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WILDLIFE SPECIES: Bos bison

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Introductory

WILDLIFE SPECIES: Bos bison

AUTHORSHIP AND CITATION :

Tesky, Julie L. 1995. Bos bison. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: www.fs.fed.us/database/feis/animals/mammal/bobi/all.html [].

ABBREVIATION :

BOBI

COMMON NAMES :

American bison
bison
plains bison
wood bison
prairie bison
woodland bison
mountain bison

TAXONOMY :

The currently accepted scientific name for the American bison is *Bos bison* Linnaeus [99]. It is in the family Bovidae [34]. American bison taxonomy has been a controversial issue for many years and classification to the subspecies level remains a matter of debate [11,53]. However, most authorities recognize two subspecies, the plains bison (*Bos bison* bison) and the wood bison (*B. bison* *athabasca* Rhoads) [11,34,53].

ORDER :

Artiodactyla

CLASS :

Mammal

FEDERAL LEGAL STATUS :

Wood bison are listed as Threatened. The Yellowstone population is Under Review for listing as Threatened or Endangered [80].

OTHER STATUS :

In Canada, wood bison are federally listed as endangered in Alberta, British Columbia, Northwest Territories, and Yukon Territory [98]. The Nature Conservancy lists them as critically imperiled in British Columbia [77]. They are also listed in the Red Data Book by the International Union for the Conservation of Nature and Natural Resources (IUCN) and are thereby recognized world-wide as endangered. Wood bison are classified as an Appendix I animal in the Conservation on International Trade in Endangered Species of Wild Flora and Fauna

(CITES), which provides regulated protection from international trade [63]. American bison are protected in Idaho [59].

WILDLIFE DISTRIBUTION AND OCCURRENCE

WILDLIFE SPECIES: Bos bison

GENERAL DISTRIBUTION :

Historically, American bison were widespread in North America from Alaska and western California across the United States and into northern New Mexico [11, 53, 66]. Today, American bison occur in geographically isolated populations in parks and preserves (See ADMINISTRATIVE UNITS), other public lands, and on private ranches. The only large herds of American bison in North America are in Yellowstone National Park, Montana and Wyoming, Wood Buffalo National Park, Alberta, and Mackenzie Bison Sanctuary and the Slave River Lowlands, Northwest Territories [11, 27, 53]. Smaller herds occur in Alaska; northeastern British Columbia; near Nahanni Butte, Northwest Territories; northwestern Saskatchewan; Elk Island National Park, Alberta; Grand Teton National Park, Wyoming; National Bison Range and Crow Reservation, Montana; Wind Caves National Park, South Dakota; Wichita Mountains Wildlife Refuge and the Tallgrass Prairie Preserve, Oklahoma; Theodore Roosevelt National Park, North Dakota; Henry Mountains, southern Utah; northeastern Colorado; Nebraska; and Kansas [11, 35, 51, 53, 83, 84, 91, 93, 96].

ECOSYSTEMS :

- FRES11 Spruce-fir
- FRES19 Aspen-birch
- FRES21 Ponderosa pine
- FRES23 Fir-spruce
- FRES26 Lodgepole pine
- FRES29 Sagebrush
- FRES35 Pinyon-juniper
- FRES36 Mountain grasslands
- FRES37 Mountain meadows
- FRES38 Plains grasslands
- FRES39 Prairie
- FRES40 Desert grasslands
- FRES44 Alpine

STATES :

AK CO KS MT NE ND OK SD UT WY AB BC NT SK YT

BLM PHYSIOGRAPHIC REGIONS :

- 8 Northern Rocky Mountains
- 9 Middle Rocky Mountains
- 12 Colorado Plateau
- 13 Rocky Mountain Piedmont
- 14 Great Plains
- 15 Black Hills Uplift
- 16 Upper Missouri Basin and Broken Lands

KUCHLER PLANT ASSOCIATIONS :

- K011 Western ponderosa forest
- K016 Eastern ponderosa forest
- K017 Black Hills pine forest
- K018 Pine-Douglas-fir forest
- K023 Juniper-pinyon woodland
- K024 Juniper steppe woodland
- K038 Great Basin sagebrush
- K051 Wheatgrass-bluegrass
- K052 Alpine meadows and barren
- K055 Sagebrush steppe
- K056 Wheatgrass-needlegrass shrubsteppe
- K057 Galleta-three-awn shrubsteppe
- K063 Foothills prairie
- K064 Grama-needlegrass-wheatgrass
- K065 Grama-buffalograss
- K066 Wheatgrass-needlegrass
- K067 Wheatgrass-bluestem-needlegrass

