



Remote Vaccination Program to Reduce the Prevalence of Brucellosis in Yellowstone Bison

Record of Decision

March 3, 2014

Recommended:

A handwritten signature in dark ink, appearing to read "Daniel N. Wenk", is written over a horizontal line.

Daniel N. Wenk
Superintendent, Yellowstone National Park

Approved:

A handwritten signature in dark ink, appearing to read "Sue E. Masica", is written over a horizontal line.

Sue E. Masica
Regional Director, Intermountain Region
National Park Service

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

RECORD OF DECISION

REMOTE VACCINATION PROGRAM TO REDUCE THE PREVALENCE OF
BRUCELLOSIS IN YELLOWSTONE BISON

Yellowstone National Park
Idaho, Montana, and Wyoming

The Department of the Interior, National Park Service (NPS) has prepared this Record of Decision (ROD) on the Remote Vaccination Program to Reduce the Prevalence of Brucellosis in Yellowstone Bison Environmental Impact Statement (EIS). This ROD includes a description of the background of the project, a statement of the decision made, synopses of other alternatives considered, the basis for the decision, a description of the environmentally preferable alternative, a listing of measures to minimize environmental harm, and an overview of public and agency involvement in the decision-making process. A finding of non-impairment for the selected action, which is required under NPS *Management Policies, 2006*, is also attached to this Record of Decision.

BACKGROUND OF THE PROJECT

Brucellosis is a contagious disease caused by the non-native bacteria *Brucella abortus* that may induce abortions or the birth of non-viable calves in livestock and wildlife. When livestock are infected, there is economic loss to producers from slaughtering infected animals, increased brucellosis testing requirements, and possibly, decreased marketability of their cattle. Bovine brucellosis has been eradicated in cattle herds across most of the United States, with the exception of occasional outbreaks in the greater Yellowstone ecosystem where bison and elk persist as one of the last reservoirs of infection. Approximately 40 to 60% of Yellowstone bison have been exposed to *Brucella abortus* bacteria.

After intensively managing bison numbers for 60 years through husbandry and culling, the Superintendent of Yellowstone National Park instituted a moratorium on removing ungulates (hoofed animals) within the park in 1969 and allowed their numbers to fluctuate in response to weather, predators, and resource limitations. Bison numbers increased rapidly under this policy and large winter migrations out of the park and into the state of Montana began in the late 1980s. Attempts to deter these movements or bait bison back into the park failed and about 3,100 bison were removed from the population during 1984 through 2000. These migrations and removals led to a series of conflicts among federal and state agencies, environmental groups, and livestock producers regarding issues of bison conservation and brucellosis containment. As a result, the federal government and State of Montana agreed to a court-mediated Interagency Bison Management Plan (IBMP) in 2000 that established guidelines for managing the risk of brucellosis transmission from bison to cattle by implementing hazing, testing for brucellosis

exposure, shipments of bison to domestic slaughter facilities, hunting outside Yellowstone National Park, vaccination, and other actions near the park boundary.

Vaccination has been proposed as a method to reduce brucellosis in Yellowstone bison by diminishing the clinical effects (induced abortions and the birth of live animals with *Brucella*) that maintain the disease through transmission. The currently available vaccine for bison (strain RB51) has decreased further brucellosis transmission in experimentally infected bison, but is less effective at preventing infection and will not prevent vaccinated bison (or cattle) from reacting positively on blood tests if they are exposed to natural strains of *Brucella*. Experimental data for hand-syringe vaccination of captive bison with strain RB51 suggest a 50 to 60% reduction in abortions, 45 to 55% reduction in infection of uterine or mammary tissues, and a 10 to 15% reduction in infection at parturition. It is uncertain how this vaccine would perform in wild bison, though results will likely vary from the experimental trials. Regardless, strain RB51 vaccine is currently the best vaccine available for bison and cattle. Other vaccines (e.g., strain 82, DNA) are undergoing testing, but it will likely be more than a decade before these evaluations are completed and their use is possible on bison or cattle in the United States.

The NPS agreed in the 2000 ROD for the IBMP to evaluate a remote-delivery vaccination program for bison inside Yellowstone National Park. Remote delivery is distinguished from hand (syringe) delivery that currently occurs in capture pens near the park boundary because it would not involve the capture and handling of bison. The most feasible strategy for remote delivery of vaccine at this time is using an air-powered rifle to deliver an absorbable bullet with a vaccine payload that is freeze dried or photo-polymerized. The goal of vaccination is to deliver a low risk, effective vaccine to calf and female bison inside the park to (1) decrease the probability of individual bison shedding *Brucella abortus*, (2) lower the brucellosis infection rate of Yellowstone bison, and (3) reduce the risk of brucellosis transmission to cattle outside the park. The migration of bison across the park boundary onto essential winter ranges in Montana would be preserved to facilitate their long-term conservation.

A final EIS for the Remote Vaccination Program to Reduce the Prevalence of Brucellosis in Yellowstone Bison was released for public review on January 15, 2014. Alternative A, the No Action Alternative, described the current hand vaccination program under the IBMP that has been implemented at capture facilities near the boundary of Yellowstone National Park. Alternative B described a combination of the hand vaccination program at capture facilities and a remote-delivery vaccination strategy that would focus exclusively on young, non-pregnant bison. Alternative C described a combination of the hand vaccination program at capture facilities and remote-delivery vaccination of young, non-pregnant bison and adult females within the park prior to mid-gestation. For each alternative, the NPS analyzed potential environmental impacts divided into the following categories: Yellowstone bison population; other wildlife; threatened, endangered and sensitive species; ethnographic resources; human health and safety; visitor use and experience; and park operations.

