cheyenne River Sioux Tribe
Chippewa Cree
Chippewa Cree Business Committee
Chocktaw Nation of Oklahoma
Comanche Indian Tribe of Oklahoma
Confederated Salish and Kootenai
Confederated Salish and Kootenai Tribes Preservation Officer
Confederated Tribes of the Colville Indian Reservation
Confederated Tribes of the Umatilla Indian Reservation
Confederated Tribes of the Yakima Indian
Crow Indian Tribe
Crow Creek Sioux Tribe
Crow Tribal Council
Devilís Lake Sioux Tribe

Dull Knife Memorial College
Eastern Shoshone
Eastern Shoshone Business Council
Eastern Shoshone Cultural Committee
Elk Valley Rancheria
Flandreau Santee Sioux
Flathead Cultural Committee
Fon du Lac Chippewa Tribe
Fort Belknap College
Fort Belknap Community Council
Fort Hall Business Council, Shoshone and Bannock Tribes
Fort Peck Community College
Fort Peck Council
Gros Ventre and Assiniboine of Fort Belknap
Ho-Chunk Nation
Indian Counseling Center
Indian Summer Festivals
Institute for Tribal Environmental Professionals
Inter-Tribal Bison Cooperative
Iowa Tribe of Kansas and Nebraska
Kaibab Paiute
Kalispell Tribe
Karuk Tribe of California
Kickapoo of Kansas
Kiowa Tribe of Oklahoma
Kootenai Cultural Program
Lac Courte Oreilles
Lakota Student Alliance
Las Vegas Pauite
Leech Lake Chippewa Tribe
Little Bighorn College
Little Shell Tribe of Chippewa Indians
Lower Brule Community College
Lower Brule Sioux Tribe
Lower Sioux Medwakanton Community
Loyal Shawnee Tribe
Menominee Indian Tribe of Wisconsin
Mesa Grande Band of Mission Indians
Mille Lacs Band Chippewa Tribe
Minnesota Chippewa Tribe
Minnesota State Indian Affairs Council
Modoc Tribe of Oklahoma
Montana Tribal Fish and Wildlife Commission
Nambe O-ween-ge Pueblo
Native Village of Fort Yukon
Native Village of Mekoryuk
Nez Perce
Nez Perce Tribal Council
Nez Perce Tribal Cultural Resource Program
Northern Arapaho Business Council
Northern Arapaho Tribe
Northern Cheyenne
Northern Cheyenne Tribal Council
Northern Cheyenne Tribal Council Cultural Commission
Northern Ute Indian Tribe
Oglala Lakota College
Oglala Sioux Parks and Recreation Authority
Oglala Sioux Tribe
Omaha Tribe of Nebraska
Oneida Tribe of Wisconsin
Onondaga Nation
Paiute Tribe
Picuris Pueblo
Pojoaque Pueblo
Ponca Tribe of Nebraska
Prairie Band Potawatomi Nation
Prairie Island Indian Community
Pueblo of Santo Domingo
Red Lake Tribal Council
Rosebud Lakota Tribal Council
Rosebud Sioux
Round Valley Indian Tribe
Sac and Fox Nation of Missouri
Sac and Fox Nation of Oklahoma
Saginaw Chippewa Tribe of Michigan
San Juan Pueblo
Sandia Pueblo

Santee Sioux Tribe of Nebraska
Sault Saint Marie Sioux Tribe of Chippewa
Shakopee Mdewakanton Sioux
Shoshone Business Council
Shoshone-Bannock Tribes, Cultural Resources Coordination
Shoshone-Bannock Tribes, Land Use Policy Committee
Sioux Tribe Utility Commission
Sisseton-Wahpeton Sioux
Southern Ute
Spirit Lake Sioux Tribe
Spokane Tribe of Indians
St Regis Mohawk Tribe
Standing Rock Sioux
Taos Pueblo
Taos Pueblo, Office of Natural Resources Protection
Tesuque Pueblo
Thunder Nation
Turtle Mountain Band of Chippewa
Tuscarora Nation of New York
Tuscarora of North Carolina
United Sioux Tribes
United Tribes Technical College
Upper Sioux of Minnesota
Ute Mountain Ute
White Earth Tribal Council
Winnebago Tribe of Nebraska
Yakama Tribal Nation
Yankton Sioux Tribe
Yurok Tribe of California
Zuni Pueblo

Native American war shield.



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Becky Keiser	Graphic Artist	B.A. Graphic Arts	6 years experience
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Tracy Hope	Desktop Publisher Word Processor	Idaho State University	5 years experience
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appendixes

APPENDIX A: CHANGES AND ADJUSTMENTS TO THE 1996 INTERIM BISON MANAGEMENT PLAN

Decision on Bison Management Operations for Winter of 1997-1998

Regulations promulgated by the Council on Environmental Quality require federal agencies to review environmental analyses under the National Environmental Policy Act to determine whether the agency should supplement existing NEPA documents. An agency triggers this requirement when the agency makes substantial changes to the proposed actions that are relevant to the environmental concerns or when the agency has significant new circumstances or information relevant to the environmental concerns and bearing on the proposed action or its impacts. 40 C.F.R. 1502.9(c).

Following the winter of 1996-97, the National Park Service, together with the Animal and Plant Health Inspection Service and the Forest Service, determined that they should adjust implementation of the interim bison management plan. The federal agencies, thus, proposed adjustments to the implementation of the interim bison management plan and transmitted those to the State of Montana on September 26, 1997. Then, on October 9, 1997, the federal and state agencies met to discuss the proposed adjustments. On November 13, 1997, the federal agencies again transmitted the proposals for bison management to the State of Montana. The federal agencies recognize that these adjustments must be implemented while they continue to work with the State of Montana to develop the long-term bison management plan and EIS.

The goal of the adjustments to the implementation of the plan is to provide a generally stable bison population by reducing the number of bison killed as part of the interim bison management actions at or outside the boundary of Yellowstone National Park, while still preserving Montana's brucellosis class-free status. The federal agencies seek to reduce the number of bison that would be shot or shipped to slaughter should extreme winter weather conditions, such as those that occurred during the winter of 1996-97, cause movement of bison to or beyond the boundary. The NPS will implement the adjustments at the onset of winter so, if bison migrate from the park, the adjustments will provide the most flexibility in reducing the number of bison that the agencies need to remove.

At the northern boundary the NPS will capture and hold, throughout the winter, all bison that test seronegative until reaching the capacity of the facility. The NPS, thereafter, will selectively ship bison testing seronegative to slaughter along with those testing seropositive. The alternatives, either shipping all captured bison to slaughter, or allowing them to leave the park and go onto private lands where they likely will be shot, would not provide this flexibility and are less likely to allow stability in the bison population. Additionally, when necessary, the NPS also will implement reasonable actions within the park, primarily through hazing, to attempt to limit bison movement from the interior of the park to the northern boundary.

It is recognized that management actions in Montana are within the jurisdiction and discretion of the State of Montana. The federal agencies have recommended that the state allow low-risk bison, as defined by APHIS in both the September 26 and November 13 letters, that evade capture to remain on public lands until 60 days before cattle are released on federal grazing allotments. As set out in the November 13 letter, allowing low- risk bison wintering on those public lands specified in the interim plan in the west boundary area will not jeopardize the brucellosis class-free status of Montana.

The adjustments that the federal agencies set out in the November 13 letter will provide for a generally stable population. The determination of what population level constitutes a viable herd or at what level the integrity of the herd would be compromised is under evaluation in the draft environmental impact statement for the interagency bison management plan for Montana and Yellowstone National Park. This decision does not address the herd viability and integrity issues because the adjustments to the implementation of the interim bison management plan will provide for a generally stable bison population, and the draft EIS is the more appropriate place for the evaluation of these complex issues.

Guided by the CEQ regulation cited above, the staff at Yellowstone National Park undertook an evaluation of the adjustments to the management actions outlined in the November 13 letter and considered the results of management actions during the winter of 1996-97. After reviewing the available information, the letters from the federal agencies to the State of Montana, Montana's responses, and the evaluation of the proposed adjustments, I have concluded that the National Park Service should implement the adjustments set out in the November 13, 1997, letter and the November 24, 1997, evaluation and also have concluded that additional analysis of those actions under NEPA is not required.

Recommended:

Marvin O. Jensen

Superintendent, Yellowstone National Park

Date: 11/27, 1997.

Approved:

John E. Cook

Regional Director, Intermountain Region

Date: 11/27/97, 1997

DEPARTMENT OF LIVESTOCK

MARC RACICOT, GOVERNOR
PO BOX 202001
STATE OF MONTANA
BRANDS ENFORCEMENT DIV. 406-444-2045
ANIMAL HEALTH DIV. 406-444-2043
BOARD OF LIVESTOCK - CENTRALIZED SERVICES 406-444-2023
MEAT, MILK & EGG INSPECTION DIV. 406-444-5202
HELENA, MONTANA 59620-2001

Decision Notice and Supplemental Environmental Evaluation
For the Management of Wild Bison
Originating from Yellowstone National Park

December 9, 1997

To:
Environmental Quality Council, Capitol Building, Helena, 59620-1704
Governor's Office, Capitol Building, Helena, 59620-0801
Montana State Library, 1515 E. 6th Ave., Helena, 59620-1800
Yellowstone National Park, attn: Mike Finley
Gallatin National Forest, attn: Dave Garber
APHIS Veterinary Services, attn: Wilbur Clark
Montana Stockgrower's Association, attn: Jim Peterson
Greater Yellowstone Coalition, attn: Jeanne-Marie Sauvigney
Fund for Animals, attn: Andrea Lococo
Montana Wildlife Federation, attn: Tony Jewett
Intertribal Bison Cooperative, attn: Mike Fox

The Montana Department of Livestock and the Montana Department of Fish, Wildlife & Parks have decided to manage bison that have been exposed to brucellosis and that originate from Yellowstone National Park and migrate into Montana according to the provisions of the August 9, 1996 Interim Bison Management Operating Procedures, with adjustments to those procedures as described in the attached supplement to the December 20, 1995 environmental assessment of the Interim Bison Management Operating Procedures. Such management will continue until the Interim Bison Management Operating Plan is revised, in cooperation with Yellowstone National Park, APHIS Veterinary Services and the Gallatin National Forest or until a long-term bison management plan and EIS have been completed.

Based on the supplemental environmental evaluation and a review of the applicable laws and regulations, we have determined that this action will not significantly affect the human environment. Therefore, an environmental impact statement is not required.

Sincerely,

Laurence Petersen, Executive Officer
Department of Livestock

Pat Graham, Director
Department of Fish, Wildlife & Parks

Adjustments to Interim Bison Management Operating Procedures
Supplemental Environmental Evaluation
December 9, 1997

Purpose and Need

The bison herd in Yellowstone National Park (YNP) is infected with brucellosis, a cattle disease that is regulated, pursuant to provisions of the National Brucellosis Program, by USDA Animal and Plant Health Inspection Service (APHIS) and state veterinarians. When bison migrate from YNP into Montana, they pose threats to human health and safety; risks of damage to private property; risk of transmission of brucellosis to domestic livestock; jeopardize Montana's compliance with the National Brucellosis Program; and, they may cause regulatory veterinarians to impose testing requirements on Montana cattle prior to importation to their states.

On August 9, 1996 the State of Montana, in Cooperation with the National Park Service (NPS), USDA Animal and Plant Health Inspection Service (APHIS) and USDA National Forest Service (USFS) implemented an Interim Bison Management Plan. That decision was supported with an Environmental Analysis that had been released for public comment on December 20, 1995 and a response to the public comments to that Environmental Analysis. The purpose of the Plan was to provide spatial and seasonal separation of bison and domestic cattle in order to maintain Montana's brucellosis class-free status, while permitting the bison herd within the park to fluctuate, to the maximum extent possible, in response to natural ecological processes. The plan was designed to prevent bison from leaving Yellowstone National Park across the Reese Creek boundary onto adjacent private lands; to limit the distribution in the West Yellowstone area to times, situations and locations in which the risk of brucellosis transmission from bison to cattle could be controlled; and, allow unrestricted use by bison of specified public lands in the Eagle Creek/Bear Creek area adjacent to Yellowstone National Park.

Management actions specified by the August 1996 Interim Plan include capture and transport to slaughter of all bison that approached the Reese Creek boundary; capture and transport to slaughter of all pregnant females and all other bison that test positive for brucellosis in the West Yellowstone area; capture, mark and release to federal lands all non-pregnant females and other bison that test negative for brucellosis in the West Yellowstone area during the period November 1 through April 30; shooting of all bison on private lands or that move beyond the specified distribution; shooting of all untested bison that cannot be captured in the West Yellowstone area; and, hazing bison back into the park or onto cattle free public lands as an acceptable alternative to lethal removal.

The 1996-97 winter, the first year of operation of the Interim Bison Management Plan, was unusually severe and an unusually large number of bison left or attempted to leave Yellowstone National Park and migrate into Montana. As a result, a total of 1,123 bison were removed from the Yellowstone bison population by various management actions. Capture operations were less effective because the APHIS trap was poorly located. If that facility functioned more effectively, fewer bison would have been shot in the West Yellowstone area.

The Interim Bison Management Plan allowed for contingency planning in the event of unusual circumstances, beyond the range of environmental conditions experienced since 1984-85, to ensure that the removal of bison in Montana do not compromise the integrity of the bison herd within Yellowstone National Park. The State of Montana proposes several adjustments to the August 1996 Interim Bison Management Plan to accomplish that purpose.

The analysis presented in this document supplements the December 20, 1995 Environmental Assessment and the Decision Notice/Finding of No Significant Impact issued by the Montana Departments of Livestock and Fish, Wildlife and Parks and Yellowstone National Park on August 9, 1996.

Adjustments to the Interim Bison Management Plan

The following adjustments to the interim plan will be implemented to reduce the number of bison that are removed by management action and to provide for a generally stable bison population at current levels:

1. Whenever it is safe and practical, hazing bison back into the park or onto public lands designated for bison use will be employed as an alternative to lethal controls. NPS will haze bison to prevent movement from the park interior to the park boundary. Montana agrees with this proposal.

2. NPS will modify operations of the Stephens Creek capture facility to remove bison that serologically test positive for brucellosis, selectively hold seronegative bison through the winter and release those bison to move back into the park in the spring. Montana agrees with this proposal.

3. In the West Yellowstone area, Montana has proposed to relocate the APHIS capture facility from the Madison River location to public lands near Horse Butte. Relocation of the facility will meet the siting criteria specified in the interim plan. A permit to locate the trap has been requested from the Hebgen Lake Ranger District, Gallatin National Forest and that permit will be supported with the appropriate environmental analysis. More efficient capture operations are intended to reduce the number of seronegative bison, including non-pregnant females, that otherwise might be shot in the field.

4. During the period November 1 through April 30, the Montana State Veterinarian will determine which untested bison represent the greatest potential for brucellosis transmission to domestic livestock. All untested adult female bison and other untested bison that the Montana State Veterinarian determines pose unacceptable risk will be removed as soon as feasible. All untested bison in the proximity of cattle will be removed. At the discretion of the Montana State Veterinarian, untested calves and bulls may be tolerated on public lands during the November 1 through April 30 period. Within 60 days of anticipated return of cattle, all bison will be hazed back into Yellowstone National Park. Those which cannot be hazed, may be removed.

Impacts of Adjustments to the Interim Bison Management Plan

A supplemental evaluation of adjustments to the Interim Bison Management Plan, dated November 24, 1997, was prepared by NPS, APHIS and USFS. That evaluation is included within Montana's evaluation as Appendix "A" and is incorporated herein. Montana concurs with and adopts that analysis, with two exceptions:

1. The analysis prepared by NPS, APHIS and USFS assumes that the regulatory veterinarians in the other 49 states would agree with APHIS' determination that untested bulls, calves, yearlings and postparturient cows that have totally passed placenta represent a low risk for brucellosis transmission if removed 60 days prior to cattle returning to public lands. Without such agreement, regulatory veterinarians from other states could make independent decisions to impose testing requirements on Montana cattle prior to importation to their states. The economic effects on the livestock industry could be substantial. To avoid that economic risk, the Montana State Veterinarian may use professional discretion about whether and when to remove bison and will retain authority for the decision to remove untested bison in the West Yellowstone area.

2. The analysis prepared by NPS, APHIS and USFS assumed tolerance for untested yearling females on public lands in the West Yellowstone area, as well as tolerance for untested bulls and calves. Under deep snow conditions, it is not always possible to distinguish between yearling females and smaller, older females. Therefore, under the worst case scenario described in the analysis, 128 bison, including 13 yearling females, might be removed. This difference would not alter the conclusion that, even under a worst case scenario, adjustments to the interim plan are sufficient to provide for a generally stable bison population at current levels.

November 24, 1997

EVALUATION OF ADJUSTMENTS TO INTERIM BISON MANAGEMENT PLAN, WINTER 1997-1998

I. SUMMARY OF INTERIM BISON MANAGEMENT PLAN, WINTER 1996-97

The goal of the interim plan is to "conduct operations ... to provide spatial and seasonal separation of bison and domestic cattle in order to maintain Montana's brucellosis class-free status, while permitting the bison herd within the park to fluctuate, to the maximum extent possible, in response to natural ecological processes." (Final Interim Bison Management Plan, page 1). The objectives of the interim plan included limiting the distribution of free-ranging bison to specified federal public lands adjacent to Yellowstone National Park in the Eagle Creek/Bear Creek area, preventing bison from leaving Yellowstone National Park in the Reese Creek boundary area and moving north onto adjacent private land where cattle are grazed, and limiting bison distribution in the West Yellowstone area to times, situations, and locations in which the risk of brucellosis transmission from bison to cattle can be controlled. The Interim Bison Management Plan adopted in 1996 called for the following actions:

1. Eagle Creek/ Bear Creek Area: The Gallatin National Forest manages this area of public land north and east of the Yellowstone River and Gardiner, MT, primarily for wildlife resources. Bison would be monitored, hazing would be attempted to discourage bison from leaving this area, and no capture operations would occur in this area. The agencies would haze those bison moving beyond the Little Trail Creek-Maiden Basin hydrographic divide back into the management area. Montana Department of Livestock (DOL) would shoot those bison that could not be hazed.

2. Reese Creek Area: The Yellowstone National Park boundary at Reese Creek abuts private land that leases cattle grazing year round. This private land is located west of the Yellowstone River and north of the park boundary. As intended in the plan, the National Park Service (NPS) constructed and operated a capture facility at Stephens Creek, about 2 miles south of the Reese Creek boundary within Yellowstone National Park, to prevent bison movement onto adjacent private land. All bison moving onto the Stephens Creek flats area were expected to eventually go beyond the boundary if not hazed or captured. Hazing would be used to keep bison from moving beyond the boundary, if possible, and bison would be captured if hazing were unsuccessful. All captured bison would be shipped to slaughter. Bison that evaded capture, were unable to be hazed, and moved beyond the Reese Creek boundary would be shot. Bison shot in the field would be donated to Native American Tribes or Associations or social services organizations. Montana would sell at public auction those bison that were shipped to slaughter.

3. West Boundary Area: Bison would be monitored and all bison beyond parkboundaries between May 1 and October 31 would be hazed back into the park or shot. Between October 31 and May 1, Montana, with assistance from APHIS, would maintain capture facilities at 2 locations. Capture facilities were located at Duck Creek on private land and at the Madison River on Gallatin National Forest. Both facilities were located immediately adjacent to the park boundary. The plan called for all bison

exiting YNP to be captured and tested for exposure to *Brucella abortus*. Montana DOL would ship to slaughter those bison testing seropositive and all seronegative, pregnant females. Seronegative males and seronegative, nonpregnant females would be released on public land. DOL could choose to shoot all bison that evaded capture and testing. Bison on private land were to be shot.

4. Contingency Measures: It was not anticipated that removals from the population would exceed the range of those experienced since 1985. The largest removal previously recorded was 569 bison during the winter of 1988-89. The plan stated, "Should unusual circumstances develop that are beyond the range of environmental conditions experienced since 1984-85, the agencies may develop contingency plans to assure that removals of bison outside of cattle-free public lands in Montana do not compromise the integrity of the bison herd within Yellowstone National Park." (Final Interim Bison Management Plan, page 1).

II. RESULTS OF INTERIM BISON MANAGEMENT PLAN, WINTER 1996-97

The bison population at the beginning of the 1996-97 winter was estimated at 3,500 bison (based on a high count of 3,436 on September 24, 1996). This included 865 bison on the northern range, 265 in the Mirror-Pelican, and 2,306 in the Mary Mountain area (includes the Gibbon, Firehole, and Madison River drainage as well as the Cougar Meadows and west boundary area). The winter began within the normal range of temperatures and snowfall. In late December heavy snows, 2 to 5 feet, were followed by several days of rain in early January, immediately followed by extreme cold. These conditions caused rain saturated snow to freeze and resulted in thick crusting and ice layers that precluded bison access to forage. These conditions did not moderate until late March, 1997.

1. Contingency Measures: In November and December, bison monitoring, hazing, slaughter, and shooting operations occurred as described in the interim plan. On January 10, 1997 and January 17, 1997, YNP wrote to Montana identifying that management removals were fast approaching the levels of historic removals (569) and that contingency measures should be developed. By January 17, 1997, 532 bison had been killed. It was proposed that YNP begin testing and holding those bison testing negative at Stephens Creek capture facility as well as additional hazing from private land back into the park or into Eagle Creek. It was also requested that Montana contact private landowners to see if there were easement opportunities where bison could be allowed on private land where livestock was not present. Additionally, it was requested that Montana stop shooting bison on public land in the West Yellowstone area where no livestock were present. A number of options were discussed between NPS and Montana staff over the next several days. On January 25, 1997, YNP informed Montana that operation of the Stephens Creek capture facility had been suspended, that negative tested bison were being held, and hazing efforts were being increased. On January 29, 1997, the agency heads of NPS, USFS, and APHIS sent a letter to Montana proposing contingency measures. These measures included testing at Stephens Creek and holding test negative animals, increased hazing, and hazing of animals leaving at Reese Creek off private land back into the park. Additional proposals for the West Yellowstone

area included suspension of shooting on public land, resumption of capture operations, and barricading park roads if additional bison begin to move from the park interior. On February 7, 1997, federal agency heads provided detailed responses to questions submitted by Montana on January 30, 1997, and provided detailed proposed contingency measures. On February, 14, 1997, Montana replied and suggested a meeting as soon as possible, outlined steps Montana would take including selectively removing only adult females on public land, removing bison on private land only at the request of the landowner, increased hazing, and hazing bison back into the park at West Yellowstone, and establishment of a quarantine facility inside the park at Stephens Creek.

2. Eagle Creek/ Bear Creek Area: Bison began moving to this area in December. As winter progressed and conditions worsened, monitoring indicated over 250 bison were in this area at peak numbers. As numbers increased and bison spent more time in the area, some began moving west beyond Little Trail Creek. Some were hazed back into the Eagle Creek/Bear Creek area, but those bison that moved west onto private land or highway rights of way were shot.

   About 250 bison survived in the Eagle Creek/Bear Creek area and inside the park in the vicinity of Mammoth and returned to the northern range when weather moderated. With the addition of the 107 released from the Stephens Creek facility, the northern range contained about 350 animals.

3. Reese Creek Area: Bison began moving to the Reese Creek area in mid-December. Animals were initially hazed but large movements occurred in late December, 1996 and early January, 1997. Capture operations began on January 4, 1997 and from that date through January 17, 1997, NPS personnel captured 467 bison at the Stephens Creek facility and transferred 347 to DOL for shipment to slaughter. At that time the available slaughter facilities were full and the total number of bison killed was 567. Beginning on January 21, 1997, the NPS began testing the remaining 120 animals for exposure to brucellosis, shipped 54 seropositive animals to slaughter, four additional animals died as a result of injuries during capture operations, and held 62 seronegative bison in the capture facility.

   Starting in late January, Park personnel implemented very intensive hazing operations (virtually 24 hours per day) to keep bison away from the boundary, move bison back into the park from across the northern boundary, or move bison further into the park. Eventually, hazing became much more difficult, inefficient, ineffective, and unsafe for personnel. For example, the bison resisted the attempts to move them and also fatigued rapidly - to the point of laying down immediately when the hazing operations ceased. Further, bison weight loss during this period increased dramatically. Park personnel concluded that continuing these efforts from the end of January through the rest of the winter would have been impractical and ineffective.

   Beginning February 11, 1997, National Park Service personnel resumed capture and testing of an additional 148 bison. When capture and testing operations were stopped on February 13, 1997, a total of 61 bison were shipped to slaughter (two additional bison died as a result of injuries in the capture facility) and 85 additional seronegative bison were held in the capture facility. The NPS was then holding and feeding a total of 147 seronegative bison in the Stephens Creek facility. The capture facility was not designed to hold bison more than a day or two and holding this large group of bison precluded operating the facility as a capture facility.

In March, as more bison migrated toward the Mammoth/Gardiner area, the park commenced hazing bison to prevent them from leaving the park or move them back into the park. DOL continued to shoot those bison that could not be hazed back into the park and moved north of the Reese Creek boundary onto adjacent private land.

In March, 35 of the 147 bison being held were transferred to Idaho for vaccine research purposes. Four female bison that tested positive at that time were transferred to Montana State University for research and one injured animal was removed. On April 24, 1997, the remaining 107 bison held in the capture facility were released and they returned on their own to the northern range.

During the winter, a total of 616 bison were captured, 462 bison were shipped to slaughter and 147 seronegative bison were held in the capture facility. In addition, NPS personnel killed six bison that received serious debilitating injuries in the capture operations. One additional bison was killed because of a previous parasite infection.

From December 30, 1996, through March 18, 1997, 257 bison that had moved out of the Eagle Creek/Bear Creek area or north of the park boundary onto private land were shot in the field. This brought the removals to 725 bison shot or shipped to slaughter, 39 additional bison removed for research purposes, plus one animal removed because of a previous parasite infection.

When comparing the number of bison on the northern range in early winter, the number of management removals, and the number of animals surviving, several hundred animals would have had to move from the interior of the park to Stephens Creek area to account for all animals removed and surviving on the northern range. This type of movement was confirmed when animals that had been captured, tested, marked, and released at Horse Butte in West Yellowstone area were subsequently observed and captured at Stephens Creek.

4. West Boundary Area: Montana constructed two capture facilities in the area north of West Yellowstone, Montana, to capture and test bison leaving the park and then ship to slaughter bison that tested seropositive and seronegative pregnant females. Montana was to release all male and nonpregnant female bison testing serologically negative. The plan provided for shooting any bison that left the park and evaded the capture facilities. By early January heavy snows and poor capture facility location largely undermined the effectiveness of the capture facilities. Bison were captured on seven occasions, November 14, 1996, November 19, 1996, December 10, 1996, January 29, 1997, February 25, 1997, March 25, 1997, and March 27, 1997. A total of 113 bison were captured with 48 (42%) seropositives or pregnant females shipped to slaughter and 65 (58%)

seronegative bison released on Horse Butte.

Untested bison that evaded capture or moved beyond the management area boundary were shot in the field from November 14, 1996 through April 15, 1997. During this period 310 bison were shot. All bison remaining in the West Yellowstone area were hazed back into the park in mid May. Classification of all bison sent to slaughter and those shot in the field in the West Yellowstone area showed 41% were males, 43% females, and 16% calves.

5. Summary of Management Removals: For the 1996/97 interim bison management operations, a total of 1,123 bison were removed from the Yellowstone bison population. A breakdown of removals north of the park boundary and at Stephens Creek includes 726 bison (462 sent to slaughter, 264 shot in the field) plus 39 additional bison sent to Idaho and Bozeman for research purposes. Removals from the West Yellowstone area includes 358 bison (48 sent to slaughter, 310 shot in the field).

III. EARLY WINTER BISON SITUATION, 1997.

1. Status and Evaluation. An aerial count of bison in YNP, conducted on July 30, 1997, resulted in the highest count so far this year. Subsequent counts in August, September, and early November observed fewer bison. Based on the July count of 1,921 adults and 248 new calves for a total count of 2,169 bison, the population is conservatively estimated at 2,200 bison.

   When examining the July, 1997, count by major wintering area, the northern range count in July included 321 adults and 33 calves, for a total of 354 bison. Some shifts in population numbers may take place before bison select their wintering area but assuming 350 winter on the northern range then approximately 1,850 bison would comprise the interior population (Mary Mountain and Pelican Valley). Some bison may move to the west boundary area.

   Movements in the last several decades on the northern range have been highly variable and have been episodic during extremely severe winters occasionally resulting in nearly all of the northern range population moving to the northern boundary. The variability is characterized by movements of no or few bison during mild winters, even at high populations, and large movements during severe winters at all population levels.

   In contrast, movements from the interior population to the western boundary area has exhibited less variability and less volatility at different population levels. A major difference between the northern range and the interior is bison use of extensive geothermal areas in the interior which moderate the effects of severe winter weather. Movements from the interior have varied over the last decade from 0% to as much as 16% (winter 1996/97) of the interior population.