- K068 Wheatgrass-grama-buffalograss
- K069 Bluestem-grama prairie
- K070 Sandsage-bluestem prairie
- K074 Bluestem prairie
- K075 Nebraska Sandhills prairie
- K081 Oak savanna
- K085 Mesquite-buffalograss
- K098 Northern floodplain forest

SAF COVER TYPES :

- 12 Black spruce
- 13 Black spruce-tamarack
- 16 Aspen
- 204 Black spruce
- 217 Aspen
- 218 Lodgepole pine
- 220 Rocky Mountain juniper
- 235 Cottonwood-willow
- 237 Interior ponderosa pine
- 239 Pinyon-juniper
- 253 Black spruce-white spruce
- 254 Black spruce-paper birch

SRM (RANGELAND) COVER TYPES :

- 101 Bluebunch wheatgrass
- 102 Idaho fescue
- 104 Antelope bitterbrush-bluebunch wheatgrass
- 105 Antelope bitterbrush-Idaho fescue
- 107 Western juniper/big sagebrush/bluebunch wheatgrass
- 110 Ponderosa pine-grassland
- 301 Bluebunch wheatgrass-blue grama
- 302 Bluebunch wheatgrass-Sandberg bluegrass
- 303 Bluebunch wheatgrass-western wheatgrass
- 304 Idaho fescue-bluebunch wheatgrass
- 305 Idaho fescue-Richardson needlegrass
- 306 Idaho fescue-slender wheatgrass
- 307 Idaho fescue-threadleaf sedge
- 309 Idaho fescue-western wheatgrass
- 310 Needle-and-thread-blue grama
- 311 Rough fescue-bluebunch wheatgrass
- 313 Tufted hairgrass-sedge
- 314 Big sagebrush-bluebunch wheatgrass
- 317 Bitterbrush-bluebunch wheatgrass
- 321 Black sagebrush-Idaho fescue
- 401 Basin big sagebrush
- 402 Mountain big sagebrush
- 403 Wyoming big sagebrush
- 409 Tall forb
- 410 Alpine rangeland
- 411 Aspen woodland
- 412 Juniper-pinyon woodland
- 422 Riparian
- 601 Bluestem prairie
- 602 Bluestem-prairie sandreed
- 603 Prairie sandreed-needlegrass
- 604 Bluestem-grama prairie
- 605 Sandsage prairie
- 606 Wheatgrass-bluestem-needlegrass
- 607 Wheatgrass-needlegrass
- 608 Wheatgrass-grama-needlegrass
- 609 Wheatgrass-grama
- 610 Wheatgrass
- 611 Blue grama-buffalograss
- 612 Sagebrush-grass
- 614 Crested wheatgrass
- 615 Wheatgrass-saltgrass-grama
- 704 Blue grama-western wheatgrass
- 708 Bluestem-dropseed
- 709 Bluestem-grama
- 710 Bluestem prairie
- 715 Grama-buffalograss
- 717 Little bluestem-Indiangrass-Texas wintergrass
- 718 Mesquite-grama
- 722 Sand sagebrush-mixed prairie

PLANT COMMUNITIES :

Before European settlement American bison occurred primarily on the central

grasslands and northern parklands of North America, but habitats ranging from semidesert to boreal forest were also used [53]. In Montana the Lewis and Clark expedition observed vast numbers of American bison in areas floristically dominated by shortgrass species [11].

Today, American bison occupy shortgrass and tallgrass prairies, boreal parklands, montane meadows, desert grasslands, and shrub-grass habitats. In Canada, coniferous forest and quaking aspen (*Populus tremuloides*) parklands with interspersed meadows and prairies form the main habitat for wood bison [11]. In the Northwest Territories, bison habitat along the Slave River Lowlands is within the boreal forest region of Canada, where white spruce (*Picea glauca*) forests separate vast open meadows supporting sedge (*Carex* spp.) and grass communities [11]. On the Beaver Hills near Edmonton, Alberta, Hudson and Frank [40] found that American bison foraged most often on grassy upland meadows dominated by Kentucky bluegrass (*Poa pratense*) and smooth brome (*Bromus inermis*) and least in forests dominated by balsam poplar (*Populus balsamifera*) and quaking aspen [40].

