Yellowstone and Grand Teton National Park and John D. Rockefeller Jr. Memorial Parkway

National Park Service
U.S. Department of the Interior

Yellowstone National Park
Wyoming

Biological Assessment

Winter Use Plans, Supplemental Environmental Impact Statement

August 2002

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OVERVIEW

This Biological Assessment (BA) addresses the preferred alternative for the *Winter Use Plan Supplemental Environmental Impact Statement for Yellowstone and Grand Teton National Parks and the John D. Rockefeller, Jr. Memorial Parkway* (SEIS 2002). The BA analyzes the effects on listed threatened or endangered wildlife species. Much of the baseline biological information presented was reviewed by the U. S. Fish and Wildlife Service (FWS) on 5 July 2000, in a document entitled, *Biological Assessment of Yellowstone and Grand Teton National Parks' Winter Use Plan* - (prepared by the National Park Service (NPS) on 1 July 2000 (Wade 2000)). The BA prepared in 2000 analyzed alternative G of the FEIS (2000) which is presented as alternative 1A of the SEIS (2002) (see Appendix A). During the earlier effort, the FWS had concurred with the NPS determination that implementation of the Winter Use Plans (FEIS 2000, alternative G), "is not likely to adversely affect threatened or endangered species or migratory birds in the action area" (Long 2000).

Current information concerning the listed threatened or endangered species, published literature, and interviews with experts familiar with the species have been used in preparing this BA. One of the species previously addressed, the threatened Ute ladies-tresses (*Spiranthes diluvialis*) is not known to occur within the action area and has not been included for further analysis in this BA, following consultation with Mr. Terry Root, FWS (2002). Detailed discussions are provided for the five threatened or endangered wildlife species listed in the Introduction, Table 1.

INTRODUCTION

Biological Assessments are prepared by the National Park Service (NPS) to comply with the requirements of section 7 of the Endangered Species Act (ESA). This BA presents and analyzes the effects of the preferred alternative for winter use management on wildlife species listed as threatened or endangered in all areas that may be affected directly, indirectly, or cumulatively by the proposed action (Table 1; U.S. Fish and Wildlife Service (FWS 2002)). Direct effects are immediate impacts resulting from the proposed action, indirect effects are impacts resulting from the proposed action that are removed in time or space but are reasonably certain to occur, and cumulative effects are impacts of future state or private activities, not involving federal activities, that are reasonably certain to occur (50 C.F.R. § 402.02). Two scales of analysis were necessary to comprehensively evaluate these effects: the project area and the action area.

The project area is the area immediately subject to the proposed action (Figure 1, attached) and includes Yellowstone National Park (YNP), Grand Teton National Park (GTNP), and the John D. Rockefeller, Jr., Memorial Parkway (the Parkway). Both direct and indirect effects may occur within the project area as a result of the proposed action. The action area encompasses the parks as well as adjacent lands within the Greater Yellowstone Area (GYA); inclusion of adjacent lands was necessary to assess cumulative effects and indirect effects associated with the proposed action. Upon evaluation of foreseeable state and private actions within the action area, NPS concludes that no cumulative effects are expected as a result of the proposed action.

Between November and April about 75% of the annual precipitation falls as snow. Hence, the GYA has developed a national reputation as a winter recreation center offering activities on national park and forest land, including snowmobiling, snowcoach tours, downhill skiing, cross-country skiing, wildlife viewing, and winter sightseeing. Winter visits to the three parks have increased from virtually none prior to 1970 to more than 100,000 per year by 1980. The number of visitors peaked at 143,000 during the winter of 1993-94 before leveling off at approximately 120,000 per year. Increased winter use has raised concerns about impacts on park resources and values, and placed significant demands on the parks' facilities, equipment, and personnel. Until recently, winter use demands were addressed according to established NPS policies with little additional funding or personnel. It is now apparent that winter activities are an integral part of the visitor experience in the parks, and that specific policies and management direction are needed to guide winter use and protect sensitive resources, including wildlife. Therefore, the NPS evaluated alternatives for winter use, and formulated a comprehensive, programmatic Winter Use Plan for all three parks. A full description of all alternatives is contained in the Winter Use Plan Supplemental Environmental Impact Statement (NPS 2002) and is hereby incorporated by reference.

DESCRIPTION OF PREFERRED ALTERNATIVE

The preferred alternative concept is to arrive, over time, at an economically sustainable level of winter motorized recreation use, including snowmobiles, that protects resource values. This alternative is an adaptive management strategy to mitigate impacts on visitor experience and access, wildlife, air quality and natural soundscapes, while allowing snowmobile access on all major oversnow routes. The identification of an appropriate level of visitation is a primary component of the adaptive management process under this alternative. This level would be identified and achieved by monitoring indicators of a quality experience and desired resource conditions by management zone (Tables 2a, 2b). Monitoring data would be compared to standards that describe the point at which management actions must be taken.

An interim level of snowmobile use would be implemented during the winter of 2003-2004 to maintain historic winter visitation to the parks. Adaptive management and monitoring programs would be implemented to allow the interim numbers to be assessed annually. The results of the adaptive management program would determine the need for adjusting snowmobile numbers up or down to ensure adequate protection of air quality, wildlife resources, visitor experience, and natural soundscapes (as defined in NPS Management Policies 2001). The first year in which adjustment, based on adaptive management, would occur is 2005-2006.

Potential issues and concerns identified during the scoping process were analyzed in the SEIS and included the effects of winter use on: (1) air resources, (2) visitor experience and access, (3) health and safety, (4) natural soundscapes, (5) socio-economics, and (6) wildlife. Key actions of the preferred alternative that would potentially affect threatened or endangered species are summarized as follows:

Actions and Assumptions Common to All Three Units:

- The intent of this alternative is to provide for historic levels of visitation based on the average of the past ten years. Visitation and access to the parks would be available in a mix of snowmobiles and snowcoaches. Implementation of this alternative would be intended to encourage continuous improvement in snowmobile technology for use in the parks, as well as the development, production, and use of a new generation snowcoach. Both modes of access would meet a standard of Best Available Technology, whereupon snowcoach use and occupancy would be emphasized over individual access.

Table 2b. Description of Management Zones for the Preferred Alternative

Management Zones⟶	5 Ungroomed Motorized Trail or Area	6 Groomed Nonmotorized Trail	7 Ungroomed Nonmotorized Trail or Area	8 Backcountry Nonmotorized Area	9 Sensitive Area (no winter use)
Resource Condition or Character	•Ungroomed snow surface •Marked except for frozen water surfaces •Gentle to moderate terrain •Vehicles must meet sound and emission standards •Generally good to excellent air quality •Sound levels intermittent, low to moderate •Wide enough to accommodate existing road corridor, pullouts, overlooks trailheads, trailhead areas •Low to moderate modification of resources to accommodate operational needs, resource protection, visitor enjoyment, and safety •Visitor use may compromise resource values	•Smooth groomed snow surface •Marked and signed •Generally gentle terrain •Creates predictable patterns of winter use and confines resource impacts to narrow corridors •Good to excellent air quality •Minimal modification of resources to accommodate operational needs, resource protection, visitor enjoyments, and safety •Visitor use may compromise resource values •Sound from human sources is intermittent, audibility is low to non-existent •Natural sound predominates the soundscape	•Ungroomed snow surface •Marked or unmarked •Gentle to steep terrain •Creates fairly predictable patterns of winter use and confines resource impacts to relatively narrow corridors •Excellent air quality •Minimal modification of resources to accommodate operational needs, resource protection, visitor enjoyments, and safety •Natural sound predominates the soundscape •Visitor use may compromise resource values	•Appears natural and untouched by humans •Gentle to steep terrain •Excellent air quality •Little to no evidence of visitor impacts •Little to no modification of resources to accommodate operational needs, resource protection, visitor enjoyments, and safety •Visitor use may compromise resource values •Natural sound predominates	•Appears natural and untouched by humans •Gentle to steep terrain •Excellent air quality •Natural and/or cultural resource values so vulnerable that winter visitor use is not permitted
Visitor Experience	•Natural attractions of high interest •Moderate probability of encountering other visitors •Chance to view the natural environment important •Solitude occasionally possible, but not expected •Moderate outdoor skills necessary •Moderate opportunities for challenge and adventure •Relatively quiet; sight and smell of vehicle exhaust not expected	•Provides a sense of immersion in a generally natural landscape •Natural attractions of high interest •High probability of encountering other users •Solitude occasionally possible, but not expected •Provides some sense of adventure •Few outdoor skills needed •Quiet desirable but not essential for visitor enjoyment	•Provides a sense of immersion in a generally natural landscape •Natural attractions of high interest •Moderate probability of encountering other users; probability increases near destination areas •Moderate opportunities for solitude •Feels somewhat distant from most comforts, conveniences, and facilities •Generally requires a commitment to time-consuming and physically and mentally exerting activities •Provides opportunities for adventure and physical challenge •Outdoor skills needed •Natural sounds predominate natural quiet is desirable	•Provides a strong sense of immersion in a very natural landscape •Natural quiet expected •Low probability of encountering other users; good opportunities for solitude •Provides strong sense of remoteness •Requires a commitment to time-consuming and physically and mentally exerting activities •Good opportunities for adventure and physical challenge •Outdoor skills such as route finding, avalanche hazard forecasting, and survival knowledge necessary •Natural sounds predominate natural quiet is desirable	• Natural soundscapes predominate
Activities and Facilities	•Predominantly oversnow vehicular travel; some non-vehicular travel •Oversnow roads, signs, barriers •Interpretive displays •Utilities, restrooms, scenic overlooks, trailhead areas	•Nonmotorized activities only, such as skiing and snowshoeing •Oversnow trails, markers, signs, •Interpretive media •Scenic overlooks, trailheads	•Nonmotorized activities only, such as skiing and snowshoeing •Signs or other route markers	•Nonmotorized activities only, such as skiing and snowshoeing •No facilities	•Limited resource management activities •No visitor activities or facilities