IV. ADJUSTMENTS TO INTERIM PLAN IN 1997 AND EVALUATION OF POSSIBLE IMPACTS.

The following proposed adjustments are consistent with the goal and objectives of the 1996 interim bison management plan. Over a wide range of population levels, it appears that winter weather is a major factor influencing bison movement outside park boundaries, with stronger influences on the northern range than for the park interior. One possible weather scenario is that the winter will be mild or average over the entire season. Under these conditions, little or no bison movement to the boundary areas would be expected. Learned behavior of bison that have previous experience with these boundary areas may result in some bison moving to or outside YNP in the Reese Creek and West Yellowstone areas. Lower winterkill would be expected.

A second scenario is that winter weather conditions are mild to average during the first part of the winter and become more severe during late February and March. This scenario may produce some movement of bison on the northern range during early winter but precipitate larger movements to the Reese Creek boundary later in the winter. In the past, hazing bison back into the park in late winter has been successful in reducing the number of bison killed as a result of management actions. Movements of the interior population in response to increasing winter severity are likely to be less than the response on the northern range. Moderate winterkill may occur depending on the timing of severe weather, location of snow conditions preventing access to forage, and spring breakup.

A third and worst case scenario is that winter weather conditions are severe throughout the winter. This scenario would likely produce larger movement of bison on the northern range during early winter and could conceivably result in most bison on the northern range seeking lower elevation winter range in the Mammoth, Eagle Creek/Bear Creek, and Stephens Creek areas. Similar to the winter of 1996/97, movements of bison in the interior of the park would likely occur earlier in response to increasing winter severity but total numbers of bison moving into the West Yellowstone area are likely to be less than on the northern range. Winterkill, similar to percentage levels in 1996/97, could occur.

1. Adjustments to the Interim Plan.

The overall objective of adjustments to the interim plan is to reduce the number of bison that are killed as part of interim bison management actions at or outside the Yellowstone National Park boundary and provide for a generally stable bison population at its current levels. Several actions, such as monitoring and sample data collection would continue as previously described in the interim plan. Whenever it is safe and practical, hazing bison back into the park or specified public lands (for example Eagle Creek/Bear Creek) will be considered first in order to reduce the need for lethal removal. If private landowners request bison to be removed they will be hazed off private land first, if appropriate, or shot. Landowners will still have all rights provided by state law for the removal of bison on their property. Hazing may also be attempted, between Madison Junction to Mammoth, to prevent bison movement from the interior portions of the park to the north boundary.

Reese Creek area. A second measure specifically addresses bison likely to exit at the Reese Creek boundary area. When hazing bison in the vicinity of Reese Creek to keep them within the park has failed or become ineffective, the NPS will capture all bison at the Stephens Creek capture facility and serologically test bison for exposure to brucellosis. Only seropositive bison would be sent to slaughter and seronegatives would be held in the capture facility. These bison will be held until late winter or early spring (mid- to late-April) and then released to move back into the park on their own. NPS personnel would shoot bison at the park boundary of Reese Creek that evade capture or are deemed unsafe to handle (usually large adult males).

West Yellowstone Area. In the West Yellowstone area, two capture facilities existed, one on private land and one on public land. The intent of the capture operations is to capture and test as many bison as possible that move into the West Yellowstone area. The capture facility that was on public land near the Madison River was dismantled and may be moved to other land near Horse Butte to increase capture efficiency and facilitate bison capture. Relocation of the capture facility would meet siting criteria described in the interim plan. These actions are intended to reduce the number of seronegative bison that might be shot in the field. However, in the event some bison are not captured and tested, APHIS has provided that untested low risk bison that include bulls, yearlings, calves, and postparturient cows that have totally passed placenta do not have to be shot in the field and can be allowed on certain public lands in the West Yellowstone area during the winter. APHIS has determined that allowing untested low risk bison wintering on those public lands specified in the interim plan in the west boundary area will not jeopardize the brucellosis class-free status of Montana. In addition, to further mitigate any potential risk, APHIS has determined that bison must be hazed back into Yellowstone National Park 60 days prior to cattle returning to the public lands, thus maintaining a temporal and spatial separation between cattle and bison. These adjustments will minimize the potential for the spread of brucellosis. The intent is to reduce the killing of low risk bison on public land when cattle are not present.

2. Impacts of Adjustments to the Bison Population.

For this evaluation, effects of the interim plan adjustments to the bison population are described for a worst case scenario under severe winter conditions. Consequently, effects are expected to be less if weather conditions are less severe (as described in the first two possible weather scenarios) and fewer bison move outside Yellowstone National Park boundaries in the West Yellowstone and Reese Creek areas.

Reese Creek area. Under severe winter conditions in 1996/97, between 200 and 250 bison left the northern winter range inside YNP and wintered in the Eagle Creek/Bear Creek area, representing 29% of the beginning winter population on the northern range. Current estimates indicate approximately 350 bison may winter in the northern range and it is expected approximately 100 (29%) bison could winter in the Eagle Creek/Bear Creek area under severe weather conditions. If the remaining 250 bison were to move to the Reese Creek area, the NPS would first attempt to hold bison in the park and haze bison further into the park. If hazing were unsuccessful, NPS personnel would capture and test all bison moving to the Stephens Creek area, ship seropositives to slaughter, and hold seronegatives until weather conditions moderate. Assuming a 50% seroprevalence rate for bison, approximately 125 bison would be sent to slaughter and 125 would be held in the capture facility. Hazing bison between Madison Junction and Mammoth is intended to prevent bison movement from the park interior toward Mammoth and the Stephens Creek areas. If hazing were not completely successful and some bison from the park interior moved to the Stephens Creek area, the NPS would capture those bison and hold additional seronegative bison in the capture facility. If the capacity of the capture facility is reached, the NPS may selectively ship seronegative bison to slaughter. These adjustments would result in approximately 125 bison remaining in the population that might have otherwise been sent to slaughter under last years operating plan. With these adjustments, approximately 225 bison could inhabit the northern range in the spring of 1998 following a very severe winter. If NPS were to take no action, all bison leaving the park could be killed under Montana law.

West Yellowstone area. Under the winter conditions of 1996/97, approximately 16% of the total bison wintering in the Mary Mountain and Pelican Valley areas moved outside the Park in the West Yellowstone area. Approximately 1,850 bison are expected to winter in the Mary Mountain and Pelican Valley areas and if severe weather conditions occurred, similar to 1996/97, approximately 300 (16%) bison may move into the West Yellowstone area during the 1997/98 winter. Assuming all bison were captured and tested 126 (42%) seropositive bison and all pregnant females would be sent to slaughter. About 174 (58%) would be released and allowed to inhabit public lands during the winter.

If the capture facilities were rendered ineffective, similar to last year, only 27% of the bison in the West Yellowstone area would be captured and tested. Of the 81 that would be captured, 34 would be sent to slaughter and 47 would be released on public land in the Horse Butte area. The remaining 219 would be untested. Removal data from 1996/97 showed 41% of all bison removed were bulls, 43% were females and 16% were calves. Past removal data from 1988/89, 1991/92, 1994/95, and 1996/97 showed yearling females comprised an average of 14% of female bison older than calves (Pac and Frey 1991, Aune unpubl. data). If higher risk adult females were shot and low risk bulls (includes yearling males), female yearlings, and calves were allowed on public land in the winter, approximately 81 adult females would be shot in the field. Approximately 90 adult and yearling males, 13 yearling females, and 35 calves would be allowed to winter on public lands in the West Yellowstone area. Under this scenario, bison removals would total about 115.

Total Estimated Bison Removals. If the agencies were to immediately implement all adjustments to the interim bison management plan a total of 240-250 bison (125 Stephens Creek, 115-125 West Yellowstone) may be removed as a result of management actions under a worst case weather scenario. Approximately 10% of the bison population was estimated to have winterkilled during the severe winter of 1996/97 and if similar conditions existed for the 1997/98 winter, approximately 220 bison might winterkill. Winterkill might actually be less because many of the older, susceptible animals likely died from last winter's conditions and the number of susceptible calves in the 1997 population (about 250) is substantially less than last winter's population (about 500). Total losses from the population could be as many as 460 to 470 bison. With a beginning winter population of 2,200, the following early spring population is estimated to be 1,730-1,740 or 87% of the early spring population in 1997. Under a worst case scenario and with average recruitment in spring 1998, the bison population would be expected to number approximately 2,000, within 10% of the 1997 summer estimate. Without adjustments to the interim plan, removals in a worst case scenario could number as many as 503 bison killed (250 sent to slaughter from the north boundary and 253 sent to slaughter or shot from the West Yellowstone area) as part of the interim plan plus 220 winterkill for an approximate total of 773. This may result in an early winter population of 1,427 or 71% of the early spring population in 1997.

3. Impacts of Adjustments to Threatened and Endangered Species.

Peregrine falcons are not found in the area during winter months. Adjustments to the interim plan are not expected to impact peregrine falcons. Whooping cranes are not found in the affected areas and will not be affected.

Bald eagles may be found along the Yellowstone River to the east of the Reese Creek area and may be present along open water corridors in the West Yellowstone area. Adjustments to the interim plan are not expected to affect bald eagles in the Reese Creek area. In the West Yellowstone area, the capture facility will be placed on public land in the Horse Butte area to avoid disturbance to bald eagles. Current measures are in place that prohibit bison removal activity within 1/2 mile of any active bald eagle nest from February 1 through May 15. The timing of activities in areas near open water and bald eagle foraging areas would be limited to periods when eagles were not foraging.

No impacts to grizzlies are predicted due to adjustments to the interim plan. Most management activity is expected to occur during winter months when bears are hibernating and capture and handling operations in the West Yellowstone and Reese Creek areas are not expected to affect grizzly bears.

Winterkill may be an important food source for bears in interior portions of Yellowstone National Park (Mattson and Knight 1992). Bison winterkill may be density-independent and largely influenced by severe weather events. For a worst case scenario under severe weather conditions, adjustments to the interim plan could result in 250 bison being killed as part of management actions. Without adjustments, as many as 503 bison could be killed. Thus, adjustments to the interim plan could potentially reduce human caused bison removals by as much as 50% compared to interim plan actions without adjustments. In a worst case scenario, adjustments to the interim plan may result in a 13% lower spring bison population compared to spring 1997 (1,740 versus 2,000) but may also result in a spring bison population 22% higher (1,740 with adjustments versus 1,427 without adjustments) than if adjustments were not implemented under similar severe winter conditions. For a worst case scenario, these adjustments would likely result in fewer bison killed and a larger bison population than if adjustments were not implemented. These adjustments could potentially provide for a larger bison population which in turn could potentially provide more carrion for bears in the future.

Gray wolves are found in several areas of Yellowstone National Park. Adjustments to the interim plan are not expected to affect gray wolves.

4. Impacts of Adjustments on Other Wildlife

Adjustments to the interim plan are not expected to significantly impact other wildlife above that analyzed for the interim plan. Capture and handling activity in the Stephens Creek area occurs on critical pronghorn winter range and capture facilities exclude pronghorn from at least 13 acres and may temporarily affect pronghorn through displacement from a much larger area of winter range. Pronghorn may also shift their activity away from the capture facility. This interim plan and associated adjustments are short term and impacts to pronghorn are expected to be minor.

5. Impacts of Adjustments on Wetland Areas

As set out in the 1995 EA, capture facilities would be located away from sensitive wetland sites and no additional impacts to wetland areas are expected due to adjustments to the interim plan.

6. Impacts of Adjustments on Vegetation

Adjustments to the interim plan are expected to impact vegetation only to the extent described for the interim plan. Capture and handling facilities and wing fences would continue to avoid rare and sensitive plant species, and adjustments to the interim plan are not expected to impact these species.

7. Impacts of Adjustments on Cultural Resources

Consistent with the 1995 EA, adjustments to the interim plan are not expected to impact archeological resources, historic structures, cultural landscapes, or ethnographic resources.

8. Impact of Adjustments on Domestic Livestock Operations

As in the 1995 EA, adjustments to the interim plan would continue to prevent bison from coming in contact with domestic cattle on private or public lands, and Montana's brucellosis class-free status would be maintained. Adjustments to the interim plan, thus, are not expected to impact domestic livestock operations.

9. Impacts of Adjustments on Visitor Use

Adjustments to the interim plan are not expected to impact visitor use beyond that previously described for the interim plan.

APPENDIX B: QUARANTINE PROTOCOL FOR BISON

Brucellosis Eradication:
Uniform Methods and Rules

Chapter 1, General Provisions—Cattle and Bison

Part II. Procedures

6. Procedures for Handling Infected or Restricted Herds

D. Approved Bison Quarantine Facilities

A group or individual may establish an approved bison quarantine facility (ABQF) to provide testing for brucellosis-exposed bison from Yellowstone and Grand Teton National Parks in order to qualify the animals as brucellosis-free. These facilities may be located in Yellowstone National Park, Grand Teton National Park, or adjacent to the Parks in the adjoining States of Idaho, Montana, or Wyoming. State and Federal animal health officials must approve each facility. Facility approval is valid for one year and can be reapproved provided all requirements are met.

State and/or Federal animal health officials will select the serological tests to be conducted, establish procedures to account for all animals entering or leaving the ABQF, and supervise all operations.

All bison entering an approved bison quarantine facility are considered to be brucellosis-exposed animals and must be permanently identified with official metal eartags and placed under quarantine restrictions. Prior to entering the facility, all animals must test negative on official brucellosis serological tests conducted at the National Veterinary Services Laboratories (NVSL) or at an approved Cooperative State-Federal Brucellosis Laboratory (CSFBL). All serological and/or milk tests conducted in the ABQF are considered preliminary and must be confirmed at NVSL or at an approved CSFBL. Specimens or milk samples for bacterial culture must also be cultured at NVSL or at an approved CSFBL.

It is recommended that test-negative bison captured during a single season entering the ABQF be placed in an ABQF holding pen until they can be sorted and penned separately into individual test groups (ITG). The holding pens and ITG pens should be separated by at least two fences that are a minimum of 10 feet apart. Upon entry into the ABQF, it is recommended, but not required, that serological tests be conducted on every bison every 30-45 days while they are in a holding pen or ITG until each animal classified as a reactor has been removed and the remaining animals test negative. If the testing results in any bison being classified as a reactor, a subsequent ITG test must be conducted on the remaining animals in the ITG at least 30 days later.

Initially, this procedure will more readily identify reactors animals, minimizing the time spent in the ABQF completing the testing requirements to qualify for quarantine release.

All *Brucella* culture-positive animals and/or all animals classified as reactors must be removed from the ABQF within 15 days of being identified. Any bison removed from the ABQF before completing the requirements to qualify for quarantine release must move under permit either to an approved research facility or to an approved slaughter facility for slaughter only. All bison that are classified as reactors because they tested positive to an official serological and/or milk test or are confirmed culture-positive must go to an approved research facility or to an approved slaughter facility for slaughter only.

Each ITG must qualify for quarantine release following the procedures listed below before any individual bison within the ITG may be released from quarantine.

1. *Sexually mature bison (3 years of age or older)*

   (a) *Males*—Male bison must pass a minimum of three consecutive negative ITG tests. The first ITG test must be conducted when the ITG starts the quarantine period. The second ITG test must be conducted at least 180 days after the first ITG test. There must be at least 12 months between the first and last consecutive negative ITG tests.

   (b) *Pregnant females*—Pregnant female bison must complete two calvings within the ABQF. Pregnant female bison not born in the facility and continually penned within a test-negative ITG must be rebred in the ABQF following their first calving to a test-negative male from a holding pen or ITG.

   An ITG test must be conducted when the ITG starts the quarantine period before the first calving, another ITG test must be conducted at least 30 days and not more than 90 days after each female has calved during the first and second calvings, and an ITG test must be conducted six months after the last animal has calved during the first and second calvings. Each postparturient female bison must have discharges, fluids, and swabs collected and cultured within 5 days after calving. There must be at least 12 months between the first and last consecutive negative ITG test.

   (c) *Nonpregnant females*—Nonpregnant female bison not born in the facility and continually penned within a test-negative ITG must be bred in the ITG to a test-negative male from a holding pen or ITG, complete a gestation cycle, calve, and pass a minimum of three consecutive negative ITG tests.

   The first ITG test must be conducted when the ITG starts the quarantine period before being bred. The second ITG test must be conducted at least 30 days and not more than 90 days after each female has calved, and the third ITG test must be conducted six months after the last animal has calved in the ITG. Each postparturient female bison must have discharges, fluids, and swabs collected and cultured within 5 days after calving. There must be at least 12 months between the first and last consecutive negative ITG tests.

2. *Sexually immature bison (under 3 years of age)*

(a) *Immature males*—Male bison under three years of age must pass a minimum of three consecutive ITG tests. The first ITG test must be conducted when the ITG starts the quarantine period, and the last consecutive negative ITG test must be conducted after the animals are at least three years of age. The second ITG test will be conducted at least 180 days after the first ITG test. There must be at least 12 months between the first and last consecutive negative ITG tests.

(b) *Immature females*—Immature female bison under three years of age not born in the facility and continually penned within a test-negative ITG must be bred to a test-negative male from a holding pen or ITG, complete a gestation cycle, calve, and pass a minimum of three consecutive negative ITG tests.

The first ITG test must be conducted when the ITG starts the quarantine period before being bred. The second ITG test must be conducted at least 30 days and not more than 90 days after each female has calved, and the third ITG test must be conducted six months after the last animal has calved in the ITG. Each postparturient female bison must have discharges, fluids, and swabs collected and cultured within 5 days after calving. There must be at least 12 months between the first and last consecutive negative ITG tests.

3. *Calves*—Calves born in the ABQF from a test- and/or culture-negative ITG of adult pregnant females may be released from quarantine at six months of age or older provided that all of the following conditions are met: 1) there have been no reactor animals in the ITG immediately after their birth or within one month prior to their birth, 2) all calves in the ITG are serologically test-negative, 3) each adult in the ITG is serologically test-negative at least 30 days postcalving and culturally test-negative within 5 days postcalving, and 4) the adult animals in the ITG have tested negative on three consecutive herd tests over a 12 month period. For calves born to females that were pregnant at the time of entrance into the ABQF and/or calves born during a time in which reactors are disclosed, the males calves would be classified as "immature males" and be tested as in 2(a) above, the females would be classified as "immature females" and be tested as in 2(b) above, or the calves could be neutered and released from quarantine without restrictions.

4. *Test- and/or culture-positive animals or animals that die in quarantine*—Any aborted fetus, stillborn animal, or an animal that dies in the ABQF for any reason, will be necropsied, serologically tested, and its tissues and other appropriate

specimens cultured for *Brucella*. Tissue collection methods should be based on the sampling protocol outlined by the Greater Yellowstone Interagency Brucellosis Committee (GYIBC). Any culture and/or serologically test-positive animal found in an ITG will cause the ITG to restart the quarantine requirements. Restarting the quarantine requires the ITG to be tested every 30-45 days until all animals classified as reactors have been removed from the ITG and a complete ITG test is negative. Bred female bison in the ITG that have been pregnancy checked and determined not be pregnant must be sacrificed, necropsied, and specimens collected and cultured. In addition, a complete epidemiologic assessment will be made of all test or culture-positive cases of brucellosis within the ABQF. All *Brucella* culture-positive animals and/or all animals classified as reactors must be removed from the ABQF within 15 days of being identified. They must be neutered, slaughtered, or moved to an approved research facility.

5. *Breeding bulls*—Bulls must be tested negative for brucellosis within 30 days of being placed within an ITG for breeding purposes or be from an ITG that has qualified for a quarantine release.

6. *Neutered animals*—Neutered bison may be released from quarantine without restrictions.

7. *Post-quarantine requirements*— The entire ITG must qualify for quarantine release before any individual bison within the ITG may be released to a group or individual in a State or area. All animals released from the ITG must be retested at approximately six months and then one year later to verify that they remain test-negative. An agreement to test must be signed by the receiving owners or managers before the animals will be released into their custody. The agreement must also state that the animals must be kept separate from all other animals until the six month test has been completed. In addition, the State Animal Health Authorities in the State of destination must authorize movement into their State.

	Minimum tests required to release	Minimum test intervals	Minimum quarantine periods
Sexually mature males	3	**1st:** start of quarantine period **2nd:** at least 180 days after first test **3rd:** at least 12 months after first test	1 year
Pregnant females	5	**1st:** before calving **2nd:** between 30 and 90 days after each animal has calved during 1st and 2nd calvings **Last:** 6 months after last animal has calved during 1st and 2nd calvings	1½ years
Nonpregnant sexually mature females	3	**1st:** before bred **2nd:** between 30 and 90 days after each animal has calved **Last:** 6 months after last animal has calved	1½ years
Immature males	3	**1st:** start of quarantine period **2nd:** at least 180 days after first test **3rd:** at least 12 months after the first test, and at least 3 years of age	1 year
Immature females	3	**1st:** before bred **2nd:** between 30 and 90 days after each animal has calved **Last:** 6 months after last animal has calved	2½ years
Calves*	1	One test at 6 months of age	½ year

* Calves born to females that were pregnant upon entry into the ABQF and calves born in an ITG in which reactors have been disclosed shall not be released as calves.

APPENDIX C: MEMORANDUM OF UNDERSTANDING AMONG THE NATIONAL PARK SERVICE, STATE OF MONTANA, U.S. FOREST SERVICE, AND ANIMAL AND PLANT HEALTH INSPECTION SERVICE

Purpose

To establish an understanding among the State of Montana, the U.S. Forest Service (USFS), and the National Park Service (NPS) regarding their roles and responsibilities in the preparation of a long-term bison management plan and environmental impact statement (EIS) for the Yellowstone area.

To establish an understanding among the above and the Animal and Plant Health Inspection Service (APHIS) regarding its role as a cooperating participant in the preparation of a bison management plan and environmental impact statement for the Yellowstone area. In addition, this memorandum recognizes an informal relationship with the Ad Hoc Technical Committee for Brucellosis in Wildlife in the Greater Yellowstone Area (Ad Hoc Committee) in order to tap their knowledge and expertise as it relates to brucellosis in the greater Yellowstone area. It is recognized that many members of this committee are also agency representatives in this process.

Background Information

In recent years, bison have emigrated during the winter months from within Yellowstone National Park to areas outside the park. Movement has occurred with the Mary Mountain herd on the west boundary near West Yellowstone, Montana, and with the Northern Range herd on the north boundary near Gardiner, Montana. Acquired knowledge of outside range areas, natural gregariousness, increased herd size, weather conditions, and human activity all appear to be factors in bison movement.

Acquired knowledge of outside range areas, natural gregariousness, increased herd size, weather conditions, and human activity all appear to be factors in bison movement.

Statement of Roles

The National Park Service, the state of Montana, and the U.S. Forest Service will be responsible as joint-lead agencies for the preparation of a bison management plan and EIS(CEQ 1501.5). Joint-lead status is so designated because each participant has significant involvement with the management of bison in the Yellowstone area. Additionally, each has approval authority for proposed actions within their jurisdiction and specific expertise related to development of the plan and the EIS. To assure adherence to schedule one of the agencies will assume a coordinator/facilitator role. The National Park Service representative will function as such since National Park Service implementing procedures will guide the process. The joint preparation of the bison management plan and EIS reflects the agencies' belief that each must agree to the final plan if the plan is to be effective. Joint preparation is expected to reduce the duplication of regulatory requirements.

APHIS and the Ad Hoc Committee will act as cooperators and consultants in the preparation of a bison management plan and EIS. As cooperators, participation will be governed by the provisions of the CEQ regulations at 40 C.F.R., Section 1501.6. Both APHIS and the Ad Hoc Committee have special expertise with the *Brucella abortus* organism.

Statement of Responsibilities

The USFS, the NPS, and the State of Montana will be jointly responsible for the preparation of the plan and EIS. The EIS will comply with the requirements of the National Environmental Policy Act, Montana Environmental Policy Act, U.S. Council on Environmental Quality and environmental policy requirements of each agency. The National Park Service's implementing procedures, as contained in NPS-12, will be followed for the preparation of the EIS.

The USFS, NPS, and the State of Montana bring special expertise to the development of this management plan. Each agency will bear its own cost for development of information directly related to its areas of expertise as described below.

The State of Montana, through the Department of Livestock and the Department of Fish, Wildlife and Parks, has particular expertise in, knowledge of, and responsibility for livestock health and management and wild game management on lands within the state and outside Yellowstone National Park. Specific contributions include but are not limited to:

Livestock Management Practices
Wildlife Management Practices
Brucellosis Information
Socioeconomic Concerns

The U.S. Forest Service has particular expertise in, knowledge of and responsibility for habitat on national forest lands outside Yellowstone National Park. Specific contributions include but are not limited to:

Natural Resources on USFS Lands
Cultural Resources on USFS Lands
Socioeconomic Concerns

Land Use Information
Threatened and Endangered Species

The National Park Service has particular expertise in, knowledge of and responsibility for bison and their habitat inside Yellowstone National Park. Specific contributions include but are not limited to:

Natural Resources on USFS Lands
Cultural Resources on USFS Lands
Visitor Use Concerns
Socioeconomic Concerns
Threatened and Endangered Species
Brucellosis Information

APHIS will bring special expertise to the development of this management plan and will develop information directly related to its areas of expertise as described below.

The Animal and Plant Health Inspection Service has particular expertise in the eradication of the *Brucella abortus* organism in domestic cattle operations. Specific contributions include but are not limited to:

Livestock Health and Management Practices
Brucellosis Information

Other Responsibilities

The USFS, the NPS, and the State of Montana will share in acquiring, analyzing and reporting public input on the plan and EIS.

The joint-lead agencies will designate staff representatives to form a core planning team. This team will meet regularly to draft the plan and environmental documents. APHIS will be consulted on a regular basis, and representatives may attend all core planning team meetings.

The USFS, the NPS, and the State of Montana will have a representative participate at all public meetings. The NPS will be responsible for publishing and distributing the draft and final EIS and the record of decision.

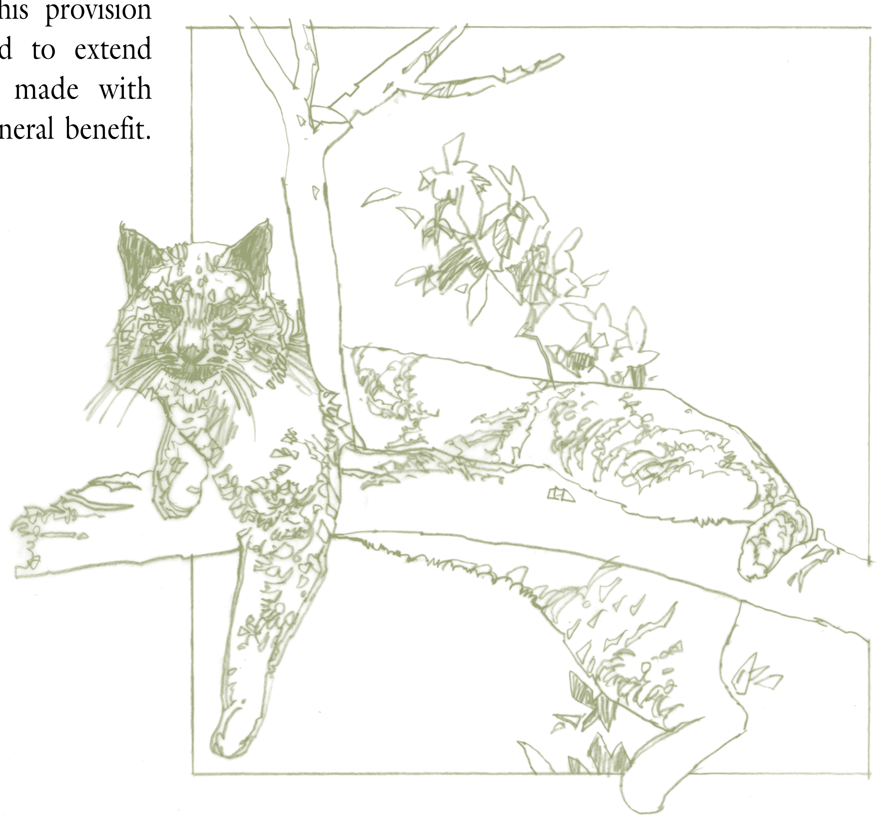
The joint-lead agencies must be in agreement on planning procedures and plan contents at each stage of the planning process. Actions and policies prescribed within the plan must be within the authorities of each of the joint-lead agencies. Each of the agencies has responsibility for development of the plan and may have responsibility for mitigation required as part of the EIS.

This Memorandum of Understanding will be considered implemented on the date of the last signature hereto.

This Memorandum of Understanding may be terminated by the withdrawal of any party hereto, upon a written 30 day notice to the other parties. This Memorandum will be terminated 60 days after completion of an approved bison management plan and EIS, with the total period not to exceed five years.

During the performance of this agreement, the participants agree to abide by the terms of Executive Order 11246 on non-discrimination and will not discriminate against any person because of race, color, religion, sex or national origin. The participants will take affirmative action to ensure that applicants are employed without regard to their race, color, religion, sex or national origin.

No member or delegate to Congress, or resident Commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom, but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.