American bison in Wind Caves National Park commonly occur on grasslands dominated by little bluestem (*Schizachyrium scoparium*), big bluestem (*Andropogon gerardii* var. *gerardii*), Kentucky bluegrass, and western wheatgrass (*Pascopyrum smithii*) [18].

In Yellowstone National Park, American bison inhabit meadows with sedge and grass interspersed with lodgepole pine (*Pinus contorta*) forests [11]. In southern Utah, American bison occupy pinyon-juniper (*Pinus* spp.-*Juniperus* spp.) habitat [29,72,91].

BIOLOGICAL DATA AND HABITAT REQUIREMENTS

WILDLIFE SPECIES: Bos bison

TIMING OF MAJOR LIFE HISTORY EVENTS :

Breeding season - Female American bison are seasonally polyestrous, with a cycle of approximately 3 weeks' duration [2,11]. However, unseasonal estrus and mating sometimes occur [2,11,51]. The breeding season for American bison generally occurs between July and October [2,11,52]. However, it varies in length depending on herd location. The breeding season has been observed to last from June 15 to September 30 at Hayden Valley, Yellowstone National Park [51]; from mid-July to mid-August in other areas of Yellowstone National Park [52]; and from June 1 to July 30 at the Wichita Mountains Wildlife Refuge [35].

Age at sexual maturity - Sexual maturity most commonly occurs at 2 to 4 years of age. However, some females breed as yearlings [11,53]. In Wood Buffalo National Park, a small proportion of the yearling bulls, approximately one-third of the 2-year-olds, and virtually all American bison 3 years of age and older were sexually mature [11]. Bulls attain sexual maturity well in advance of becoming part of the active breeding population [52]. In the Hayden Valley American bison herd, Yellowstone National Park, bulls 8 years old and older were the most active sexually [51].

Gestation and calving season - The gestation period for American bison is 9 to 9.5 months [11,51,53]. In most regions, the calving season is generally from mid-April to May with births concentrated from the end of April through the first 2 weeks of May [53]. However, conception and, therefore, parturition can occur at any time of year [11]. McHugh [51] noted that a few calves were born from June through October in herds at Yellowstone National Park, the Crow Reservation, Montana, the National Bison Range, and Wind Caves National Park.

Number of young - Females generally give birth to one calf; twins are rare [11,53]. American bison generally produce two calves every 3 years [11].

Development of young - Calves are able to stand and nurse within 30 minutes of birth. They may try to graze by 5 days of age and will drink water after the first week. The cow nurses her calf for at least 7 to 8 months; most calves are weaned by the end of the first year [53].

Longevity - In the wild few American bison survive more than 20 years, although there are records of cows surviving at least 40 years [53]. In wild populations, by the time a American bison has reached age 15 it can be considered old. In captivity, lifespan increases [11].

PREFERRED HABITAT :

The primary habitat requirements for American bison are adequate forage, water, and space [8]. American bison thrive in open grasslands, meadows, and parklands. When available, American bison use forested areas for shade and to escape insects. These areas also furnish forage when open areas are covered by "deep" snow [8]. However, American bison can survive in open valleys covered with several feet of snow [94]. During severe weather, forested areas and some topographical features furnish cover [8]. Scattered thermal sites (particularly warm ground with less snow than the surrounding area) provide favorable sites for wintering American bison in Yellowstone National Park [94]. In northern Canada forested and shrub covered areas are often used as daily and seasonal travel corridors [11].

Most American bison are seasonally migratory; movements are both directional and altitudinal in some regions [11,52,70]. During historical times, large herds of American bison commonly moved southward 200 miles (322 km) or more to winter range [2]. Directional and altitudinal movements between summer and winter ranges still occur annually at Wood Buffalo National Park and Yellowstone National Park [2,11,52,94]. During November and May, American bison at Wood Buffalo National Park migrate from wooded hills to the Peace River Valley, a distance of as much as 150 miles (241 km) [2]. Factors that may influence seasonal migrations include tradition, supply and accessibility of forage, open water, shelter, insect harassment, spring weather conditions and temperatures, and fall snowstorms at higher elevations [53,58].