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- NPS will continue to facilitate efforts for the research, development, production, and purchase of new generation snowcoaches.

Actions and Assumptions for Yellowstone National Park

- Recreational snowmobile access allowed in YNP only when accompanied by an NPS-permitted guide. Guided groups may contain from 3-11 snowmobiles, including the guide.
- Continue all existing major groomed motorized routes.
- Allow snowcoaches only on groomed motorized trails such as the Fountain Flats Road.
- Implement the winter use season during the period from late-November to mid-March. Beginning the Friday following President's Day weekend, allow access to YNP only via snowcoach, snowshoe, or skis. Allow early season travel by rubber track vehicle only, until sufficient snow has accumulated for snowmachine use.
- Reduce administrative snowmobile use and supplement with administrative snowcoaches, subject to available funding and authority. Phase in a limited number of administrative snowmobiles to a type using the best clean and quiet technology available.
- Allow non-recreational use of snowmobiles by employees living in the interior. Subject to available funding and authority, provide administrative snowcoaches and replace snowmobiles with those using the best clean and quiet technology available.

Actions and Assumptions for Grand Teton National Park and the Parkway

- The current Flagg Ranch permit will be honored for access by plowed road until it expires in 2008.
- Continue existing motorized routes; in 2002-2003 eliminate snowmobile use on the Teton Park Road and all motorized use on Jackson Lake.

Mitigation for Federally Protected Species and Species of Concern:

- Monitoring is a critical component of this alternative. The mitigation of continued snowmobile use is contingent upon funding and implementation of monitoring sufficient to gage the multiple resource impacts of snowmobiles in a site-specific manner.
- NPS personnel will patrol sensitive resources to ensure compliance with area closures.
- Bald eagle populations will be monitored to identify and protect nests. The parks will continue to support the objectives of the Greater Yellowstone Bald Eagle Management Plan.
- Continue to monitor gray wolf populations.
- Undertake Canada lynx and other carnivore surveys to document the distribution and abundance of Canada lynx and their relationship to packed surfaces.
- Continue to assess grizzly bear abundance, distribution, and habitat selection, including the location of dens. Monitor in accordance with the Interagency Grizzly Bear Management Guidelines and the parks bear management plans.
- Monitoring potential or known winter use conflicts will result in area closures, if necessary, to protect wildlife habitat.

enforces a 0.5-mile buffer zone around active bald eagle nests along the Snake River to provide protection from human disturbance. Alert and flight responses by the bald eagle to human activity occurred at the 75% level when activity was within 500 m, and vehicles and pedestrians elicited the highest response frequencies (NatureServe 2002a).

Nest building or repair intensifies around this time followed by a 35-day incubation period from February through March (Swensen et al. 1986, Harmata and Oakleaf 1992, Stangl 1994). The majority of nesting territories are located along major rivers or lakes within five km of their inlets or outlets, or along thermally-influenced streams or lakes (Alt 1980). Nests and roosts commonly occur in mature and old growth trees in multi-layered stands of Douglas-fir (*Pseudotsuga menziesii*), black cottonwood (*Populus trichocarpa*), and spruce (*Picea* spp.). Nearby food, suitable perches, and security from human activities are important habitat components for both nest and roost sites.

Activity

GTNP contains 11 known nesting territories and pairs, however not all pairs nest in the park each year (Oakleaf pers. comm.). Known territories are located along the shorelines of the Snake River and Jackson Lake. One pair of bald eagles is known to nest near the Snake River within the Parkway, and the upper Snake River is used extensively for foraging year-round (Alt 1980, Cain pers. comm.). Bald eagles that nest along the Snake River in GTNP may remain on their nest territories throughout the year, occasionally leaving for short periods during the non-breeding season to exploit abundant or ephemeral food sources elsewhere. Lake-nesting birds may remain on territory for the period of time Jackson Lake is ice-free. Other winter foraging areas in GTNP include the Buffalo Fork River and Cottonwood Creek (Figure 2).

In YNP, 26 bald eagle nests produced 14 young in 1999; most of these nests were located on the shoreline of Yellowstone Lake. Thirty bald eagle nest sites are currently known for YNP (Oakleaf pers. comm.). After the lake freezes, eagles may move north to feed on winter-killed ungulates on the Northern Range, or to take advantage of gut piles associated with the fall and winter big-game hunt outside of the park. Other eagles occur in thermally influenced areas, or near rivers that remain ice-free such as the Yellowstone and Firehole (NPS 1997; Figure 2, attached).

Some resident adult eagles remain in the parks as winter approaches, and others migrate short distances dictated by food availability. During the winter, large numbers of migratory eagles join resident eagles, with up to a 45% influx reported in some years (Stangl 1999). In general, bald eagle winter habitat is associated with areas of open water where fish or waterfowl congregate (Swensen et al. 1986), or ungulate winter range where eagles scavenge on carcasses of large winter killed mammals.

Conservation Measures

Measures that would be undertaken by the parks to mitigate impacts to the bald eagle include:

- NPS would patrol sensitive resource areas to ensure compliance with area closures;
- Bald eagle populations would be monitored to identify and protect nests;
- The parks would continue to support the objectives of the Greater Yellowstone Bald Eagle Management Plan;
- The parks would provide area closures to protect wildlife habitat if winter use conflicts are identified during monitoring; and
- The Parks would continue winter closures on the Snake River floodplain and Buffalo Fork River floodplain, among others.

be insignificant because eagle breeding activities initiate when winter activities begin to decrease in the parks in late February.

Indirect Impacts

No indirect impacts to bald eagles are likely to occur under the preferred alternative.

Short-term Impacts

As stated above, low-level human use and disturbance associated with motorized winter recreational activities may occasionally displace eagles from perches, but the impact is considered short-term and insignificant due to the fidelity bald eagles have to their traditional perches.

Long-term Impacts

No long-term impacts would be likely to occur under the preferred alternative, due to stated mitigation measures and management actions prescribed under the adaptive management program.

Cumulative Effects

The cumulative impacts expected to occur have been presented in the SEIS (2002) and include off-park conflicts with other human use activities such as general recreation, hunting, and ranching. Development on private lands, loss of open space habitat, or road construction are other possible sources of cumulative impacts. The most relevant impact sources are those which occur in the winter. Upon evaluation of foreseeable state and private actions within the action area, the NPS concludes that no cumulative effects to the bald eagle are expected as a result of the preferred alternative.