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JOINT-LEAD PARTICIPANTS

Governor, State of Montana — Date May/15/92

for Regional Forester, U.S. Forest Service, Northern Region — Date 4/13/92

Regional Director, National Park Service, Rocky Mountain Region — Date 1/10/92

COOPERATING PARTICIPANT

Director, Western Region,
USDA Animal and Plant Health Inspection Services-
Veterinary Services — Date 2/5/92

United States Department of Agriculture
Animal and Plant Health Inspection Service — Date 3/5/92

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ATTORNEYS FOR DEFENDANT

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF MONTANA
HELENA DIVISION

THE STATE OF MONTANA, et al., Plaintiffs, v. UNITED STATES OF AMERICA, et al., Defendants	CV 95-6-H-CCL NOTICE OF WITHDRAWAL FROM 1992 MEMORANDUM OF UNDERSTANDING AMONG THE STATE OF MONTANA, THE DEPARTMENT OF THE INTERIOR, AND THE DEPARTMENT OF AGRICULTURE

Defendants respectfully file the attached letter (attached hereto as Attachment 1) to the Governor of Montana from the Under Secretary for Marketing and Regulatory Programs of the Department of Agriculture, the Under Secretary for Natural Resources and Environment of the Department of Agriculture, and the Assistant Secretary for Fish and Wildlife and Parks of the

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Department of the Interior. The letter serves as a 30-day notice of withdrawal from the 1992 Memorandum of Understanding (attached hereto as Attachment 2), which established the roles and responsibilities of the respective parties in the preparation of a long-term bison management plan for the Yellowstone area. The letter explains the reason for the federal agencies' withdrawal and states that the federal agencies will proceed without Montana with the issuance of a Final Environmental Impact Statement for the Interagency Bison Management Plan and a Record of Decision based thereon.

The MOU provides that "[t]his MOU may be terminated by the withdrawal of any party upon written 30-day notice to the other parties." The Settlement Agreement entered in the fall of 1995 (attached hereto as Attachment 3), settling the above-captioned lawsuit, incorporated the MOU. The Settlement Agreement provides that this Court "will maintain jurisdiction . . . until the federal and state agencies complete the final EIS . . . or withdraw from the MOU." The settlement agreement further provides that if a party withdraws from the MOU, the party must provide written notification and an explanation of the reasons for withdrawal. The Settlement Agreement also provides that "[u]pon . . . withdrawal from the MOU, the parties agree to move the Court to dismiss this case." After the expiration of the 30-day notice period to Montana, the federal agencies will seek dismissal of this case pursuant to the Settlement Agreement.

Date: December 13, 1999 Respectfully submitted,

Martin J. Lalonde

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DEPARTMENT OF AGRICULTURE
OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20250

December 13, 1999

The Honorable Marc Racicot
Governor
State of Montana
State Capitol
Helena, MT 59620-0801

Dear Governor Racicot:

The Department of the Interior National Park Service, Department of Agriculture United States Forest Service, and the Department of Agriculture Animal and Plant Health Inspection Service agree that continuing the efforts with the State of Montana to arrive at a joint State-Federal preferred alternative for the final Environmental Impact Statement for the Interagency Bison Management Plan would not be fruitful at this time. We regret reaching this decision, but feel we have no alternative given Montana's position respecting long-term bison management.

The proposed Federal modified preferred alternative addresses the dual goals of protecting Montana's cattle industry while maintaining a wild, free-roaming bison herd in Yellowstone National Park. The Federal proposal would keep bison and cattle apart to prevent the transmission of brucellosis; would commit the Federal Agencies to the eradication of brucellosis from the bison herd through development and use of a safe and effective vaccine; would allow for tolerance of bison outside the Park as opposed to unnecessary killing of bison; and would provide strong assurances from the Animal and Plant Health Inspection Service (APHIS) that Montana will maintain its brucellosis free status. Despite our proposed long-term bison management plan that protects both State and Federal interests, Montana has presented unreasonable objections to the Federal proposal. Accordingly, the Federal Agencies hereby reluctantly provide Montana with a 30-day notice of their withdrawal from the Memorandum of Understanding (MOU) for the joint preparation of an Environmental Impact Statement (EIS) for a long-term bison management plan and advise that they intend to proceed with preparation of a final EIS and a Record of Decision for an Interagency Bison Management Plan without an agreement with Montana.

The following (1) outlines the process that Montana and the Federal Agencies have pursued in an attempt to reach agreement on bison management, (2) highlights the relevance of the major elements of the modified preferred alternative to the agreed upon objectives enumerated in the draft EIS, (3) discusses the impasse that Montana and the Federal Agencies have reached, (4) explains the reasons for the Federal Agencies' withdrawal from the MOU, and (5) sets forth the next steps that the Federal Agencies will undertake to complete the final EIS.

AN EQUAL OPPORTUNITY EMPLOYER

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1. JOINT EIS PROCESS

In the spring of 1992, Montana, the United States Forest Service (USFS), National Park Service (NPS), and Animal and Plant Health Inspection Service (APHIS) entered into a MOU to establish the roles and responsibilities of the respective parties in the preparation of a long-term bison management plan for the Yellowstone area. Under the MOU, Montana, NPS and the USFS would be joint-lead agencies and APHIS would be a cooperating agency in the preparation of an Environmental Impact Statement for the bison management plan. The MOU further provided that the joint-lead agencies must agree on planning procedures and plan contents.

In the fall of 1995, Montana, the Department of Agriculture, and the Department of the Interior entered an agreement settling a lawsuit, captioned Montana v. Babbitt, 95-6-H-CCL. The settlement agreement provided, among other commitments, that the State, NPS, and APHIS would perform their roles as set out in the 1992 MOU.

Pursuant to the settlement agreement and MOU, Montana and the Federal Agencies issued a draft EIS for an Interagency Bison Management Plan in June 1998. The Draft EIS considered seven alternatives for bison management, including a preferred alternative. A 120-day comment period (subsequently extended by 3 weeks to accommodate a request by the United States Animal Health Association (USAHA)) commenced on June 12, 1998. Over 67,000 comments from individuals or organizations were received on the Draft EIS.

Based on these public comments, continuing dialogue among the joint-lead and cooperating agencies, and additional information from research on the viability of *Brucella abortus* bacteria, the Federal Agencies formulated a modified preferred alternative that they presented to you and your staff on May 3, 1999. The federal agencies memorialized the proposed modified preferred alternative in a detailed May 12, 1999, letter to Montana, subsequently annotated on July 7, 1999, to clarify various aspects of the proposal.

Since July, Federal and State personnel have met in person or on conference calls on numerous occasions. In late July, Dr. Craig Reed, the Administrator of the APHIS, and Dr. Alfonso Torres, the Deputy Administrator of Veterinary Services for APHIS, met for 2 days with Dr. Arnold Gertonson, Montana's State Veterinarian, and Mark Bridges, Executive Officer to the Montana Board of Livestock to discuss various issues related to the proposed modified alternative. In August and September, these individuals had additional phone conversations and exchanged correspondence in an effort to reach a mutual understanding and agreement on the bison management issues presented in the proposed modified preferred alternative. On September 16, Dr. Reed, as well as NPS staff and representatives from USAHA, met with State personnel in Bozeman, MT.

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On September 29, 1999, you and your staff, Under Secretary Dunn, Assistant Secretary Barry, and personnel from APHIS, USFS, NPS, and DOJ met in Salt Lake City in an attempt to finalize a modified preferred alternative. After this meeting, on October 4, 1999, Montana provided a one page skeletal outline of a two-stage bison management plan. The Federal Agencies provided a response to this proposal and, on October 8, Federal and State personnel discussed Montana's outline of a proposal and the Federal Agencies' response to the proposal on a conference call. You and your staff and the Federal Agencies also discussed the plan during the week of October 11. On October 24, 1999, Montana provided a further brief explanation of its proposed management concepts. On November 3, 1999, the Federal Agencies provided an updated proposed modified preferred alternative that considered the issues and counter-proposals from Montana, incorporated what the Federal Agencies had previously proposed, and set forth a multi-step adaptive management approach to long-term bison management. Based on progress being made in identifying technical management issues of concern, the Federal and State agencies scheduled a meeting of technical staff for November 8 and 9 in Bozeman, Montana, to resolve such issues.

On November 3, 1999, you joined a conference call with Federal personnel including Assistant Secretary Barry. You expressed additional reservations regarding certain aspects of the Federal proposed modified alternative that the Federal Agencies addressed in a November 5, 1999, letter to Montana. On November 5, 1999, you canceled the technical meeting scheduled for November 8 and 9 between the State and Federal agencies, citing Montana's disagreement with certain aspects of the modified preferred alternative that you suggested should first be worked out at a policy level. On November 16, 1999, Under Secretary Dunn and Assistant Secretary Barry joined you and your staff on a conference call where it became clear to both you and Messrs. Dunn and Barry that the State and Federal Agencies had reached an impasse in their long efforts to derive a final long-term bison management plan for the Yellowstone area.

2. ELEMENTS OF THE MODIFIED PREFERRED ALTERNATIVE

The modified preferred alternative would satisfy all nine principal objectives set forth in the joint Federal/State Draft EIS for the Interagency Bison Management Plan. Indeed, the carefully crafted modified preferred alternative fulfills the overarching objective of the draft EIS "[t]o maintain a wild, free ranging population of bison and address the risk of brucellosis transmission to protect the economic interest and viability of the livestock industry in the state of Montana."

Primarily, the modified preferred alternative further minimizes the risk of transmission of brucellosis from bison to cattle, initiates the eradication of brucellosis from the bison herd, and decreases the unnecessary killing of bison thus allowing the agencies to maintain a wild, free-ranging bison herd. To meet these objectives, the proposal relies on four main components: (1) spatial separation of bison and cattle through a zone management approach that limits the number

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and movements of bison in Montana and provides temporal separation of bison and cattle, (2) vaccination of cattle near Yellowstone National Park (Park) that may occupy lands used by bison in the winter, (3) increased monitoring and surveillance of cattle near the Park that may occupy lands used by bison in the winter, and (4) vaccination of bison (initially calves and yearlings) outside the Park when a safe vaccine is available and inside the Park when a safe and effective vaccine and remote delivery mechanism are available. These and other aspects of the modified preferred alternative (including population limits and the use of a quarantine facility) are fully detailed in the attached "Modified Preferred Alternative for Interagency Bison Management Plan, December 1999." The following explains how these different approaches fulfill the primary goals of the Draft EIS.

A. Minimizing the Risk of Transmission of Brucellosis from Bison to Cattle

The modified preferred alternative would minimize the risk of transmission of brucellosis from bison to cattle primarily through separating the cattle and bison in space and time (e.g., through implementation of spatial and temporal separation).

i. Spatial Separation

The object of spatial separation is to limit bison movements on public lands outside the Park and prevent the commingling of bison and cattle when bison are outside the Park during the winter months (the modified preferred alternative would not permit bison outside the Park from the late spring until late fall, would not permit bison to move onto private lands where there are any cattle, and would otherwise call for the removal of bison from private lands upon landowners requests). Spatial separation involves boundary control through the use of a zone management approach at the north and west boundary areas. This approach provides for increasingly stringent management of bison moving from the Park in successive zones, including a core zone where bison are tolerated on public lands; a bison-free zone where bison would be intercepted, hazed back to the tolerance zone if possible, and killed if necessary; and an extra bison-free buffer zone where there would be zero tolerance for bison. Notably, no cattle are in these zones during the winter months. A limited number of bison would be permitted outside the Park during the winter in the core tolerance zone (although subject to adjustment based on subsequent data on carrying capacities, the initial tolerance levels would be 100 bison in the west boundary area, 100 in the Reese Creek area, and 200 in the Eagle Creek/Bear Creek area).

The zones would take advantage of the natural terrain to limit bison movement and would be managed through the commitment of additional Federal resources for monitoring, hazing and, under certain limited circumstances, capture, test and slaughter operations. To this end, in the northern boundary area, NPS would continue to operate the Stephens Creek capture facility inside the Park and the Federal Agencies would construct and operate an additional capture facility near Yankee Jim Canyon to assist with the maintenance of spatial and temporal separation. In the

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western boundary area, NPS would provide additional staff to assist in monitoring bison leaving the Park and to assist with hazing and, if necessary, removal of bison outside the Park. Such assistance would supplement Montana's operation, in certain limited circumstances, of the Duck Creek and Horse Butte capture facilities to enforce spatial separation.

ii. Temporal Separation

The object of temporal separation is to ensure that a sufficient period has elapsed between bison and cattle occupancy of public lands outside the Park such that it is highly unlikely that any *Brucella abortus* bacteria that bison may shed would still exist when cattle graze on those lands. Based on its expert consideration of ongoing research and other information, APHIS, in an abundance of caution, has concluded that a 45-day separation is sufficiently conservative to ensure that, even if a seropositive pregnant female were to shed a contaminated fetus, the bacteria would not survive by the time cattle occupied the land. The 45-day period could be shortened through coordination between the Montana State Veterinarian and the Federal Agencies, taking into account such factors as weather conditions and ages and sexes of the bison outside the Park.

The Federal Agencies would commit the same resources to ensure the appropriate temporal separation is maintained as it would commit to ensuring spatial separation as explained above.

iii. Federal Provision of Additional Risk Management Tools in the Modified Preferred Alternative

Combined, the spatial and temporal separation by themselves provide significant assurances against transmission of brucellosis from bison to cattle. To further minimize the risk of transmission, cattle outside the Park that seasonally occupy lands that may be used by bison would be vaccinated, with the direct cost of such vaccination paid by APHIS. Further, to provide assurances that the risk management tools are working, APHIS would provide the resources for additional monitoring and surveillance to insure cattle in the area can become and remain certified as brucellosis free.

B. Eradication of Brucellosis from the Bison Herd

i. Federal Commitment to Vaccination

A commitment to eradicating brucellosis from the bison herd is an important aspect of any long-term bison management plan. The initiation of a bison vaccination program serves as an important step in the eventual eradication of brucellosis from the bison herd. The modified preferred alternative demonstrates the Federal Agencies' commitment to vaccination and the eventual elimination of brucellosis in bison.

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The implementation of the bison vaccination program within the Park would occur once there is a safe and effective vaccine as defined by the criteria established by the Greater Yellowstone Interagency Brucellosis Committee (GYIBC), when a safe and effective remote delivery mechanism for the vaccine is developed, and when the Federal Agencies issue a decision on a vaccination program pursuant to appropriate NEPA compliance. Vaccine safety involves the vaccine's effects on morbidity, mortality, and reproductive success of both the bison and nontarget species. As explained in the July 7, 1999, Memorandum Annotating the Federal Proposed Modified Preferred Alternative and subsequent federal correspondence, safety studies for bison vaccination of calves and yearlings should be completed by the winter of 2000-2001. Studies on vaccine effectiveness in calves and yearlings should be completed by the fall of 2002 and a safe and effective remote delivery mechanism should be tested and developed by the summer of 2002 for implementation in 2003-2004.

ii. Long-Term Impact of Vaccination on Bison Herd

In addition to starting the process for eradicating brucellosis in bison, over the long term, a bison vaccination program should decrease the seroprevalence rate in the bison herd resulting in further decreasing the already small risk of transmission of brucellosis from bison to cattle under the modified preferred alternative for bison management. Because the risk of transmission would already be extremely low, the initial implementation of the vaccination program would have only a minimal impact on the risk of transmission. By the time vaccination is initiated, the other components of the modified preferred alternative would be in place and would have been tested to ensure that the risk of transmission remains extremely low.

C. Tolerance of Untested Bison Outside the Park

The implementation of the risk management regime of the modified preferred alternative would permit tolerance of a limited number of untested bison on public lands outside the Park because their presence would not jeopardize the interest of Montana and APHIS in preventing the transmission of brucellosis to cattle from bison. Tolerance of the bison would, in turn, alleviate the need to kill bison leaving the Park, which killing has been highly controversial with the public both nationally and internationally as evidenced by the public comments received on the draft EIS.

Tolerance of untested bison furthers the goal of maintaining a wild, free-roaming bison herd. It allows the bison population to maintain a level that fulfills a number of responsibilities of the USFS and NPS in managing for this wildlife population. In particular, tolerance of untested bison would allow the NPS to fulfill its responsibilities to provide for the enjoyment of visitors to the Park, who expect to have the opportunity to view bison herds. It would also facilitate the USFS's fulfillment of its wildlife and habitat management goals and would enable the USFS to increase visitor enjoyment of bison on the Federal public lands adjacent to the Park. Furthermore,

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the additional tolerance would result in a bison population capable of providing a substantial source of carrion that is important to the recovery of grizzly bears in the Yellowstone area.

Tolerance of untested bison would also mitigate adverse impacts to the structure and integrity of the bison population. Currently, a disproportionate number of fecund female bison are eliminated from the bison herd under the interim bison management plan, which calls for the killing of all pregnant bison leaving the Park, including those that test seronegative. Chronic reduction of the reproductive segment of the population of the magnitude that would continue without adoption of the modified preferred alternative may severely diminish the ability of the bison herd to reproduce and recover from severe natural or management caused mortality. Important cascading effects would also occur in the system, including long-term reductions of bison carrion available to grizzly bears and other species.

D. Additional Protections of Montana's Interests Offered in the Modified preferred alternative.

Successful implementation of the above risk management tools can alone assure Montana that its interests are fully protected. Nevertheless, the modified preferred alternative provides several additional layers of protection to Montana's stated interests.

i. APHIS Assistance to Montana if Other States Threaten Sanctions.

First, under the modified preferred alternative, APHIS would aggressively intervene should other States threaten or impose sanctions on Montana for actions taken in conformance with the modified preferred alternative. Should a State threaten or impose sanctions, APHIS would immediately consult with the State threatening or imposing such sanctions to convince the State that such sanctions are not necessary and are not scientifically supportable. Should the State persist and impose sanctions or refuse to withdraw sanctions already imposed, APHIS would work with Montana to pursue all legal remedies against such State, including seeking an injunction against any such sanction. For example, APHIS, with Montana's concurrence, would be willing to recommend that the U.S. Department of Justice to seek an injunction against a State imposing such a sanction.

ii. Monitoring and Certification of Cattle Herds

Second, as an extra precaution, to defuse any threats from other States, the modified preferred alternative provides that APHIS would be prepared to cooperate with Montana to implement two other actions. The agencies could conduct additional monitoring of cattle herds that graze in areas that bison may occupy during the winter to ensure that the cattle have not contracted brucellosis. Such additional monitoring would consist of regular testing of test-eligible cattle in proximity to the Park, and possible adult vaccination of these cattle herds. In

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addition, APHIS would be prepared to offer livestock operators the option of having their cattle herds certified as brucellosis-free through APHIS's testing protocol. APHIS would make funding available to accomplish this certification process for livestock operators who graze cattle in areas that bison may occupy during the winter. Such monitoring and certification would provide assurances that, indeed, the bison management plan is working.

iii. Additional Testing if Bison Commingle with Cattle

Third, in the unlikely event that bison commingle with cattle despite the implementation of the management regime to ensure spatial separation, the Federal Agencies would be prepared to provide funds for the direct costs of additional testing of these cattle. The timing and frequency of the testing of these cattle herds would depend on many epidemiologic factors, which APHIS would determine on a case by case basis in conjunction with the Montana Department of Livestock.

iv. APHIS Procedures for Maintaining Brucellosis Class-Free Status

Fourth, in an even more unlikely event that a cattle herd were to contract brucellosis, the agencies would follow the established APHIS procedures so that Montana's class free status is not jeopardized.

These additional actions that APHIS would take if Montana follows the modified preferred alternative should alleviate any concerns that Montana may have regarding the extremely unlikely event that the Plan would not work.

3. ADAPTIVE MANAGEMENT

The modified preferred alternative employs an adaptive management approach used successfully in natural resource management plans nationwide. The adaptive management approach would allow the agencies to gain experience and knowledge with different aspects of the bison management plan. The agencies would be prepared to adjust the plan and improve risk management in accordance with the knowledge gained and as conditions change. Specifically, the modified preferred alternative consists of a series of steps for implementing the main approaches of the bison management plan.

A. Spatial Separation - Initial Implementation with Test Negative Bison

For example, for spatial separation, the modified preferred alternative calls for the initial implementation of the zone management approach with test negative bison. Using test negative bison for the initial adaptive management period of the zone management approach would give the agencies experience in implementing the management actions in the different zones and the

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opportunity to adjust the zone boundaries and/or the management actions within the zones. It would also provide the agencies with additional confidence that they could enforce the spatial separation such that, ultimately, untested bison outside the Park would not commingle with cattle and, therefore, even seropositive bison would have no opportunity to transmit brucellosis to cattle.

During the initial adaptive management period, the Federal Agencies would monitor seronegative pregnant bison outside the Park through the use of telemetry location devices by funding research on several aspects of seronegative pregnant female bison. Seronegative pregnant female bison on public lands at the western boundary area would receive a vaginal radio telemetry implant during handling at capture facilities. The implant would be expelled and activated upon abortion or birth. Even now, Montana Department of Fish, Wildlife and Parks is working with the United States Department of Agriculture, the USGS-BRD and the NPS on similar research in the Park. New Federal funding would provide the transmitters and technical capacity to monitor and locate abortion or birth sites upon activation of a shed vaginal transmitter. Thus, in the unlikely event that a seronegative pregnant bison did sero-convert and then did abort, the site would be immediately located for mitigation or continued study of the persistence and viability of *Brucella abortus.*

B. Bison Vaccination

For bison vaccination, the modified preferred alternative calls for three adaptive management steps. First, as soon as the safety data for calfhood vaccination meets the GYIBC criteria, calves and yearlings that are otherwise captured would be vaccinated in the capture facilities. Second, once a remote delivery mechanism is available (currently under development by the U.S. Geological Survey – Biological Resources Division (USGS-BRD) and NPS), the modified preferred alternative calls for the remote vaccination of calves and yearlings that move outside the Park. Finally, once safety and efficacy studies warrant, in-Park remote vaccination of vaccination eligible bison (initially calves and yearlings) would commence.

C. Tolerance of Bison Outside the Park

Tolerance of bison outside the Park also follows the adaptive management framework. Initially, only test negative bison would be permitted outside the Park. Subsequently, the modified preferred alternative calls for the tolerance of untested bison outside the Park upon the initiation of the in-Park calfhood vaccination program so long as, by that time, the agencies have obtained sufficient experience through adaptive management that shows that the spatial and temporal separation risk management regime, coupled with cattle vaccination, will work.

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4. FEDERAL WITHDRAWAL FROM MEMORANDUM OF UNDERSTANDING

The Memorandum of Understanding, under which the parties are preparing the EIS for the long-term bison management plan, provides that "[t]his MOU may be terminated by the withdrawal of any party upon written 30-day notice to the other parties." The Stipulation entered into in Montana v. Babbitt also provides that if a party withdraws from the MOU, the party must provide written notification and an explanation of the reasons for withdrawal. In the paragraphs that follow, the Federal Agencies explain that they are withdrawing from the MOU because of Montana's position related to its lack of tolerance of untested and seronegative pregnant bison outside the Park despite the numerous safeguards of the modified preferred alternative.

A. Intolerance of Untested Bison

As we understand from representations made at the November 16 conference call, Montana insists that it will tolerate untested bison outside the Park only after the initiation of a whole-herd, in-Park vaccination program that will vaccinate all classes and ages of bison. The federal agencies cannot endorse a bison management plan that ties tolerance of untested bison outside the Park to a "whole-herd" vaccination program inside the Park. Indeed, the Federal Agencies consider the spatial and temporal separation management regime, coupled with cattle vaccination, alone to be sufficient to justify tolerance of untested bison outside the Park. Nevertheless, the Federal Agencies have addressed Montana's stated additional concerns by proposing a modified preferred alternative that would not require Montana's tolerance of untested bison outside the Park until the initiation of the vaccination program inside the Park on vaccination eligible bison (calves and yearlings).

The Federal Agencies could agree only to a bison vaccination program based on the best available science on vaccine safety and efficacy. Thus, the vaccination program inside the Park would necessarily be initiated on those bison for which the agencies have the required safety and efficacy information that meet the GYIBC criteria. Calf and yearling bison vaccination in the Park would occur first because the agencies reasonably expect to have the necessary safety and efficacy data to warrant vaccinating calves and yearlings prior to having such information to warrant vaccinating adult males and adult females. As the Federal Agencies have explained in communications with Montana, the preliminary findings for "calfhood vaccination" have been very encouraging and safety research on calves and yearlings should be completed by the fall of 2000, with efficacy results for "calfhood vaccination" completed in 2002. Accordingly, the Park Service believes that it would be prepared to commence bison vaccination of calves and yearlings inside the Park by 2003-2004.

Insufficient scientific data and much uncertainty exist regarding vaccine safety and efficacy data for adult pregnant bison, and, therefore, the agencies are unable to predict when adult females may be included in the vaccination program. Limited data suggests that vaccination with

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the leading candidate for bison vaccination, RB51, causes some pregnant females to abort. Given this state of knowledge regarding the effects of the vaccine on adult female bison, the agencies cannot justify vaccination of such bison in the near term. Nevertheless, as soon as safety and efficacy data warrants, the National Park Service would initiate adult vaccination.

The Federal Agencies cannot, however, endorse a modified preferred alternative that waits for the initiation of "whole-herd" vaccination inside the Park prior to Montana increasing its tolerance of bison outside the Park. Our best estimates are that it will take several years before sufficient safety, efficacy, and dosage data may be developed to ensure that vaccination of adult female bison will not lead to pathogenic responses, including abortions. In any event, even when whole-herd vaccination proceeds, it would have a limited immediate effect on the risk of transmission of brucellosis from bison to cattle outside the Park. For some time after vaccination in the Park begins (even if all classes and ages of bison were being vaccinated), the agencies would have to employ the risk management regime for any bison outside the Park. The primary method of managing this risk would continue to be the maintenance of spatial and temporal separation. Only over the long term, when vaccination reduces the seroprevalence of brucellosis in the bison herd, would the vaccination program have more than a minimal impact on the risk.

The agencies agree that the vaccination of bison will play a preeminent role in the eventual eradication of brucellosis from the bison herd. Initiation of calfhood vaccination inside the Park would show the Federal Agencies' commitment to the eradication of brucellosis from the bison herd. Initiation of "whole-herd" vaccination is not necessary to show that commitment.

For these reasons, the Federal Agencies find untenable Montana's insistence on tying the tolerance of untested bison outside the Park to "whole-herd" vaccination inside the Park.

B. Intolerance of Test-Negative Pregnant Bison

As explained in the November 5, 1999 letter from Martin J. LaLonde, permitting seronegative pregnant bison outside the Park at the initiation of the bison management plan would present an insignificant risk to Montana while intolerance of this class poses an important risk to the integrity of the Yellowstone bison population. Montana has indicated an unwillingness to accept pregnant seronegative bison outside of the Park, however, because of a perceived risk of *Brucella abortus* being spread into the environment. Although Montana's perceived risk is not supported by science, the modified preferred alternative takes into account Montana's stated concerns. As explained above, during the initial adaptive management steps to test the zone management approach to ensure spatial separation of bison and cattle, the agencies would use telemetry location devices to manage seronegative pregnant bison as to eliminate any risks associated with tolerating this class of bison on public lands outside the Park.

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This method would provide other important benefits as well. It would provide the agencies important scientific information to guide the agencies' management of bison outside the Park in the future and would further assist the agencies to gain acceptance of the management approach from their constituencies and the public. Moreover, allowing sero-negative pregnant bison outside the Park in this controlled circumstance would mitigate adverse impacts to the bison population structure that will likely occur through the continued removal of seronegative fertile bison and its associated loss of calves.

For these reasons, Montana's refusal to tolerate seronegative pregnant bison outside the Park under the conditions of the modified preferred alternative and to forgo the significant benefits to be gained from this tolerance is without scientific foundation and is unwarranted.

C. The Federal Agencies Can Not Endorse a Bison Management Plan That Unnecessarily Kills Bison

Through the successful implementation of the modified preferred alternative, which includes spatial and temporal separation, cattle vaccination, and bison vaccination, the risk of transmission from any bison, even those that are seropositive, to cattle in the Yellowstone area is exceedingly small. Accordingly, because these risk management tools are available to the agencies, the killing of bison outside the prescriptions identified in the modified preferred alternative cannot be justified by unsupported claims that such bison must be killed because they give rise to intolerable levels of risk.

The Federal Agencies modified preferred alternative prevents the unnecessary killing of bison. Montana's plan does not, because it provides for no additional tolerance of untested or seronegative pregnant bison outside the Park. For this reason, the Federal Agencies have concluded that they cannot endorse Montana's position and cannot proceed further with Montana in the development of a joint Interagency Bison Management Plan.

5. NEXT STEPS

November 3, 1999, marked the one year anniversary of the close of the public comment period on the draft Interagency Bison Management Plan EIS. The Federal Agencies have now concluded that to complete an Interagency Bison Management Plan, they must withdraw from the current process in order to be able to make a final decision on the appropriate long-term bison management plan. The Federal Agencies now intend to proceed with completion of the final EIS without Montana as a co-lead. The Federal Agencies would consider a request from Montana to participate as a cooperating agency pursuant to 40 C.F.R. § 1501.6. The final EIS will include the modified preferred alternative as the Federal proposed action.

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In accordance with Council on Environmental Quality regulations, the Federal Agencies will now proceed in preparing a final EIS, with the USFS, APHIS, and NPS as co-leads. The final EIS will address the public comments received on the draft EIS; correct and update the analysis of draft EIS alternatives 1 through 7; and analyze the alternatives submitted by the public during the comment period and by Native American tribes on October 6, 1999.