In mountainous areas, altitudinal movements to lowland winter range in fall and to higher summer range in spring are quite common. Snipe flies (*Symphoromyia* spp.) may be responsible for some altitudinal movements by Yellowstone National Park American bison herds during the summer [52]. Large, windswept prairies may also be chosen in summer for relief from insects. American bison, particularly cows, show strong affinity to traditional winter range [52,70]. Shaw and Carter [70] found that older females appear to be more prone than younger ones to seek new winter range and return to the new range in subsequent winters.

COVER REQUIREMENTS :

American bison thrive in open areas. When available, shrub or forest cover may be used for shade, escape from insects, or shelter from severe weather [8].

FOOD HABITS :

Adult American bison require approximately 30 pounds of forage every day [25]. Where grasses and sedges are available in the habitat, they are selectively grazed by American bison, and where they are sparse, browse may be substituted [8,11,20,53,88].

Dietary shifts from grasses to sedges and back again within a habitat type are usually associated with plant phenology [11]. In Yellowstone National Park, sedges comprised the highest proportion of American bison diets in all seasons, while grasses were second in importance. Minor quantities of forbs (6%) and browse (2%) were consumed, mainly in summer [52]. In northeastern Colorado, sedges were important to American bison only during spring. American bison herds located at Wood Buffalo National Park and Elk Island National Park were observed feeding on grasses in summer and sedges in winter [11].

In the Slave River Lowlands, American bison diets contained 29 different plant species. Slough sedge (*Carex atherodes*) was the most abundant plant in the diet, varying from 42 percent in winter to 77 percent in spring. The second most common food was reedgrass (*Calamagrostis* spp.), which varied from 15 percent of the diet in spring to 35 percent in winter. Together, these two forages comprised more than 70 percent of the American bison diet at all seasons [64].

Diet and habitat selection of wood bison were studied in the Mackenzie Bison Sanctuary between February 1986 and April 1988. Wood bison showed pronounced seasonal changes in their diet. Sedges constituted 96.1 to 98.8 percent of the winter diet. During the summer, the diet became a more diverse mix of sedge (*Carex* spp.), grasses (*Poaceae*), and willow (*Salix* spp.). Reindeer lichen (*Cladonia* spp.) became a major dietary component in fall. Summer browsing on willows increased when sedge standing crops were reduced [45].

In some areas forbs are seasonally important to foraging American bison [11,89]. In semidesert range in southwestern Colorado, forbs were common food items during all seasons but never exceeded 17 percent in any one season [89]. In Yellowstone National Park and in northern Canada, forbs appeared to be important to American bison only during summer; in northeastern

Colorado, forbs were important during fall and winter [11].

On the shortgrass plains in Colorado, where blue grama (*Bouteloua gracilis*) is the dominant species, American bison consumed 36 different plant species. However, only 11 contributed significantly to the total. Blue grama and buffalo grass (*Buchloe dactyloides*) were the most abundant plants in the habitat and also in the diet. Where available, western wheatgrass was preferred over blue grama. Other commonly consumed species were red threeawn (*Aristida purpurea*), sun sedge (*Carex heliophila*), scarlet globemallow (*Sphaeralcea coccinea*), sand dropseed (*Sporobolus cryptandrus*), needle-and-thread grass (*Stipa comata*), fringed sagebrush (*Artemisia frigida*), buckwheat (*Eriogonum* spp.), and sixweeks fescue (*Vulpia octoflora*) [61].

On semidesert range at Colorado National Monument, the most common plant species in the American bison diet during most seasons was fourwing saltbush (*Atriplex canescens*), followed by needle-and-thread grass, which was important during cooler months. Sand dropseed and galleta (*Hilaria jamesii*) were prominent in the diet in warmer seasons. The only forbs significantly utilized during all seasons except winter were mallows (*Sphaeralcea* spp.). Prickly pear (*Opuntia* spp.) was among the ten top forage species during all seasons except summer. Some of the most common plants in the habitat, cheatgrass (*Bromus tectorum*), Utah juniper (*Juniperus osteosperma*), and big sagebrush (*Artemisia tridentata*), were the least preferred forages [89].