Current Management Policies and Requirements Related to Bald Eagles

Current NPS policies:

- Retain winter use closures in GTNP along the Snake River and Buffalo Fork floodplains.
- Continue to close areas within a 0.5-mile radius around nests starting 15 February in GTNP.
- Continue to remove carcasses on and along roads.

Current USFS policies:

Most national forest plans in the GYA do not contain specific management direction for bald eagles, but some forests are required to carry out measures for the protection of the species as a result of Section 7 consultation (e.g., the Gallatin National Forest). However, it is anticipated that the forests will continue to abide by the Bald Eagle Management Plan for the Greater Yellowstone Ecosystem. Any identified site-specific conflicts between winter uses and bald eagles would be addressed through management practices and the standards and guidelines prescribed in the Bald Eagle Management Plan.

Summary

The primary impacts to bald eagles under the preferred alternative would be related to perch abandonment due to motorized winter recreation along riparian corridors. Using trained guides and group leaders, as well as quieter and cleaner snow machines, would result in this impact being considered insignificant. The parks will continue to abide by the Bald Eagle Management Plan for the Greater Yellowstone Ecosystem (Greater Yellowstone Bald Eagle Working Group 1996). It is the established management

Direct Impacts

No direct impacts associated with motorized winter recreation would occur under the preferred alternative because the whooping crane is not a winter resident of the project or action area.

Indirect Impacts

No indirect impacts associated with motorized winter recreation would occur under the preferred alternative because the whooping crane is not a winter resident of the project or action area.

Short-term Impacts

No short-term impacts associated with motorized winter recreation would occur under the preferred alternative, because the whooping crane is not a winter resident of the project or action area.

Long-term Impacts

No long-term impacts associated with motorized winter recreation would occur under the preferred alternative, because the whooping crane is not a winter resident of the project or action area.

Cumulative Effects

Cumulative impacts to the whooping crane include those that could occur during migration to and from Bosque del Apache NWR in New Mexico. Upon evaluation of foreseeable state and private activities within the action area, NPS concludes that no cumulative effects are expected to the whooping crane as a result of the preferred alternative.

Current Management Policies and Requirements Related to Whooping Cranes

Current NPS policies:

- Continue to protect whooping cranes and their habitat. Areas used by cranes would be closed to public entry while occupied.
- Investigate all reported observations, and record verified observations in park files.

Current USFS policies:

- Continue to protect whooping cranes and their habitat.

Summary

Because the whooping crane is not a winter resident of the project or action area, it is not affected by motorized winter recreational activities under the preferred alternative. Therefore, the actions of the preferred alternative **will not affect** the continued survival of the whooping crane in the parks.

Background

The NPS is responsible for protecting grizzly bear populations and habitat as mandated by the Yellowstone Park Act (1872); the National Park Service Organic Act (1916); NEPA (1969); the ESA (1973); and the National Parks Omnibus Management Act (1998). Based on these legal requirements and plans, NPS policy requires that national parks perpetuate native animal populations against destruction, removal, harassment, or harm through human actions (NPS 1988, 1991).

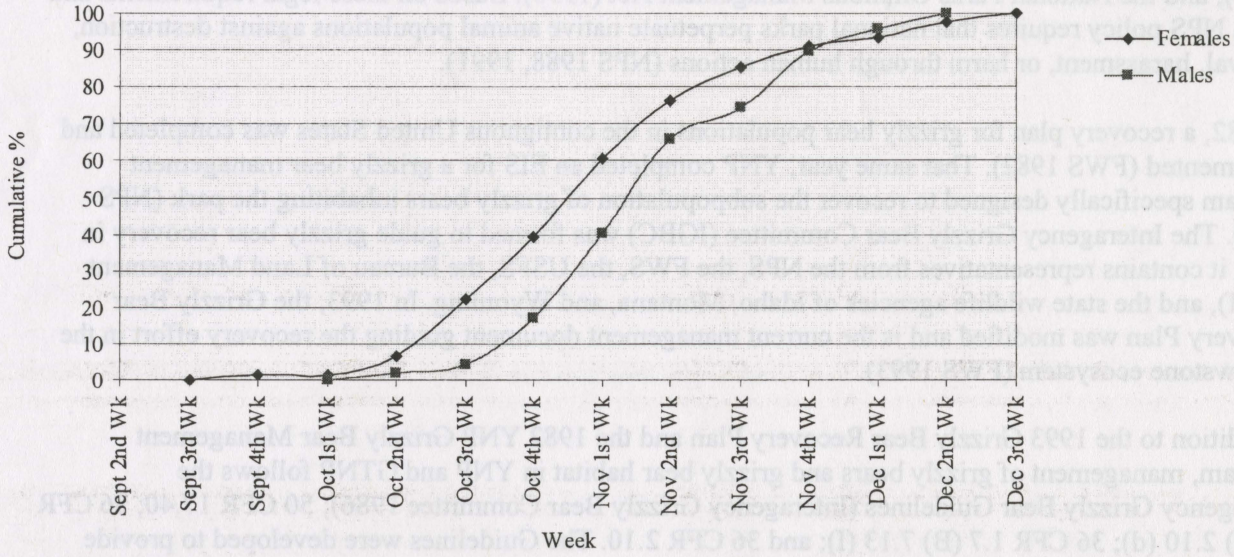
In 1982, a recovery plan for grizzly bear populations in the contiguous United States was completed and implemented (FWS 1982). That same year, YNP completed an EIS for a grizzly bear management program specifically designed to recover the subpopulation of grizzly bears inhabiting the park (NPS 1982). The Interagency Grizzly Bear Committee (IGBC) was formed to guide grizzly bear recovery in 1983; it contains representatives from the NPS, the FWS, the USFS, the Bureau of Land Management (BLM), and the state wildlife agencies of Idaho, Montana, and Wyoming. In 1993, the Grizzly Bear Recovery Plan was modified and is the current management document guiding the recovery effort in the Yellowstone ecosystem (FWS 1993).

In addition to the 1993 Grizzly Bear Recovery Plan and the 1982 YNP Grizzly Bear Management Program, management of grizzly bears and grizzly bear habitat in YNP and GTNP follows the Interagency Grizzly Bear Guidelines (Interagency Grizzly Bear Committee 1986); 50 CFR 17.40; 36 CFR 1.7(B) 2.10 (d); 36 CFR 1.7 (B) 7.13 (I); and 36 CFR 2.10. The Guidelines were developed to provide effective direction for the conservation of grizzly bears and their habitat to federal agencies responsible for managing land within the recovery zone. Submitted to the FWS for formal consultation as required by 50 C.F.R., Section 402.04, the guidelines received a Biological Opinion that stated "It is our opinion that implementation of the Guidelines will promote conservation of the grizzly bear." The IGBC subsequently approved the application of the Guidelines on federal lands throughout grizzly bear ecosystems in Idaho, Montana, and Wyoming. To supplement the Guidelines and to address the need for a comprehensive bear management, research, and monitoring program, GTNP revised its Human-Bear Management Plan in 1989 (GTNP 1989).

Management of grizzly bears in the parks under these programs has been highly successful in promoting grizzly bear recovery and reducing human-bear conflicts and human-caused bear mortalities. Although YNP comprises approximately 24% of the primary area currently occupied by grizzly bears in the Yellowstone ecosystem, it contains approximately 39% of the adult female grizzlies observed with cubs annually, and 40% of the total number of cubs counted each year. Even though these numbers are high, YNP accounts for only 5% of the human-grizzly bear conflicts and 7% of the human-caused grizzly bear mortalities occurring in the ecosystem (Gunther et al. 1999, Gunther and Hoekstra 1998). Important for motorized winter recreation considerations, only one human-bear confrontation occurred in YNP in the springtime prior to April, and two conflicts occurred in late November resulting in one management action to translocate one bear (Gunther, pers. comm., Cain, pers. comm.). None of these conflicts were related to oversnow vehicle activity (Gunther, pers. comm.).