In addition, the final EIS will present the modified Federal preferred alternative compared against at least two other scenarios: (1) the Federal preferred alternative implemented inside the Park by the NPS and by the State outside the Park under current prescriptions, and (2) the State's October 24, 1999, proposal. These scenarios would provide the public and decision makers with a clear and thorough analysis of long-term impacts to the bison herd while protecting cattle from the risk of transmission of *Brucella abortus*.

At this time, we are planning to issue a notice in the Federal Register that the Federal partners will proceed in completing the final EIS that will include the modified preferred alternative. The final EIS will be ready for review by spring 2000, with a Record of Decision issued during fall 2000. In addition, after the 30-day period following this letter, we intend to seek dismissal of Montana v. Babbitt pursuant to the terms of the stipulation entered in that case.

6. Conclusion

Both the Federal Agencies and Montana have a high stake in bison management in the Yellowstone area. Through APHIS, the Federal Government has, and continues to, expend significant funds in controlling and eradicating brucellosis. A plan that does not work to protect cattle from the spread of brucellosis is unacceptable to APHIS. In addition, the NPS has a significant interest in having a bison management plan that will work. Without a plan that controls the risk of transmission of brucellosis from bison to cattle, the NPS understands that it will not be able to attain the goal of maintaining a wild and free-ranging bison herd. In addition, without a workable plan, the USFS will not be able to attain its management goals involving bison.

To serve these important State and Federal interests, therefore, the Federal Agencies have taken extraordinary care to craft a modified preferred alternative for the Interagency Bison Management Plan that would make it highly unlikely that bison moving from YNP would commingle with cattle or shed bacteria that would survive until the return of cattle and, therefore, would make it extremely unlikely that transmission of brucellosis from the bison to cattle would occur. The modified preferred alternative would accomplish this primarily through the maintenance of spatial and temporal separation of bison from cattle and also through the vaccination of cattle that would occupy areas that bison may have occupied during the winter. The vaccination of bison would, over the long run, reduce seroprevalence in the bison herd and further reduce the minimal risk of transmission of brucellosis from bison to cattle. The Federal

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Agencies' commitment to commencing a bison vaccination program within YNP also demonstrates that the agencies have committed to the eventual eradication of the disease from the bison herd. Consequently, the modified preferred alternative would protect Montana's and the Federal Agencies' interests over the short and long term.

Montana would forgo some of the benefits of the modified preferred alternative if it chooses to follow an independent bison management course outside the Park. For example, it would not receive the benefits of the expenditure of additional federal resources outside the Park for bison management, it would not receive the extensive assistance that APHIS would provide under the modified preferred alternative to protect Montana against sanctions from other States, and it may not receive the expenditures for additional monitoring of cattle. Finally, if Montana chooses to kill bison outside the Park despite the numerous layers of protection that would be provided under the modified preferred alternative, it would do so without the support of a scientifically supported and joint Federal-State bison management plan and without the assistance and support of the Federal Government. Simply put, Montana would forgo involvement in a bison management plan that would best fulfill the various objectives set forth in the draft EIS for the Interagency Bison Management Plan.

After the 30-day period provided by this notice, we will initiate the post-withdrawal steps outlined above. In the meantime, we intend to notify the Court of the status of the State and Federal efforts to derive a long-term bison management plan.

We take this action reluctantly upon concluding that, after extensive discussions, neither the Federal Agencies nor Montana believe that further negotiations are likely to be successful. However, while we are firm in our decision to withdraw from the MOU and move forward independently on completion of a long-term bison management plan, we would be happy to discuss ways in which the Federal Agencies and Montana may continue to cooperate on bison management issues in the future.

Sincerely,

Donald J. Barry
Donald J. Barry
Assistant Secretary Fish and Wildlife and Parks
Department of Interior

James R. Lyons
Under Secretary for Natural Resources ~~and~~ Environment
Department of Agriculture

Michael V. Dunn
Michael V. Dunn
Under Secretary for Marketing and Regulatory Programs
Department of Agriculture

APPENDIX D: BRUCELLOSIS/BISON/ELK INFORMATION NEEDS AND RESEARCH TOPICS

The following lists the major gaps in the present understanding of bison management, continuing data needs, and the necessity of improving management. Carrying out these talks will help advance scientifically sound bison and brucellosis management. This list was developed by a GYIBC technical committee. Also see "Research Efforts" section of the "Actions Common to All Alternatives" chapter.

CATEGORY	PRIORITY	STATUS
I = Disease	H = High	O = Ongoing
II = Ecology	M = Medium	P = Proposed/Planned
III = Compliance	L = Low	N = No Action

Pathology	Category	Priority	Status
Pathologic effects of *Brucella* in bison females	I	M	O
Pathologic effects of *Brucella* in bison males	I	M	O
Pathologic effects of *Brucella* on populations of other species e, g., moose, bighorns, pronghorns.	I	L	N
Epidemiology			
Modes and rates of transmission under free-ranging conditions among bison by age and sex class	I	H	O
Modes and rates of transmission under free-ranging conditions between bison and elk by age and sex class	I	H	P
Modes and rates of transmission under feed ground conditions between elk and between bison and elk by age and sex class	I	H	N
Modes and risk of transmission under free-ranging conditions between bison and cattle by age and sex class and season	I	H	N
Seroprevalence (seropositive) rates of bison by age and sex	I	H	O
Infection (culture positive) rates of bison by age and sex	I	H	O
What are the most definitive or reliable sample sites to determine culture status in bison	I	H	O
Infectious (capable of shedding infectious amount) rates of bison by age and sex	I	H	N
Infective dose (ID50 or other level) for bison	I	M	N

Pathology *(continued)*	Category	Priority	Status
Frequency and timing of abortion for bison	I	H	O
Bison birth/abortion behavior and relationship to fate of the fetus, placenta, placental fluids, soil/vegetation contamination and exposure opportunity by age and sex class.	I	H	O
Brucella survival and persistence at infective levels in the environment, including fluids, birth material, and fetus under field conditions	I	H	O
Role of male bison in *Brucella* transmission. Can bull bison transmit venereally? Are bull bison a risk of transmission to cattle?	I	H	N
Will/can wild bison attempt to breed with domestic cattle under free ranging conditions; if so at what season?	I	H	N
Transmission risk assessment modelling and development of risk management options	I	H	P/O
Assessment of genetic resistance to *Brucella* in elk and bison including methods to identify individuals with such resistance. Techniques to use natural genetic resistance (if it occurs) in management of GYA populations.	I	M	N/O
Role, if any, of other species in *Brucella* transmission, including possible reservoirs.	I	L	N
Impact of *Brucella* on populations of other species, e.g., moose, bighorns, pronghorns.	I	L	N/O
***B. Abortus* Detection Techniques**			
Determination of optimum organ/site sampling for detection of *B. abortus* presence in bison and/or elk	I	H	O
Use of PCR techniques to detect *B. abortus* in vitro, tissue samples, and environmental samples	I	H	O
Evaluate NRAMP in Yellowstone bison	I	L	N/O
Develop and evaluate field (remote) test techniques	I	M	N
Serology			
Calibration for bison of commonly used serologic tests to evaluate serologic status and relationship to culture positive status	I	H	N
Evaluation of relationship between serologically positive bison and culture positive status	I	H	N

Pathology *(continued)*	Category	Priority	Status
Vaccines			
Biosafety of parenterally delivered strain RB51 in bison	I	H	P/O
Efficacy of parenterally delivered strain RB51 in bison	I	H	P/O
Biosafety of strain RB51 in nontarget species: moose, bighorn, pronghorn, coyote, fox, rodents, birds (raptors, ravens, vultures)	I	H	P/O
Feasibility assessment of ballistic vaccination of free-ranging bison	I	H	N/O
Biosafety of orally delivered strain RB51 in bison	I	H	P
Efficacy of orally delivered strain RB51 in bison	I	H	P
Biosafety of parenterally delivered *B. neotomae* in bison	I	L	N
Efficacy of parenterally delivered *B. neotomae* in bison	I	L	N
Biosafety of parenterally delivered *B. neotomae* in elk	I	L	N
Biosafety of orally delivered *B. neotomae* in bison	I	L	N
Efficacy of orally delivered *B. neotomae* in bison	I	L	N
Biosafety of *B. neotomae* in nontarget species: moose, bighorn, pronghorn, coyote, fox, rodents, birds (raptors, ravens, vultures)	I	L	N
Evaluation of suitability and effectiveness of delivery options for oral vaccine systems for bison	I	H	N
Evaluation of potential development of *B. abortus* vaccine using inert, non-living, or engineered organisms	I	M	P
Dose titration of RB51 in bison	I	H	O
Quarantine			
Develop bison quarantine protocols	III	H	Complete
Develop bison quarantine regulations and NEPA compliance	III	H	P
Develop quarantine design prototype	III	H	P
Determine suitable geographic locations for quarantine facilities	III	H	P
Estimate quarantine facility development and operational costs	III	H	P
Evaluate logistic and economic feasibility of quarantine	III	H	P
If quarantine feasible, determine priorities for distribution of bison that do not clear and do clear quarantine	III	H	P

Pathology *(continued)*	Category	Priority	Status
Bison Population Dynamics			
Develop aerial survey methodology for bison with sightability indices	II	H	P
Develop annual bison population estimates with statistical confidence limits	II	H	P
Determine trends of age structure of bison population	II	M	N
Determine trends of sex structure of bison population	II	M	N
Determine reproductive rates of bison by age class including pregnancy rates and birth rates, and seasonal survival/mortality rates by age and sex class	II	H	P
Develop predictive population model to estimate population response to environmental conditions and management alternatives	II	H	P
Develop minimum viable population (MVP) size estimates including persistence and genetic factors	II	H	P
Develop ecologically viable population estimates	II	H	P
Develop genetic profile including assessment of heterogeneity and immunity	II	M	N
Using population and epidemiology data estimate effects of *B. abortus* on bison recruitment and population dynamics	II	M	N
Evaluation of immunocontraception options	II	L	N
Bison Ecology			
Determine seasonal bison movements and distribution by age and sex class	II	H	P
Determine seasonal bison habitat selection by age and sex class	II	H	P
Determine seasonal use of roads by bison (winter and summer) by age and sex class	II	H	P
Determine survival and mortality differential of bison that use road system versus those that do not use road system	II	M	P
Determine reproductive rate differential of bison using roads versus those that do not.	II	M	P
Determine seasonal habitat preference, use, and distribution at various population levels and climatic conditions	II	H	P
Model bison habitat, selection, and use for various population levels, population composition, and environmental conditions	II	H	P

Pathology *(continued)*	Category	Priority	Status
Estimate ecological carrying capacity for bison sub-populations in northern range, Mary Mountain, and Pelican groups in Yellowstone National Park and population Grand Teton National Park	II	H	P
Economics			
Determine effects of and visitor preference for wildlife viewing, species preference, opportunity to see large numbers of animals	III	M	N
Estimate economic effects of hunting bison	III	H	N
Monitor and estimate economic effects of private property damage by bison and elk	III	M	N
Determine cattle regional production, location, and seasonal distribution on public and private land	III	H	P
Determine rate and frequency of cattle vaccination rates	III	H	N
Determine regulatory requirements for testing, vaccination, movements, and interstate shipment of cattle	III	H	N
Estimate regulatory costs — APHIS, states, producers	III	H	N
Social and Cultural Aspects			
Determine national public values and attitudes regarding bison, elk, and brucellosis	III	M	N
Determine regional public values and attitude regarding bison, elk, and brucellosis	III	M	N
Determine park or national forest visitor values and attitude regarding bison, elk, and brucellosis	III	M	N
Determine Native American relationships to Yellowstone National Park bison regionally and nationally	III	M	N

SUMMARY AND STATUS REPORT OF NATIONAL PARK SERVICE BISON RESEARCH PROJECTS

Yellowstone National Park and Grand Teton National Park

(Summaries compiled from research project quarterly and annual reports, project proposals, and a summary report (10/2/99) prepared and provided by T. Roffe, USGS-BRD.)

Guide to funding sources and research investigators:

APHIS	U.S. Department of Agriculture, Animal and Plant Health Inspection Service
ARS	U.S.D.A. Agricultural Research Service
BRD	Biological Resources Division
IDGF	Idaho Department of Fish and Game
INEEL	Idaho National Engineering and Environmental Laboratory
MDFWP	Montana Department of Fish, Wildlife and Parks
MSU	Montana State University
NPS	National Park Service
NRPP	Natural Resource Preservation Program
TAMU	Texas A & M University
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
WS	Washington State
WYG&F	Wyoming Game and Fish

BIOLOGICAL RESOURCES DIVISION INITIATIVE BISON RESEARCH PROJECTS STATUS AND INFORMATION

USGS/BRD PROJECTS
Yellowstone National Park

PROJECT TITLE:
Epidemiology and pathogenesis of brucellosis in Yellowstone National Park

PRINCIPAL INVESTIGATOR(S): J. Rhyan (USDA/APHIS), T.Roffe (USGS/BRD), K. Aune (MDFWP)

COOPERATORS: M. Philo, T. Gidlewski, R. Clarke, S. Olsen (USDA/APHIS); J. Mack (NPS)

FUNDING SOURCE(S): USGS/BRD, USDA/APHIS, NPS

STARTING DATE: Pilot initiated October 1995; full study initiated October 1997

ENDING DATE: Fieldwork ending spring 2001; final reports in FY 2002

ABSTRACT: The purpose of this multi-agency project is to describe and quantify the natural course of brucellosis in free-ranging Yellowstone National Park bison. Researchers are studying radio-collared female bison to assess epidemiological factors involved in the transmission of brucellosis and to determine the pathogenesis of *Brucella abortus* infection in Yellowstone National Park bison. This study will estimate the proportion of serologic reactors that may be infected with the bacteria, the frequency and modes of bacterial shedding and bacterial persistence in the environment, and the proportion of successful pregnancies by age and serologic status. Activities involve 1) assessing the brucellosis status of adult females and relating it to calving success and status of calves, 2) examining calving sites for birth products and potential contamination (soil and vegetation are collected and cultured for *Brucella*), and 3) monitoring birthing events for bison contact and or consumption of birth products, and for other species contact with birth sites and movement or ingestion of birth products.

CURRENT STATUS: Pilot project expanded into full study October 1997. There are currently approximately 21 radio-collared bison in the Northern

Range, and 19 radio-collared bison in the Madison-Firehole drainage (numbers may vary slightly due to mortalities, dropped collars, or re-collaring and calf collaring operations). The remaining 2 years of this study will focus on younger animals more likely to have clinical brucellosis, and on environmental contamination and persistence. One publication has appeared in the October 1999 Journal of Wildlife Management: "Brucellosis in Yellowstone National Park bison: quantitative serology and infection." A second publication is in preparation.

PROJECT TITLE:
Seasonal movements and habitat selection by bison in Yellowstone National Park

PRINCIPAL INVESTIGATOR(S): P. Gogan (USGS/BRD)

CO-INVESTIGATOR(S): E. Olexa (USGS/BRD)

FUNDING SOURCE(S): USGS/BRD

STARTING DATE: October 1997

ANTICIPATED ENDING DATE: end FY 2001

ABSTRACT: Approximately 2,500 bison currently inhabit Yellowstone National Park. Three major subpopulations exist, each with discrete winter ranges but which commingle on summer ranges. Approximately 90 individual bison have been radio-collared by scientists from USGS/BRD, USDA APHIS, and MT Dept. of Fish, Wildlife and Parks as part of several cooperating research projects. Scientists from USGS/BRD are using aerial locations of these bison to study the pattern and timing of each subpopulations' seasonal movements. Movements and distribution will be analyzed relative to environmental factors such as vegetative types, topography, and snow depth characteristics. The information will assist managers in identifying important seasonal habitats for bison within the park, and to infer areas of seasonally suitable habitat outside the park boundary that may be sought by bison.

CURRENT STATUS: Two years of data collection have been completed. Sixty-two collared bison are being located at approximately 10-day intervals (collar numbers may vary slightly due to mortalities or dropped collars; relocation interval is highly dependent on weather).

PROJECT TITLE:
Development of aerial survey methodology for bison population estimation in Yellowstone National Park

PRINCIPAL INVESTIGATOR(S): R. Garrott (MSU)

CO-INVESTIGATOR(S): S. Hess, L. Eberhardt (MSU)

FUNDING SOURCE(S): USGS/BRD

STARTING DATE: October 1997

ANTICIPATED ENDING DATE: September 2000

ABSTRACT: Scientists from Montana State University are developing and testing a number of aerial survey techniques for estimating bison populations and other population parameters in Yellowstone National Park. This study includes identifying high and low density strata and appropriate sampling techniques for each strata, comparing surveys conducted during the period of summer breeding and winter range aggregations, identifying conditions that provide the best opportunities for accurately counting bison, and exploring techniques for estimating the proportion of animals detected during each survey. Products of this research will include development of statistically rigorous survey methodologies, estimates with confidence intervals of parkwide bison populations, and specific routine population monitoring recommendations for managers.

CURRENT STATUS: Two full years of data collection have been completed, including successful collaboration with other Yellowstone National Park-based bison research and monitoring efforts to gather comparative ground and aerial counts.

PROJECT TITLE:
Determining forage availability and habitat use patterns for bison in the Hayden Valley of Yellowstone National Park

PRINCIPAL INVESTIGATOR(S): L. Irby (MSU)

CO-INVESTIGATOR(S): T. Olenicki (MSU)

FUNDING SOURCE(S): USGS/BRD

STARTING DATE: May 1998

ANTICIPATED ENDING DATE: March 2001

ABSTRACT: Scientists at Montana State University and USGS are studying bison-vegetation interactions and testing the accuracy of various sampling methods in Hayden Valley, the central area of summer range for bison in the interior of Yellowstone National Park. Bison habitat preferences (for cow-calf herds and bull groups), seasonal use patterns, and consistency-of-use patterns at the landscape level will be determined from overlays of radio-collared bison on GIS layers related to vegetation type, topography, snow-melt patterns, and forage biomass. The resulting information will be used in the development of bison-vegetation interaction model. A pilot study on this topic was conducted in the Madison-Firehole Range of Yellowstone National Park.

CURRENT STATUS: Two field seasons of data collection completed; one field season remaining.

PROJECT TITLE:
Bison-forage relationships in the Madison/Firehole area of Yellowstone National Park

PRINCIPAL INVESTIGATOR(S): L. Irby (MSU)

CO-INVESTIGATOR(S): S. Dawes (MSU)

FUNDING SOURCE(S): NPS-NRPP

STARTING DATE: Spring 1996

ENDING DATE: May 1998

ABSTRACT: Scientists at Montana State University and USGS conducted a pilot study to test the feasibility of several approaches for estimating the forage base available to bison in the Madison/Firehole area of Yellowstone National Park, a major wintering area for bison. Researchers used observations and fecal-count transects to determine the seasonal distribution of bison in a portion of the Madison/Firehole area. Timing and extent of forage utilization was determined by using exclosures and clipping experiments. Estimates of standing crop were obtained from handheld radiometer readings. This information was used to estimate maximum forage availability and to test a model for estimating standing crop from satellite imagery.

CURRENT STATUS: Fieldwork completed late 1997; final report (M.S. Thesis) completed May 1998.

PROJECT TITLE:
The effect of groomed roads on behavior and distribution of bison in Yellowstone National Park

PRINCIPAL INVESTIGATOR(S): R. Garrott (MSU)

CO-INVESTIGATOR(S): D. Bjornlie (MSU)

FUNDING SOURCE(S): USGS/BRD

STARTING DATE: Winter 1997–98

ENDING DATE: Spring 2000

ABSTRACT: A two-year field study was initiated by faculty and graduate students from Montana State University to investigate the ecological effects of the use of groomed roads by bison during the winter. The study included intensive observations of bison activity and behavior to test a number of hypotheses about the effects of snowpack and use of groomed roads on bison foraging activity and distributional shifts throughout the winter. The study was conducted in the upper Madison River drainage, a major wintering area for bison and a primary area of concern for bison exiting the park. Products of this research will include quantifying bison use of groomed roads during the winter, identification of movement patterns and major distributional shifts, identifying major travel corridors, and other data useful in evaluating the effects of groomed roads on bison ecology.

CURRENT STATUS: Fieldwork completed in spring 1999; analysis ongoing and final report anticipated spring 2000.

PROJECT TITLE:
Population Characteristics of Yellowstone National Park Bison

PRINCIPAL INVESTIGATOR(S): P. Gogan (MSU)

CO-INVESTIGATOR(S): E. Olexa (MSU) W. Clark, J. Mack (NPS)

FUNDING SOURCE(S): USGS/BRD

STARTING DATE: Winter 1996–97

ANTICIPATED ENDING DATE: Fall/winter 2001

ABSTRACT: Samples secured from bison slaughtered at or beyond the boundaries of Yellowstone National Park are providing scientists with an opportunistic source of information on the population ecology of Yellowstone bison. Data are obtained on the age structure of bison herds, the reproductive rate, fetal sex ratio and prevalence of brucellosis. Blood and tissue samples are being provided to research projects into Polymerase Chain Reaction (PCR) based diagnostic testing for *Brucella* presence, and genetic profiling.

CURRENT STATUS: Data from first 3 winters are being compiled and analyzed. Preparations are being made to continue sampling during the 1999–2000 winter if bison are killed. Preliminary results from 1996–97 winter presented at 1998 annual meeting of The Wildlife Society.

PROJECT TITLE:
Spatial-dynamic modelling of bison carrying capacity in the greater Yellowstone Ecosystem — A synthesis of bison movements, population dynamics, and interactions with vegetation

PRINCIPAL INVESTIGATOR(S): M. Coughenour (USGS/BRD)

FUNDING SOURCE(S): USGS/BRD

STARTING DATE: Winter 2000–01

ANTICIPATED ENDING DATE: Winter 2001–02

ABSTRACT: Estimates of ecological carrying capacity for bison are needed to interpret past increases in bison population sizes and ranges, and to assess the likelihood of future increases and movements within and across Yellowstone National Park boundaries. Population increases up until 1997 may have been in response to available habitat and forage, climate, and the nomadic tendencies of bison, as well as possibly the plowing and grooming of roads and trails in the winter and resultant effects on bison movements, energetics, and survival. The effects of bison on vegetation and other ecosystem components must also be considered. Colorado State University scientists are developing a spatial-dynamic ecosystem model as a means to integrate these components, provide a broader explanation for past changes, and explore possible future scenarios. Data from current and previous Yellowstone National Park bison research projects will be used to develop the model.

CURRENT STATUS: Collaborating with investigators on other 10 BRD Initiative bison research projects to help guide data collection and ensure that modelling needs will be met by field data collection. Modelling will begin in FY 2001.

PROJECT TITLE:
Genetic analysis of* Brucella *from bison and the generation of a PCR-based diagnostic system for epidemiological and ecological studies

PRINCIPAL INVESTIGATOR(S): R. Rodriguez (USGS/BRD), F. Roberto (Idaho National Engineering Laboratory)

CO-INVESTIGATOR(S): J. Payeur (USDS/ARS)

FUNDING SOURCE(S): USGS/BRD, NPS, INEEL

STARTING DATE: Mid 1998

ANTICIPATED ENDING DATE: Late 2001

ABSTRACT: Researchers are using the Polymerase Chain Reaction (PCR) to genetically analyze DNA from *Brucella* isolates derived from bison, cattle, and other animal hosts. These studies will aid researchers in determining how many species are in the genus *Brucella* and whether the genus comprises host-specific species, isolates, or both. The genetic studies will be used to develop an effective, highly sensitive, PCR-based diagnostic system to detect the presence of *Brucella* in blood, body fluids, and environmental samples. This diagnostic system will allow managers to determine if bison are currently infected with *Brucella* and the diversity of isolates or species present in the animals. Future studies will result in field applicable diagnostic systems to rapidly detect *Brucella* and discriminate live and dead bacterial cells.

CURRENT STATUS: PCR fragments have been identified and made available to develop primers to detect species-specific strains of *Brucella*. Primers have been tested to determine the limits of detection. Rapid extraction techniques for field use are being tested. Known samples have been obtained from other *Brucella* research projects for validation of techniques.

PROJECT TITLE:
RB51 and strain 19 Vaccine Safety in Nontarget Species (several projects)

PRINCIPAL INVESTIGATOR(S): T. Kreeger, Tom Thorne (WY G&F), Stan Anderson (U. WY), T. Roffe (USGS/BRD)

CO-INVESTIGATOR(S): Glenn Stout, Dave Zeiler, Sandy Anderson, W. Edwards, W. Cook (WY G&F), Steve Olsen (USDA APHIS ARS), T. DeLiberto (USDA/WS)

FUNDING SOURCE(S): NPS, USGS/BRD

STARTING DATE: FY 1998

ANTICIPATED ENDING DATE: FY 2001

ABSTRACT: State and federal agencies have been working cooperatively under the auspices of the Greater Yellowstone Brucellosis Committee to plan for the elimination of brucellosis from the GYA in the next 10 years. Effective vaccine programs have contributed to control or elimination of brucellosis in domestic cattle, and theoretically an intensive vaccination program could eliminate brucellosis from wildlife populations under certain conditions. Vaccination of bison has been proposed as a component of bison management plans in the GYA to reduce the risk of transmission of brucellosis from bison to domestic cattle. Brucellosis vaccines are comprised of living, mutant *Brucella* bacteria that create immunity by provoking a long-lasting immune response. If a large-scale vaccination is initiated in the GYA, it is possible that nontarget species may be exposed to the vaccine through direct consumption (vaccine administered by bait), exposure to fetuses, tissues or fluids of vaccinated animals, contact with residual vaccine on vegetation, or consumption of carcasses of vaccinated animals. Several collaborative research projects are evaluating the safety of strain 19 and RB51 in a variety of species that could be exposed to vaccines administered to bison or elk in the GYA.

CURRENT STATUS: Research on common ravens, deer mice, and Richardson's ground squirrels has been completed and final reports are pending. Reports on pronghorn, mule deer, bighorn sheep, coyotes and wolves are pending. Research on moose is continuing and is expected to be completed in early 2001.

PROJECT TITLE:
Statistical analysis and synthesis of 30 years of bison data

PRINCIPAL INVESTIGATOR(S): M. Meagher (USGS/BRD), M. Taper (MSU)

FUNDING SOURCE(S): USGS/BRD

STARTING DATE: Ongoing

ENDING DATE: Late 1999

ABSTRACT: Using statistically rigorous methods, scientists have been analyzing over 30 years of bison data collected by USGS biologist Mary Meagher. Data on population age and sex structure, reproductive rates, distribution, and population change have been evaluated. The information will shed light on issues such as how bison are influenced by natural regulation and whether bison use of groomed and packed winter roads in Yellowstone National Park affect bison population dynamics.

CURRENT STATUS: Draft final report completed September 1999; final report pending.

USGS/BRD PROJECTS
Grand Teton National Park, National Elk Refuge:

PROJECT TITLE:
Bison interactions with elk and predictive models of bison and elk carrying capacity, snow models, and population management scenarios in the Jackson Valley

PRINCIPAL INVESTIGATOR(S): F. Singer (USGS/BRD)

CO-INVESTIGATOR(S): M. Coughenour (USGS/BRD), P. Farnes (Snowcap Hydrology)

FUNDING SOURCE(S): National Park Service-NRPP, USGS/BRD

STARTING DATE: Spring 1998

ANTICIPATED ENDING DATE: Winter 2001–2002

ABSTRACT: USGS and university scientists are studying bison and elk range potential in the Jackson Valley of Grand Teton National Park and the National Elk Refuge. Currently, elk and bison are artificially fed at several sites in the valley. Managers seek to reduce the concentrations of the two species at these feeding grounds which may contribute to high seropositive rates of brucellosis. Scientists are developing models of typical snow depths and habitat suitability that, in concert with geographic information systems (GIS), will enable them to predict the natural winter habitat of elk and bison in the absence or reduction of feeding grounds. The group is also sampling biomass and availability of forages that will enable them, with use of a spatially explicit ecosystem model called SAVANNA, to predict the elk and bison numbers that might be supported under a variety of feeding scenarios. The information will provide managers with predictions for various management scenarios aimed at reducing interactions and the presence of brucellosis on elk and bison.

CURRENT STATUS: Two years fieldwork completed; GIS data entry ongoing

ADDITIONAL BISON RESEARCH PROJECTS STATUS AND INFORMATION

NATIONAL PARK SERVICE PROJECTS
Yellowstone National Park

PROJECT TITLE:
Evaluating risk factors for transmission of brucellosis from bison to elk in Yellowstone National Park

PRINCIPAL INVESTIGATOR(S): R. Garrott (MSU)

CO-INVESTIGATOR(S): M. Ferrari (MSU)

FUNDING SOURCE(S): National Park Service-NRPP

STARTING DATE: Winter 1996–97

ENDING DATE: February 1999

ABSTRACT: Management of brucellosis in bison could potentially be complicated by transmission of the disease between elk and bison. Scientists from Montana State University assessed the potential for such interspecies disease transmissions in the Madison-Firehole area of Yellowstone National Park. This area was selected because it is the major wintering ground for approximately 1,000 bison as well as an estimated 600–800 nonmigratory elk. The restricted wintering habitats available in this area, combined with high densities of both elk and bison, suggest that the potential risk of interspecies transmission of brucellosis would be high in this area. The study included serological surveys, studies of elk and bison distributional shifts and population estimates, habitat affinities of each species and how these change seasonally and with varying snowpack conditions, and measures of direct association and interaction between the two species during spring when probability of *Brucella* transmission is believed to be the highest. This research will contribute information that may be useful in developing long term management plans.