PREDATORS :

The main predators of American bison are gray wolf (*Canis lupus*), [10,11,38,65] grizzly bear (*Ursus arctos horribilis*), and coyote (*Canis latrans*) [11]. On the Slave River Lowlands, American bison were the most important of six major prey types eaten by gray wolves and represented 88 percent of prey weight during the period of snow cover (Nov. 8, 1976-April 15, 1977). Gray wolf predation in 1976 and 1977 accounted for about 31 percent of adult and subadult American bison mortality and approximately 27 percent of calf mortality [65]. Winter-killed American bison may be important food sources to grizzly bear in early spring after they emerge from their dens [11].

MANAGEMENT CONSIDERATIONS :

American bison are attracted to grassland sites altered by black-tailed prairie dog (*Cynomys ludovicianus*). American bison often feed selectively near the perimeters of colonies. These areas are constantly clipped by black-tailed prairie dog and, therefore, have more readily digestible perennial grasses, with higher nitrogen concentration and greater accessibility of green tissues, than vegetation from uncolonized areas. Consequently, black-tailed prairie dog colonies may receive a disproportionately high amount of American bison use. Prolonged grazing pressure on colonies may result in changes in plant composition [18,19,12,87]. On a mixed-grass prairie, selective use of black-tailed prairie dog colonies by American bison resulted in considerably more biomass removed than by prairie dog activity alone. Additionally, selective use of plant species (i.e., grasses) by American bison may contribute to an increase in forb:graminoid ratios [95].

The thick hair on the head and forequarters of American bison is ideally suited for dispersal of awned, barbed, or sticky seed-bearing structures. For example, the seeds of buffalo grass, cocklebur (*Xanthium perforatum*), and St. Johnswort (*Hypericum perforatum*) readily adhere to American bison hair. The dissemination of the latter throughout the National Bison Range is thought to have been accomplished by American bison [51]. American bison also aid in dispersal by ingesting seeds. Samples from four buffalo chips at Wichita Mountains Wildlife Refuge contained 219 seeds that germinated. Of these, 195 (89%) were monocots, mostly Japanese brome (*Bromus japonicus*). American bison may accelerate seed dispersal to burned sites because American bison are attracted to recently burned areas [17].

Localized stands of timber may be considerably affected by American bison horning and thrashing during the rut and at other times. McHugh [51] estimated that 51 percent of lodgepole pine in some areas of Yellowstone National Park has been horned by American bison. Such activity may inhibit succession of grassland to forest [11].

Where American bison trails or wallows (concave disturbances formed as American bison paw the ground and roll in the exposed soil) are cut into steep hillsides, considerable water and wind erosion can occur. Hillside trails can serve as drainage channels, effectively lowering the water table in upland areas and causing a change in the vegetation. Where trails cut near the top of steep, sandy hills, erosion and slippage may produce barren areas. However, by creating trails through different habitats,

American bison help provide access corridors for many species of mammals, including humans [11].

American bison wallows can serve as water catchments on flat terrain. In Oklahoma American bison wallows have been observed to hold water for prolonged periods during the spring rainy season. Such small ponds become available to both vertebrates and invertebrates. These water-holding wallows may also enhance growth of specific vegetation such as ruderal species and species adapted to wet habitats [11,81]. On the Wichita Mountains Wildlife Refuge, ruderal species such as Japanese brome and false-pennyroyal (*Hedeoma hispida*) had highest cover values within American bison wallows. Other common taxa within the wallows were Torrey rush (*Juncus torreyi*), purple ammania (*Ammannia coccinea*), lythrum (*Lythrum* spp.), and taperleaf flatsedge (*Cyperus acuminatus*), all of which are species adapted to wet habitats [17].

Diseases - Anthrax (an infectious disease caused by the bacteria *Bacillus anthracis*) outbreaks cause sporadic mortality in northern American bison herds. In Wood Buffalo National Park, 50 percent of American bison may be infected by tuberculosis, a chronic infectious disease [53]. Tuberculosis in a herd of American bison for more than 26 years did not appear to interfere with herd productivity. However, the importance of tuberculosis as a mortality factor is difficult to determine for large American bison herds [11]. Brucellosis is an infectious disease caused by the bacteria *Brucella abortus*. Abortion caused by brucellosis has been reported in American bison. It is assumed that infected American bison shed brucella organisms, thereby contaminating feed and water. Dissemination of the disease is enhanced due to the gregarious nature of American bison [11]. The role of brucellosis and its affect on reproductive activity in American bison is difficult to determine due to the lack of data on the incidence of abortion in American bison [11,52].