In GTNP, three grizzly bear-human conflicts have resulted in human injuries, only one of which occurred in March (2001) during the shoulder seasons (late November-mid-December, and mid-February-mid-March (Cain, pers. comm.)). Also, one grizzly bear-human conflict has resulted in human injuries in the Parkway. In addition, only four management actions have resulted to grizzly bears in the parks. The management actions taken were: 1) one bear was euthanized after repeated depredations on cattle; 2) one bear was euthanized after becoming habituated to people at Flagg Ranch; 3) one bear was translocated after becoming habituated to people at the AMK Ranch; and 4) one bear was translocated to the Parkway after becoming habituated to humans. None of these actions occurred during the shoulder seasons. However, increasing winter use of steep, high-elevation terrain by non-motorized backcountry

Figure 5. Timing of den entry (cumulative % of bears in dens) by week for female and male grizzly bears in the GYA, 1975-99. Week of den entry was determined for individual bears if the days between the last active date and the first known den date was less than 15 days (Haroldson et al. 2002).



The availability of these foods and weather conditions influence the initiation of denning (Craighead 1979). During years of ample food, mild temperatures, and low snow cover, grizzly bears tend to den later in the season. Based on 24 years of den entry data for grizzly bears in the GYA, approximately 90% are denned by the end of November (Table 4, Figure 5; Haroldson et al. 2002). In one study, grizzly bears were documented to frequent the immediate area of their dens from eight to 22 days before denning (Judd et al. 1986). Dens were often located at sites with whitebark pine and subalpine fir at an average elevation of 8,100 feet (range: 6,500 - 10,000 feet), and were found on north slopes in the 30-60 degree range (Judd et al. 1986).

Grizzly bears emerge from their dens when temperatures rise and food availability increases (e.g., winter killed ungulates or spring vegetation). Consequently, when spring arrives early and melting snow exposes green vegetation and carcasses, grizzly bears may emerge from dens earlier in the season (Craighead 1979). First to emerge are adult males between mid-February and late March, followed by subadults and solitary females in late March or early April; lastly, females with new cubs emerge between early and mid-April (Table 5, Figure 6; Haroldson et al. 2002). From March through May, ungulate carrion (primarily elk (*Cervus elaphus*) and bison (*Bison bison*)) is the most important grizzly bear food (Mattson et al. 1991), along with elk calves and cutthroat trout (*Onchorhynchus clarkii*). Grizzly bears may also consume over-wintered whitebark pine seeds if seed production was abundant the previous fall (Mattson et al. 1992).

Several of the most important early-spring and late-fall grizzly bear foods in the Yellowstone area are limited in distribution and subject to wide annual fluctuations in availability, including elk and bison carcasses and whitebark pine seeds (Mealey 1975, Pritchard and Robbins 1990, Craighead et al. 1995). Consequently, grizzly bear distribution during the pre- and post-denning periods in any given year is a function of the abundance and occurrence of these foods. During years when these food sources are abundant, there are few human-bear conflicts in the Yellowstone ecosystem (Gunther et al. 1997). In contrast, during years when there are shortages of one or more of these foods, especially whitebark pine seeds, human-bear conflicts are more frequent and there are generally higher numbers of human-caused

days between their last known den date and the first known active date was less than 15 days (Haroldson et al. 2002.).

Activity

Grizzly bears are found throughout YNP, in GTNP, and in the Parkway; grizzly bears have increased from relatively uncommon to common in GTNP during the last 10 years, in conjunction with a steady trend toward increasing bear density in the southern GYA. Home ranges of 27 radio-collared bears from 1975–98 included parts of GTNP and the Parkway. Grizzly bears are now common in the Two Ocean Lake area and Gros Ventre Mountains on the southeastern border of GTNP, and southeast to the upper Green River Basin. In the Teton Range, they are regularly observed north of Moran Canyon and the Badger Creek drainage, where visitor use of the backcountry occurs at relatively low levels. On the Jackson Hole valley floor, they are common north of the Triangle X ranch, and have been observed in the Snake River drainage on several occasions.

Conservation Measures

Measures that would be undertaken by the parks to mitigate impacts to the grizzly bear include:

- NPS would patrol sensitive resource areas to ensure compliance with area closures;
- The parks would monitor in accordance with the Interagency Grizzly Bear Management Guidelines and the parks bear management plans;
- The parks would continue to assess grizzly bear abundance, distribution, habitat selection, and den locations; and
- The parks would provide area closures to protect wildlife habitat if winter use conflicts are identified during monitoring.

Direct Impacts

Few data exist on the impacts of motorized winter human activity on denning grizzly bears (Reinhart and Tyers 1999), and no studies have documented that winter recreation disturbs hibernating bears (Root, pers. comm.). Several studies indicate that while certain activities (hydrocarbon mining, overflights by fixed-wing aircraft, and winter seismic testing) may have caused bears to move inside their dens or elevated their heart rates, the affects were probably minimal (Reynolds et al. 1984). Furthermore, preferred denning habitats are generally remote and thus are removed from most motorized winter recreation in the parks (Figure 6, attached; Gunther, pers. comm.). For these reasons, it is anticipated that motorized winter activities would have discountable impacts on grizzly bears.

Of greater concern are the effects of human activities that occur near important grizzly bear foraging habitats during the pre- and post-denning period. Whether or not conflicts occur is largely dependent upon the number of visitors in the parks, where recreational activities occur, and the abundance and distribution of natural bear foods in any given year. During years of high whitebark pine seed production, grizzly bears are not as likely to come into conflict with human activities prior to denning because this food source occurs at high elevations in remote, less-visited areas. Most management actions occur in the early to mid-fall, prior to the initiation of the motorized winter use season, when the whitebark pine seed crop has failed and grizzly bears seek out human sources of food, including garbage (Gunther, pers. comm.). Park policy currently calls for closing areas of high-bear use at any time to reduce the risk of human-bear conflicts.

snowmobile use affects denning grizzly bears. Should the winter use plan of the preferred alternative somehow result in a displacement of snowmobilers to adjacent USFS-managed lands, indirect impacts to denning grizzly bears could occur, and would be assessed using the following or similar data.

The Interagency Grizzly Bear Study Team (IGBST) has documented 380 grizzly bear den sites of radio-collared grizzly bears from 1975-99 in the GYA. These data represent the last known den site for an individual bear in a given year and only one site per bear per denning year. Den site data are only a small sample of den locations in the GYA and are not representative of all potential denning habitats in the GYA. Radiotelemetry efforts during most of this period were focused within the recovery area. Consequently, inferences beyond this area are subject to minimal sample size and interpretation. In addition, den site locations are only accurate to + or – 100 meters. The IGBST has begun a process to model potential grizzly bear denning habitat, and that information has been accepted for publication this year (Schwartz pers. comm., Podruzny et al. 2002). In addition, an Interagency assessment, completed in March 1999 (Greater Yellowstone Winter Use Working Group 1999) identified areas closed to snowmobile use, areas open to snowmobile use, and areas and routes currently used by snowmobiles in the GYA. These data have limitations in accuracy and resolution, e.g., the large mapped polygons (1:250,000 scale) identifying areas open to and used by snowmobiles on national forest lands in the GYA likely contain inclusions of steep or forested terrain inaccessible to snowmobiles, as well as low snow areas.

Even with the limitations identified, these data allow a general evaluation of where bears have denned as it relates to snowmobile use in the GYA. Approximately 88% of all dens were located in areas currently closed to dispersed snowmobile use and about 96% of all dens were located in the grizzly bear recovery area (Table 6). This high percentage within the recovery area likely reflects sampling effort and historic bear distribution. In recent years, bears have reoccupied areas outside the recovery area in greater numbers. However, the telemetry sample from this group of bears is limited. Although 12% of the dens were within mapped areas actually used by snowmobiles and other recreation use (Table 6) only about 5% of the dens were within mapped areas actually used by snowmobiles (Table 7). Most of the areas where snowmobiling is available but not currently used either do not reliably accumulate enough snow to sustain oversnow motorized recreation or are better suited to nonmotorized winter uses (Greater Yellowstone Winter Use Working Group 1999). Four of 14 dens that were in areas open to snowmobiling outside the recovery area were in areas defined as low or unpredictable snow depths (Greater Yellowstone Winter Use Working Group 1999). The distance from dens to existing snowmobile routes and play areas was also evaluated in 500-meter intervals (Table 7). Almost 83% of all dens were greater than 2,000 meters away from snowmobiling use areas or routes.