CURRENT STATUS: Fieldwork completed early 1998; final report (M.S. Thesis) completed February 1999.

PROJECT TITLE:
Snow measurements and modelling in relation to animal movement in Yellowstone National Park

PRINCIPAL INVESTIGATOR(S): K. Hansen (MSU)

CO-INVESTIGATOR(S): P. Farnes (MSU/Snowcap Hydrology), C. Heydon (MSU)

FUNDING SOURCE(S): National Park Service-NRPP

STARTING DATE: Ongoing

ANTICIPATED ENDING DATE: Early 2000

ABSTRACT: Montana State University scientists have developed an Index of Winter Severity for elk in northern Yellowstone that may help predict seasonal elk movements. These researchers are using data from snow courses, SNOTEL sites, and climatological stations, combined with information on growing degree-days and calculations of soil moisture deficit to update the Index of Winter Severity for elk and to calculate an Index of Winter Severity for bison. Indices of Winter Severity will be obtained for elk and bison for

various winter ranges in or near Yellowstone National Park. This study will provide a critical data layer for a related project in which Montana State University researchers are developing a Geographic Information Systems (GIS) model to predict mammal migrations in the GYA.

CURRENT STATUS: Preparing final report on "Snowpack Distribution Across Yellowstone National Park," summarizing daily data across the park. Issues regarding calculation of the Index of Winter Severity are still being resolved, including data transfer and methodology summary.

PROJECT TITLE:
Hayden Valley and Swan Lake-Norris bison distribution, movements, and road use monitoring

PRINCIPAL INVESTIGATOR(S): G. Kurz, D. Reinhart (National Park Service)

FUNDING SOURCE(S): National Park Service

STARTING DATE: Winter 1998

ANTICIPATED ENDING DATE: Spring 2001

ABSTRACT: In response to concerns regarding impacts of winter road grooming for snowmobile use on wildlife, Yellowstone National Park personnel are monitoring bison use of groomed roads in the Fishing Bridge to Canyon and the Swan Lake Flats to Norris road corridors in Yellowstone National Park. This effort, proposed to last a minimum of three years for each road segment, is providing baseline descriptive data on bison use of roads, location of entry and exit points, and bison movement patterns, as well as bison use of adjacent nongroomed, off-road areas. Managers will use this information to determine whether road closures are needed to more fully understand the impacts of groomed roads on wildlife. Information gathered from this monitoring study may be used in future studies as a basis for possible comparison with closed road segments.

CURRENT STATUS: Hayden Valley road segment in final year of monitoring; Swan Lake-Norris road segment in second year of monitoring with one year remaining. Decision regarding continuation of monitoring or potential road closure for further evaluation is anticipated late in 2000, based on findings of work completed up to that time.

PROJECT TITLE:
Assessing impacts of winter recreation on wildlife in Yellowstone National Park

PRINCIPAL INVESTIGATOR(S): R. Garrott (MSU)

CO-INVESTIGATOR(S): A. Hardy, S. Creek (MSU)

FUNDING SOURCE(S): National Park Service

STARTING DATE: Winter 1998–99

ANTICIPATED ENDING DATE: Spring 2001

ABSTRACT: In response to concerns regarding impacts of winter road grooming for snowmobile use on wildlife, scientists at Montana State University are quantifying and comparing levels of recreation use in the Madison-Firehole area with that measured by K. Aune in a similar study conducted 20 years previously. Researchers are also observing wildlife behavior, population, and distribution in that area to compare with both Aune's data and current activity patterns in areas with differing intensities of winter recreation. Researchers are measuring stress hormone levels in samples of feces and urine to determine whether psychological stress occurs under varying levels of recreation intensity. Several species are under investigation, with emphasis on bison and elk.

CURRENT STATUS: One field season complete and second field season in progress.

PROJECT TITLE:
The application of conservation genetics to the long-term management of bison in five national parks

PRINCIPAL INVESTIGATOR(S): J. Derr (TAMU)

CO-INVESTIGATOR(S): J. Templeton (TAMU)

FUNDING SOURCE(S): USGS/BRD-NRPP

STARTING DATE: Anticipated mid-2000

ANTICIPATED ENDING DATE: ????

ABSTRACT: Investigators propose to analyze genetic samples from bison in five national parks to determine comparative levels of heterozygosity, genetic relatedness among populations, and prevalence of gene conferring resistance to infection by *Brucella abortus* bacteria.

CURRENT STATUS: Funding pending; many samples have been collected and archived.

NATIONAL PARK SERVICE PROJECTS
Grand Teton National Park

PROJECT TITLE:
Prevalence of brucellosis in southern Greater Yellowstone Ecosystem moose

PRINCIPAL INVESTIGATOR(S): T. Roffe (USGS/BRD), J. Berger (University of Nevada-Reno)

FUNDING SOURCE(S): ??

STARTING DATE: 1996

ANTICIPATED ENDING DATE: ??

ABSTRACT: Moose have been considered a species sensitive to brucellosis, although very little data exist on the effects of *Brucella abortus* on individual moose and on moose populations. As part of a collaborative effort, scientists are using data from another ecology project that involves capturing and radio-collaring moose to assess brucellosis seroprevalence, pregnancy rates, and calving in moose coexisting with brucellosis endemic bison and elk.

CURRENT STATUS: This project is ongoing as a monitoring "add-on" to a primary project on moose reproduction and predation. Over 40 moose have been sampled thus far; a publication in the journal "Conservation Biology" is in press.

PROJECT TITLE:
Snowpack distribution across lower elevations of Grand Teton National Park and National Elk Refuge

PRINCIPAL INVESTIGATOR(S): K. Hansen (MSU)

CO-INVESTIGATOR(S): P. Farnes (MSU/Snowcap Hydrology), C. Heydon (MSU)

FUNDING SOURCE(S): National Park Service

STARTING DATE: ??

ANTICIPATED ENDING DATE: Completed

ABSTRACT: Prior to 1975, most bison that summered in GTNP wintered in the park's lower elevations north of the National Elk Refuge. Heavy snows in 1975 displaced bison to even lower elevations, where they discovered supplemental feed on the National Elk Refuge. Since 1980 most bison now travel to the National Elk Refuge in early winter regardless of snow conditions or forage availability to the north. Scientists from Montana State University are using historic data on snowpack distribution across the lower elevations of Grand Teton National Park and the National Elk Refuge to determine when bison might migrate into this area, and over what portion of the winter range bison may be able to obtain adequate forage. This information may assist managers in developing plans to entice bison to winter farther north, rather than mixing with elk on the National Elk Refuge.

CURRENT STATUS: Completed

PROJECT TITLE:
Reproduction and demography of brucellosis infected bison in the southern GYA

PRINCIPAL INVESTIGATOR(S): BRD scientists

FUNDING SOURCE(S): BRD

STARTING DATE: 1997

ANTICIPATED ENDING DATE: 2002

ABSTRACT: This project examines the impact brucellosis may be having on the small population of Jackson bison by measuring reproductive rates and calf growth rates compared to nonexposed populations.

CURRENT STATUS: Two years of a four year project are complete.

PROJECT TITLE:
Biosafety, efficacy and recrudescence of RB51 vaccine in bison calves and pregnant bison (3 projects)

PRINCIPAL INVESTIGATOR(S): BRD scientists

COLLABORATORS: USDA-ARS, USDA-APHIS, Ft. Niobrara NWR, IDGF

FUNDING SOURCE(S): ??

STARTING DATE: ??

ANTICIPATED ENDING DATE: 2002

ABSTRACT: The first study (completed) examined the pathology, shedding, transmission and persistence of RB51 in bison calves. A second, supplemental study (completed) examined persistence of RB51 bacteria in bison vaccinated as calves and looked at reproductive success of those animals. A third study, (ongoing) is examining the offspring of bison vaccinated with RB51 to assess whether the vaccine will express itself as disease when these animals go through their first pregnancy.

CURRENT STATUS: The completed RB51 calf study found no clinical illness, pathology, or shedding and transmission of RB51 in vaccinated calves, although infection persisted for over 6 months. Results are published in the July 1999 “Journal of Wildlife Management.” The RB51 persistence study is completed, but the findings were inconclusive. The study of potential RB51 effects in bison born to vaccinated females is ongoing; all bison have been bred and the study will be completed in spring 2000 if all are pregnant.

APPENDIX E: LEGISLATION AND POLICY GUIDANCE NATIONAL PARK SERVICE, U.S. DEPARTMENT OF INTERIOR

ACTS OF CONGRESS

The Act of March 1, 1872 (17 Stat.32, 16 U.S.C. Sec. 22) established Yellowstone National Park, and states it is "dedicated and set apart as a public park or pleasuring ground for the benefit and enjoyment of the people."

The Act of May 7, 1894 (28 Stat.73, 16 U.S.C. Sec. 26) established regulations prohibiting "killing, wounding, or capturing at any time of any bird or wild animal, except dangerous animals, when it is necessary to prevent them from destroying human life or inflicting an injury . . . within the limits of said park" and "for the protection of the animals and birds in the park, from capture or destruction, or to prevent their being frightened or driven from the park."

The Act of August 25, 1916 (39 Stat.535, 16 U.S.C. Secs. 1, 2, 3, as amended) established the National Park Service, and states its basic mission:

"To conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

The Act of January 24, 1923 (42 Stat. 1214 16 U.S.C. Sec. 36) authorized that the secretary of the interior "may sell or otherwise dispose of the surplus buffalo of the Yellowstone National Park herd."

The National Environmental Policy Act of 1969 (U.S.C. 4321–4347 as amended) requires consideration of the environmental effects of proposed federal actions. NEPA procedures ensure that environmental information is available to public officials and members of the public before decisions are made and before actions are taken.

The Act of August 18, 1970, as amended in 1978 (16 U.S.C. Sec. 1a-1) states "regulation of the various areas of the National Park System be consistent with and founded in the purpose established

. . . to the common benefit of all the people of the United States, and that the authorization of activities be construed and the protection, management, and administration of these areas be conducted in light of the high public value and integrity of the National Park System and not be exercised in derogation of the values and purposes for which these various areas have been established, except as may have been or shall be directly and specifically provided by Congress."

The Endangered Species Act of 1973, as amended (87 Stat. 884, 16 U.S.C. 1531 et. seq.) requires the park to consult with the U.S. Fish and Wildlife Service on management actions that could affect listed threatened and endangered species. Management actions cannot jeopardize the continued existence of threatened or endangered species.

The Act of November 13, 1998, (112 Stat. 3501, 16 U.S.C. Sec. 5936) requires the Secretary of the Interior to use the results of scientific study when making decisions about park management. Additionally, when making a decision that "may cause a significant adverse effect on a park resource," the administrative record must reflect how the manager considered the resource studies.

DEPARTMENT OF INTERIOR, DEPARTMENTAL MANUAL 516 DM 1.2F

Requires the park to "provide, to the fullest extent practicable, timely information to the public to better assist in understanding Departmental plans and programs affecting environmental quality and to facilitate their involvement in the development of such plans and programs."

NATIONAL PARK SERVICE MANAGEMENT POLICIES (1988)

Park Planning in a Regional Context (2:9)

"Recognizing that parks are integral parts of larger regional environments, the National Park Service will work cooperatively with others to anticipate, avoid, and resolve potential conflicts, to protect park resources, and to address mutual interests in the quality of life for community residents, considering economic development as well as resource and environmental protection."

Biological Resource Management (Chapter 4)

"Ecological processes altered in the past by human activities may need to be abetted to maintain the closest approximation of the natural ecosystem where a truly natural system is no longer attainable." **(Chap. 4:2)**

"The National Park Service will seek to perpetuate the native animal life as part of the natural ecosystems of the park. Management emphasis will be on minimizing human impacts on natural animal population dynamics." **(Chap. 4:5)**

"Superintendents will develop agreements with other federal, state, and local agencies, native American authorities, and private landowners where appropriate to coordinate plant and animal management activities. . . . In addition, superintendents will seek the cooperation of others in minimizing the impacts of outside influences . . . and other means of preserving and protecting park resources." **(Chap. 4:5)**

"Natural processes will be relied on to control populations of native species to the greatest extent possible. Unnatural concentrations of native species caused by human activities may be controlled if the activities causing the concentrations cannot be controlled." **(Chap. 4:6)**

"Parks having native migratory species will ensure the preservation of their populations and their habitats inside the park and will cooperate wherever possible with others to ensure the preservation of their populations and habitats outside the park. Management action may include participation in regional land use planning efforts and cooperation with states and native American authorities in the setting of game harvest regulations for lands outside the park." **(Chap. 4:7)**

"Hunting and trapping wildlife will be allowed only in parks where such use is specifically authorized." **(Chap. 4:7)**

"When individual plants or animals must be removed for any reason - hunting, fishing, pest management, or culling to reduce excess populations resulting from human activities - the National Park Service will consider the need to maintain appropriate levels of genetic diversity in the residual park population." **(Chap. 4:10)**

"The National Park Service will strive to protect the full range of genetic types (genotypes) native to plant and animal populations in the parks by perpetuating natural evolutionary processes and minimizing human interference with evolving genetic diversity." **(Chap. 4:10)**

YELLOWSTONE NATIONAL PARK MASTER PLAN (1974)

"Ongoing and future wildlife management actions will be directed toward reducing or eliminating disruptive human influences, relying, whenever possible, upon natural controls to regulate animal numbers."

YELLOWSTONE NATIONAL PARK STATEMENT FOR MANAGEMENT (1986)

"Permit natural processes to function within the park ecosystem with minimum disturbance by man's activities."

"Maintain close and harmonious relations with neighboring communities, counties, and States and work closely with other federal agencies, private groups, organizations, and individuals to provide a full understanding of park operations and purpose."

YELLOWSTONE NATIONAL PARK RESOURCE MANAGEMENT PLAN (1982)

Bison management practices designed "to both preserve the unique aesthetic and scientific values of its bison herds and prevent any contacts with domestic cattle."

YELLOWSTONE NATIONAL PARK RESOURCE MANAGEMENT PLAN (1995)

The fundamental goals of Yellowstone's resource management program, as outlined in this *Resource Management Plan*, are "to preserve the natural and cultural resources of Yellowstone and to allow natural processes and interactions between resources to occur within a minimum of human influence."

Recommended projects or activities within the bison management program of the *Resource Management Plan* include continued aerial and ground monitoring of bison, cooperation with Montana and others to gather information on bison, "prepare a cooperative long-range management plan for controlling bison problems, such as reducing the possibility of *Brucella* organism transmission to cattle and reducing human conflicts and property damage outside Yellowstone National Park, while ensuring opportunities to view free-ranging bison and maintaining a self-perpetuating bison population in Yellowstone," and continued participation in the Greater Yellowstone Interagency Brucellosis Committee (GYIBC).

U.S. FOREST SERVICE, DEPARTMENT OF AGRICULTURE

Acts of Congress

The Act of May 26, 1926 (16 U.S.C. 37) to enable the secretary of the interior to acquire certain private or State lands for the purpose of providing the ". . . winter range and winter feed facilities indispensable for the adequate and proper protection, preservation, and propagation of the elk, antelope, and other game animals of the Yellowstone National Park and adjacent land . . . such lands to become part of the national forest system"

The Act of May 26, 1926, Multiple Use Sustained Yield Act of 1960 (P.L. 86-517) 16 U.S.C. 528–531 declares congressional policy that national forests shall be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes.

Code of Federal Regulations

36 CFR 219.19 mandates the U.S. Forest Service to manage fish and wildlife habitat "to maintain viable populations of existing native and desired non-native vertebrate species" and the Forest Service will "provide for and maintain diversity of plant and animal communities to meet overall multiple-use objectives."

36 CFR 219.19(a)(3) requires consultation with state fish and wildlife agencies and other federal agencies to coordinate planning for fish and wildlife, including planning for the reintroduction of extirpated species.

36 CFR 222.8(a)(1) states that the U.S. Forest Service has a duty to cooperate and manage with the states regarding diseases that affect livestock.

Forest Service Manual 2611.1 (1978)

Gallatin Forest Land and Resources Management Plan (Forest Plan, II-1, III-3) reiterates Forest Service policy and specifies the Forest will provide for increasing big game populations and will emphasize forage and cover needs on big game winter range.

ANIMAL AND PLANT HEALTH INSPECTION SERVICE

Acts of Congress

The Act of May 29, 1884 (Animal Industry Act; 21 U.S.C. 112 through 114a-1, 115, 117–119, 130) authorized the secretary of Agriculture to cooperate with states, farmers' associations, similar organizations, and individuals to prevent the spread of livestock diseases and to prohibit the transportation of diseased livestock from one state or territory to another.

The Act of February 2, 1903 (32 Stat. 791, 21 U.S.C. 111, 112, 120–122) authorizes the secretary of agriculture to make such regulations and take such measures as he may deem proper to prevent the introduction or dissemination of the contagion of any contagious, infectious, or communicable disease of livestock or poultry from a foreign country into the United States, or from one state or territory of the United States or the District of Columbia into another.

The Act of March 3, 1905 (33 Stat. 1264, 21 U.S.C. 123–127) authorizes the secretary of agriculture to quarantine any state or portion thereof when he determines that animals in such state or territory are affected with any contagious, infectious, or communicable disease of livestock or poultry. It also prohibits the transportation of quarantined animals from quarantined areas except in accordance with such rules and regulations the secretary may issue.

The Act of July 2, 1962 (76 Stat. 129, 21 U.S.C. 134a through 134h) authorizes the secretary of agriculture to guard against the introduction or dissemination of communicable diseases of livestock or poultry and to seize, quarantine, or dispose of in a reasonable manner (1) any animals moving in interstate or foreign commerce contrary to laws administered by the secretary to guard against such diseases; (2) any animals moving into the U.S. or interstate that are affected or exposed to such diseases of livestock or poultry, (3) any animals moved into the U.S. or interstate that were affected or exposed at the time of such movement; and (4) any animals on any U.S. premises if he determines that an extraordinary emergency exists in connection with an outbreak that threatens livestock or poultry of the U.S. The secretary is also authorized to protect the livestock or poultry of the U.S. by issuing regulations prohibiting or regulating the movement into the U.S. of any animals that are or have been affected or exposed to or otherwise treated for any such disease or are likely to introduce or disseminate such disease. It also authorizes the secretary of agriculture to designate employees to stop and inspect, without a warrant, means of conveyances and to enter upon premises with a warrant under certain circumstances.

TITLE 9, CODE OF FEDERAL REGULATIONS, PART 78

The regulations of 9 CFR 78 govern the interstate movement of domestic cattle, domestic bison, and swine to prevent the spread of brucellosis. The regulations provide a system for classifying states or portions of states (areas), herds, and individual animals with respect to brucellosis status. The requirements for interstate movement are based upon the disease status of the individual animal and the status of the herd, area, or state from which the animal moves.

States or portions of states are classified according to the rate of *brucella* infection present in livestock herds and by complying with other requirements for disease surveillance and response. The classifications are class-free, class A, class B, and class C. States or areas that do not meet the minimum standards for class C are placed under federal quarantine. Restrictions on the interstate movement of cattle, bison, and swine are generally more stringent for movements from class A states or areas than from class-free states or areas, and are more stringent for movements from class B states or areas than from class A states or areas, and so on. The most stringent restrictions are for movements from quarantined states or areas.

The regulations are authorized by 21 U.S.C. 111-114a-l, 114g, 117, 120, 121, 123-126, 134b, and 134 f; 7 CFR 2.17, 1.51, and 371.2(d).

STATE OF MONTANA, DEPARTMENT OF LIVESTOCK

Duties and Powers of Department (General Provisions) (81-1-102 MCA) states that the department shall exercise general supervision over and, so far as possible, protect the livestock interests of the state from theft and disease and recommend legislation which, in the judgment of the department, fosters this industry.

Powers of Department (Administration of Animal Health Laws) (81-2-102 MCA) states that the department may (a) supervise the sanitary conditions of livestock in this state, under provisions of the constitution and statutes of this state and the rules adopted by the department. . . . The department may quarantine livestock in this state when the livestock is affected with or has been exposed to disease or disease-carrying medium. . . (b) foster, promote and protect the livestock industry in this state by the investigation of diseases and other subjects related to ways and means of prevention, extirpation, and control of diseases . . . and may perform any other acts and things as may be necessary or proper in the fostering, promotion, or protection of the livestock industry in this state; . . . (d) adopt rules and orders which it considers necessary or proper to prevent the introduction or spreading of infectious, contagious, communicable, or dangerous diseases affecting livestock in this state and to this end may adopt rules and orders necessary or proper governing inspections and tests of livestock intended for importation into this state before it may be imported into this state; (e) adopt rules and orders which it considers necessary or proper for the inspection, testing, and quarantine of all livestock imported into this state; . . . (I) slaughter or cause to be slaughtered any livestock in this state known to be affected with or which has been exposed to an infectious, contagious, communicable, or dangerous disease, when such slaughter is necessary for the protection of other livestock.

81-2-104 MCA states that when the department determines that is it necessary to eradicate or control an infectious, contagious, communicable, or dangerous disease of livestock in this state, in cooperation with the United States Department of Agriculture or other federal agency, and to appraise and destroy animals affected with or that have been exposed to a disease or to destroy property in order to remove the infection and complete the cleaning and disinfection of the premises or to do any act or incur any other expense reasonably necessary in suppressing this disease, the board may accept and adopt on behalf of the state the rules adopted by the United States Department of Agriculture or other federal agency under authority of an act of Congress or the portion considered necessary, suitable, or applicable. The department may adopt other rules necessary or desirable for this purpose and cooperate with the United States Department of Agriculture or other federal agency in the enforcement of the rules accepted and adopted.

81-2-108 MCA states that it shall be unlawful for any owner, agent, or person in charge of any domestic animal or animals that are known to be suffering from or exposed to a dangerous, infectious, contagious, or communicable disease to permit such animal or animals to run at large on the public range or public highway. It shall be the duty of the owner or agent or person in charge of animals that died or they have reason to suspect did die from an infectious, contagious, communicable, or dangerous disease to properly bury or burn the same.

81-2-120 and 81-2-121 MCA. The following statutory and regulatory provisions are applicable: 81-2-120 - Management of wild buffalo or bison for disease control; and 81-2-121 - Taking of publicly owned wild buffalo or bison that are present on private property.

81-2-703 MCA states that (1) except as provided in subsection (6), no animal, animal semen, or animal biologic may be brought into the state without a permit and also a health certificate. (2) The department shall issue a permit if no significant danger to the public health will ensue upon importation of the animal into the state. No permit may be issued for livestock infected with or exposed to brucellosis, tuberculosis, or any other infectious, contagious, or communicable animal disease, except that cattle with a positive reaction to a recognized test for brucellosis may be permitted entry when destined directly for slaughter at a slaughterhouse under United States Department of Agriculture supervision.

Title 32, Administrative Rules of Montana, describe the Department of Livestock's disease control responsibilities (appendix E); and Title 32, Subchapter 4 is specific to brucellosis. Portions of that rule that relate to the bison management plan include ARM 32.3.224 which states: (1) Bison may enter the state of Montana provided they enter in conformity with sections 32.3.201 through 32.3.211 and in addition are (a) officially tested negative for brucellosis within 30 days of entry except the following (I) steers, spayed heifers, and calves under 12 months of age; (ii) bison consigned directly to an official slaughtering establishment for immediate slaughter; (iii) an official calfhood vaccinate in which the first pair of permanent incisors has not erupted and which are not parturient, post parturient, or in the last trimester of pregnancy; (iv) originate in an official certified brucellosis free bison herd. . . . ARM 32.3.224A states that when estrayed or migratory bison exposed to or affected with brucellosis . . . enter into or are otherwise present within the state of Montana one of the following actions will be taken: (a) The live bison may be physically removed by the safest and most expeditious means from within the state boundaries. This means may include but not be limited to capture, trucking, hazing/aversion, or delivery to a departmentally approved slaughterhouse; (b) If live bison cannot safety by reasonable and permanent means be removed from the state they shall be summarily destroyed where they stand by the use of firearms. If firearms cannot be used with due regard for human safety and public property, bison may be relocated to such a danger free area and destroyed by firearms or by any other practicable means of euthanasia; (c) When bison of necessity or unintentionally are killed through actions of the department, the carcass remains will be disposed of by the most economical means possible. This may include but not be limited to burying, incineration, rendering, or field dressing for delivery to a departmentally approved slaughterhouse or slaughter destination. The following statutory provisions are applicable: 81-2-102, 81-2-120, and 81-2-121. ARM 32.4.410 states that a herd containing reactor animals shall be quarantined by the department to specified premises. . . . A herd containing exposed animals or a contact herd may be quarantined . . . pending the results of an official test for the presence of brucellosis. ARM 32.3.417 states that animals determined to be reactor animals as the result of an official test for brucellosis must be removed from the quarantined premises and slaughtered. . . . ARM 32.3.425 states that animals in a quarantined herd other than reactor animals may not be moved from the quarantined herd or the quarantined premises, sold, given away, offered for sale, or otherwise disposed of, except as authorized by the department under written permit of the department. . . . The department shall issue a permit for the movement of animals other than reactor animals in a quarantined herd from the quarantine premises as follows: (a) for suspect and negative animals upon the condition that they are consigned directly to and their immediate destination is (I) a slaughtering establishment; (ii) for immediate marketing and slaughter; (iii) for immediate sale and shipment to a slaughtering establishment; (iv) a feedlot approved by the state veterinarian of the state of Montana as a quarantined feedlot under ARM 32.3.121, or a feedlot approved as a quarantined feedlot by the appropriate regulatory authority or another state, to be fed in such quarantined feedlot until removed from such quarantined feedlot for direct consignment to; (A) a slaughtering establishment in this state or in another state. . . . ARM 32.3.431 states that a brucellosis quarantine shall be removed by the department from a quarantined herd when two consecutive negative herd tests have been performed provided the first negative test is made not less than 30 days after the removal of all reactor animals from the herd and the second negative test (the release test) is made not less than 180 days after removal of the last reactor. (2) Upon order of the department, an owner of a herd released from brucellosis quarantine, or his agent, shall present all animals of the herd so released from quarantine still in his possession, and any animals intermingled with them since the release from quarantine, for an official assurance retest from the presence of brucellosis not sooner than 180 days after the date of release from brucellosis quarantine. . . . ARM 32.3.432 states that (1) All dead fetuses, membranes, and afterbirths from reactor animals must be destroyed immediately by burning or proper burial.

STATE OF MONTANA, DEPARTMENT OF FISH, WILDLIFE AND PARKS

Powers and Duties (87-1-201) authorizes the Montana Department of Fish, Wildlife and Parks to supervise all the wildlife, fish, game and nongame birds and the game and furbearing animals of the state.

87-1-216, MCA. Wild buffalo or bison as species in need of management-policy-department duties.

(1) The legislature finds that significant potential exists for the spread of contagious diseases to persons or livestock in Montana and for damage to persons and property by wild buffalo or bison. It is the purpose of this section:

(a) to designate publicly owned wild buffalo or bison originating from Yellowstone National Park as a species requiring disease control;

(b) to designate other wild buffalo or bison as a species in need of management; and,

(c) to set out specific duties for the department for management of the species.

(2) The department:

(a) is responsible for the management, including but not limited to public hunting, of wild buffalo or bison in this state that have not been exposed to or infected with a dangerous or contagious disease but may threaten persons or property;

(b) shall consult and coordinate with the department of livestock on implementation of the provisions of subsection (2)(a) to the extent necessary to ensure that wild buffalo or bison remain disease free; and,

(c) shall cooperate with the department of livestock in managing publicly owned wild buffalo or bison that enter the state on public or private land from a herd that is infected with a dangerous disease, as provided in 81-2-120, under a plan approved by the governor. The department of livestock is authorized under the provisions of 81-2-120 to regulate publicly owned wild buffalo or bison in this state that pose a threat to persons or livestock in Montana through the transmission of dangerous disease.

(3) The department and the department of livestock are strongly urged to enter into an agreement with the national park service for the long-term management of the Yellowstone national park wild buffalo or bison herd. If the national park service does not proceed in good faith in a timely manner to enter a long-term management agreement that, in the determination of the department and the department of livestock, responds adequately to the needs of Montana, the department and the department of livestock are strongly urged to take appropriate court action. The department and the department of livestock shall prepare a joint report to the 55th legislature regarding the present state of wild buffalo or bison in Montana and any progress on an agreement for the long-term management of the Yellowstone national park herd.

(4) The department may adopt rules with regard to wild buffalo or bison that have not been exposed to or infected with a contagious disease but are in need of management because of potential damage to person or property.

Powers of the Commission (87-1-301) authorizes the Fish, Wildlife and Parks Commission to set the policies for the protection, preservation, and propagation of the wildlife, fish, game, furbearers, waterfowl, nongame species, and endangered species of the state and for the fulfillment of all other responsibilities of the department as provided by law.