FIRE EFFECTS AND USE

WILDLIFE SPECIES: Bos bison

DIRECT FIRE EFFECTS ON ANIMALS :

Fires commonly occur on American bison ranges without causing appreciable American bison mortality [11]. In the past, when large herds of American bison roamed the prairies, some prairie fires killed hundreds of American bison [11,13,57]. One report in 1850 stated that as many as 300 American bison were seen lying together on the ground with their hair burned off by a prairie fire [11]. There were only nine known direct American bison mortalities due to the 1988 fires in Yellowstone National Park [56].

HABITAT RELATED FIRE EFFECTS :

Fire is important in creating and maintaining American bison habitat. Fire regenerates grasslands and enhances production, availability, and palatability of many American bison forage species [9,11,67,68]. Fire frequency has been estimated to occur once every 3 to 5 years on some prairies [97]. During presettlement times American bison habitats were to a large extent created and maintained by lightning-caused fires or fires set by Native Americans [44,47,49,50]. The results of intense grazing by large American bison herds on recently burned areas may have reduced fuel loads, making the grazed areas less likely to burn and even allowing them to function as firebreaks [49,75]. In contrast, unburned areas would have been little grazed, thereby increasing fuel loads and the probability of burning. The slaughter of American bison in the late 1800's may have shortened fire return intervals and increased fire severity during the early settlement period. Steuter [75] suggested that integrating a regional fire behavior model with estimates of presettlement American bison patterns could provide a valuable tool for natural area management in the northern mixed-grass prairie.

Several studies have shown that American bison prefer to forage on recently burned areas [5,7,22,28,70,87]. In tallgrass prairie on the Konza Prairie Research Natural Area, northeastern Kansas, 45 American bison range over an array of watersheds with different fire regimes [87]. The watersheds are burned in April annually or at 2-, 4-, or 20-year intervals. In the spring of 1988 and 1989, Vinton and others [87] studied American bison grazing and use patterns among these watersheds as influenced by fire regime. American bison used some watersheds preferentially and the pattern of watershed use changed seasonally. During the spring of both years (April-June 30), American bison selected only watersheds that had been recently burned (annually or biennially), and were observed up to three times more frequently than expected on these watersheds. In 1988, preferential

grazing of recently burned watersheds persisted through the summer months. During autumn and winter of both years, American bison preferred the annual and 20-year burn watersheds to watersheds that were burned every 2 or 4 years.

On the same study site as above, little bluestem was sampled to determine how fire influences its use by American bison and its responses to grazing. Plants were marked at the beginning of the 1992 growing season. Little bluestem was sampled in an annually burned watershed and a watershed burned at 4-year intervals (referred to as "unburned") that had been grazed by American bison since 1987, and nearby annually burned and 4-year burn interval watershed that were ungrazed. The 4-year burn interval watersheds had last burned 2 years before sampling. On unburned prairie, American bison grazed only 5 percent of the available little bluestem, selecting it only 30 percent as frequently as big bluestem, the codominant species. On burned prairie, grazing frequency of little bluestem was more than 3 times as great as on unburned sites and equal to that of big bluestem. The increased grazing frequency on little bluestem in recently burned prairie is most likely the result of the removal of its persistent standing dead tillers by burning. Burning did not affect grazing on big bluestem, a plant lacking persistent standing dead tillers. With longer intervals between fires, American bison might display even greater avoidance of little bluestem in favor of other grasses [93].

A combination of fire and American bison grazing may increase the standing crop of rhizomatous grasses at the expense of bunchgrasses. Pfeiffer and Steuter [96] conducted a study on Nebraska sandhills during the 1991 and 1992 growing seasons to determine the response of sandhills prairie vegetation to spring and summer prescribed burns and subsequent American bison grazing. Approximately 1,235 acres (500 ha) were burned in early May, and another 247 acres (100 ha) were burned in late July, 1991. During the 1992 growing season, American bison grazing on burned areas reduced bunchgrass standing crop by 56 percent, while reducing rhizomatous grass standing crop by only 18 percent. Forbs generally appeared unaffected by American bison grazing. The increased grazing pressure by American bison lasted only one season. Rhizomatous grasses of the Great Plains are better adapted to large herbivore grazing than are bunchgrasses. Burning and grazing would increase the amount of forage available since, in unburned prairie, standing dead tillers deter use of bunchgrasses.