PURPOSE AND NEED FOR ACTION

As stated in the final EIS, the purpose of the EIS is to evaluate the potential implementation of a remote delivery vaccination program for bison within Yellowstone National Park to address the

NPS responsibilities as directed by the IBMP. The purpose and need for a vaccination program is to (1) decrease abortion events in bison due to the non-native disease brucellosis, (2) reduce the transmission of brucellosis among bison, (3) increase tolerance for untested bison on essential winter ranges in Montana when cattle are not present, and (4) reduce the need for capture and shipments of large numbers of bison to slaughter. Expanding the current bison vaccination program to include remote delivery vaccination may further protect livestock from the risk of brucellosis infection, which may help to increase acceptance for bison that have not been tested for brucellosis to seasonally migrate outside of Yellowstone National Park.

The 2000 IBMP indicated that the release of untested bison outside of the park would begin after implementation of a remote delivery vaccination program inside of the park, but only after additional evaluation on the proposed remote vaccination program was completed pursuant to the National Environmental Policy Act (NEPA). This final EIS and ROD will complete the NEPA requirement as directed in the IBMP.

The following objectives were developed for the EIS:

- Preserve the migration of bison across the park boundary onto essential winter ranges in Montana to facilitate the long-term conservation of bison.
- Decrease the probability of individual bison shedding the *Brucella abortus* bacteria.
- Lower the brucellosis infection rate of bison.
- Reduce the risk of brucellosis transmission to cattle outside of the park.
- Develop, test, and use a safe and effective system to deliver vaccine to bison.

ALTERNATIVES CONSIDERED

The EIS analyzed three alternatives: Alternative A—the No Action Alternative; Alternative B—Remote Delivery Vaccination for Young Bison Only; and Alternative C—Remote-Delivery Vaccination for Young Bison and Adult Females.

Alternative A (the No Action Alternative) continues the current hand vaccination program (syringe vaccination of strain RB51 vaccine) that has been occasionally implemented at the Stephens Creek capture facility in Yellowstone National Park, in accordance with the 2000 IBMP. Under this alternative, no in-park, remote-delivery vaccination operations would occur. The Stephens Creek facility would continue to be the only location in the park where bison are vaccinated during some years when some bison migrate to the park boundary and are able to be captured. Also, some bison may be vaccinated outside of the western boundary of Yellowstone National Park at the Duck Creek capture facility. The current technique used for vaccinating bison is to capture a small group of animals by hazing them into a holding pen and subsequently moving these animals through a series of progressively smaller pens to a squeeze chute where staff draws blood for diagnosing brucellosis exposure status. Bison diagnosed with no antibody response to brucellosis antigen can be re-handled and given a subcutaneous injection of strain RB51 vaccine via hand syringe. Currently, only calves and yearlings are vaccinated. Current mitigation measures and adaptive management strategies outlined in the 2000 IBMP would continue.

Alternative B—Remote Delivery for Young Bison Only, includes a combination of the existing hand-vaccination program at Stephens Creek and implementation of a remote-delivery vaccination program that would focus exclusively on calves (both sexes) and yearling females. This alternative expands the vaccination program to the whole park, but continues targeting calves and yearlings as in Alternative A. Remote delivery vaccination could occur from mid-September through November and April through June, each year, in areas where bison are distributed in the park. Remote delivery vaccination would not involve capture and handling of individual animals and would use the most feasible technology available to remotely vaccinate bison (currently an air-powered rifle that delivers an absorbable projectile with freeze dried or photo-polymerized vaccine encapsulated in the payload compartment). Under Alternative B, it is anticipated that remote delivery of vaccine to calves and yearlings may take many months, requiring rotating field teams to systematically travel across the vast landscape (1+ million acres) surveying and vaccinating bison. The duration of delivery time is uncertain; it may take a few years to learn bison tolerance for humans in close proximity delivering the vaccine. Alternative B would include the possibility of remote vaccination by two methods: fixed location or active approach. The specific strategies for delivering vaccine to bison would involve teams of two to four individuals traveling across the landscape by foot, horseback, skis, snowshoes, or in vehicles along roadways, searching for bison. The distance of approach for both fixed location and active approach would be contingent upon the behavioral response of bison. Multiple field teams may be deployed at any given time once field delivery is initiated. In some cases, the field team would be able to work around the group of bison while they delivery vaccine to target individuals. If advantageous and suitable sites exist for a fixed location, a portion of the team may relocate to the fixed location while the remaining team members provide low levels of pressure to move bison toward the delivery team waiting at the fixed location. The final EIS details proposed mitigation measures under Alternative B.

Alternative C— Remote-Delivery Vaccination for Young Bison and Adult Females, would expand the current hand-syringe vaccination program described under Alternative A to include a remote delivery program focusing on calves (both sexes) and adult and yearling females within Yellowstone National Park. The methods for traveling the landscape, locating groups of bison, and approaching groups to deliver vaccine would be the same as those described under Alternative B. This alternative differs from alternatives A and B in that it also includes remote vaccination of adult female bison. Therefore, more bison would be vaccinated under Alternative C than alternatives A and B. Delivery would focus on a period from mid-September through November, but avoid delivery to adult females during the third trimester of pregnancy (mid-January through May), to avoid the possibility of vaccine-induced abortions. The final EIS details proposed mitigation measures under Alternative C.

DECISION

Description of the Selected Action

The NPS will implement Alternative A—No Action Alternative, as the selected action. Under the selected action, there will be no remote delivery of vaccine to bison. The NPS will continue to implement actions currently approved under the 2000 IMBP, which occasionally include capturing some bison that move to the boundary of Yellowstone National Park, containing them

within fenced facilities, individually handling each animal, conducting blood tests to determine past exposure to brucellosis, and vaccinating young, non-pregnant animals with strain RB51 vaccine. Under the selected action, the NPS will continue to implement the IBMP, as adjusted, to conserve Yellowstone bison while mitigating the risk of brucellosis transmission from bison to livestock in Montana. Also, the NPS will continue to use adaptive management to learn more about brucellosis and answer uncertainties, as well as to develop or improve suppression techniques that could be used to facilitate effective outcomes, minimize adverse impacts, and lower operational costs of possible efforts to reduce brucellosis prevalence in the future.