Table 6. Number of grizzly bear dens (1975-99) in areas open to and areas closed to snowmobiles in the Greater Yellowstone Area (Greater Yellowstone Winter Use Working Group 1999).

Area	Outside GB Recovery Area	Inside GB Recovery Area	Total
Closed to snowmobiles	1	332	333 (87.6%)
Open to snowmobiles	14	33	47 (12.4%)
Total	15 (3.9%)	365 (96.1%)	380

Besides impacts to denning bears, snowmobile activity could lead to an increase in human-bear conflicts during the shoulder seasons when bears may be active. This impact would be partially dependent on snow conditions, as snowpacks in the forests from late November to mid-December are generally poor. Furthermore, some forest closures to protect ungulate winter range are in effect beginning 1 December and remain in effect until 1 May. The areas on national forests identified as having the greatest potential for conflicts between snowmobile use and grizzly bears in the spring include Hebgen Lake – Gallatin National Forest (NF), Hell Roaring – Beaverhead -Deerlodge NF, Pahaska – Shoshone NF (Greater Yellowstone Winter Use Working Group 1999).

Another indirect impact considered, but difficult to quantify, is the effect of whitebark pine blister rust (Reed 2002). This disease could kill trees outright or reduce seed production from whitebark pine, a principal food source for the grizzly bear.

Short-term Impacts

The short-term impacts of the preferred alternative on grizzly bears would include the following: 1) potential, yet unsubstantiated disturbance to denning bears; 2) potential displacement of individual grizzly bears from important spring and fall habitat as a result of human activities associated with motorized winter recreation; 3) potential disruptions to behavior, social systems, and activity patterns as a result of management actions that remove bears from the parks; and 4) the potential for short-term declines in reproductive potential as a result of management actions that remove grizzly bears. The impacts described in numbers 1 and 2 would be more likely to occur on adjacent project area lands versus on the parks. Because of the low numbers of human-bear conflicts and removals that occur in the late fall and early spring, it is expected that the impacts to grizzly bears associated with motorized winter recreation in the parks would be adverse, but discountable.

Long-term Impacts

The long-term impacts of the preferred alternative on grizzly bears would be related to the loss of individuals and their reproductive potential due to any removals that may occur, and the effects of this loss on the long-term viability of the GY population. However, as previously stated, it is expected that the impacts to grizzly bears associated with motorized winter recreation in the parks would decrease as compared to current winter use management due to features of the preferred alternative that restrict public access for motorized oversnow vehicle use.

Cumulative Effects

The cumulative impacts expected to occur have been presented in the SEIS (2002) and include off-park conflicts with other human use activities such as general recreation, hunting, and ranching. Development on private lands, loss of open space habitat, or road construction are other possible sources of cumulative impacts. The most relevant impact sources are those which occur in the winter. Upon evaluation of foreseeable state and private actions within the action area, the NPS concludes that no cumulative effects to the grizzly bear are expected as a result of the preferred alternative.

Recommended Monitoring

As discussed under Indirect Impacts, an examination of the spatial relationship between grizzly bear dens and areas of snowmobile use on the forests indicated that a relatively small proportion of dens were located in snowmobile use areas. Whether or not snowmobiles may disturb denning bears is unknown. The IGBST is aware of this problem and plans to establish monitoring protocols for assessing the impacts of snowmobiles on denned grizzly bears (Barber, pers. comm.). Upon completion of the monitoring

established and reproduce in each of the three recovery areas for three successive years, the gray wolf is eligible for removal from the list of endangered species in Idaho, Montana, and Wyoming. The anticipated date of recovery is 2002, when responsibilities for wolf management will be turned over to individual state and federal agencies providing that approved management plans are in place. The recovery criteria (for removing gray wolves from the endangered species list) were met in 2000 and 2001; it is expected that the process of delisting could begin in 2003 if state management plans are in place (FWS 2002, Jimenez pers. comm.).

Background

Although gray wolves are native to the GYA (Young and Goldman 1944, Hall and Kelson 1959), human depredation resulted in their extirpation by the 1930s (Reinhart 1999). The FWS published a final rule on 22 November 1994, directing the reintroduction of gray wolves in YNP. The rule contained several measures to direct the management of reintroduced gray wolves, including prohibitions on taking or possessing of gray wolves (with certain exceptions) and restrictions on human access to gray wolf facilities and dens in the national parks.

Reintroduction efforts in YNP began in the winter of 1994-1995, when 14 gray wolves were released; 17 additional gray wolves were released in 1996 (Phillips and Smith 1997). At the end of 1999, there were approximately 118 gray wolves present in the GYA; of these 38 were in 11 established packs (FWS, Nez Perce Tribe, NPS, USDA Wildlife Services 2000). As of 2001, the Greater Yellowstone Recovery area supported an estimated 218 gray wolves (FWS 2002).

Gray wolf management in the parks consists of monitoring population dynamics and gathering ecological data relevant to the gray wolf's return to the GYA. To determine territory sizes and locate dens, collared gray wolves are monitored using both ground-based and aerial telemetry. By observing dens, birthing dates are estimated and the number of pups counted. In addition, gray wolf deaths are investigated, and gray wolf-prey relationships are documented by observing gray wolf predation directly and by recording characteristics of prey at kill sites. Collaborative research is ongoing and represents pioneering work on gray wolf ecology.

Gray wolves concentrate winter and spring activities on ungulate winter range where they prey primarily on elk and scavenge carcasses (Reinhart 1999). Therefore, motorized winter recreation that occurs near or on ungulate winter range is of primary concern for winter use management.

Activity

Gray wolf packs occur throughout the central GYA, including areas to the north and east of the parks (Figure 7, attached). In 1998, gray wolf pack territory sizes averaged 359 square miles (range: 135-955 square miles; Smith et al. 1998). Gray wolf winter ranges are concentrated in areas of high prey, consequently ungulate winter range is closely associated with gray wolf activity. Depending upon prey abundance, gray wolves may occupy a variety of habitats including grasslands, sagebrush steppes, coniferous and mixed forests, and alpine areas.

In GTNP, prior to the reintroduction, unverified reports of wolves or wolf tracks had been received since the late 1960s (GTNP wildlife observation files). In 1994, reports from a variety of sources, including three area biologists, provided very good evidence of a single wolf using the area between Pacific Creek and lower Berry Creek (Reid, pers. comm.).

Gray wolves dispersing from YNP began to appear in GTNP in 1997. The Teton Pack (formerly the "Teton Duo") and the Gros Ventre Pack (formerly the "Jackson Trio") ranged widely throughout the park

- The parks would provide area closures to protect wildlife habitat if winter use conflicts are identified during monitoring.

Direct Impacts

Direct impacts to gray wolves occur within the parks and within the project area. At least 16 wolves died in the GYA during 2000. Thirteen died due to human-caused mortality (nine in control actions, two to wheeled vehicles, and two to illegal killing), and three died due to natural causes. At least eight gray wolves from the GYA in Montana died during 2001; five in depredation control actions (FWS 2002). Gray wolf depredation to domestic animals was summarized for 2001and included 40 cattle, 138 sheep, six dogs, and four llamas (FWS 2002). In response, 18 gray wolves were translocated and 19 were killed within the three-state area.

Direct impacts to wolves from activities associated with motorized recreation include mortality from being hit by automobiles. Out of 60 documented wolf mortalities from 1995 to 1998, motorized vehicles killed 11 wolves (10 in or near YNP and one in GTNP). In general, wolves avoid roads that are open to the public, but have been documented to use closed or limited use roads (Thurber et al. 1994, Carbyn 1974). In YNP, wolves cross roads periodically, but little use of roads as travel corridors has been documented (Smith, pers. comm.). The likelihood of wolves being hit by automobiles is highest for those packs that inhabit areas on the north side of YNP, and to a lesser degree, packs in GTNP (Figure 7, attached). Also, to protect scavengers, the parks routinely remove carcasses from roads and roadsides. No wolves have been killed by oversnow vehicles to date. The risk of a wolf being hit by a snowmobile or snowcoach is considered very small, and therefore, the impact is considered discountable.