Several studies concerning American bison response to prescribed fire have been conducted at Wind Cave National Park [5,28,32]. Two prescribed fires in ponderosa pine (*Pinus ponderosa*)-grassland habitat were conducted on October 16, 1974 and May 9, 1975. The spring fire was conducted on a site adjacent to the fall fire. American bison were noted in the area of the burns during the course of burning. They utilized regrowth vegetation on the burned areas throughout the summer of 1975 [32]. A prescribed fire conducted on April 1, 1981, burned 110 acres (44.5 ha) of mixed-grass prairie and 134 (54.4 ha) of forest land. American bison fed within the burn in 1981 and 1982, moving in 1983 to an area burned by wildfire [28].

On the Wichita Mountains Wildlife Refuge, Shaw and Carter [70] studied seasonal range use by American bison before and after spring prescribed fires on a mixed-grass prairie interspersed with post oak (*Quercus stellata*)-blackjack oak (*Q. marilandica*) woodlands. American bison increased use of the burned portion of their summer range. They showed no apparent response to prescribed burning of an area of new winter range, but they delayed their spring departure to traditional summer range.

Some studies have shown that cow-calf herds graze burned areas more often than bulls [5,18]. The first postfire years following a fall prescribed fire in grassland habitat at Wind Cave National Park, bulls were found less than cow-calf herds on burned sites. Both cow-calf herds and bull groups tended to use the burn more in June of the first postfire season than at any other time. However, only cow-calf herds consistently grazed the burn during the rest of the summer [18].

Wallows enhance species diversity in American bison habitat. In Wichita Mountains National Wildlife Refuge, ruderal species (e.g., Japanese brome and false pennyroyal) and mesic species (e.g., purple ammania, pepperwort [*Marsilea mucronata*], and seacoast sumpweed) had higher cover values within willow than outside them. Willows may be especially abundant and heavily used on burned sites because American bison are attracted to graze in such areas [16]. Collins and Uno [16] examined the effects of February, 1982, prescribed fire on willow vegetation in Wichita Mountains Wildlife Refuge. Vegetation samples taken during June and early July, 1982, from the edge and interior of unburned willows were more similar to each other than were edge and interior samples from burned willows. Species diversity and richness were significantly lower

in burned than in unburned wallows. Winter annuals were more abundant in unburned wallows, perhaps because they were burned during their growing season. The authors suggested that spring fires may reduce cover of winter annuals in wallows, but summer and fall fires could increase their importance [16].

Sedge-grasslands, which are important winter habitat for American bison, often increase in area after fire removes surrounding shrubs or trees [9]. Fires in open black spruce (Picea mariana) forests and shrublands may result in expansion of sedge-grasslands. In 1977, the Bear Creek wildfire near Farewell, Alaska, moderately to severely burned a closed spruce-hardwood forest and an open black spruce forest with an understory of willow, shrubs, and sedges. The fire converted 100 square miles (260 km sq.) of predominantly open black spruce forest to sedge-grassland. Most of the American bison in this area winter on sites with extensive sedge cover. By postfire year 4 the sedge-grassland habitat had more than doubled in area. Fire-related snowpack changes also may have stimulated American bison winter range expansion. Before the fire, the disjunct and widely scattered sedge-grasslands were separated by extensive open black spruce forest and shrublands. This habitat generally has a greater snowpack than sedge-grasslands and, therefore, is likely to discourage American bison movements. After the 1977 fire, sedge-grasslands showed less snow cover than adjacent unburned open black spruce forests and shrublands [9].

FIRE USE :

Prescribed fire has been used to manage free-roaming American bison herds [6,18,46,70]. Strategic placement of burns should integrate knowledge of American bison foraging behavior and preferences, American bison travel routes, and distributions of mineral licks and water [6,18]. Using prescribed fire to improve grasses and sedges may reduce the need for expensive supplemental feeding of American bison in some areas [68].