Mitigating Measures/Monitoring under the Selected Action

The following mitigation measures will be implemented as part of the selected action:

- All vaccination operations inside Yellowstone National Park will occur at the Stephens Creek capture facility or during immobilization operations for research and monitoring (such as the fitting of bison with radio collars). Vaccination of bison at Stephens Creek typically occurs during a short time period (February and March).
- Staff involved in vaccination at Stephens Creek or immobilization operations will be limited in number.
- The NPS will order vaccine from a supplier when it is imminent that management operations will require vaccination of calves and yearling bison. Consequently, there will be little or no storage time at the capture facility.
- Staff will clean and disinfect areas where vaccine is mixed and used, and all individuals will wear sturdy rubber or latex gloves when handling the vaccine. Following work with the vaccine, all staff will wash with soap and hot water.
- For the safety of park visitors, an area closure will be enforced to keep park visitors from inadvertently encountering operations near the Stephens Creek capture facility. No visitors will be allowed near immobilization operations.
- The NPS estimates that fewer than 500 doses of *Brucella abortus* vaccine, strain RB51, Live Culture, Code 1261.00 (licensed product for use in cattle prepared by Colorado Serum Company) will be used each year. The product will be formulated at approximately two milliliters per dose and received in small shipments as needed through the winter operations season. To ensure accurate safety records, the NPS will keep records of the number of doses of each type of vaccine received, used, and discarded.
- Stringent bison handling protocols to address safety concerns and minimize risk to humans implementing the vaccination program will be implemented and include:
 - Calm, controlled movement of animals through facility chutes that will reduce injuries.
 - Dominant, aggressive animals, such as large bulls, will be separated from smaller bison when animals are held at the capture facility. Filling pens with bison of similar age classes reduces injury risk due to confinement in small areas.
 - Monitoring of captive bison will be conducted daily to detect animals likely to abort or complete their pregnancy in the capture facility. These animals will be separated from the remainder of the group to protect against infectious shedding events.
 - All bison held in the capture facility will be provided adequate food and water.
- All syringes and needles used for vaccination will be sterilized to prevent infection.

- Vaccines will be given subcutaneously (under the skin) rather than in muscle tissue to reduce trauma.
- Vaccination at the Stephens Creek capture facility will typically occur in February and March to avoid conflicts with listed threatened and endangered species.
- The NPS will notify state wildlife agencies and American Indian tribes with recognized treaty harvest rights near Yellowstone of forthcoming vaccination efforts through established working groups and communications networks so that hunters can be cautioned not to consume the meat of a bison killed within 21 days of being vaccinated.
- The NPS may mark vaccinated animals (e.g., ear tags) during hand-syringe delivery vaccination at capture facilities or field immobilization for subsequent monitoring to assess the extent of protective immune responses.
- A safety officer will be assigned to observe operations and recommend safety guidelines.
- The NPS will implement a health screening (i.e., medical monitoring) program for brucellosis exposure to biologists that handle vaccine and bison.

The selected action will also continue the implementation of mitigating measures described in the 2000 ROD for the IBMP, the 2008 Adaptive Adjustments Memorandum, and subsequent adaptive management documents. The NPS will continue monitoring and research on the relationship between vaccine-induced immune responses and protection from clinical disease (e.g., abortions). Examples of monitoring and research projects that could be conducted as part of the adaptive management strategy to improve our understanding of brucellosis suppression and vaccination include:

- Identifying the ecological factors that influence immune suppression and vulnerability to infection;
- Evaluating if multiple vaccinations (i.e., booster vaccination) within a given year or across years increase protection from clinical disease (i.e., abortions and infectious live births);
- Evaluating if late-winter vaccinations elicit sufficient immune responses that are protective the following year;
- Identifying methods that effectively increase vaccination coverage (i.e., the proportion of each age class that can be consistently vaccinated each year), and evaluating whether this level of coverage combined with the estimated efficacy of the vaccine is adequate to reduce the level of infection within the bison population;
- Validating active infection in selectively culled bison based on age and immune responses measured with standard screening tests;
- Evaluating the safety and effectiveness of alternate vaccines and delivery methods for domestic livestock and wildlife, including cost-benefit analyses of different options;
- Evaluating behavioral responses of animals subject to vaccine delivery methods to avoid deleterious effects;
- Evaluating whether there are genetic effects to bison as a result of selective culling practices (e.g., shipment to slaughter or quarantine) that are based on brucellosis exposure (e.g., presence of antibodies);
- Conducting social science studies about human values and attitudes towards the conservation of wildlife affected by brucellosis to improve the effective exchange of information and enhance collaborative decision making; and

- Holistically evaluating brucellosis infection in bison and elk throughout the greater Yellowstone ecosystem and considering landscape-level brucellosis management strategies.

Under the selected action, the NPS will also continue to work with other federal and state agencies, American Indian tribes, academic institutions, non-governmental organizations, and other interested parties to develop holistic management approaches, monitoring and research projects that could be conducted to improve the adaptive management decision process, and better vaccines, delivery methods, and diagnostics for reducing the prevalence of brucellosis in bison and elk and transmissions to cattle.

OTHER ALTERNATIVES CONSIDERED

Several alternatives or actions suggested during scoping by other agencies or the public were not examined in detail in the final EIS. Consistent with section 1502.14 of the Council on Environmental Quality (1978) regulations for implementing the National Environmental Policy Act, this section identifies those alternatives and actions, and summarizes the reason(s) why they were not considered further.

Low Risk and Effective Remote Delivery System with Vaccine that Results in No Detectable Change. The purpose and need for the action would not be met by a low risk and effective delivery system that uses a vaccine (e.g., strain 19) showing no detectable difference between vaccinated bison and bison infected by natural exposure to *Brucella abortus* bacteria currently found in the environment. Use of this type of vaccine would prevent effective monitoring of a reduction in brucellosis prevalence because vaccine titers would be indistinguishable from natural infection using currently available diagnostic tests.