Snow grooming may directly affect wolves by compacting snow, thus facilitating travel into areas that would normally be inaccessible due to deep snow. Consequently, predator/prey dynamics and prey movement across the landscape may be modified (Paquet et al. 1998). However, the ecological significance of altering natural movement and foraging patterns is not fully known (Reinhart 1999). Furthermore, wolves in YNP have not been documented to travel on groomed snowmobile routes (Smith, pers. comm.).

Lastly, the potential displacement of wolves by human winter activities, including snowmobiling, may have both short- and long-term effects on wolves, including both temporary and permanent displacement and impacts to energy budgets from repeated disturbance (see below). Although wolves may range widely in the winter, snow depth and condition may influence their movements (Mech 1970) thus the effects of displacement on wolves may vary with winter severity.

Impacts to denning wolves would not be expected to occur because wolves den in April, after the closure of the winter recreation season in the parks. In accordance with park policy, areas within a one-mile radius of the dens are closed to public entry in YNP; GTNP also has the authority to enact closures. In addition, in YNP, many of the wolf dens are within grizzly bear spring closure areas, and thus are not subjected to disturbance from motorized human activity.

Indirect Impacts

Grooming of roads and trails may influence ungulate movements (Meagher 1993) and indirectly affect gray wolves. Because gray wolves primarily rely on calves and winter-weakened adult elk from late February to April, any displacement of ungulates may, in turn, displace gray wolves and alter predator-prey dynamics. Such displacement may also impact energy budgets for gray wolves in the vicinity of groomed roads and trails. These impacts would be expected to be adverse, but insignificant.

Summary

The primary impacts to gray wolves under the preferred alternative would be related to the effects of motorized winter recreation on wolf foraging habitats and energy budgets. The gray wolf may have access to a larger foraging range because of compacted snow surfaces. As the gray wolf population increases and the territory expands, the potential to impact individuals and packs due to motorized winter recreation activities would increase. However, the impacts would be few relative to the larger number of individuals. Because of the relatively insignificant and discountable nature of the potential adverse impacts, it is in the opinion of the NPS that the preferred alternative **may affect, but is not likely to adversely affect** gray wolves.

CANADA LYNX

Status

The FWS proposed to list the Canada lynx (*Lynx canadensis*) as a threatened species under the ESA in July 1998 (63 FR 36993). In July 1999, the FWS extended the normal 12-month rule-making process six months to allow for consideration of new scientific information and additional public comments (64 FR 36836). A final ruling, issued 21 March 2000, declared the Canada lynx a threatened species.

Historical range of the Canada lynx in the GYA includes Idaho, Montana, and Wyoming (FWS 1998). Both Montana and Idaho classify the Canada lynx as a furbearer, but no longer allow trapping. In Idaho, a 1990 survey indicated that the population was stable or declining (FWS 1998). Recent confirmed records are scarce, and the Canada lynx is considered rare. The Montana Department of Fish, Wildlife and Parks estimated the Canada lynx population at 1,040 animals in 1994, and the FWS considers Canada lynx to be resident in that state (FWS 1998b).

In Wyoming, the Canada lynx has been protected as a non-game species with no open season since 1973. It is considered rare (FWS 1998) in the state, and has been documented in the Wind River and Wyoming Mountain Ranges. The Canada lynx is classified as a Species of Special Concern-Class 2 by the Wyoming Department of Game and Fish, indicating that habitat is limited and populations are restricted or declining (NPS 1998).

Background

In response to the emerging awareness of the uncertain status of Canada lynx populations and habitat in the coterminous United States and the onset of the listing process, an interagency Canada lynx coordination effort was initiated in March 1998. The FWS, USFS, BLM, and NPS have participated in this effort. Three products important to the conservation of Canada lynx on federally managed lands have been produced "The Scientific Basis for Lynx Conservation" (Ruggiero et al. 1999); the Lynx Conservation Assessment and Strategy (LCAS; USFS 1999); and Lynx Conservation Agreements (CA) between the FWS and various land management agencies. The NPS is currently developing a CA with the FWS for Canada lynx that was completed in draft form in the second quarter of 2000. That agreement will promote the conservation of Canada lynx and its habitat in the national parks and identify actions the NPS agrees to take to reduce or eliminate adverse effects or risks to Canada lynx and their habitat. The LCAS was produced in 1999 to provide a consistent and effective approach to conservation of Canada lynx on federal lands, and was used as a basis, along with researcher knowledge, for assessing the effects of the preferred alternative on Canada lynx in the parks.

during the winter season. It is focused on the Canada lynx, slated to run from 2001-2003, and cover three winter and three summer field seasons. A female Canada lynx was detected in East YNP using summer hair-snare surveys and was later confirmed using winter tracking surveys. Probable Canada lynx tracks were observed near Le Hardy Rapids (Canyon-Lake road segment) and Cub Creek, and a possible track was observed near Mary Mountain (Murphy et al. 2002). It was also observed that several road segments in YNP occur in high-quality Canada lynx habitat.

Little information on Canada lynx abundance and distribution is available for GTNP and the Parkway. GTNP files include only 12 unverified reports (Figure 8, attached; GTNP wildlife observation files). During a transect survey of 169 km at nine locales in northern GTNP and vicinity in 1998, S. Patla (Wyoming Game and Fish Department, pers. comm.) found no sign of Canada lynx.

In general, due to low habitat availability, snowshoe hares are believed to be at low densities in the parks, consequently, Canada lynx densities may be low as well. Because of the secretive nature of Canada lynx and their use of deep-forest habitats, few ecological studies of Canada lynx exist, including research on the effects of winter recreation. However, some speculative impacts related to the preferred alternative are addressed below.

Conservation Measures

Measures that would be undertaken by the parks to mitigate impacts to the Canada lynx include:

- NPS will patrol sensitive resource areas to ensure compliance with area closures;
- The parks would undertake Canada lynx surveys to document their distribution and abundance, including relationship to packed snow surfaces; and
- The parks would provide area closures to protect wildlife habitat if winter use conflicts are identified during monitoring.

Direct Impacts

Direct impacts from the preferred alternative to individual lynx would include being hit by wheeled vehicles on plowed roads and snowmobiles or snowcoaches on groomed roads (Figure 8, attached). Although a possibility, there are few records of lynx being killed on highways (USFS 1999) and no road-killed lynx have been documented in the GYA (Halfpenny et al. 1999). Carnivore research in Canada suggests that traffic volumes of 2,000-3,000 vehicles a day are problematic (USFS 1999). During the winters of 1992-99, the average number of wheeled vehicles entering YNP through the north entrance station was 306 vehicles a day. In GTNP, where all the main access routes are plowed, an average of 1,330 vehicles a day entered the park (including the Parkway) during the same period of time (NPS park visitation records). This could result in an insignificant adverse effect on Canada lynx in the parks.

The closure of oversnow travel from about 8:00 p.m. to 7:30 a.m. would be a beneficial impact and would decrease the possibility of Canada lynx, which are primarily active from dusk until dawn, from being hit by snowmobiles and snowcoaches. Also of benefit to lynx, snowmobile and snowcoach speeds would be monitored by trained guides and group leaders, while traffic volumes would be monitored, under the preferred alternative. Future levels of use could include lowering the volume along a road segment.

Indirect Impacts

Indirect impacts resulting from the preferred alternative include reduction in habitat effectiveness resulting from motorized traffic on plowed and groomed roads and increased competition for prey from

snow compacting activities. Traffic volumes would remain similar to the current levels under the snowmobile access and snowcoach mass transit feature of the preferred alternative, and large areas of relatively undisturbed potential lynx habitat exist in the parks (Figure 9, attached). Travel would be managed by trained guides and group leaders ensuring reasonable speeds. In addition, snow machines would be required to be quieter and less polluting than current machines. However, insignificant adverse affects to Canada lynx would be expected with these changes in operations and equipment requirements. The closure of oversnow travel from about 8:00 p.m. to 7:30 a.m. would be a beneficial impact to the Canada lynx.