House Bill 763 (1985) authorized a hunting season for bison. Although the legislature has subsequently repealed the season, House Bill 763 still is germane to a bison management plan. The statement of intent included the following: "it is the intent of the legislature that the regulated hunting of wild buffalo allowed by House Bill 763 be considered only one of many solutions available to the Department and the National Park Service for controlling the migration of wild buffalo across the boundaries of Yellowstone National Park. The legislature encourages further negotiations and cooperation between the Department and the National Park Service to seek other methods of controlling, as soon as possible, the migration of wild buffalo into Montana from Yellowstone National Park. It is the intent of the legislature that the department adopt rules flexible enough to address each situation in which wild buffalo travel across the boundaries of Yellowstone National Park into the state of Montana presenting the potential for infecting Montana livestock with brucellosis and for inflicting property damage to property owned by the residents of the state."

House Joint Resolution 32, adopted by the 1989 legislature, states: "the Senate and the House of Representatives of the State of Montana urging the National Park Service and the Montana Department of Fish, Wildlife and Parks to take immediate action to seek and implement solutions for the long term management of elk and bison in the Yellowstone Ecosystem."

"Be it further resolved that the long-term solution be directed toward addressing the regulation of elk and bison populations within Yellowstone National Park."

Montana Fish, Wildlife and Parks Commission Position Statement, March 1989, states: "the solution to elk and bison management in the Yellowstone Ecosystem lies in a combination of the following actions: Addressing the regulation of elk and bison populations within the park . . . initiating a cooperative county, state, federal and private effort to address long-term solutions for the Northern elk and bison herds both within and outside Yellowstone Park."

87-5-103 MCA authorizes the Department of Fish, Wildlife and Parks to promulgate regulations for the management of nongame wildlife. Further, it states that the department shall by such regulations establish proposed limitations relating to taking, possession, transportation, exportation, processing, sale or offer for sale, or shipment as may be deemed necessary to manage such nongame wildlife. The department may make such changes in the proposed regulations as are consistent with effective management of nongame wildlife as designated by the legislature.

APPENDIX F: SUMMARY OF BISON MANAGEMENT TECHNIQUES

In consultation with various individuals and organizations, an analysis of what constitutes humane treatment has been developed. Their input has helped to define what impacts various management techniques have on the rights and welfare of individual bison, domestic animals, and humans. The information provided by the consultants does not necessarily translate into an endorsement of any particular course of action.

Various proposals of the draft environmental impact statement involve bison management techniques such as hazing, herding, capture, handling, and transport. Euthanasia many also be required if bison are seriously injured during these procedures.

HAZING

Hazing is described as moving animals away from a facility or location. Examples of hazing are moving bison away from developed areas or from private property and back into Yellowstone Park, national forests or other federal land. Equipment and methods used for hazing bison include cracker shells or rubber bullets, careful moving of bison on foot, horseback, or by helicopter, or using a combination of these methods. The methods used in hazing vary with each situation and preferably involve those which (1) do not injure animals or cause significant physical or psychological stress, (2) are least dangerous for people involved, and (3) are least destructive to private and federal property.

Hazing can be beneficial if (1) bison do not repeatedly return to the location from where they were hazed, (2) their new location adequately provides for the physiological needs of the bison, and (3) their new location does not result in additional conflict with human activities or development.

In many situations, hazing may be detrimental to bison and bison management. Repeated hazing in early winter may produce weight loss and poor body condition, which decreases the animal's ability to endure the remaining winter. Bison can also develop avoidance behavior with repeated hazing. One consequence of this, observed in 1991, is that bison move out of the park at night to feed and return to the park before sunrise. Avoidance behavior can also result in bison overreacting to hazing by running excessively, and/or moving to higher elevations. This makes continued hazing or control actions more difficult.

Hazing bison back into the park can bring individuals into areas where other bison are present. This results in larger groups, which if they return, may be more difficult to manage, or may be beneficial if capture operations require a minimum number of animals to be efficient. In some situations, hazing bison into the park returns animals to poorer wintering conditions similar to those which had initially stimulated bison to migrate.

HERDING

Herding is described as moving animals as a group or herd to an intended location. The modes of human travel used for herding are essentially the same as for hazing, however herding usually involves moving bison farther distances with more effort to keep groups together.

The advantages and disadvantages of herding are similar to hazing. Herding can be most successful if bison are moved as quietly as possible. For this reason, helicopters and projectiles, such as cracker shells or rubber bullets, may be counter-productive. Bison can become completely unwilling to move especially after being herded several times. Under these conditions, they may stop on vantage points, such as a ridge or hill, and then splinter into groups traveling several directions.

CAPTURE

Capture is described as either herding or voluntary movement of bison into a holding facility. Because free-ranging bison are generally best managed in groups, capture of individuals is usually not practical or cost-effective.

If bison are moved or handled, operations will be most effective, by all standards, if the well-being of each animal is addressed as highest priority. Facilities and techniques designed to accommodate bison behavior and physiology in the least stressful manner available will maximize operation efficiency and minimize injuries to bison and personnel; and bison will be handled as humanely as possible.

Most holding facilities that capture bison consist of a wing fence that directs bison into a large fenced holding pasture that can be closed once bison are inside. A typical example of this type of construction is in the Theodore Roosevelt National Park south unit. Park facilities there include a wing fence that is 7 foot high with double woven wire. The wing fence directs bison into a 5.5-acre holding pasture. The holding pasture is fenced with 10 foot high woven wire on posts 10 feet apart. The additional 3 feet in height was included to accommodate elk trapping. Theodore Roosevelt National Park typically herds their bison by helicopter along the wing fence and into the holding pasture.

Previously, Yellowstone bison have been successfully gathered into corrals using helicopters. Disadvantages of using helicopters are that it is difficult to minimize physical exertion, excitement, injury, and stress in the herded bison; and some bison eventually become tolerant of helicopters and are difficult to herd.

Baiting with hay may be effective in winter and early spring to encourage bison to voluntarily move into a holding pasture or into a “trapping pasture” designed to hold small groups which can then be moved into a larger holding pasture adjacent to handling facilities. Elk Island National Park, Alberta, Canada, uses a variation of this method for their plains bison. Although herding bison into a capture facility by horseback is often ineffective because bison can easily outrun horses, herding by horseback may be effective in moving animals to baited areas. Wind Cave National Park, where salt is naturally deficient, uses salt to bait bison into capture pens.

HANDLING

Bison handling is described as procedures involving bison within a corral or holding facility. The purposes of handling bison would be to test for diseases, to mark or identify individuals, or to gather animals for transport. It can be difficult to handle wildlife within holding facilities without incurring injury or mortality of individuals. Proper facility construction and handling techniques are crucial for minimizing these problems. Components of bison handling include facilities design and construction, handling technique, personnel, and bison injuries.

Facility Design and Construction

Handling facilities are generally designed to gradually divide groups of bison into smaller groups and eventually into individual animals. In addition to needing alleys, gates, and sorting systems, abundant pens allow flexibility for sorting. To reduce injuries, bison are also separated by sex and body size.

Many contemporary facilities are designed to use bison behavior to minimize animal stress and injury, and maximize handling efficiency. Examples of these design principles include using curved alleys and eliminating 90 corners. All successful handling facilities, regardless of design principles, have relied on previous experience or consultation from experienced bison handling organizations when designing and constructing their facilities.

Handling Techniques

Handling techniques for bison vary among both public and private organizations. Some organizations feel it necessary to use loud and forceful actions when moving bison through handling facilities. However, research has demonstrated that in cattle, quiet handling that uses the behavior of the animal improves animal health, and reduces stress, injury, and subsequent illness (Grandin 1989). These principles also apply to bison (Temple Grandin, Professor of Animal Sciences, Colorado State University, pers. comm.). Bison owner Ken Throlsen (New Rockford, North Dakota, pers. comm.) simply states, “The louder you shout, the higher bison jump,” and “The slower you move them, the quicker you will be done.”

Elk Island National Park, which annually handles both wood and plains bison, also assumes a quieter, calmer approach is more successful. Their principles include (1) minimizing noise and general activity within the facility, (2) allowing the animal to walk down an alley rather than pushing it into a run, (3) utilizing the animal’s flight zone by having handlers entering it just enough to move the animal, and (4) severely restricting the use of electrical prods.

Personnel

The knowledge, attitude, and habits of personnel handling bison significantly affect the animals and success of the operation. Elk Island National Park provides a handler information package, handling objectives, and rules of conduct. An orientation is provided for employees just prior to the handling operation. Theodore Roosevelt National Park noted that handling operations were physically challenging to handlers (Bob Powell, Chief Ranger, Theodore Roosevelt National Park). For this reason, handlers could be required to pass a step test.

In addition to general handlers, a veterinarian is usually needed throughout the handling process to assess and treat injuries, collect samples for disease testing, provide input on animal care, and determine conditions requiring euthanasia. It can also be valuable having a representative of an animal protection agency attend capture, handling and transport processes. The presence of such an agency can provide a positive input on the well-being of handled bison and inform the public on operation precautions and care.

Potential Injuries

The most common injury incurred by bison is loss of horn sheaths. This form of injury can be minimized with facility construction, which prevents bison from catching horns on fencing or chutes, and with quiet handling, which reduces the speed that bison move through handling facilities.

Goring is another cause of injury associated with bison in handling and transport operations. These injuries can be minimized by separating bison by sex and body size.

TRANSPORT

Transport is described as the shipment of animals, by motorized vehicles, away from the handling facility. Significant injury and stress to bison can occur during transport. Bison health is maximized if animals are sorted by sex and body size and animals are not crowded within the transport vehicle. Animals being moved interstate must meet applicable disease testing requirement and certifications.

EUTHANASIA

Euthanasia is the act of inducing a humane death in an animal. If a bison is injured seriously enough to require euthanasia, the euthanasia method chosen should be as painless and rapid as possible. The American Veterinary Medical Association (AVMA) recognizes that an accurately delivered gunshot is an acceptable method of euthanasia; for larger wildlife such as bison, the preferred target is the head or neck. Although physical methods of euthanasia, such as gunshot, may be considered by some to be aesthetically displeasing, some of these methods cause less fear and anxiety, and may be more rapid, painless, humane and practical than other forms of euthanasia (AVMA 1993).

If any bison becomes injured, an attending veterinarian can inspect the animal to assess if the injury can be treated, or if the injury is serious enough to necessitate euthanasia. Euthanasia by gunshot would be conducted only by agency personnel certified in firearms training with expert marksmanship and an understanding of animal anatomy for proper bullet placement.

The advantages of euthanasia by gunshot include (1) unconsciousness is instantaneous if the bullet is properly placed, (2) the remaining carcass is safe for consumption by humans or animals, and (3) it may be the only effective means of euthanasia. The disadvantages include (1) under some field conditions the vital target area may be difficult to hit, (2) the use of firearms may create risk to personnel, and (3) it can be aesthetically unpleasant. The disadvantages of euthanasia by gunshot can be minimized by enacting proper safety precautions and limiting nonessential personnel from areas of activity.

Another method that is acceptable for euthanizing large animals such as bison is an intravenous administration of a euthanasia solution (AVMA 1993). Barbiturates in general, such as sodium pentobarbital, are acceptable for euthanasia. Proper and effective intravenous placement is best accomplished by a licensed veterinarian.

Euthanasia by intravenous injection is best considered as a secondary option if the animal cannot be euthanized by gunshot. The advantages of intravenous injection is (1) it is the most reliable method of performing euthanasia, and (2) there is minimal discomfort to the animal. The disadvantages of this method is (1) it may be impractical or inhumane to properly restrain the animal, (2) this method may create risk to personnel, and (3) the carcass produced by this method is toxic and therefore carcasses must be disposed of by incineration or burial that will prevent consumption by humans or animals.

APPENDIX G: DEFINITION OF LOW RISK BISON

United States Department of Agriculture

Animal and Plant Health Inspection Service

Veterinary Services

Western Regional Office
384 Inverness Drive South
Suite 150
Englewood, CO 80112

Subject: Low Risk Bison

Date: October 17, 1997

To: Joan M. Arnoldi
Deputy Administrator, VS
Washington, DC

This memorandum defines the term "low risk bison" as it is used in the Draft Environmental Impact Statement for the Interagency Bison Management Plan for Montana and Yellowstone National Park.

DEFINITION
Low risk bison are those bison that do not present a significant risk of transferring brucellosis to livestock through environmental contamination - bulls, yearlings, calves, and postparturient female bison that have live calves and have totally passed all birth membranes.

This definition applies to untested bison for which trapping attempts have been unsuccessful, within the Special Management Area (as defined in certain EIS alternatives) in the area adjacent to the western boundary of the Park, where there is temporal separation of cattle and bison.

RATIONALE
Birth membranes and associated fluids are the greatest potential source of increasing the risk of brucellosis transmission through environmental contamination. Low risk bison, as defined above, are not capable of contaminating the environment with birth membranes and fluids. A postparturient female that has a live calf and has passed all birth membranes is not likely to be infected. In the event she is infected, the quantity of infective organisms she may shed is de minimis compared to that in the birth membranes and fluids.

APHIS - Protecting American Agriculture

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Joan M. Arnoldi

Cattle and bison are present in the western boundary area at separate times during the year, reducing the risk of transmission. Cattle north of the Park are on private land all year long, greatly increasing the risk of transmission due to a greater potential for commingling with bison.

R. M. Nervig
Director, Western Region
Veterinary Services

Carl Bausch
Director, PPD, Environmental
Analysis and Documentation

DEPARTMENT OF LIVESTOCK

MARC RACICOT, GOVERNOR
PO BOX 202001

STATE OF MONTANA

BRANDS ENFORCEMENT DIV. 406-444-2045
ANIMAL HEALTH DIV. 406-444-2043
BOARD OF LIVESTOCK - CENTRALIZED SERVICES 406-444-2023
MEAT, MILK & EGG INSPECTION DIV. 406-444-5202
HELENA, MONTANA 59620-2001

From: Dr. Arnold Gertonson, Montana State Veterinarian

Re: "Low Risk" Definition for Yellowstone National Park Brucellosis Exposed Bison Herd

Date: April 16, 1998

The definition proposed by NPS, APHIS and USFS assumes that the regulatory veterinarians in the other 49 states would agree with APHIS' determination that untested bulls, calves, yearlings and postparturient cows that have totally passed placenta represent a low risk for brucellosis transmission if removed 30-60 days prior to cattle returning to public lands. Without such agreement, regulatory veterinarians from other states could make independent decisions to impose testing requirements on Montana cattle prior to importation to their states. The economic effects on the livestock industry could be substantial. To avoid that economic risk and risk of disease transmission, the Montana State Veterinarian may use professional discretion about whether and when to remove bison and will retain authority for the decision to remove untested bison in the West Yellowstone area.

The definition proposed by the federal agencies of low risk bison has not been adopted by the State of Montana for the following additional reasons:

1) Bison bulls can be infected with brucellosis. The mode of transmission from bulls to other animals would be from semen, urine or infective material draining from abscessed testicles if they would open.

2) Calves may be infected at birth if the dam is infected. Calves may also be infected by ingestion of milk from an infected dam and ingestion of infective material from the dam or other infected animals. It is possible that a "short yearling" bison, which is seropositive or seronegative as a neonate will remain culture positive.

3) Brucellosis infected post-parturient cows can pass infective material via discharged placental membranes, vaginal discharges, milk, or feces from a cow which has ingested placental tissue or birthing fluids from a brucellosis infected bison female which has aborted.

4) Yearlings may be infected from birth if their dam is infected, and remain infected, or become infected by the ingestion of infective material shed by infected animals. In addition, given body condition of older females, and snow conditions during seasons of operations, it is not always possible to distinguish between yearling females and smaller, poor body conditioned older females. Yearlings are by definition animals that are twelve to twenty-four months of age. It is possible for animals classified as yearlings to be pregnant, thus they would be high risk animals.

For these reasons, Montana has exercised its discretion to determine whether, and when, to remove untested bison in the West Yellowstone area.

Call Montana Livestock Crimestoppers 800-647-7464

Appendix H: Threatened, Endangered, And Sensitive Animal Species That May Occur In Areas Likely To Be Affected By Alternative Bison Management Plans

Animal Species	Status[1] USFWS	USFS	MT	WY
American peregrine falcon *Falco peregrinus anatum*	-	S	E	SSC3
Bald eagle *Haliaeetus leucocephalus*	FT	E	P	SSC2
Grizzly bear *Ursus arctcos horribilis*	FT	T	-	-
Gray wolf *Canis lupus*	FEX	-	E	-
Montana arctic grayling[2] *Thymallus arcticus grayling*	FC	S	-	-
Canada lynx *Lynx canadensis*	FT	T	-	SSC2
North American wolverine *Gulo gulo luscus*	-	S	-	SSC3
Harlequin duck[3] *Histrionicus histrionicus*	-	S	-	SSC3
Yellowstone cutthroat trout[2] *Oncorhyncrus clarki bouvieri*	-	S	-	-
Trumpeter swan *Cygnus buccinator*	-	S	-	SSC2

1. U.S. Fish and Wildlife Service: FE = Federal Endangered, FT = Federal Threatened, FEX = Federal experimental nonessential population, FC = Federal Candidate;
U.S. Forest Service: E = USFS endangered, T = USFS threatened, S = USFS sensitive;
State of Montana: E = MT endangered, P = MT protected (endangered and protected defined under The Nongame and Endangered Species Conservation Act, Mont. Code Ann. § 87-5-101, 1995); and
State of Wyoming (Game and Fish Status): SSC1 = WY class 1 species of special concern which includes species with ongoing habitat loss, population greatly restricted or declining, and extirpation appears possible. SSC2 = WY class 2 species in which (1) habitat is restricted or vulnerable (but no recent or significant loss has occurred) and populations are greatly restricted or declining; or (2) species with ongoing significant loss of habitat and populations that are declining or restricted in numbers and distribution (but extirpation is not imminent). SSC3 = WY class 3 species in which (1) habitat is not restricted, but populations are greatly restricted or declining (extirpation appears possible); or (2) habitat is restricted or vulnerable (but no significant loss has occurred) and populations are declining or restricted in numbers or distribution (but extirpation is not imminent); or (3) significant habitat loss is ongoing but

the species is widely distributed and population trends are considered stable.

2. Grayling and cutthroat trout are typically not found in or near the affected areas. Their preferred habitat of streams and lakes would not be physically disturbed under any of the alternatives. Plus, riparian habitat and water quality would not be adversely affected. Because these species would not be affected, they were not addressed in the "Affected Environment" and "Environmental Consequences."
3. Harlequin ducks are typically not found in or near the affected areas. Their preferred habitat of swift-moving streams and the adjacent riparian and forested areas would not be physically disturbed. Site-specific mitigation would also help protect this species. Because this species would not be impacted, it was not addressed in the "Affected Environment" and "Environmental Consequences."

SOURCES: Montana Natural Heritage Program. Species of special concern list prepared for the *Draft Environmental Impact Statement* for the Interagency Bison Management Plan. Nov. 7, 1997; Wyoming Natural Diversity Database. Database Search for Plant and Animals of Concern. Nov. 10, 1997.

Stalking bobcat.

FEIS APPENDIX I: HISTORY OF NATIVE AMERICAN CONSULTATION

SUMMARY OF NATIVE AMERICAN CONSULTATIONS

Over the past three years, a number of meetings have occurred with tribes concerning Yellowstone bison management. The comments contributed by the tribes and tribal organizations have revealed the importance of bison to their cultural beliefs, values, and lifestyle. These comments also noted Native Americans' views of Yellowstone National Park's management of the bison herd. The "Tribal Comment" map illustrates those tribes who have buffalo on their land and also those tribes who commented that they would welcome live, quarantined bison on their land.

CONSULTATION PROCESS

In the summer of 1998, 5 meetings were held at the following locations with tribes:

- Tribal Consultation at Yellowstone National Park, Mammoth School on August 12, 1998. Representatives (18 total) attended from the following tribes and Native American organizations: Assiniboine Tribe, Blackfeet Nation, Cheyenne River Sioux Tribe, Confederated Salish and Kootenai Tribe, Crow Tribe, Gros Ventre Tribe, Ho-Chunk Nation-Wisconsin, Inter-Tribal Bison Cooperative, Northern Arapaho Nation, Prairie Band of Potawatomi Nation, Rosebud Sioux Tribe, United Sioux Tribes of South Dakota, Winnebago Tribe of Nebraska, and Yankton Sioux Tribe.
- Tribal Consultation hosted by Cheyenne River Sioux Tribe in Eagle Butte, South Dakota on August 21, 1998. There were 20 attendees, including four Pine Ridge Sioux representatives.
  - Tribal Consultation hosted by Shoshone-Bannock Tribal Council in Fort Hall, Idaho on August 28, 1998. 13 attendees.
  - Tribal Consultation hosted by Confederated Salish and Kootenai Tribal Council in Pablo, Montana on September 8, 1998. 12 attendees.
  - Tribal Consultation hosted by Gros Ventre and Assiniboine Tribal Council in Fort Belknap, Montana on September 10, 1998. 15 attendees.

In addition, National Park Service has held three Native American consultations since the close of the official comment period.

- Tribal consultation held at Yellowstone National Park, Mammoth School on May 21, 1999. The following 16 tribes and Native American organizations had representatives (29 total) in attendance: Assiniboine - Fort Belknap, Cheyenne River Lakota, Colville, Comanche Tribe, Confederated Salish & Kootenai, Inter-Tribal Bison Cooperative, Little Shell Band Chippewa, Nez Perce, Oglala Sioux, Onondaga Nation, Rosebud Sioux Tribe, Santee Sioux, Sisseton-Wahpeton Sioux, Turtle Mountain Chippewa, Winnebago Tribe of Nebraska, Yurok-Karuk.
- Tribal Consultation meeting held at Yellowstone National Park on October 6, 1999. The following 9 tribes and Native American organizations had representatives (11 total) in attendance: Assiniboine & Sioux – Fort Peck, Cheyenne River Sioux, Confederated Salish & Kootenai, Crow, Inter-Tribal Bison Cooperative, Lac Courte Oreilles, Nez Perce, Rosebud Sioux, Winnebago Tribe of Nebraska.
- Tribal Consultation meeting held at Yellowstone National Park on April 26, 2000. The following tribes and Native American organizations had representatives (11 total) in Attendance: Shoshone-Bannock, Rosebud Sioux Tribe, Confederated Salish & Koottenai, Winnebago Tribe of Nebraska, Prairie Band of Potawatomi Nation, Eastern Shoshone, Nez Perce, Oglala Sioux, Gray Eagle Society, Intertribal Bison Cooperative, and Fort Belknap Tribes.

CHRONOLOGY OF NATIVE AMERICAN TRIBAL CONTACTS AND CONSULTATIONS

November 1989 *The Yellowstone Bison: Managing a National Heritage* brochure published and distributed to the public.

May 1990 *Yellowstone Bison: Background and Issues* booklet published and distributed to the public accompanied by a scoping letter that suggested a range of alternatives for bison management.

August 11–October 31, 1990 Written and verbal public comments identifying issues and concerns about the suggested alternatives in *Yellowstone Bison: Background and Issues* were sought at public scoping meetings in Gardiner, West Yellowstone and Bozeman, Montana on October 9, 10, and 11, 1990, respectively.

Spring 1991 Public input session focused on the review of a short list of alternatives.

Spring 1992 *Bison Symposium* held in Bozeman, Montana. American Indian speakers presented individual comments regarding range of management alternatives for bison management.

June 23, 1992 Letter sent to tribal chairs to notify them of the preparation of the Bison Management Environmental Impact Statement and "…to help ensure that the proposed project will not negatively impact ethnographic resources with a cultural affinity to members of your tribe." The following eight tribes were notified: Blackfeet, Confederated Salish and Kootenai, Crow, Nez Perce, Northern Arapaho, Northern Cheyenne, Shoshone, Shoshone and Bannock.

January 23, 1995 Resolution regarding the bison issue made by the Crow Creek Sioux Tribe - Resolution No. CC-95-01-23-19.

June 21, 1995 Gallatin National Forest archeologists met with Crow Tribal Cultural Committee Chairperson John Pretty on Top, to share the results of the Gallatin National Forest inventory, and to ask for his comment. Mr. Pretty on Top expressed his concern that care be taken in the construction and use of the bison handling facilities to avoid bringing public attention to the sites.

November 1995 The park consulted with National Park Service Rocky Mountain Regional Office and Denver Service Center compliance specialists, anthropologists, and the American Indian Liaison to obtain recommendations on how to conduct tribal consultation for the environmental assessment process. At their direction, Yellowstone staff phoned tribes before and after the draft was sent.

November 2–8, 1995 Yellowstone staff notified chair persons and cultural committee coordinators of the nine tribes listed below to notify them that the environmental assessment was going to be sent and to encourage them to make comments. (Review period was December 20, 1995 – February 2, 1996).

December 20, 1995 Environmental assessment was sent to chair persons and cultural committee coordinators for the following nine tribes: Blackfeet, Confederated Salish and Kootenai, Crow, Eastern Shoshone, Gros Ventre and Assiniboine, Nez Perce, Northern Arapaho, Northern Cheyenne, and Shoshone-Bannock.

January 18–31, 1996 Calls were made to chairpersons and cultural committee coordinators of the nine tribes listed above to verify receipt of the draft, answer questions, notify them of the comment period extension, and to encourage them to make comments.

January 16–February 2, 1996 Comments on the *Interim Bison Management Plan Environmental Assessment (EA)* were submitted by the following tribes and tribal organizations: Bureau of Indian Affairs (Wind River Indian Agency), Choctaw Nation of Oklahoma, Gros Ventre and Assiniboine, Inter-Tribal Bison Cooperative, Lower Brule Sioux, Nambe Pueblo, Nez Perce, Northern Arapaho, Shoshone-Bannock, Taos Pueblo, and Winnebago Tribe of Nebraska.

February 7, 1997 Resolution regarding the bison issue made by the Fort Belknap Indian Community Council — Resolution No. 38-97.

February 24, 1997 Yellowstone staff faxed the March 6, 1997 flyer, "National Day of Prayer for the Buffalo" to announce the event to tribal chairpersons of the Blackfeet, Confederated Salish and Kootenai, Crow, Eastern Shoshone, Gros Ventre and Assiniboine, Nez Perce, Northern Arapaho, Northern Cheyenne and Shoshone-Bannock Tribes.

February 26, 1997 Resolution regarding the bison issue made by the Montana-Wyoming Tribal Leaders Council — Resolution No. 97-02.

March 5, 1997 Resolution regarding the bison issue made by the Cheyenne River Sioux Tribe of South Dakota — Resolution No. E-__.

March 6, 1997 The "National Day of Prayer for the Buffalo" was held. This event was coordinated by the Inter-Tribal Bison Cooperative; Yellowstone staff processed the Public Assembly permit, assisted in logistics and participated in the event.

March 19, 1997 Michael Soukup, National Park Service Associate Director, Natural Resource Stewardship and Science, replied to nine tribal chairpersons about their letters supporting the Memorandum of Understanding between the Inter-Tribal Bison Cooperative and the National Wildlife Federation. These tribes were added to the Environmental Impact Statement mailing list: (Flandreau Santee Sioux, Lower Brule Sioux, Loyal Shawnee, Modoc Tribe of Oklahoma, Nambe Pueblo, Native Village of Mekoryuk, Picuris Pueblo, Round Valley Tribal Council, Sisseton-Wahpeton Sioux Tribe list.

April 14, 1997 Resolution regarding the bison issue made by the Rosebud Sioux – Resolution No. 97-87.

May 7, 1997 Yellowstone's Assistant Director, Yellowstone Center for Resources, Wayne Brewster and Chief, Branch of Cultural Resources, Laura Joss participated on a panel of speakers at the Native American Fish and Wildlife Society conference in Bozeman, Montana. Brewster and Joss provided updates on the *Bison Management Draft Environmental Impact Statement* and answered questions from participants.

August 13, 1997 Letter sent from Yellowstone National Park Superintendent Michael V. Finley to Michael T. Pablo, Chairman, Montana Tribal Leaders Council in response to their Resolution 97-06 ("A Resolution Calling for the Departments of Agriculture and Interior to Act to Support the Tribal Alternative as the Preferred Alternative to the Yellowstone Bison EIS").

August 26, 1997 By invitation, Yellowstone's Chief, Branch of Cultural Resources, Laura Joss attended a tribal Council of Elders meeting to discuss the bison issue at Hebgen Lake, Montana.

March 19, 1998 By invitation, Yellowstone Wildlife Biologist John Mack and Chief, Branch of Cultural Resources Laura Joss attended the Northwest Inter-Tribal Agricultural Council Conference, hosted by the Shoshone-Bannock Tribes in Pocatello, Idaho. John Mack made a presentation to the group regarding the management of Yellowstone's bison herd, gave updates and answered questions about the *Draft Environmental Impact Statement (DEIS) for the Interagency Bison Management Plan for the State of Montana and Yellowstone National Park*. Laura Joss met with Shoshone-Bannock tribal representatives to discuss current park issues.

March 21, 1998 By invitation, Yellowstone's Chief, Branch of Cultural Resources, Laura Joss attended Buffalo Nations "Day of Prayer for the Buffalo" ceremony West Yellowstone, Montana.

May 26–29, 1998 Calls were made to tribes affiliated with Yellowstone (Blackfeet, Confederated Salish and Kootenai, Crow, Eastern Shoshone, Gros Ventre and Assiniboine, Nez Perce, Northern Arapaho, Northern Cheyenne, Rosebud Sioux, Shoshone-Bannock) to notify them that the *Bison Management Draft Environmental Impact Statement* was about to be mailed and encourage them to make comments on it; check with them on preferences for potential consultation meeting dates for the *Draft Environmental Impact Statement*; and to check on the progress of their review of the park's Draft Ethnographic Overview and Assessment.