Low Risk and Effective Delivery System that Results in Permanent Changes in Behavior or Demography. Aerial delivery (e.g., helicopter) of a low risk and effective vaccine using remote delivery equipment (e.g., bio-bullet, dart) was considered and rejected because it would likely result in a detectable change in bison behavior and/or demography (e.g., survival). Also, the NPS does not intend to conduct extensive capture operations in the interior of Yellowstone National Park to handle most bison and inject them with vaccine because this repetitive action would detract from the wild qualities of the bison population and could have a major adverse impact on the distribution of bison.

Vaccination with Killed Vaccines. Current vaccines against brucellosis such as strains 19 and RB51 contain live, weakened bacteria because, to date, experiments with vaccines consisting of heat-killed or subcellular fractions of *Brucella* bacteria have not induced substantial protective immune responses. However, live vaccines generally do not prevent infection, can induce abortions, and are infectious to humans. Thus, the NPS may reconsider this alternative when scientists develop a killed vaccine that induces protective levels of immunity (i.e., resistance) in bison, and the technology (including delivery) is ready for implementation.

Vaccination with Remote Delivery Methods that have High Liabilities. Oral and aerosol remote delivery mechanisms were considered, but rejected, due to the uncertainty regarding their

effectiveness to deliver a consistent recommended dosage to the intended portion of the bison population, while avoiding delivery to unintended bison and other species. In addition, the use of darts containing live *Brucella abortus* vaccine was considered but determined not feasible because of the liability to visitors and other wildlife from lost darts left about the landscape.

Buy Out Cattle in Yellowstone, Madison, and Gallatin River Valleys. This alternative would provide a means for reducing the risk of brucellosis transmission to cattle and address the larger issue of whether wild bison can be accommodated in Montana outside the currently negotiated conservation area boundary. However, buying out cattle would not decrease abortion events in bison due to the non-native disease brucellosis or reduce the transmission of *Brucella abortus* among bison. Also, buying out cattle producers to cease ranching on private lands in the Yellowstone, Madison, and Gallatin River valleys would be an enormously costly venture that would not solve the debate about the extent of the conservation area boundary for bison near Yellowstone National Park.

BASIS FOR THE DECISION

The NPS chose Alternative A—No Action Alternative as the selected action based on substantial uncertainties associated with vaccine efficacy, delivery of vaccine, duration of the vaccine-induced protective immune response, diagnostics, potential adverse impacts to bison behavior and visitor experience (wildlife viewing), existing management flexibilities, and evaluation of public comments on the EIS. The NPS has identified that implementation of a remote vaccination program at this time would not substantially suppress brucellosis in Yellowstone bison and could have unintended adverse effects to the bison population and visitor experience due to:

- Our limited understanding of bison immune responses to brucellosis suppression actions such as vaccination;
- The absence of an easily distributed and highly effective vaccine (e.g., 10 to 15% reduction in infection; short duration of immune protection; cannot vaccinate females in second half of pregnancy);
- Limitations of current diagnostic and vaccine delivery technologies (e.g., inconsistent vaccine hydrogel formulation; short rifle range; no rapid diagnostics for live animals);
- Effects of bison nutrition, condition, and pregnancy/lactation during winter that lessen protective immune responses from vaccination;
- Potential adverse consequences (e.g., injuries; changes in behavior) to wildlife and visitor experience from intrusive brucellosis suppression activities (e.g., capture; remote vaccination); and
- Chronic infection in elk which are widely distributed and would almost certainly re-infect bison if brucellosis prevalence in bison was significantly reduced from current levels.

The NPS has determined that the Selected Alternative best meets the objectives outlined in the purpose and need. The NPS determined through comparison of alternatives and objectives that the Selected Alternative:

- Preserves the migration of bison across the park boundary onto essential winter ranges in Montana to facilitate the long-term conservation of bison. Remote vaccination of bison in the park interior will not occur and not significantly affect their migration patterns.

Though migration of bison across the park boundary onto winter ranges in Montana will be allowed, the NPS does not have jurisdiction over bison there. As a result, there is uncertainty regarding management actions and the extent of tolerance for bison in Montana.

- Could decrease the probability of individual bison shedding *Brucella abortus* bacteria somewhat if vaccination is implemented consistently. However, this alternative focuses on young bison and is unlikely to induce a long-term protective immune response from a single dose of attenuated live vaccine. It is difficult to achieve lifetime immunity to intracellular pathogens through vaccination.
- Includes an adaptive management strategy to focus on research that answers uncertainties, improves technology, and evaluates thresholds and strategies for action that may accomplish a reduction in brucellosis infection in the long term. A significant reduction in brucellosis prevalence is not feasible in the short term given the currently available vaccines, delivery methods, diagnostics, and ecology of wildlife species.
- Reduces the risk of brucellosis transmission from bison to cattle outside the park by maintaining separation between them. Also, the NPS is committed to careful consideration of measures to decrease the risk of brucellosis transmission from wildlife to cattle, including improved vaccines, delivery methods, and diagnostics when they become available.
- Develops, tests, and uses a safe and effective system to deliver vaccine to bison. Also, the Selected Action will include a research program to answer uncertainties, improve technology, minimize adverse impacts, and lower operational costs. Remote vaccination could be reconsidered in the future if advances in technologies and techniques for vaccines, delivery, and diagnostics occur.

Evaluation of potential impacts to park resources and values from each of the alternatives provided the basis for the Selected Action. The NPS determined through analyses in the EIS that the impacts of the Selected Action ranged from negligible to major for both adverse and beneficial impacts. Although the Selected Action has similar impacts to alternatives B and C, Alternative A was selected because it meets the project objectives the best with respect to the original selection criteria, given existing information. The Selected Action will create conditions that promote the protection of the following resources:

Bison Population

Adaptive management (research/monitoring) adjustments regarding the vaccination of bison at boundary capture facilities could include changes in vaccine, changes in the number and type of animals vaccinated, or discontinuing vaccination. Consideration of alternate vaccines or delivery of vaccine to additional animals would necessitate additional studies in controlled environments and the field to assess the level and duration of protective immune responses and the potential for abortions and shedding of *Brucella* bacteria following vaccination. Even though the population is reproductively prolific and has recovered rapidly from modest decreases in abundance, adverse impacts could occur from these studies in the short term due to removing some bison from the wild for research in captivity. Beneficial impacts could occur over the long term if new information from monitoring and research leads to advances in brucellosis suppression, a reduction in intensive management actions, and/or greater tolerance for wild bison in Montana.