Cumulative Impacts

The cumulative impacts expected to occur have been presented in the SEIS (2002) and include off-park conflicts with other human use activities such as general recreation, hunting, and ranching. Development on private lands, loss of open space habitat, or road construction are other possible sources of cumulative impacts. The most relevant impact sources are those which occur in the winter. Upon evaluation of foreseeable state and private actions within the action area, the NPS concludes that no cumulative effects to the Canada lynx are expected as a result of the preferred alternative.

Current Management Policies and Requirements Related to Canada Lynx

NPS policies:

The NPS is in the process of developing a conservation agreement with the FWS on a conservation strategy for lynx. The conservation agreement between the FWS and the NPS is currently under review and awaiting signatures (Dratch, pers. comm.).

USFS policies:

Due to the relatively recent nature of the lynx listing, GYA forest plans do not provide specific management direction concerning lynx. The forests will manage for lynx and their habitat by following the Conservation Strategy for lynx, and have entered into a Conservation Agreement with the FWS to that effect.

Summary

The primary impacts to lynx under the preferred alternative would be related to the effects of motorized winter recreation on habitat effectiveness and snow compaction. Habitat effectiveness may be decreased due to human activities in prime lynx habitat, and groomed roads and trails may allow other predators to compete with lynx in deep snow conditions where otherwise lynx would have a competitive advantage. However, in the parks, motorized use is highly regulated, no new groomed or designated routes would be planned without evaluating potential effects to the Canada lynx, and large areas of relatively undisturbed potential Canada lynx habitat exist. Therefore, it is in the opinion of the NPS that with the implementation of the mitigation measures discussed, the preferred alternative **may affect, but is not likely to adversely affect** Canada lynx in the parks.

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LIST OF ATTACHMENTS

- backcountry ski restrictions →

no off trail skiing

APPENDIX A
ALL ALTERNATIVES ANALYZED IN THE DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

The Department of Agriculture, The Department of the Interior, Brucellosis, and the Farmer

Mary Meagher

The United States Department of Agriculture has been carrying on a comprehensive program for the eradication of brucellosis within the borders of the United States. A target date of 31 December 1975 has been set, and large amounts of money are being spent on testing cattle and other domestic animals and destroying those infected.

The Department of the Interior has been accused of indifference and lack of cooperation by people in Agriculture, farmers, and state officials because they have not agreed to carry out a program of eradicating brucellosis from the bison herd in Yellowstone National Park. Methods involving everything from confining the bison, testing them, and slaughtering the infected animals to the near elimination of the herd have been proposed.

In a letter to *BioScience*, Mary Meagher, Research Biologist at Yellowstone, reports as follows:

"The presence of brucellosis in the Yellowstone National Park bison is a focal point of increasing concern to livestock and associated organizations. A brucellosis eradication program within the park would destroy the Yellowstone bison as a free-ranging wild population with unique and irreplaceable values. Accordingly we have proposed an alternative program of boundary control which would both preserve the integrity of the bison population, yet reduce to zero the remote possibility that the park bison could serve as a source of infection for cattle. Our alternative proposal remains unacceptable to these concerned people.

"The question of an eradication program within the park raises a major issue concerning park values and purposes, and our ability to maintain these in today's society. An environmental impact statement would have to accompany an eradication proposal—for certainly the public interest is involved."

And an enclosure:

Brucellosis and the Yellowstone Bison

A. Yellowstone bison have unique esthetic and scientific values which cannot be duplicated elsewhere, and which cannot be replaced if the park bison are destroyed or manipulated into domestication. These bison are seen and photographed in their natural habitat by many thousands of park visitors in all seasons each year.
   1. The only population of wild bison in the United States which was not exterminated in historic times survived in Yellowstone to continue existence in freeranging herds.
   2. These bison are descended from both mountain bison which originally inhabited the park and plains bison introduced in 1902. The mountain bison subspecies was completely exterminated elsewhere in the United States.
   3. The Yellowstone bison are the only U. S. population regulated solely by natural processes. Bison which die from various natural causes provide food for the park's meat-eating wildlife—including rare and endangered species such as the grizzly bear, gray wolf, and bald eagle.

B. Brucellosis in park bison:
   1. Is reflected by blood tests, but apparently does not cause disease conditions or abortions in park bison.
   2. The absence of disease conditions from the *Brucella* organism in park bison suggests a long, natural association. A natural immunity in bison, as well as a specific host requirement for the organism, may have developed.

C. Past brucellosis control programs in Yellowstone have been carried out only in conjunction with reductions to control bison population numbers. Present knowledge suggests there may be no need for future reductions.

D. The efficiency and effects of capturing wild bison for a brucellosis *control* (test, slaughter positive reactors, vaccinate female calves) program have been tested. The 1964-66 brucellosis control-reduction program showed the following:
   1. This kind of program would be never-ending because:
      (a) Even with the most favorable trapping conditions during severe winters, less than 75% of the bison in the more accessible winter herds could be captured.
      (b) The efficiency of trapping decreased during milder winters and from previously trapped bison becoming more wary.
      (c) A natural mixing of animals from herds that wintered in inaccessible wilderness and could not be trapped would also preclude obtaining a brucellosis-free bison population.
   2. The yearly slaughter of all bison that were positive reactors would remove dominant lead-females that are essential to retain historical patterns of habitat use, and would reduce smaller herds to such low numbers that their survival in Yellowstone's harsh environment would be threatened.

Mary Meagher is at Yellowstone National Park, Wyo. 82190.

3. Trapping changed the natural habits and behavior of wild bison so that the opportunities for park visitors to see and photograph the animals were greatly reduced.

E. A brucellosis *eradication* program has been proposed by other agencies as an alternative to the unworkable test-slaughter-vaccinate methods. This proposal involved capturing all bison possible, holding the animals in pens, and slaughtering all positive reactors. All bison that were too wary to be trapped, or occurred in areas where trapping was not possible, were to be shot. After all bison that could not be captured were destroyed, the penned animals that were not reactors would be released. This program would have irreparable effects on Yellowstone's bison population for the following reasons:

1. At least 80% of the park's bison population would have to be destoryed because they could not be trapped. [In contrast to the winters of 1964-66, one of the then accessible winter herds cannot now be subjected to trapping. Hence the percentage of the *total* population which could not now be trapped is at least 80%.]
2. Two entire herds in remote wintering areas would have to be destroyed. Past experience indicates that bison would not naturally reinhabit one, perhaps both, of the two vacant areas because of affinities for specific wintering areas.
3. Killing all bison that were not in pens would require several years or more, and the animals held within pens over this period would tend to be little more than domestic stock.
4. The opportunity for park visitors to see wild, freeranging bison would be virtually eliminated.
5. We would complete what the bison poachers nearly accomplished about the turn of the century—the destruction of the only U.S. population of wild bison which survived in the environment and under the conditions to which it was native.

F. The extermination of the Yellowstone bison almost certainly would not eradicate brucellosis.

1. There are six accepted species of the genus *Brucella:* these are fairly host-specific. Eradication in the United States is directed primarily at *B. abortus*, the bovine form, but also includes several other forms.
2. Brucellosis is known from bovids since ancient times.
3. The presence of *B. abortus* at low levels of incidence in a wide variety of non-bovid wild ungulates has been attributed to the persistence of brucellosis in bovids. This may be questioned since *B. abortus* has also been detected in some wild rodents and ectoparasites such as biting flies and ticks. The variety of *B. abortus* hosts in differing locales suggests that the organism may persist at low levels without a bovid source of infection. These assorted hosts are not believed to pose a threat to livestock, but their existence would probably preclude eradication of the organism.