June 1, 1998 *The Draft Environmental Impact Statement (EIS) for the Interagency Bison Management Plan for the State of Montana and Yellowstone National Park* was sent to the following 32 American Indian tribes and organizations: Blackfeet Tribe, Cheyenne River Sioux Tribe, Chippewa Cree Business Committee, Choctaw Nation of Oklahoma, Confederated Salish and Kootenai Tribes, Crow Tribe, Crow Creek Sioux Tribe, Eastern Shoshone Business Council, Eastern Shoshone Cultural Committee, Flandreau Santee Sioux, Fort Belknap Community Council (Gros Ventre and Assiniboine Tribes), Fort Hall Business Council, Shoshone and Bannock Tribes, Fort Peck Council, Inter-Tribal Bison Cooperative, Little Shell Tribe, Lower Brule Sioux Tribe, Lower Brule Wildlife Enterprise, Loyal Shawnee Tribe, Medicine Wheel Alliance, Modoc Tribe of Oklahoma, Native Village of Mekoryuk, Nambe Pueblo, Nez Perce Cultural Resource Program, Nez Perce Tribal Council, Northern Arapaho Business Council, Northern Arapaho Tribe, Northern Cheyenne Tribal Council, Northern Cheyenne Tribal Council Cultural Commission, Oglala Sioux, Picuris Pueblo, Rosebud Lakota Tribal Council, Round Valley Tribal Council, Santo Domingo Tribe, Shoshone Business Council, Shoshone-Bannock Tribes Cultural Resource Coordinator, Shoshone-Bannock Tribes Land Use Director, Shoshone-Bannock Tribes Land Use Policy Committee, Sisseton-Wahpeton Sioux, Taos Pueblo, Office of Natural Resource Protection, Ute Indian Tribe, Winnebago Tribe of Nebraska.

At the request of 15 additional tribes, copies were provided later to: Assiniboine and Sioux, Confederated Tribes of the Yakama Indians, Ho Chunk Nation, Lower Sioux Indian Community, Minnesota Chippewa Tribe, Mohawk Nation Territory, Montana Tribal Fish and Wildlife Commission, Prairie Band of Potawatomi, Prairie Island Tribal Council, Pueblo of Pojoaque, Saginaw Chippewa Tribe of Michigan, Shakopee Mdewakanton Sioux Community, United Sioux Tribes, Upper Sioux Community and Yankton Sioux Tribe.

June 10–11, 1998 Calls were made to tribes affiliated with Yellowstone (Blackfeet, Confederated Salish and Kootenai, Crow, Eastern Shoshone, Gros Ventre and Assiniboine, Nez Perce, Northern Arapaho, Northern Cheyenne, Rosebud Sioux, Shoshone-Bannock) to notify them that the *Bison Management Draft Environmental Impact Statement* had been mailed and encourage them to make comments on it; announce tentative consultation meeting dates for the DEIS; and to check on the progress of their review of Yellowstone National Park *Draft Ethnographic Overview and Assessment.*

A total of five government-to-government consultation meetings were conducted with American Indian tribes during the public comment period. Through these meetings, National Park Service representatives met with 18 tribes and 4 American Indian organizations.

July 29–30, 1998 Calls were made to the chair, governor, or president of the following 50 tribes regarding the schedule for upcoming government-to-government consultation meetings: Assiniboine/Sioux, Blackfeet, Chippewa Cree, Choctaw, Cheyenne River Sioux, Confederated Salish and Kootenai, Confederated Tribes of the Colville, Confederated Tribes of the Umatilla, Crow, Crow Creek Sioux, Eastern Shoshone, Elk Valley Rancheria, Flandreau Santee Sioux, Gros Ventre and Assiniboine, Ho-Chunk, Kalispel, Lower Brule Sioux, Loyal Shawnee, Menominee, Mesa Grande Band, Modoc, Nambe-O-ween-ge Pueblo, Nez Perce, Northern Arapaho, Northern Cheyenne, Oglala Sioux, Oneida Tribe of WI, Picuris Pueblo, Pojoaque Pueblo, Ponca Tribe of Nebraska, Prairie Band Potawatomi, Prairie Island Indian Community, Rosebud Sioux, Round Valley Indian Tribe, San Juan Pueblo, Sandia Pueblo, Santee Sioux Tribe of Nebraska, Sault Ste. Marie Sioux Tribe of Chippewa, Shoshone-Bannock, Sisseton-Wahpeton Sioux, Spirit Lake Sioux, Spokane Tribe of Indians, Standing Rock Sioux, Southern Ute, Taos Pueblo, Tesuque Pueblo, Ute, Ute Mountain Ute, Winnebago Tribe of Nebraska, and Yankton Sioux.

July 29, 1998 A letter inviting tribes to the August 12, 1998 meeting was sent to the 50 tribes listed above, the Native Village of Fort Yukon, and the Native Village of Mekoryuk.

July 29–August 4, 1998 The July 29, 1998 letter was faxed to chairs of the 52 tribes listed above.

August 12, 1998 Government-to-government consultation held at Yellowstone National Park, Mammoth School. Hosted by Yellowstone National Park, the following 15 tribes and Native American organizations had representatives (18 total) in attendance: Assiniboine Tribe, Blackfeet Nation, Cheyenne River Sioux Tribe, Confederated Salish and Kootenai Tribe, Crow Tribe, Gros Ventre Tribe, HoChunk Nation – Wisconsin, Inter-Tribal Bison Cooperative, Northern Arapaho Nation, Prairie Band of Potawatomi Nation, Rosebud Sioux Tribe, Sisseton Wahpeton Sioux Tribe, United Sioux Tribes of South Dakota, Winnebago Tribe of Nebraska, Yankton Sioux Tribe.

August 18, 1998 Letters were sent to the chairpersons of Cheyenne River Sioux, Confederated Salish and Kootenai, Gros Ventre and Assiniboine, and Shoshone-Bannock to thank them for agreeing to host government-to-government consultation meetings. Also, on August 18, 1998, a letter was sent to the Crow tribal chairperson asking them to host a government-to-government consultation meeting. No response was received.

August 21, 1998 Letters were sent to the chairs of all 54 tribes listed above (including the native village of Fort Yukon and the native village of Mekoryuk) to announce the dates and locations of the government-to-government consultations hosted by tribes.

August 21, 1998 Government-to-government consultation hosted by Cheyenne River Sioux Tribe, Eagle Butte, SD (20 attendees, included 4 Pine Ridge Sioux representatives).

August 27, 1998 Resolution regarding the bison issue made by the Oglala Sioux Tribe – Resolution No. 98-75.

August 28, 1998 Government-to-government consultation hosted by Shoshone-Bannock Tribal Council, Fort Hall, ID (13 attendees).

September 1998 Public hearings in Denver, CO; Salt Lake City, UT; San Francisco, CA; Austin, TX; Meeting with Inter-Tribal Bison Council.

September 8, 1998 Government-to-government consultation hosted by Confederated Salish and Kootenai Tribal Council, Pablo, MT (12 attendees).

September 10, 1998 Government-to-government consultation hosted by Gros Ventre and Assiniboine Tribal Council, Fort Belknap, MT (15 attendees).

September 23, 1998 The *Bison Management Environmental Impact Statement* Team Captain Sarah Bransom attended and spoke at the Inter-Tribal Bison Cooperative's 1st Annual National Conference in Denver, Colorado.

October 1, 1998 Resolution regarding the bison issue made by the White Earth Tribal Council – Resolution No. 057-98-003.

October 5, 1998 Resolution regarding the bison issue made by the Upper Sioux Community – Resolution No. 37-98.

October 6, 1998 Resolution regarding the bison issue made by the Yankton Sioux Tribe – Resolution No. 98-304.

October 9, 1998 The tribal chairperson, governor, or president of the following 58 tribes were called by Yellowstone National Park to alert them of the extension of the *Draft Environmental Impact Statement* comment period to November 12, 1998. Copies of the press release were faxed to Cheyenne River Sioux, Nambe Pueblo and Winnebago Tribe of Nebraska at their request.

Assiniboine and Sioux, Blackfeet, Cheyenne River Sioux, Chippewa Cree, Choctaw, Confederated Salish and Kootenai, Confederated Tribes of the Colville Indian Reservation, Crow, Crow Creek Sioux, Eastern Shoshone, Elk Valley Rancheria, Flandreau Santee Sioux, Gros Ventre & Assiniboine, Ho-Chunk Nation, Iowa Tribe of Kansas and Nebraska, Kaibab Paiute, Kalispel Tribe, Kickapoo of Kansas, Las Vegas Paiute, Lower Brule Sioux, Loyal Shawnee Tribe, Menominee Indian Tribe of WI, Mesa Grande Band of Mission Indians, Moapa, Modoc Tribe of Oklahoma, Nambe Pueblo, Nez Perce, Northern Arapaho, Northern Cheyenne, Oglala Sioux, Omaha Tribe of Nebraska, Oneida Tribe of WI, Picuris Pueblo, Pojoaque Pueblo, Ponca Tribe of Nebraska, Prairie Band Potawatomi, Prairie Island Indian Community, Rosebud Sioux, Round Valley Indian Tribe, Sac and Fox of Missouri, San Juan Pueblo, Sandia Pueblo, Santee Sioux Tribe of Nebraska, Sault Ste. Marie Sioux Tribe of Chippewa, Shoshone-Bannock, Sisseton-Wahpeton Sioux, Southern Ute, Spirit Lake Sioux, Spokane Tribe of Indians, Standing Rock Sioux, Taos Pueblo, Tesuque Pueblo, United Sioux Tribes, Ute, Ute Mountain Ute, Winnebago Tribe of Nebraska, Yankton Sioux.

October 15, 1998 Resolution regarding the bison issue made by the Lac Courte Oreilles – Resolution No. 98-76.

October 18–23, 1998 Resolution "Yellowstone Buffalo Slaughter" made by the National Congress of American Indians – Resolution No. MRB-98-019.

October 28, 1998 Resolution regarding the bison issue made by the Santee Sioux Tribe of Nebraska – Resolution No. 99-09.

February 8, 1999 Yellowstone's Assistant Director, Yellowstone Center for Resources, Wayne Brewster and Chief, Branch of Cultural Resources, Laura Joss were invited to and attended a meeting of One People, One Nation at Big Sky, Montana to give updates and answer questions about the *Bison Management Environmental Impact Statement* content and process.

February 27–28, 1999 Yellowstone personnel assisted with logistics and processed a Public Assembly Permit for a ceremony celebrating the arrival of approximately 100 American-Indian participants in the “Buffalo March” *(Tatonka Oyate Mani - They Walk for the Buffalo People)*. The marchers left Rapid City, South Dakota on February 7, 1999 to travel 507 miles by foot, car, and horse to Yellowstone National Park to honor and bring attention to the plight of Yellowstone's bison herd. Led by Sicangu Lakota traditional leader, Joseph Chasing Horse, the group relayed a buffalo pipe, three sacred staffs adorned with eagle feathers, buffalo hide, and leather, and a ceremonial bundle containing other items relating to bison. Participants included Lakota, Nez Perce, Navajo, Apache, Tuscarora, Algonquin, Crow, Assiniboine, Southern Ute, Northern Cheyenne and Blackfeet tribal members.

According to the report *Content Analysis of Public Comment for the Interagency Bison Management Plan for the State of Montana and Yellowstone National Park,* prepared by National Park Service in March 1999, 16,501 comments were received regarding the cultural resources section of the Environmental Impact Statement. Most of the comments were received from Native Americans. Comments were received from the following 40 tribes and tribal organizations: Assiniboine and Sioux, Assiniboine Tribe, Fort Belknap Tribal Council, Blackfeet Tribe, Cheyenne River Sioux Tribe, Chippewa Cree, Colville Confederated Tribes, Confederated Salish and Kootenai Tribes, Confederated Tribes of the Yakama Indians, Crow Tribe, Flandreau Santee Sioux, Fort Belknap Community Council, Gros Ventre Tribe, Ho-Chunk Nation, Indigenous Support Coalition of Oregon, Inter-Tribal Bison Cooperative, Lower Brule Sioux Tribe, Lower Sioux Indian Community, Minnesota Chippewa Tribe, Minnesota Indian Affairs Council, Mohawk Nation Territory, Montana Tribal Fish and Wildlife Commission, Nez Perce Tribe, North American Independent Indigenous Community, Northern Arapaho Nation, Northern Cheyenne Tribe, Oglala Sioux, Prairie Band of Potawatomi, Prairie Island Tribal Council, Pueblo of Pojoaque, Rosebud Lakota Tribal Council, Saginaw Chippewa Tribe of Michigan, Shakopee Mdewakanton Sioux Community, Shoshone-Bannock Tribes, Sisseton-Wahpeton Sioux, Thunder Nation, United Sioux Tribes, United Tribes Technical College, Upper Sioux Community, Winnebago Tribe of Nebraska, Yankton Sioux Tribe.

March 29, 1999 Yellowstone’s Wildlife Biologist John Mack and Chief, Branch of Cultural Resources, Laura Joss met with a group of 25 Lakota, Nakota, Dakota, Ojibowa and Ponca youths and adults who had traveled to the park to lean about bison. Mack and Joss presented the park's bison management program, the Bison Management EIS and the tribal consultation process, and answered questions.

April 12–13, and 19, 1999 Yellowstone staff called and mailed letters to the tribal chairs of the following 78 tribes to notify them of the May 21, 1999 consultation meeting to discuss comments received on the *Bison Management Environmental Impact Statement*.

Assiniboine and Sioux, Bad River Band of Lake Superior Chippewa Indians, Blackfeet, Bois Forte Chippewa Tribe, Cheyenne River Sioux, Chippewa Cree, Choctaw, Commanche Indian Tribe of Oklahoma, Confederated Salish and Kootenai, Confederated Tribes of the Colville Indian Reservation, Confederated Tribes of the Umatilla Indian Reservation, Crow, Crow Creek Sioux, Eastern Shoshone, Elk Valley Rancheria, Flandreau Santee Sioux, Fond Du Lac Chippewa Tribe, Gros Ventre and Assiniboine, Ho-Chunk Nation, Iowa Tribe of Kansas and Nebraska, Kaibab Paiute, Kalispel Tribe, Kickapoo of Kansas, Kiowa, Lac Courte Oreilles, Las Vegas Paiute, Leech Lake Chippewa Tribe, Little Shell of Chippewa, Lower Brule Sioux, Lower Sioux Mdwakanton, Loyal Shawnee Tribe, Menominee Indian Tribe of WI, Mesa Grande Band of Mission Indians, Mille Lacs Band Chippewa Tribe, Modoc Tribe of Oklahoma, Nambe Pueblo, Native Village of Fort Yukon, Native Village of Mekoryuk, Nez Perce, Northern Arapaho, Northern Cheyenne, Northern Ute, Oglala Sioux, Omaha Tribe of Nebraska, Oneida Tribe of WI, Onondaga Nation, Picuris Pueblo, Pojoaque Pueblo, Ponca Tribe of Nebraska, Prairie Band of Potawatomi, Prairie Island Indian Community, Pueblo of Santo Domingo, Rosebud Sioux, Round Valley Indian Tribe, Sac and Fox of Missouri, Saginaw Chippewa Tribe of Michigan, San Juan Pueblo, Sandia Pueblo, Santee Sioux Tribe of Nebraska, Sault Ste. Marie Sioux Tribe of Chippewa, Shakopee Mdewakanton Sioux Community, Shoshone-Bannock, Sisseton-Wahpeton Sioux, Southern Ute, Spirit Lake Sioux, Spokane Tribe of Indians, St. Regis Mohawk Tribe, Standing Rock Sioux, Taos Pueblo, Tesuque Pueblo, Tuscarora Nation, Upper Sioux of Minnesota Community, Ute, Ute Mountain Ute, White Earth Tribal Council, Winnebago Tribe of Nebraska, Yakama Tribal Nation and Yankton Sioux.

April 23, 1999 Invitations to the May 21, 1999 *Bison Management Environmental Impact Statement* consultation meeting were faxed to the following 23 tribes: Assiniboine and Sioux, Blackfeet, Cheyenne River Sioux, Confederated Salish and Kootenai, Crow, Crow Creek Sioux, Eastern Shoshone, Flandreau Santee Sioux, Gros Ventre and Assiniboine, Kiowa, Little Shell of Chippewa, Lower Brule Sioux, Nez Perce, Northern Arapaho, Northern Cheyenne, Oglala Sioux, Rosebud Sioux, Shoshone-Bannock, Sisseton-Wahpeton Sioux, Spirit Lake Sioux, Standing Rock Sioux, Winnebago Tribe of Nebraska, Yakama Tribal Nation, and Yankton Sioux.

May 5–19, 1999 Calls were made to the following tribes to remind them of the May 21, 1999 consultation meeting and to get names of attendees: Assiniboine and Sioux, Blackfeet, Cheyenne River Sioux, Confederated Salish and Kootenai, Crow, Crow Creek Sioux, Eastern Shoshone, Gros Ventre and Assiniboine, Kiowa, Lower Brule Sioux, Nez Perce, Northern Arapaho, Northern Cheyenne, Oglala Sioux, Rosebud Sioux, Shoshone-Bannock, Sisseton-Wahpeton Sioux, Spirit Lake Sioux, Standing Rock Sioux, and Yankton Sioux.

May 6, 1999 Invitation to the May 21, 1999 *Bison Management Environmental Impact Statement* consultation meeting faxed to Zuni Pueblo at their request.

May 13, 1999 Resolution regarding the bison issue made by the Modoc Tribe of Oklahoma – Resolution No. 99-20.

May 17, 1999 Resolution regarding the bison issue made by the Mille Lacs Band of Ojibwe – Resolution No. 08-03-70-99.

May 17, 1999 Resolution regarding the bison issue made by the Turtle Mountain Band of Chippewa Indians - Resolution No. TMBC1367-05-99.

May 17, 1999 Resolution regarding the bison issue made by the Winnebago Tribe of Nebraska – Resolution No. 99-54.

May 21, 1999 Government-to-government consultation held at Yellowstone National Park, Mammoth School. The following 16 tribes and Native American organizations had representatives (29 total) in attendance: Assiniboine - Fort Belknap, Cheyenne River Lakota, Colville, Comanche Tribe, Confederated Salish and Kootenai, Inter-Tribal Bison Cooperative, Little Shell Band Chippewa, Nez Perce, Oglala Sioux, Onondaga Nation, Rosebud Sioux Tribe, Santee Sioux, Sisseton-Wahpeton Sioux, Turtle Mountain Chippewa, Winnebago Tribe of Nebraska, Yurok-Karuk.

June 17, 1999 Resolution regarding the bison issue made by the Santee Sioux Tribe of Nebraska – Resolution No. 99-36.

July 26, 1999 Yellowstone's Chief, Branch of Cultural Resources, Laura Joss and Wendy Clark, Wildlife Biologist, made presentations to 15 Dull Knife College students from Lame Deer, MT (Northern Cheyenne reservation). Topics were Yellowstone's bison program, cultural resources program, and the park's work with American Indian tribes.

August 4, 1999 Resolution regarding the *Bison Management Environmental Impact Statement* made by the Lac Courte Oreilles Band of Lake Superior Chippewa Indians – Resolution No. 99-78.

August 30 – September 10, 1999 Invitations were faxed, mailed, or phoned to the following 84 tribes to invite them to the October 6, 1999 government-to-government consultation meetings on the *Bison Management Environmental Impact Statement* and Winter Use *Environmental Impact Statement* at Yellowstone National Park. Invitations were also sent to Governor Racicot, Montana; USDA/APHIS; Forest Supervisor, Gallatin National Forest.

Assiniboine and Sioux, Bad River Band of Lake Superior Chippewa Indians, Blackfeet, Bois Forte Chippewa Tribe, Cheyenne River Sioux, Chippewa Cree, Choctaw Nation of Oklahoma, Comanche Indian Tribe of Oklahoma, Confederated Salish and Kootenai, Confederated Tribes of the Colville Indian Reservation, Confederated Tribes of the Umatilla Indian Reservation, Crow, Crow Creek Sioux, Eastern Shoshone, Elk Valley Rancheria, Flandreau Santee Sioux, Fond Du Lac Chippewa Tribe, Gros Ventre and Assiniboine, Ho-Chunk Nation, Iowa Tribe of Kansas and Nebraska, Kaibab Paiute, Kalispel Tribe, Karuk Tribe of California, Kickapoo of Kansas, Kiowa, Lac Courte Oreilles, Las Vegas Paiute, Leech Lake Chippewa Tribe, Little Shell of Chippewa, Lower Brule Sioux, Lower Sioux Medwakanton, Loyal Shawnee Tribe, Menominee Indian Tribe of WI, Mesa Grande Band of Mission Indians, Mille Lacs Band Ojibwe Tribe, Modoc Tribe of Oklahoma, Nambe O-ween-ge Pueblo, Native Village of Fort Yukon, Native Village of Mekoryuk, Nez Perce, Northern Arapaho, Northern Cheyenne, Northern Ute, Oglala Sioux, Omaha Tribe of Nebraska, Oneida Tribe of WI, Onondaga Nation, Paiute Tribe, Picuris Pueblo, Pojoaque Pueblo, Ponca Tribe of Nebraska, Prairie Band of Potawatomi, Prairie Island Indian Community, Pueblo of Santo Domingo, Red Lake Tribal Council, Rosebud Sioux, Round Valley Indian Tribe, Sac and Fox of Missouri, Sac and Fox of Oklahoma, Saginaw Chippewa Tribe of Michigan, San Juan Pueblo, Sandia Pueblo, Santee Sioux Tribe of Nebraska, Sault Ste. Marie Sioux Tribe of Chippewa, Shakopee Mdewakanton Sioux Community, Shoshone-Bannock, Sisseton-Wahpeton Sioux, Southern Ute, Spirit Lake Sioux, Spokane Tribe of Indians, St. Regis Mohawk Tribe, Standing Rock Sioux, Taos Pueblo, Tesuque Pueblo, Turtle Mountain Band of Chippewa, Tuscarora Nation, Tuscarora of North Carolina, Upper Sioux of Minnesota, Ute Mountain Ute, White Earth Tribal Council, Winnebago Tribe of Nebraska, Yankton Sioux, Yurok Tribe of California, Zuni Pueblo.

October 6, 1999 Government-to-government consultation meetings on the *Draft Environmental Impact Statement* and *Winter Use Environmental Impact Statement* held at Yellowstone National Park. The following nine tribes and Native American organizations had representatives (11 total) in attendance: Assiniboine & Sioux – Fort Peck; Cheyenne River Sioux; Confederated Salish & Kootenai; Crow; Inter-Tribal Bison Cooperative; Lac Courte Oreilles; Nez Perce; Rosebud Sioux; Winnebago Tribe of Nebraska.

March 9–10, 2000 Invitations to the April 26, 2000 government-to-government consultation meeting on the *Draft Environmental Impact Statement* to be held at Yellowstone National Park were faxed and mailed to the following tribes:

Assiniboine and Sioux, Bad River Band of Lake Superior Chippewa Indians, Blackfeet, Bois Forte Chippewa Tribe, Cheyenne River Sioux, Chippewa Cree, Choctaw Nation of Oklahoma, Comanche Indian Tribe of Oklahoma, Confederated Salish and Kootenai, Confederated Tribes of the Colville Indian Reservation, Confederated Tribes of the Umatilla Indian Reservation, Crow, Crow Creek Sioux, Eastern Shoshone, Elk Valley Rancheria, Flandreau Santee Sioux, Fond Du Lac Chippewa Tribe, Gros Ventre and Assiniboine, Ho-Chunk Nation, Iowa Tribe of Kansas and Nebraska, Kaibab Paiute, Kalispel Tribe, Karuk Tribe of California, Kickapoo of Kansas, Kiowa, Lac Courte Oreilles, Las Vegas Paiute, Leech Lake Chippewa Tribe, Little Shell of Chippewa, Lower Brule Sioux, Lower Sioux Medwakanton, Loyal Shawnee Tribe, Menominee Indian Tribe of WI, Mesa Grande Band of Mission Indians, Mille Lacs Band Ojibwe Tribe, Modoc Tribe of Oklahoma, Nambe O-ween-ge Pueblo, Native Village of Fort Yukon, Native Village of Mekoryuk, Nez Perce, Northern Arapaho, Northern Cheyenne, Northern Ute, Oglala Sioux, Omaha Tribe of Nebraska, Oneida Tribe of WI, Onondaga Nation, Paiute Tribe, Picuris Pueblo, Pojoaque Pueblo, Ponca Tribe of Nebraska, Prairie Band of Potawatomi, Prairie Island Indian Community, Pueblo of Santo Domingo, Red Lake Tribal Council, Rosebud Sioux, Round Valley Indian Tribe, Sac and Fox of Missouri, Sac and Fox of Oklahoma, Saginaw Chippewa Tribe of Michigan, San Juan Pueblo, Sandia Pueblo, Santee Sioux Tribe of Nebraska, Sault Ste. Marie Sioux Tribe of Chippewa, Shakopee Mdewakanton Sioux Community, Shoshone-Bannock, Sisseton-Wahpeton Sioux, Southern Ute, Spirit Lake Sioux, Spokane Tribe of Indians, St. Regis Mohawk Tribe, Standing Rock Sioux, Taos Pueblo, Tesuque Pueblo, Turtle Mountain Band of Chippewa, Tuscarora Nation, Tuscarora of North Carolina, Upper Sioux of Minnesota, Ute Mountain Ute, White Earth Tribal Council, Winnebago

Tribe of Nebraska, Yakama Tribal Nation, Yankton Sioux, Yurok Tribe of California, and Zuni Pueblo.

March 9–15, 2000 Yellowstone staff called the tribal chairs or governors of the above listed tribes to notify them of the April 26, 2000 government-to-government consultation meeting on the *Bison Management Environmental Impact Statement* to be held at Yellowstone National Park.

April 26, 2000 Government-to-government consultation held at Yellowstone National Park, YACC Camp Training Room.

Wallowing bison.