Injuries and infection could result from the Selected Action in the short term, as well as stress sustained by bison during capture, confinement, physical restraint, and hand-syringe vaccination. Injured individuals could be more susceptible to predation and winter-kill following their release from captivity. However, Alternative B could result in young bison remotely vaccinated via bio-bullet having more tissue damage and a higher risk of bleeding and infection. More injuries could result from Alternative C because adult females would be vaccinated via bio-bullet in addition to young bison.

The proportion of bison vaccinated under alternatives B and C would be greater than the Selected Action, which could result in additional short term injuries, infection, and stress. Beneficial impacts will be minor under the Selected Action because access to bison for hand-syringe delivery of vaccine at the capture pens will be limited and model stimulations suggest the number of vaccinated bison that receive protection from the vaccine would be less than 1% over a 30-year period. Vaccinated young and non-pregnant bison may have some resistance against future brucellosis transmission. Alternative B could result in greater beneficial impacts in the long term from vaccinating a larger portion (10% over a 30-year period) of the population due to remote vaccination of young bison. Alternative C could result in beneficial impacts in the long term from vaccinating a larger portion (29% over a 30-year period) of the population due to remote vaccination of young and adult female bison. However, with alternatives B and C bison will likely react to remote delivery, which could reduce the portion vaccinated over time. Also, limitations of current remote delivery technologies (inconsistent vaccine hydrogel formulation; short rifle range) will reduce effectiveness and the portion of bison vaccinated over time.

The Selected Action and Alternative B could result in minor beneficial impacts from increasing the duration of protective immune response by vaccinating young and non-pregnant bison and providing them with some short term resistance against future brucellosis transmission. However, the duration of the protective immune response induced by strain RB51 is uncertain and a single dose given to calves and yearlings is not expected to provide lifetime resistance to *Brucella*. Alternative B presents a higher probability that bison vaccinated as calves would receive a second vaccination as yearlings. This booster vaccination could extend the duration of protective immune response, but is unlikely provide lifetime resistance to *Brucella*. Alternative C could have moderate to major beneficial impacts that result from vaccinating young and adult female bison. With remote vaccination, there is a higher probability that many bison will receive multiple vaccinations through their lives; thereby extending the duration of the vaccine-induced protective immune response. However, the effects of bison nutrition, condition, and pregnancy/lactation could substantially lessen these protective immune responses.

The Selected Action could result in minor to moderate beneficial impacts in the short and long term if brucellosis prevalence in the population is reduced by about 25% due to a lower probability of transmission following vaccination. Alternatives B and C could result in moderate and major beneficial impacts if prevalence is reduced by about 40% and 66%, respectively. However, it is highly uncertain where substantial brucellosis reduction can be achieved given the limited understanding of bison immune responses to suppression actions such as vaccination, absence of an easily distributed and highly effective vaccine, and limitations of current diagnostic and vaccine delivery technologies.

Alternatives B and C could result in moderate and major beneficial impacts by protecting bison from brucellosis-induced abortions if vaccinating and booster vaccinating provides bison with longer resistance against future brucellosis transmission. However, remote delivery of vaccine would likely induce less of a protective immune response than the Selected Action which vaccinates by hand-syringe. Also, less than 10% and 30% of the population is likely to be vaccinated under these alternatives. The Selected Action is likely to result in minor beneficial impacts by vaccinating a small portion of young and non-pregnant bison to provide them with some short-term resistance against future brucellosis transmission. Hand-syringe vaccination with strain RB51 provides only modest immune protection against *Brucella abortus*, including a 50-60 % reduction in abortions, 45-55% reduction in infection of uterine or mammary tissues, and a 10-15% reduction in infection at parturition.

The Selected Action could result in minor beneficial impacts in the short term due to a 50-60% reduction in future abortions by vaccinated animals. However, only a small portion of the population is likely to be vaccinated. Although less than 10% of the population is likely to be vaccinated under Alternative B, it could result in moderate beneficial impacts in the short term due to a reduction in future abortions by more vaccinated animals. The decrease in infectious events would likely be greater for Alternative C because it would maximize the number of bison (about 30%) that are vaccinated and should result in the lowest potential for bison transmitting brucellosis to cattle outside the park. Moderate to major beneficial impacts could result in the long term due to a reduction in future abortions by vaccinated young and adult female bison. Minor beneficial impacts for all alternatives could result in the short term from brucellosis-free bison being exposed to abortions by infectious bison in the capture facilities.

The Selected Action could result in adverse impacts to the behavior and demography of bison in the short and long term because confinement and feeding may lead to food conditioning, disease transmission, and disruption of traditional migratory patterns. However, alternatives B and C could result in greater impacts in the short and long term because of reasons described for the Selected Action, as well as alter bison behavior in a way that leads to avoidance of people, disruption of social bonds, and higher energy expenditures.

Anticipated cumulative impacts include other capture facilities, hunting, livestock operations, housing development, quarantine efforts, winter recreation, road and facility construction, and increased visitation. These actions occurring within the park and the surrounding area could result in negligible to major adverse and beneficial impacts for all alternatives in the EIS.

Other Wildlife Including Threatened and Endangered Species

The Selected Action would have less adverse impacts on other wildlife. In contrast, impacts from alternatives B and C would be greater and more widespread due to the implementation of park-wide remote vaccination. Some animals could be exposed to bio-bullets that deflect from the intended bison target and fall to the ground and are eaten. All alternatives will likely have negligible to minor effects on grizzly bears, lynx, critical habitat for lynx, and wolverines. For the purposes of Section 7 of the Endangered Species Act, the U.S. Fish and Wildlife Service concurred with the NPS determination of may affect, not likely to adversely affect Canada lynx and grizzly bear (the grey wolf and bald eagle have since been delisted) on January 12, 2007.