G. Transmission of *B. abortus* from Yellowstone bison to cattle is a remote possibility.

1. There are no data to substantiate a case of brucellosis transmission from Yellowstone bison to cattle. No brucellosis has been reported from cattle herds adjacent to the boundary for more than 10 years.
2. The bison, because of affinities for particular areas, rarely leave the park.
3. The few bison which do leave are nearly all bulls; a cow has been reported only once in the last 30 years.
4. Bison calving areas are remote from park boundaries.

H. Yellowstone's alternative plan for brucellosis control is designed to both preserve the unique esthetic and scientific values of its bison herds and prevent any contacts with domestic cattle. The park's program is based upon reviews of historical records dating from 1860 and intensive studies of Yellowstone's bison population that have been in progress since 1963. It involves the following:

1. Routine monitoring of bison distributions to determine if any animals are in boundary areas where they might move to outside ranges that are used by domestic cattle.
2. Destroy any bison that are in specified boundary areas inside the park. Cooperative agreements for destroying the occasional bison that may cross park boundaries have been worked out with adjoining states fish and game departments.
3. It is highly unlikely that domestic cattle would ever trespass into the park a sufficient distance to encounter bison. If this occurs, such animals would be impounded and tested for brucellosis at the owner's expense.

 Meagher 1973

TABLE 10. *Comparison of female pregnancy rates, by age classes, 1940-41 and 1964-66.*

Age class	No. sampled		Percent pregnant	
	1940-41[a]	1964-66	1940-41[a]	1964-66
2.5	2	7	0	14
3.5	4	11	50	27
4.5	13	7	92	71
Young adult	10	6	100	50
Adult	49	23	86	57
Aged	8	17	100	75
Entire sample	86	71	86	52

[a]From Skinner, Curtis K. 1941. Special report on Yellowstone National Park bison. Yell. Natl. Park Bio. Files, 715-03. Buffalo (General). Typed.

second year of life, thus prolonging the physical drain on the cows (and perhaps influencing the possibility of conception). Fuller considered brucellosis infection and severe climate as possible adverse influences on reproductive rates in Wood Buffalo National Park.

Calf survival apparently was not an important influence on the reproductive rate determined by the present study. Although survival appeared high (see Calf Mortality), no yearlings were observed nursing during the study. Only 4% of the cows (Table 11) examined during the mid-winter reductions were still lactating.

Brucellosis in Yellowstone animals did not appear to be a factor in the low incidence of pregnancy. Rate of infection according to tests from 1964-66 averaged about 54% for Lamar, 42% for Pelican, and 26% at Nez Perce Creek in the Firehole area (Barmore 1968). These rates were all lower than the 62% at Lamar in 1941 when the pregnancy rate, at 86%, was much higher than now. Although Rush (1932a) mentions that a number of abortions were known to have occurred, abortions were apparently rare except in the crowded corral at the Buffalo Ranch (Dave Pierson 1968 pers. comm.). Quortrup (1945) stated that brucellosis had little or no effect on the herds, as did Tunnicliff and Marsh (1935) and McKenney (Skinner 1941).

TABLE 11. *Summary of reproductive data and fetal sex ratios, 1931-32 through 1964-66.*

Year	Source	Number sampled	Total pregnant percent	Pregnant and lactating percent	Pregnant only percent	Lactating only percent	Number sampled	Fetal sex ratio male/female	Percent unclassified
1931-32	Rush, 1932a	184	65	52	12	24	54	108/100	—
1940-41	Skinner, 1941	86	86	—	—	5	74	163/100	1
1943-44	Yell. Natl. Park files	219	75	—	—	—	—	—	—
1945-46	Yell. Natl. Park files	82[a]	79	—	—	—	62	112/100	5
1949-50	Yell. Natl. Park files	115	94	—	—	—	104	138/100	1
1964-66	Present Study[b]	71	52	3	50	1	—	—	—

[a]Sample included only females 4 years of age and older. Other samples included some females in the younger age classes.
[b]This study sampled the entire population. Previous studies sampled only Lamar.

newly growing hair is very short, resembling fine, black plush. They are particularly vulnerable to biting insects.

Three genera of Muscidae were associated with bison in Yellowstone. The stable fly (*Stomoxys calcitrans*) and the horn fly (*Haematobia irritans*) were observed feeding on bison with no noticeable effect. The face fly (*Musca autumnalis*) was first collected by Burger in 1967. He suggested that this exotic species, if it becomes established in Yellowstone, could cause eye disorders in bison. He noted evidence of severe conjunctivitis associated with the presence of this fly among bison at the National Bison Range.

Diseases

Disease-caused mortality was not identified in the present wild bison population, although outbreaks of hemorrhagic septicemia in 1912, 1919, and 1922 caused considerable mortality in the introduced herd in Lamar Valley. In two instances during the study, young animals died from causes which were not apparent when ample food was available. One was a yearling female, observed by park personnel for some time, unable to keep up with the herd animals, moving very little, and becoming gradually weaker. The other was a young cow, seen for several days at Old Faithful before she died. Both carcasses were nearly consumed by scavengers before examination was possible, but the fat-depleted bone marrow in both cases indicated very malnourished animals. Neither tuberculosis nor anthrax, which have been important causes of mortality in Wood Buffalo National Park (Fuller 1961; Choquette et al., 1966), have ever been detected in Yellowstone.

Brucellosis (Bang's disease, undulant fever in humans), caused by the bacterium *Brucella abortus*, occurs in the present bison population. Whether the organism was introduced or was endemic among North American bovids is not known; it was first tested for and reported in Yellowstone in 1917. The rate of infection has varied considerably among tests made in different years during reduction operations, and also among the wintering populations of a given year. In 1964-65, 129 animals tested in Lamar, 33 tested in Pelican, and 302 tested at the Nez Perce Creek trap showed rates of 59, 42, and 28%, respectively (Barmore 1968).

Evidence suggests that brucellosis has little effect on the Yellowstone bison. Limited examination of reactors slaughtered during the study period indicated normal pregnancies. Rate of pregnancy was apparently not influenced, as discussed previously. Veterinarians who investigated brucellosis in Yellowstone before the study period agreed that there were no apparent effects on the population (Tunnicliff and Marsh 1935; Skinner 1941; Quortrup 1945). Quortrup mentioned that few abortions were observed and gross lesions were rarely seen at postmortem examinations. Dave Pierson, Buffalo Herder and Animal Keeper over a period of 30 years, believed that observed abortions occurred as a result of the handling of pregnant females in chutes, and their confinement in pens during the reductions held at the Buffalo Ranch (1968 pers. comm.). Quortrup believed that brucellosis had probably existed in the Yellowstone bison for a long time, and that they had acquired a natural immunity.

Investigations among bison have apparently concentrated on the incidence of brucellosis rather than its effects. Most bison herds in the United States are maintained in a brucellosis-free condition as part of the U.S. Department of Agriculture brucellosis control program. In Wood Buffalo National Park in Canada, where the presence of brucellosis was confirmed in 1956, Fuller (1962) considered it a possible influence on conception rate. Choquette et al. (1966) also assumed that brucellosis influenced productivity. Among cattle, effects include abortion of calves, temporary sterility, and lowered milk production (Gilman and McAuliff 1956).

Further studies of brucellosis in bison may indicate that mutual adaptation or equilibrium exists, as between parasites and hosts that have long lived together (Allee et al. 1949). Physiological effects of brucellosis, if any, may contribute to maintenance of the bison population within levels which the habitat can support.

Brucellosis is of economic concern to cattlemen, and of health importance to the general public. It is presumed that bison can transmit brucellosis to cattle, because the causative organism is apparently the same in both species of bovids. Transmission tests have not been made to verify this, but on the basis of the assumption, the National Park Service has cooperated with the Department of Agriculture in brucellosis control among bison. In Yellowstone, cooperation has consisted of vaccination of calves and removal of reactors during reductions (held primarily to cut herd numbers). This cooperation resulted in reduction of animal numbers below the park's management objective at Lamar in 1964-65. No reductions have been held specifically for brucellosis control in Yellowstone.

Participation in brucellosis control in Yellowstone National Park has recently been reevaluated by the National Park Service (Barmore 1968). Present bison management objectives are to maintain a wild population under natural conditions. By order of the Super-