Summary of comments from Native American Tribes and Tribal Organizations

Tribes or Tribal Organizations	Summary of Comments and Concerns Regarding Cultural Significance of Bison	Summary of Comments Regarding Management of the Yellowstone Bison Herd	Comments Received
American Indian Movement	bison are our way of life, our relatives, our sustenance; bison are sacred		10-6-98
Assiniboine Tribe	buffalo sacred; economic benefits of buffalo for tribe; bison provide life and substance to tribes, religiously and physically; "dear to our hearts;" buffalo based culture	park should make bison brucellosis-free; tribes would like to manage herd jointly with park; bison should not be managed like cattle; Indian harvest of buffalo should reflect respectful relationship between bison and Indian peoples; as little management as possible is best for bison	8-12-98 8-25-98 9-10-98
Cheyenne River Sioux Tribe	part of our creation story; buffalo sacred; a spiritual relationship exists between buffalo and our people; our relatives; bison were mainstay for economy and life of Lakota people; historic treaty hunting rights; we are the buffalo people; due to lack of healthy buffalo diet, diabetes and other health problems have arisen; without buffalo our culture can not exist, we cannot exist; buffalo are a symbol of our strength and unity	keep bison inside the park boundaries; feed the bison to keep them in the park; if the slaughter of buffalo continues, someone should take care of them properly	8-12-98 8-21-98 9-17-98 9-29-98
Chippewa Cree Indians	bison are sacred beings given not only to Indian people, but to all people to share, to eat	regarding the slaughter: we use that buffalo, every part of it; nothing is wasted or thrown away	8-25-98
Colville Confederated Tribes	bison are spiritually sacred; fundamental to the practice and retention of many religious ceremonies and traditions	bison should remain wild and free-roaming	Comment Database

Summary of comments from Native American Tribes and Tribal Organizations (continued)

Tribes or Tribal Organizations	Summary of Comments and Concerns Regarding Cultural Significance of Bison	Summary of Comments Regarding Management of the Yellowstone Bison Herd	Comments Received
Commanche Caddo	bison sacred	regarding the slaughter: this should be done in a sacred way, it should not be done inhumanely	9-29-98
Confederated Salish and Kootenai Tribes of the Flathead Nation	oral documentation provides accounts of our people traveling down to Yellowstone to hunt bison; historic treaty hunting rights; history of bison follows the history of our people in this country; bison are a critical element of indigenous culture	federal government should buy private lands around the park for bison; possibility of tribes taking over management of Yellowstone; if desecration is a form of bison management, tribes should be given first opportunity to hunt; free-ranging bison are being managed as livestock; elk brucellosis carriers	8-12-98 9-8-98 Comment database
Confederated Tribes of the Yakima Indian Nation		bison should remain wild and free-roaming and be managed by wildlife professionals; park should acquire winter range lands outside of park	Comment database
Crow Tribe	still have hunting and fishing rights in Yellowstone	National Park Service's bison "hands-off" policy is responsible for the killing of bison	8-12-98
Flandreau Santee Sioux Tribe		park should be allowed to preserve an intact wilderness ecosystem with healthy free-ranging wildlife; ranchers should bear the responsibility of preventing spread of brucellosis	Comment database
Fort Belknap Community Council		bison should remain wild and free-roaming and be managed by wildlife professionals; park should acquire winter range lands outside of park	Comment database
Fort Belknap Tribal Council		low to mid-income people did not receive first choice of bison meat	9-10-98

Summary of comments from Native American Tribes and Tribal Organizations (continued)

Tribes or Tribal Organizations	Summary of Comments and Concerns Regarding Cultural Significance of Bison	Summary of Comments Regarding Management of the Yellowstone Bison Herd	Comments Received
Gros Ventre Tribe	bison are important to all Indians	park should make bison brucellosis-free	9-10-98
Ho-Chunk Nation	connection that exists still between Indians and bison		8-12-98
Indian Counseling Center		bison should remain wild and free-roaming and be managed by wildlife professionals; park should acquire winter range lands outside of park	Comment database
Indian Summer Festivals		bison should remain wild and free-roaming and be managed by wildlife professionals; park should acquire winter range lands outside of park	Comment database
Inter-Tribal Bison Cooperative	unique relationship between tribes and buffalo that takes a lifetime to understand; our existence depends on bison's existence; restoration of bison to tribal lands has healed the people; legends and creation stories say we are the same as buffalo; bison are the lifeblood of our tribal people; historic treaty hunting rights	bison should remain wild and free-roaming and be managed by wildlife professionals; park should acquire winter range lands outside of park	7-27-98 8-12-98 8-25-98 9-23-98 10-6-98 Comment database
Lower Brule Community College		bison should remain wild and free-roaming and be managed by wildlife professionals; park should acquire winter range lands outside of park	Comment database

Summary of comments from Native American Tribes and Tribal Organizations (continued)

Tribes or Tribal Organizations	Summary of Comments and Concerns Regarding Cultural Significance of Bison	Summary of Comments Regarding Management of the Yellowstone Bison Herd	Comments Received
Lower Brule Sioux Tribe		bison should remain wild and free-roaming and be managed by wildlife professionals; park should acquire winter range lands outside of park	Comment database
Lower Sioux Indian Community		bison should remain wild and free-roaming; wrongful killing of bison should be stopped and turned over to Indian people	Comment database
Minnesota Chippewa Tribe	bison are a source of pride for all of us	bison should remain wild and free-roaming and be managed by wildlife professionals; park should acquire winter range lands outside of park	Comment database
Minnesota State, Indian Affairs Council		bison should remain wild and free-roaming and be managed by wildlife professionals; park should acquire winter range lands outside of park	Comment database
Montana Tribal Fish and Wildlife Commission	Plains Tribes were nomadic hunters whose lives depended upon the buffalo; every part of the bison was used for food, tools and religious ceremonies; we hold this magnificent creature in high esteem and recognize its role in the survival of our species; bison represent our spirit and remind us of how our lives were once lived, “free and in harmony with nature;” the buffalo is a sacred animal that nurtured our people for generations; buffalo skull is used in the sacred powerful Sundance (Native American celebration of the New Year-spring); a covenant exists between Indian people, the Creator, and buffalo; historic treaty hunting rights	bison should remain wild and free-roaming and be managed by wildlife professionals; park should acquire winter range lands outside of park; regarding management of the slaughter of bison, many bison carcasses did not go to Indians; elk and other ungulates are possible carriers of brucellosis	Comment database

Summary of comments from Native American Tribes and Tribal Organizations *(continued)*

Tribes or Tribal Organizations	Summary of Comments and Concerns Regarding Cultural Significance of Bison	Summary of Comments Regarding Management of the Yellowstone Bison Herd	Comments Received
Nez Perce Tribal Executive Committee	bison are woven into the culture of the Nez Perce people; the value of harvesting bison helps the Nez Perce people relive an ancient tradition; they provide great economic benefits for the tribe; eating native foods such as bison will help eliminate diabetes and other health problems	National Park Service should manage the bison resource as a cultural resource on behalf of, and for the benefit of, Nez Perce people; bison should remain wild and free-roaming; cattle should be kept separate from bison in public lands near the park; elk are possible carriers of brucellosis	Comment database
Northern Arapaho Tribe		Indians will happily manage bison on their own lands	8-12-98
Northern Cheyenne Tribe	we are the buffalo tribe and we understand their needs; we value buffalo highly in our culture; they were a total source of life for our people as well as other tribes; the buffalo is a sacred symbol within our religious ceremonies	park must make bison brucellosis-free; park needs to feed the buffalo so they will not leave the park	8-25-98
Oglala Lakota College	bison have a spiritual connection with native tribes and all people; bison are in every part of the Lakota circle of life; they represent religion, nutrition, culture, strength, education, spiritual guidance, family values and harmony; bison are excellent cultivators of the land from their hoof actions to their wallowing activities	bison should remain wild and free-roaming and be managed by wildlife professionals; park should acquire winter range lands outside of park; slaughter of the bison is poor management; grazing permits should be modified so that bison and cattle can be on public lands at separate times of year	Comment database
Oglala Sioux Tribe	historically, the people and the buffalo had a co-existence; we feel that buffalo are of great historical, cultural, and spiritual significance; bison have a significant role in the health of the ecosystem; buffalo meat contributed to a healthy diet for Indians	the recent buffalo slaughter was politically, not scientifically, motivated; our tribe opposes unnecessary killing, confining or interference with the natural migration of Yellowstone buffalo on public lands	8-21-98 10-6-98 Comment database

SUMMARY OF COMMENTS FROM NATIVE AMERICAN TRIBES AND TRIBAL ORGANIZATIONS *(CONTINUED)*

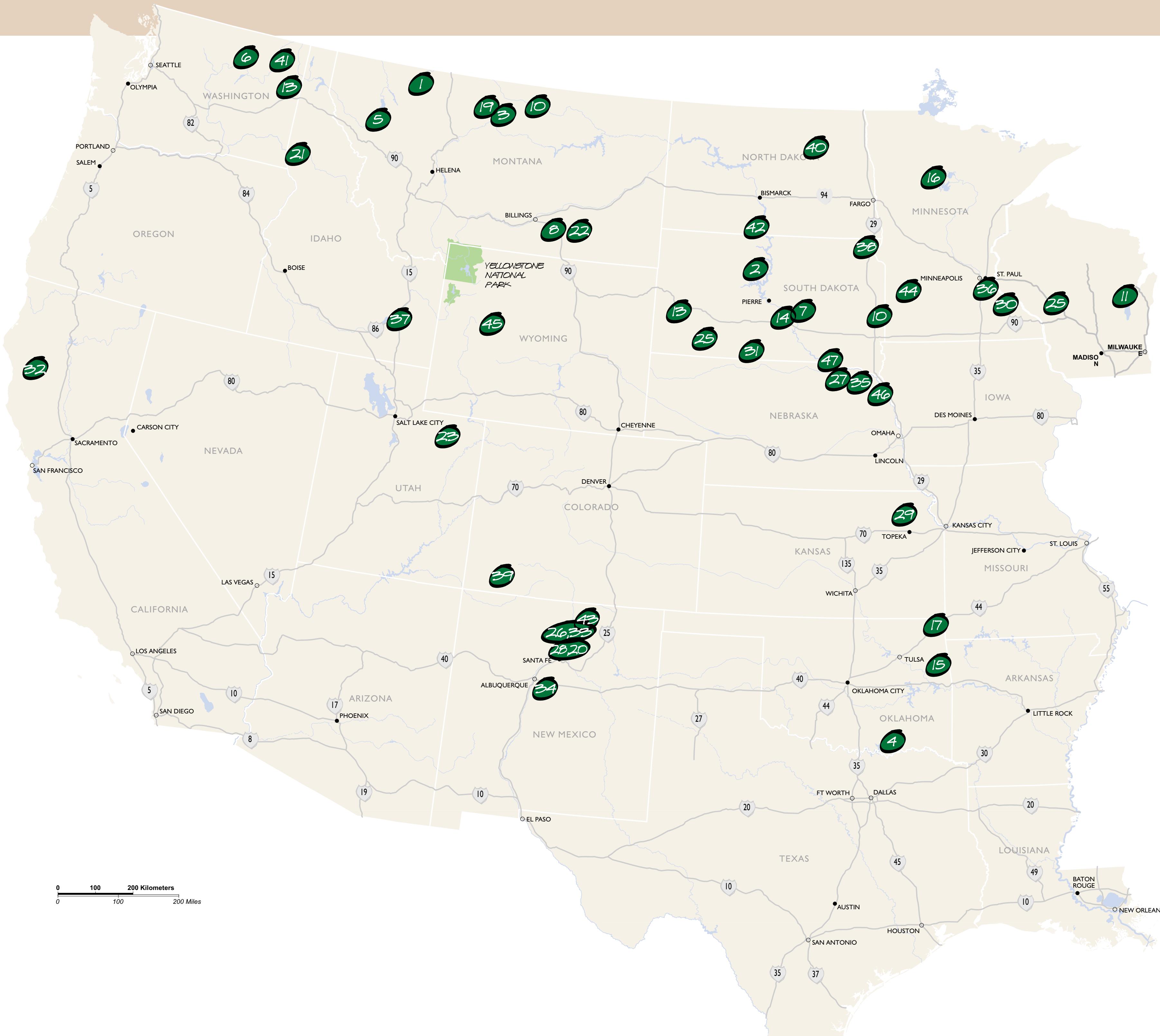
Tribes or Tribal Organizations	Summary of Comments and Concerns Regarding Cultural Significance of Bison	Summary of Comments Regarding Management of the Yellowstone Bison Herd	Comments Received
Prairie Band of Potawatomi Nation	bison are important to the religious beliefs and value system of our people		8-12-98
Prairie Island Tribal Council		bison should remain wild and free-roaming and be managed by wildlife professionals; park should acquire winter range lands outside of park	Comment database
Pueblo of Pojoaque		bison should remain wild and free-roaming	Comment database
Saginaw Chippewa Tribe	buffalo are important to the native people because they represent survivors, just like the native people are survivors		9-29-98
Shakopee Mdewakanton Sioux Community		bison should remain wild and free-roaming	Comment database
Shoshone-Bannock Tribes	buffalo are very holy to us because they are held in our religious ceremonies; bison are a very important resource in our everyday life, for they provide food, shelter, clothing and tools; part of our culture is having live buffalo; bison are both a natural and cultural resource for us; historic treaty hunting rights	bison should remain wild and free-roaming; bison should not be expected to stay only in park; park needs to feed the buffalo so they will not leave the park; if bison must die, tribal members should have the right to kill them for they will be treated with respect; tribes need to be considered as co-managers of the land, not public entities; tribes should have a direct say in management; the new management strategy is not managing the bison; management of the naturals (bison) rather than the domestics (cattle); why shoot the bison if the cattle have brucellosis?	8-18-98 Comment database
Sisseton Wahpeton Sioux Tribe		National Park Service should focus on the problem of bison leaving the park	8-12-98

Summary of comments from Native American Tribes and Tribal Organizations (continued)

Tribes or Tribal Organizations	Summary of Comments and Concerns Regarding Cultural Significance of Bison	Summary of Comments Regarding Management of the Yellowstone Bison Herd	Comments Received
Thunder Nation		current management of bison is motivated by money and no one is listening to Mother Earth	10-6-98
United Sioux Tribes		tribes and National Park Service should provide technical management assistance to each other; when there is excess buffalo, management, animal control, and environmental development are important	8-12-98
United Tribes Technical College		bison should remain wild and free-roaming and be managed by wildlife professionals; park should acquire winter range lands outside of park	Comment database
Upper Sioux Community	we feel that buffalo are of great historical, cultural, and spiritual significance; bison have a significant role in the health of the ecosystem	bison should remain wild and free-roaming; management by slaughtering bison is politically, not scientifically, motivated	Comment database
Winnebago Tribe of Nebraska	our relationship to the bison represents a historical and cultural linkage and it is part of who we are; when bison returned to our tribal lands, people were beginning to understand little things about their lives that they did not know before; bison took care of us in the past, and we will care for them in the future	bison should remain wild and free-roaming and be managed by wildlife professionals; park should acquire winter range lands outside of park; management by slaughtering bison cannot be condoned	8-12-98 Comment database
Yankton Sioux Tribe	we feel that buffalo are of great historical, cultural, and spiritual significance; bison have a significant role in the health of the ecosystem; bison are sacred to our people because we lived off them for hundreds of years	bison should remain wild and free-roaming; management by slaughtering bison is politically, not scientifically, motivated	8-12-98 Comment database

TRIBAL COMMENT

INTERAGENCY BISON MANAGEMENT PLAN EIS



TRIBES AND ORGANIZATIONS ARE SHOWN WHO PROVIDED THE FOLLOWING INFORMATION DURING THE OFFICIAL PUBLIC COMMENT PERIOD

TRIBES WITH BUFFALO

TRIBES/ORGANIZATIONS EXPRESSING INTEREST IN RECEIVING LIVE BISON / QUARANTINE

LOCATION ON MAP

1 Blackfeet Nation
2 Cheyenne River Sioux Tribe
3 Chippewa-Cree Indians of the Rocky Boy's Reservation
4 Choctaw Nation of Oklahoma
5 The Confederated Salish and Kootenai Tribes of the Flathead Reservation
6 Confederated Tribes of the Colville
7 Crow Creek Sioux Tribe
8 Crow Tribe
9 Flandreau Santee Sioux Tribe
10 Fort Belknap Indian Community
11 Ho–Chunk Nation
12 The Intertribal Bison Cooperative
13 Kalispel Indian Community
14 Lower Brule Sioux Tribe
15 Loyal Shawnee Tribe
16 Minnesota Chippewa Tribe
17 Modoc Tribe of Oklahoma
18 Mohawk Nation (not depicted on map)
19 Montana Tribal Fish and Wildlife Commission
20 Pueblo of Nambe
21 Nez Perce Tribe
22 Northern Cheyenne Tribe
23 Northern Ute Indian Tribe
24 Oglala Sioux Tribe
25 Oneida Tribe of Wisconsin
26 Pueblo of Picuris
27 Ponca Tribe of Nebraska
28 Prairie Band of Potawatomi
29 Prairie Island Indian Community
30 Pueblo of Pojoaque
31 Rosebud Sioux Tribe
32 Round Valley Indian Tribes
33 Pueblo of San Juan
34 Pueblo of Sandia
35 Santee Sioux Tribe
36 Shakopee Mdewakanton Sioux Community
37 Shoshone–Bannock Tribes
38 Sisseton–Walpeton Sioux Tribe
39 Southern Ute Indian Tribe
40 Spirit Lake Tribe
41 Spokane Tribe
42 Standing Rock Sioux Tribe
43 Pueblo of Taos
44 Upper Sioux Indian Community
45 Shoshone and Arapaho Tribe
46 The Winnebago Tribe of Nebraska
47 Yankton Sioux Tribe

March 2000

United States Department of the Interior

FISH AND WILDLIFE SERVICE
MONTANA FIELD OFFICE
100 N. PARK, SUITE 320
HELENA, MONTANA 59601
PHONE (406) 449-5225, FAX (406) 449-5339

File: M.25 - Yellowstone National Park (I) July 20, 2000

Memorandum

To: Mr. Michael Finley, Superintendent, Yellowstone National Park

From: Acting Field Supervisor, Montana Field Office

Subject: Biological Assessment for the Environmental Impact Statement for the Interagency Bison Management Plan for the State of Montana and Yellowstone National Park

This memorandum responds to your March 17 letter requesting U.S. Fish and Wildlife Service (Service) review of the biological assessment for the Interagency Bison Management Plan for the State of Montana and Yellowstone National Park (Park), as it pertains to Federally listed threatened and endangered species. The Service received your request on March 27 and received additional information related to the testing of RB51 vaccine from your staff on July 6.

The Service has reviewed the biological assessment and the additional information you provided on July 6, as well as information in our files related to listed species in the Greater Yellowstone Ecosystem. The best information available leads us to concur with the determinations that the proposed actions are not likely to adversely affect the threatened bald eagle (*Haliaeetus leucocephalus*), grizzly bear (*Ursus arctos horribilis*), Canada lynx (*Lynx canadensis*), or the non-essential experimental gray wolf (*Canis lupus*). Therefore, pursuant to section 402.13(a) of the 50 CFR, formal consultation is not required. The Service bases its concurrence on the entire body of information presented in the biological assessment, additional information you sent, information in our files, and on discussions with Park staff and Interagency Study Team members.

According to your biological assessment, the proposed action may slightly alter the distribution of bison during the winter, but should result in bison numbers similar to current management practices. Therefore the number of bison available to listed species, primarily grizzly bears and wolves, as carrion or prey should not be substantively affected by the proposed action. Most recent information on grizzly bears and wolves in the Yellowstone area indicate stable to increasing populations.

However, as your biological assessment acknowledges, ungulate meat may become even more important to the nutritional well-being of grizzly bears if whitebark pine seeds and cutthroat trout are reduced by introduced organisms. The draft *Conservation Strategy for Grizzly Bears in the Yellowstone Area* (November 1999) calls for monitoring these and other grizzly bear foods. The Interagency Grizzly Bear Study Team is currently conducting whitebark pine transects in the Yellowstone ecosystem and the Park is monitoring the effects of lake trout reduction efforts on cutthroat trout population trends. If such research or other information should suggest a decline in whitebark pine seed production or other key grizzly bear foods to levels that would impact grizzly bear nutritional status, an additional evaluation of the bison management plan should occur. The evaluation should examine, among other issues, whether

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bison management is substantively limiting the number of bison carcasses available to grizzly bears or whether the plan could be modified to allow bison to provide additional food resources for bears. Furthermore, if during implementation of the action, effects on grizzly bears or other threatened or endangered species occur other than those described in your March 15 biological assessment, a revised biological evaluation may be necessary. The Service will then issue a letter of concurrence or nonconcurrence for the revised biological evaluation.

The biological assessment and the additional information indicate that research related to the effects of direct or indirect exposure to RB51 on non-target species indicate that the vaccine did not cause morbidity or mortality in any of the species tested. Testing the effects of RB51 on grizzly bears will not be final until the spring of 2002. However, preliminary results of testing the effects of RB51on grizzly bears indicate no mortality or overt clinical or pathological effects. Further, as your additional information explains, prior to spring of 2002, grizzly bears would be exposed to only a relatively small number of vaccinated bison. Considering that large doses of the vaccine was found to be safe in coyotes (a surrogate for wolves), you do not expect that indirect exposure to RB51 will result in adverse effects to wolves. If preliminary or final results of further testing indicate that any of the above listed species may be adversely affected by indirect exposure to the vaccine, then a revised biological assessment will be necessary. The Service will then issue a letter of concurrence or nonconcurrence for the revised biological evaluation. Your additional information indicates that prior to population-wide remote vaccination of bison with RB51 in Yellowstone, further analysis under the National Environmental Policy Act and the Endangered Species Act would occur.

If you have questions regarding this issue, please contact Anne Vandehey at the addresses provided above or by phone (406) 449-5225 ext. 212. Your cooperation and assistance in meeting our joint responsibilities under the Endangered Species Act are appreciated.

Sincerely,

Kate Walker

Acting Field Supervisor

cc: Governor Marc Racicot, Helena
Mr. Dave Garber, USFS, Gallatin National Forest, Bozeman
ES, R-6, MS 60101, attn. Susan Linner
Grizzly Bear Coordinator, USFWS, Missoula

Glossary, bibliography, index

GLOSSARY

APHIS. Animal and Plant Health Inspection Service, United States Department of Agriculture.

Bison calf. Bison that are 0–12 months old.

Bison yearling. Bison that are 13–24 months old.

Biological assessment. The information prepared by or under the direction of the federal agency concerning listed and proposed species and designated and proposed critical habitat that may be present in the action area and the evaluation of potential effects of the action on such species and habitat (50 CFR 402.02).

Blood testing. The withdrawal of a sample of blood from the vein of an animal for testing on one or more serological tests that are available.

BRD. Biological Resources Division.

Brucellosis. Infection with or disease caused by the *Brucella abortus* bacteria. Also known as Bangs disease, undulant fever, and contagious abortion.

Culling. The removal of an animal from the herd.

DEIS. Draft Environmental Impact Statement.

Depopulate. The removal of all animals in the herd.

Deterministic model. A model based on averages.

Ecosystem. A complex community of plants and animals that function as an ecological unit in nature.

Effectiveness (or efficacy). Ability to impact protection from abortion and infection when exposed to brucellosis.

EIS. environmental impact statement.

Endangered species. Any species that is in danger of extinction throughout all or a significant portion of its range [16 USC 1532(6)].

Epidemiology. That field of biological science which is concerned with the relationship to the various factors and conditions which determine the frequencies and distributions of an infectious process, a disease, or a physiological state in an animal population.

Feedgrounds. An area where a herd of elk are given feed during the winter months.

FEIS. final environmental impact statement.

Genetic diversity. A source of genetic material supplied by a diverse population of animals.

Grazing allotments. A permit authorizing livestock to use national forest system or other lands under U.S. Forest Service control for the purpose of livestock production [see 36 CFR 222.1(b)(5)].

Groomed trails. In the context of this environmental impact statement, mechanically smoothed and compacted rough surfaces of snow that provide easier movement across in either snow machines, snow cats, or skis.

GYA. Greater Yellowstone Area.

GYIBC. Greater Yellowstone Interagency Brucellosis Committee.

Heifer. A female calf.

Immunity. A specific defense mechanism of resistance brought about by the interaction of a specific agent and the humoral and cellular factors of the host.

Immunocontraception. The induction of contraception by injecting an animal with a compound that produces an immune response that precludes pregnancy.

Infectious period. The time during which the microorganism progeny are making an exit from the host or are available for transfer to a new host.

Jeopardy opinion. The decision of the U.S. Fish and Wildlife Service that an action would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing reproduction, numbers, or distribution of that species (see CFR 402.02).

Management situation 1 and 2 (MS1 and MS2). MS1 areas are those that contain grizzly bear population centers and/or habitat that is needed for the survival and recovery of the species. In those areas the needs of the grizzly bear are given priority over other management considerations. MS2 areas have grizzly bears, although there are no population centers, and no highly suitable habitat occurs. The needs of the grizzly bear will be given consideration where feasible. Management should accommodate grizzly populations and/or habitat use if feasible, but not to the extent of excluding other land uses. Where the importance of habitat resources for recovery has not been determined, other uses prevail to the extent that they do not preclude the possibility of restratification to MS1.

MEPA. Montana Environmental Policy Act.

MOU. Memorandum of Understanding.

NEPA. National Environmental Policy Act.

Pathogenesis. The natural course of a disorder from the first interaction with the disease provoking stimuli to the changes in form and function which result or until equilibrium is reached or recovery, defect, disability, or death ensues; OR,

The natural course of a disease that results in changes in form or function of the body until the animal recovers, becomes disabled, or dies.

Plowed roads. Roads where snow has been removed.

Policies. A definite course of action selected by a government agency to guide and determine present and future decisions.

Range management. Range management is the manipulation of rangeland components to obtain the optimum combination of goods and services for society on a sustained basis. Range management has two basic components: (1) protection and enhancement of the soil-vegetation, and (2) maintenance and improvement of the outputs of consumable range products such as red meat, fiber, wood, water, and wildlife. The range management profession deals with the plant-animal interface rather than dealing with either plants or animals in isolation. The distinguishing feature of range management is that it deals with manipulation of grazing activities by large herbivores so that both the plant and animal production will be maintained or improved (Holechek, Pieper, and Herbel 1989, 5).

Reactor. An animal that is officially classified as a brucellosis reactor based on results of one of more official tests or is positive on bacterial examination for field strain *Brucella abortus.*

Recovery. Improvement in the status of a listed species to the point at which listing no longer is appropriate under the criteria set out in 16 USC 1533(a)(1).

Recovery zone. The Yellowstone grizzly bear recovery zone as defined by the Grizzly Bear Management Subcommittee of the Interagency Grizzly Bear Committee.

Recruitment. The natural addition of mature calves into the adult herd.

Regulation. A rule or order issued by a government agency, having the force of law under power granted through legislation.

Reservoir of infection. The natural habitat of the organism in which an infectious agent lives, multiplies, and depends primarily for survival reproducing itself in such a manner that it can be transmitted to animal or man.

Riparian areas. Zones of transition from aquatic to terrestrial ecosystems, dependent on surface and or subsurface water for existence, and which manifest the influence of that water.

Rules. An accepted set of written procedures having the force of regulations but established by agreement between the industries, agencies, and groups involved.

Rut. Breeding activity.

Sensitive species. Those plant and animal species identified by a regional forester for which population viability is a concern.

Seroconversion. The process whereby an animal that was previously seronegative becomes seropositive.

Serological. The use of serum.

Serology. The study of disease and infection in populations by the measurement of serum variables present in blood serum.

Seronegative. An animal with no detectable antibody in blood serum.

Seropositive. An animal with a detectable antibody titre in blood serum.

Slaughter. The killing of livestock or other animals and preparation of their meat, hides, etc., for sale or for other use by humans.

Special management area (or SMA). An area contiguous to the park where some of all bison may be tolerated for part or all of the year without increasing the risk of brucellosis transmission to domestic livestock.

Stochastic. Random or unpredictable event such as severe winter weather, snow depth, and access to forage.

Test and slaughter. A procedure that involves capture, handling, and testing a group of cattle or bison for brucellosis, tuberculosis, or other communicable livestock diseases, identifying the seropositives, and removing them from the herd to a slaughter establishment for slaughter.

Threatened and endangered species. Any species of fish, wildlife, and plants that is listed as threatened or endangered by the U.S. Fish and Wildlife Service.

Threatened species. Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range [16 U.S.C. 1532(20)].

Undulant fever. A persistent human brucellosis caused by several species of *Brucella* and marked primarily by remittent fever, pain and swelling in the joints, and great weakness.

Wild, free-ranging bison. Bison not routinely handled by humans that can move without restrictions within specific geographic areas.

Wildlife management. The science of protecting, restoring, or manipulating populations of wild animals in order to meet any of several objectives ranging from intense human use to preservation of complete natural processes.

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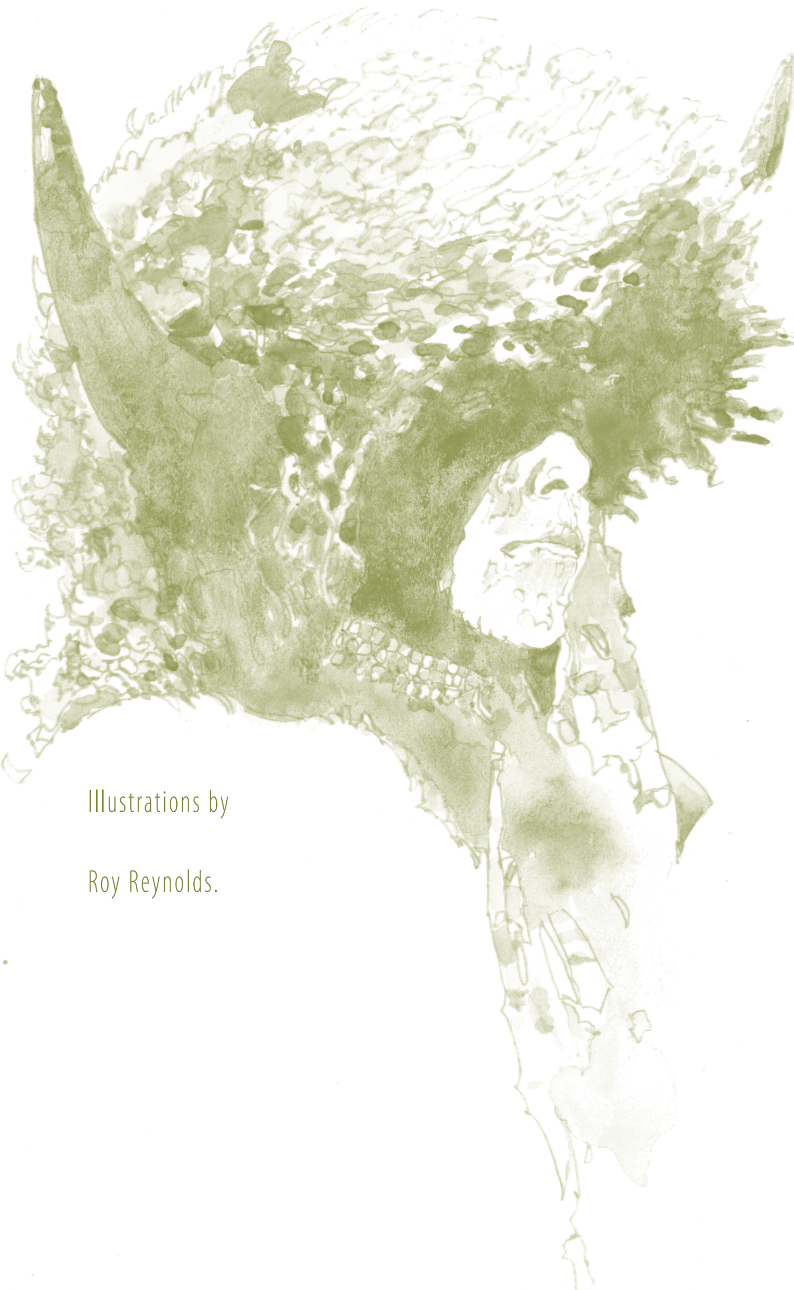

Illustrations by

Roy Reynolds.

As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

NPS D-655a/August 2000

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