Ethnographic Resources

Impacts to ethnographic resources would be similar for all Alternatives but result in greater impacts under alternatives B and C than the Selected Action. Under alternatives B and C, remote vaccination operations would occur park-wide may create reduced value of Yellowstone bison by some tribal members due to vaccination.

Following guidance in the National Historic Preservation Act, Section 106 consultation with both the Wyoming and Montana State Historic Preservation Officers was completed in December, 2006, with concurrence of the NPS determination that no historic properties will be affected by the proposed action.

Health and Human Safety

All alternatives could result in minor to moderate impacts in the short and long term if humans are accidentally exposed to the vaccine. However, the impacts from alternatives B and C would constitute a slightly higher degree of human health and safety concern because the increase in the number of vaccines handled by staff and contractors results in a higher risk of exposure. The remote delivery aspect also adds a storage and handling component for field staff implementing delivery and laboratory staff encapsulating the vaccine in the remote delivery projectiles. Also, it is uncertain how many hunters would be exposed to remotely vaccinated bison since these animals would not be held in captivity during the vaccine withdrawal time.

Visitor Use and Experience

Alternatives B and C would result in greater adverse impacts than the Selected Action because the impacts could be more extensive and widespread due to the use of park-wide remote vaccination. Remote vaccination would result in additional injuries, the marking of more bison, and likely, changes in bison behavior (avoidance of people) that reduce visitor viewing opportunities.

Park Operations

Vaccination delivery under alternatives B and C would be more extensive and widespread due to the use of park-wide remote vaccination. The Selected Action would not require additional staff for implementation. Some park staff would be required to learn and implement new skills and technologies under alternatives B and C. Occasional traffic delays could occur due to remote vaccination. Additionally, alternatives B and C would have additional levels of inquiry, increased reporting requirements, and additional duties by some park staff related to vaccine encapsulation.

ENVIRONMENTALLY PREFERRABLE ALTERNATIVE

The NPS is required to identify the environmentally preferable alternative in its NEPA documents for public review and comment. The NPS, in accordance with U.S. Department of Interior NEPA Regulations (43 CFR 46) and the Council of Environmental Quality's Forty

Questions, defines the environmentally preferable alternative (or alternatives) as the alternative that best promotes the national environmental policy expressed in NEPA (section 101(b)) (516 DM 4.10). The Council of Environmental Quality's Forty Questions (46 FR 18026) (Q6a) further clarifies the identification of the environmentally preferable alternative stating, "this means the alternative that causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources."

NPS staff identified Alternative A—No Action as the environmentally preferable alternative. This alternative would cause the least damage to the biological and physical environment by conserving a large, wild, and genetically diverse population of bison and preserving important natural aspects and behaviors of this historic and iconic population by minimizing human intervention and unintended consequences resulting from remote vaccination. Alternative A also includes an adaptive management process to answer uncertainties, make improvements, and attain reasonable assurances of success for decreasing the prevalence of brucellosis in bison while protecting and preserving the historic, cultural, and natural resources of the park. Alternatives B and C propose to implement remote vaccination which may have an adverse effect on the natural behavior of bison, cause more tissue injury to individual bison, and may cause other unintended consequences to the biological and physical environment. Therefore, these alternatives, when compared to Alternative A, would not be environmentally preferable.

PUBLIC AND AGENCY INVOLVEMENT

Public Scoping

Public scoping for the bison vaccination program was initiated in August 2004 when the Notice of Intent to Prepare an EIS was published in the Federal Register. Public scoping newsletters were mailed to 155 individuals, organizations, and interested parties in August 2004. The public scoping newsletter provided information on the scope, purpose and need, description of the proposed action, and the process for providing comments, including dates and times for planned open house meetings. The newsletter also included instructions on how to submit comments by mail, facsimile, electronic mail (i.e., e-mail), and an automated comment form on the project website. The public was encouraged to provide their comments by October 2, 2004. Comments received within five days following the deadline for submission were accepted.

In addition, announcements for the open house meetings were published in six local newspapers, including the Bozeman Daily Chronicle, Billings Gazette, Cody Enterprise, West Yellowstone News, Jackson Hole Guide, and Associated Press Livingston Enterprise. A project webpage was set up on the park website that contained the scoping schedule. Open house meetings were held during the week of September 12, 2004. Four regional locations were selected for these meetings so that various interested parties could participate. The schedule for the public scoping open house meetings was as follows: 1) Gardiner, Montana on September 13, 2004; 2) Bozeman, Montana on September 14, 2004; 3) Idaho Falls, Idaho on September 15, 2004; and 4) Cody, Wyoming on September 16, 2004. Representatives from the park's Bison Ecology and Management Program and Greystone Environmental Consultants attended and helped facilitate all four public scoping meetings.

A total of 126 comment documents were received during the public scoping period and a total of 37 people attended public meetings. Most of the letters were received via mail, e-mail, and comment forms collected at the open houses. In addition, 11 individuals provided comments using the project website. More than 800 specific comments within the 126 documents were tallied. The NPS also considered 90 comments regarding vaccination of bison that were recorded during the planning process for the IBMP. These comments were organized into 13 issues that either supported implementing a vaccination program or indicated the vaccination of bison was unnecessary or would not accomplish the goals of the program.

Public Comment and Review of the Draft Environmental Impact Statement

A draft EIS for the Remote Vaccination Program to Reduce the Prevalence of Brucellosis in Yellowstone Bison was released for public comment on May 28, 2010 and comments were accepted for more than 120 days. The NPS conducted three public meetings to gain information from the public on the park's purpose and significance, issues, and alternatives presented in the draft EIS. These meetings were held in Bozeman, Montana on June 14, 2010; Helena, Montana on June 15, 2010; and Malta, Montana on June 16, 2010. Yellowstone's public information office issued a news release to describe specific dates and locations for the public meetings. The meetings were attended by a total of 106 people. Also, information about the planning process and how to comment about this process was available through the Yellowstone National Park web site.