Prescribed fire is effective in mitigating American bison impacts on black-tailed prairie dog colonies. American bison use of a black-tailed prairie dog colony was compared before and after a prescribed fire on adjacent, uncolonized grassland at Wind Cave National Park, in 1979 and 1980. Cow-calf herds increased their use (measured as hours of feeding time) of the burned grassland by a factor of 12 and decreased their use of the colony by 30 to 63 percent following the burn. Bulls were less attracted to the burned site than cow-calf herds. To decrease American bison impacts on black-tailed prairie dog colonies, burns should be located a "considerable" distance from colonies [18].

FIRE REGIMES :

Find fire regime information for the plant communities in which this species may occur by entering the species name in the [FEIS home page](#) under "Find Fire Regimes".

FIRE CASE STUDY

SPECIES: Bos bison

FIRE CASE STUDY CITATION :

Tesky, Julie L., compiler. 1995. Bos bison. Improving bison forage with fall prescribed fire in Wind Cave National Park, South Dakota

FIRE CASE STUDY REFERENCE:

Bock, Jane H.; Bock, Carl E. 1981. Some effects of fire on vegetation and wildlife in ponderosa pine forests of the southern Black Hills. Final Report. Contracts CX-1200-9-B034, CX-1200-0-B018, CX-1200-1-B022; Grant No. RM-80-105 GR. Unpublished report on file with: U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Fire Sciences Lab, Missoula, MT. 58 p. [5].

SEASON/SEVERITY CLASSIFICATION :

Fall/low-moderate

STUDY LOCATION :

The study was located on a small knob in the northwest corner of Wind Cave National Park, Custer County, South Dakota.

PREFIRE HABITAT :

This study was located in a ponderosa pine (*Pinus ponderosa*) forest and ponderosa pine-grassland ecotone. The dominant species in the canopy was ponderosa pine. Common understory species included sedges (*Carex* spp.), big bluestem (*Andropogon gerardii* var. *gerardii*), little bluestem (*Schizachyrium scoparium*), Sandberg bluegrass (*Poa secunda*), sideoats grama (*Bouteloua curtipendula*), blue grama (*B. gracilis*), hairy grama (*B. hirsuta*), needlegrass (*Stipa* spp.), wheatgrass, leadplant (*Amorpha canescens*), pulsatilla (*Pulsatilla patens*), Louisiana sagewort (*Artemisia ludoviciana*), beautiful shootingstar (*Dodecatheon pulchellum*), and western snowberry (*Symphoricarpos occidentalis*).

SITE DESCRIPTION :

A detailed description of the site was not given.

FIRE DESCRIPTION :

Conditions for the prescribed fire (the "Cone Burn") were met at midday 17 October 1979, when the wind was about 10 miles per hour (16 km/h), temperature was 58 degrees Fahrenheit (14.4 deg C), and relative humidity was 45 percent. The fire passed over a 156-acre (63 ha) area in about 4 hours. A few standing dead snags on the north and west faces of the area were still burning at midmorning the following day, when they were extinguished by a rain shower. Fire varied from discontinuous, low-severity (leaving some patches unburned) to crowning behavior. Combustion of surface fuels was nearly complete, except in unburned patches.

FIRE EFFECTS ON ANIMAL SPECIES AND HABITAT :

Effect on vegetation - Vegetation was measured 1 year before the fire and for 2 years after (May-June of 1980 and 1981) the fire. Plants that increased as a result of the fire included sedges, needlegrasses, and beautiful shootingstar; bare ground also increased. Plants reduced by the fire included bluegrasses (*Poa* spp.), little bluestem (1980 only), ponderosa pine (both canopy and immature trees), and shrubs (1980 only). The fire caused only a modest decline in overall similarity between experimental and control vegetation plots, and this decline persisted through two postfire growing seasons.

Effect on American bison - American bison preferred feeding on burned sites during the first postfire growing season. Before the fire, American bison cow-calf herds preferred the control areas. After burning, they were attracted to the recently burned area for feeding. However, this grazing preference disappeared in the second postfire year. Before the fire, bulls preferred the control site. During the first postfire year the bulls used both sites, while in the following year, they showed a preference for the unburned site. Small bull groups tended to defer in habitat use to cow-calf herds.

FIRE MANAGEMENT IMPLICATIONS :

This study showed that prescribed fires can be used in ponderosa pine-grassland ecotones of the Black Hills to temporarily improve forage for American bison.

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WILDLIFE SPECIES: Bos bison

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