The NPS received a total of 1,644 correspondences via letters, e-mail, faxes, comments from public meetings, park forms, web forms submitted via the NPS's Planning, Environment and Public Comment website (PEPC), and other sources. These correspondences were distilled into 9,410 individual comments. From this correspondence, the NPS identified 6,629 substantive comments, which were divided into 26 concern statements. Most respondents associated with conservation constituencies opposed the remote vaccination program and recommended vaccination of cattle rather than bison. Conversely, most respondents associated with livestock groups supported remote vaccination (Alternative C). Many respondents suggested that the projected cost of park-wide remote vaccination (\$300,000 per year for at least 30 years) was too expensive to justify the benefits, especially given the substantial uncertainties associated with vaccine efficacy, delivery, duration of vaccine protection, diagnostics, and bison behavior.

In addition, a Citizens Working Group comprised of people from a diverse group of stakeholders (including environmental groups and livestock producers), which was organized to seek responsible management solutions for Yellowstone bison, made a consensus recommendation after nearly a year of discussions that vaccination of wild bison using the current vaccine and remote delivery method should not be a priority at this time and that vaccination is unlikely to be effective at substantially reducing brucellosis prevalence in Yellowstone bison without the removal of infectious animals (both bison and elk) which serve as the primary transmission source.

In February 2013, the NPS and Montana Fish, Wildlife & Parks invited scientists from federal, state, academic, and non-governmental entities to (1) review what is known about the vaccine-

induced immune responses of bison and elk, (2) review the benefits and limitations of existing tools and emerging technologies for suppressing brucellosis prevalence in Yellowstone bison and elk, (3) evaluate whether substantial brucellosis suppression is feasible and sustainable without significantly affecting bison behavior or visitor experience, and (4) provide ideas for the future direction of brucellosis suppression activities (including suitable tools, research, and surveillance), considering that the primary mission of Yellowstone National Park is to preserve its natural and cultural resources for the benefit of the American people. At the close of the workshop, the panel members provided the following summary:

- To date, management to maintain separation between cattle and bison appears to be effective at preventing transmission of brucellosis between these species because no documented transmission has occurred under the IBMP.
- The best available data do not support that vaccination of wild bison with currently available vaccines will be effective at suppressing brucellosis to a level that changes bison management strategies under the IBMP.
- Control of bison population size will likely include culling or removal as tools in the future, along with hunting. Past and current culling practices have not had an apparent effect on reducing the overall prevalence of brucellosis in the bison population.
- Intervention through contraception is not needed to achieve the current goals of the IBMP. Contraception could potentially be a valuable tool for brucellosis suppression, but the available data are insufficient to make a judgment at this time. Further research, combined with modeling to evaluate contraception for disease control, is needed.

Agency Consultation and Coordination

Pursuant to Section 7 of the Endangered Species Act of 1973, as amended, the NPS initiated consultation with the United States (U.S.) Fish and Wildlife Service during the public scoping period. Consultation with staff in the Cody, Wyoming office led to a draft biological assessment that was presented to the level one consultation team at a meeting in Moose, Wyoming during October 2006. The biological assessment was subsequently submitted to the Cheyenne office of the U.S. Fish and Wildlife Service through a letter of transmittal from the park Superintendent in November 2006. The biological assessment determined that the proposed actions may affect, but are not likely to adversely affect the bald eagle, Canada lynx, grizzly bear, and gray wolf. The U.S. Fish and Wildlife Service concurred with this assessment in January 2007. The bald eagle and the gray wolf have since been removed from the federal List of Endangered and Threatened Wildlife and Plants.

Initial consultation with the Montana and Wyoming offices of the State Historic Preservation Officers was conducted during June 2005. The NPS initially informed these offices of its intent to include an assessment of effects on cultural resources as part of the draft EIS. Subsequent analyses led the NPS to initiate a separate consultation that determined alternatives B and C for vaccination of free-ranging bison may have an impact on historic properties, but no historic properties would be adversely affected by the undertaking. The State Historic Preservation Officers concurred with this determination in December 2006.

Five federal and state agencies are responsible for implementing the IBMP—the NPS; Animal and Plant Health Inspection Service, U.S. Forest Service, Montana Department of Livestock, and

Montana Fish, Wildlife & Parks. Prior to, and during the course of drafting and releasing the final EIS for the IBMP, the federal agencies conducted government-to-government consultations with American Indian tribes, as described in Volume 1, Appendix H of that document. The Confederated Salish and Kootenai Tribes, Nez Perce Tribe, and InterTribal Buffalo Council became members of the IBMP in 2009. The NPS has briefed the other IBMP members several times per year at public meetings on progress related to the decision whether to implement remote vaccination of bison in Yellowstone National Park (see website at <ibmp.info>).

NPS employees from Yellowstone National Park periodically travel to meet with tribal representatives at their respective locations. NPS representatives made trips to Pierre, South Dakota in October 2003 to meet with many tribes from this region and shared information about the potential remote vaccination of Yellowstone bison. In addition, park staff went to Blackfoot, Idaho in November 2004 and October 2005 to meet with representatives from Fort Hall, where bison management and vaccination issues were part of the broader conversation. In December 2004, the Superintendent sent letters to 198 tribal representatives from 25 tribes informing them of this environmental study and requesting input regarding the effects of vaccination on Yellowstone bison. Also, during May 2010 letters requesting comments on the draft EIS were sent to 73 American Indian tribes and the InterTribal Buffalo Council, which is a federally chartered organization of 56 member tribes committed to reestablishing buffalo populations on Indian lands.

CONCLUSION

The NPS has chosen Alternative A—No Action as the selection action for this EIS. The NPS has decided not to implement remote vaccination of bison in Yellowstone National Park at this time because it would not substantially suppress brucellosis and could have unintended adverse effects to the bison population and visitor experience. Instead, under the No Action alternative, the NPS will continue to implement the current IBMP, as adjusted, to conserve Yellowstone bison while mitigating the risk of brucellosis transmission from bison to livestock in Montana. The NPS official responsible for implementing the selected action is the Superintendent, Yellowstone National Park.

Appendix—Finding of Non-Impairment

National Park Service's *Management Policies, 2006* requires the analysis of potential effects to determine whether or not actions would impair park resources. The fundamental purpose of the national park system, established by the Organic Act and reaffirmed by the General Authorities Act, as amended, begins with a mandate to conserve park resources and values. Managers for the NPS must always seek ways to avoid, or to minimize to the greatest degree practicable, adversely impacting park resources and values. Section 1.4.3 of Management Policies 2006 states:

"The fundamental purpose of all parks also includes providing for the enjoyment of park resources and values by the people of the United States ... Congress, recognizing that the enjoyment by future generations of the national parks can be enjoyed only if the superb quality of park resources and values is left unimpaired, has provided that when there is a conflict between conserving resources and values and providing for enjoyment of them, conservation is to be predominant. This is how courts have consistently interpreted the Organic Act."

However, the laws give the NPS the management discretion to allow impacts to park resources and values when necessary and appropriate to fulfill the purposes of the park, as long as the impact does not constitute impairment of the affected resources and values. Although Congress has given the NPS the management discretion to allow certain impacts within the park, that discretion is limited by the statutory requirement that the NPS must leave park resources and values unimpaired, unless a particular law directly and specifically provides otherwise. The prohibited impairment is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values. An impact to any park resource or value may, but does not necessarily, constitute an impairment, but an impact would be more likely to constitute an impairment when there is a major or severe adverse effect on a resource or value whose conservation is:

- Necessary to fulfill specific park purposes identified in the establishing legislation or proclamation of the park; or
- Key to the natural or cultural integrity of the park; or
- Identified as a goal in the park's general management plan or other relevant NPS planning documents.

An impact would be less likely to constitute impairment if it is an unavoidable result of an action necessary to pursue or restore the integrity of park resources or values and it cannot be further mitigated.

The park's resources or values that are subject to the no-impairment standard generally include:

- The park's scenery, natural and historic objects, and wildlife, and the processes and conditions that sustain them, including, to the extent present in the park: ecological, biological, and physical processes that created the park and continue to act upon it; scenic features, natural visibility, both in daytime and at night; natural landscapes, natural soundscapes and smells; water and air resources; soils; geologic resources;

paleontological resources, archeological resources; cultural landscapes; ethnographic resources, historic and prehistoric sites, structures, and objects; museum collections; and native plants and animals.

- Appropriate opportunities to experience enjoyment of the above resources, to the extent that can be done without impairing them;
- The park's role in contributing to the national dignity, the high public value and integrity, and the superlative environmental quality of the national park system, and the benefit and inspiration provided to the American people by the national park system; and
- Any additional attributes encompassed by the specific values and purposes for which the park was established.

Impairment may result from NPS activities in managing the park, visitor activities, or activities undertaken by concessioners, contractors, and other operating in the park. The NPS's threshold for considering whether there could be impairment is based on whether an action would have major or significant effects. Impairment findings are not necessary for visitor use and experience, socioeconomic, human health and safety, park operations, and surface and air transportation, because impairment findings relates back to park resources and values, and these impact areas are not generally considered park resources or values according to the Organic Act, and cannot be impaired in the same way that an action can impair park resources and values. The topics remaining to be evaluated for impairment include the Yellowstone bison population, other wildlife (including threatened and endangered species), and ethnographic resources.

Yellowstone Bison Population—The selected action, Alternative A (i.e., current management), would likely have minor to moderate adverse impacts on the Yellowstone bison population. Capture, confinement, feeding, and vaccination may lead to some injuries, food conditioning, disease transmission, and disruption of traditional migratory patterns. Also, some bison may be removed from the wild for brucellosis suppression, population control, quarantine, or research. However, the population is wild and reproductively prolific, and as a result, can recover rapidly from relatively short periods of confinement and/or small decreases in abundance. Thus, there would be no impairment to the Yellowstone bison population under the selected decision.

Other Wildlife (including Threatened and Endangered Species)—Adverse impacts to other wildlife, including special concern, threatened, endangered, and candidate species would likely be no greater than minor. Individuals of multiple species may be affected by disturbance and displacement from capture and vaccination operations, but those impacts would be localized and would not be detectable at the population level. Threatened grizzly bears are denning during most bison capture operations and there is spatial separation between capture facilities and areas used by threatened lynx and wolverine (proposed). If these species feed on a carcass of a vaccinated bison, it would be less of a source of brucellosis infection than carcasses infected with natural strains of *Brucella*. For the purposes of Section 7 of the Endangered Species Act, the U.S. Fish and Wildlife Service concurred with the NPS determination of may affect, not likely to adversely affect Canada lynx and grizzly bear (the grey wolf and bald eagle have since been delisted) on January 12, 2007. Thus, there would be no impairment to other wildlife under the selected action.

Ethnographic Resources—The selected action would likely have minor to moderate adverse impacts on ethnographic resources. Capture and vaccination operations are offensive to some American Indians and some tribes in general. Also, bison should not be consumed for 21 days after vaccination, and as a result, are held in the capture facility and not allowed to migrate into Montana where treaty harvests occur. If vaccination contributes to decreasing brucellosis prevalence, however, then bison productivity could increase and contribute to more brucellosis-free bison for harvest and transfer to tribal lands. Following guidance in the National Historic Preservation Act, Section 106 consultation with both the Wyoming and Montana State Historic Preservation Officers was completed in December, 2006, with concurrence of the NPS determination that no historic properties will be affected by the proposed action. Thus, there would be no impairment to ethnographic resources under the selected action.

Summary—Adverse impacts under the selected action would not rise to the levels that would constitute impairment of any resource or values whose conservation is necessary to fulfill specific purposes identified in the establishing legislation of Yellowstone National Park, that are key to the natural or cultural integrity of the park or opportunities for enjoyment, or that are identified as significant in relevant Yellowstone and NPS planning documents.

