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IMPACTS ON ARCHEOLOGICAL AND ETHNOGRAPHIC RESOURCES

The National Environmental Policy Act requires that effects be analyzed for the cultural resources that could be affected by federal actions. Cultural resources include historic structures, cultural landscapes, archeological sites, ethnographic resources, and museum objects. Native American tribes define cultural resources very broadly as the resources necessary for the survival and maintenance of their way of life. Ethnographic resources include plants and animals, ceremonial sites, tribal historic sites, and areas of sacred geography possessing mythic/spiritual significance (Walker in prep.). Many tribes view elk and bison, in particular, not just as a "natural" resource but as integral to their culture, traditions, and lifeways (USIECR 2000; Walker in prep.). Bison were used for fresh meat, cached (stored) meat, clothing, shelter, and trade, and their spirits were asked to assist in healing and other ceremonies. Bison were hunted through the 1870s (Walker, pers. comm. 2005).

IMPACTS ON CULTURAL RESOURCES

METHODOLOGY FOR ANALYZING IMPACTS

Analysis was primarily based on previous archeological inventories of areas within the National Elk Refuge and the surrounding area. Cultural resource inventories of all regions that may be potentially impacted by this project must be conducted prior to initiating any activities being considered in the alternatives. These inventories must be conducted to ensure that unknown archeological sites would not be inadvertently destroyed. Should cultural resources be discovered, appropriate measures must be taken to accurately delineate the area encompassing the cultural resource, and the appropriate tribal and regulatory agencies must be notified.

Under section 106 of the National Historic Preservation Act, if a project changes in any way the characteristics that enabled the cultural resource to qualify for listing on the National Register of Historic Places, the project is considered to have an "effect" on the resource. There are three possible ways an undertaking can effect a cultural resource:

- *No effect* — There would be no effect of any kind (that is, neither harmful nor beneficial) on the historic property.
- *No adverse effect* — There could be an effect, but the effect would not be harmful to those characteristics that qualify the property for inclusion on the national register.
- *Adverse effect* — There could be an effect, and that effect could diminish the integrity of such characteristics.

Since farming and grazing activities have occurred within the assessment area for an extended period of time, the potential for adverse effects to cultural resources is low. The impact analysis is focused on prehistoric sites and historic structures within high-use areas, which is where effects would likely occur.

IMPACTS OF THE ALTERNATIVES

Alternatives 1 and 3 (Option A)

Analysis

Under Alternative 1 and Option A of Alternative 3 farming of about 2,400 acres on the refuge would continue. Disking, plowing, and other activities that disturb soil surface have been ongoing in cultivated fields on the refuge since the late 1800s, and continuing these activities would have no adverse effect.

While the average number of elk on the refuge and park would not differ substantially from baseline conditions under Alternative 1, the already large number of bison would continue to increase well beyond natural population levels for Jackson Hole. Alternative 1 would lead to further adverse impacts caused by increased trailing, trampling, wallowing, and erosion on the refuge and park, which could possibly expose subsurface archeological resources, such as fire hearths, and could potentially adversely affect them, particu-

larly in areas near water. Under section 106, this could result in an adverse effect.

Bison numbers and associated impacts on soils and potentially to archeological resources would remain similar to baseline numbers under Alternative 3. This could maintain an elevated potential for cultural resources to be adversely impacted. However, because it is part of baseline conditions, it would constitute a no adverse effect action. Elk numbers would decline substantially, which would result in a net decline in soil disturbance and erosion.

Under Alternative 3 increased use of native winter range in the Bridger-Teton National Forest and increased use of the Green River basin by elk (if large numbers of elk began migrating there) could potentially increase soil erosion in localized areas, with no more than negligible adverse impacts on archeological resources.

Conclusion

Alternative 1 could result in a negligible adverse effect on archeological resources due to growing bison numbers. Option A of Alternative 3 would have beneficial effects as compared to Alternative 1. Archeological resources in the park would not be impaired under these alternatives.

Alternatives 2 and 3 (Option B)

Analysis

Restoring native vegetation on the refuge and in the park under Alternative 2 and Option B of Alternative 3 would likely include disturbance of soils prior to seeding. These alternatives likely would not have an adverse impact on archeological resources since all of the land was previously farmed throughout most of the 20th century. Under section 106 of the National Historic Preservation Act, there would be no adverse effect.

Bison and elk numbers would decline substantially under Alternative 2, as compared to baseline conditions and Alternative 1, which could result in less soil disturbance and erosion in use areas, and potentially less disturbance to archeological resources. Bison numbers under Alternative 3 would remain similar to baseline numbers, which could lead to negligible, localized adverse impacts to archeological resources. Elk numbers would decline substantially, resulting in a net decline in soil disturbance and erosion. In the long term, there would be a net decline in soil disturbance and erosion under both alternatives, as compared to baseline conditions and Alternative 1, with no adverse effect.

Increased use of native winter range in the Bridger-Teton National Forest and the Green River basin, resulting from reduced winter feeding on the refuge, could possibly result in increased soil erosion, which in turn could expose archeological resources.

Conclusion

These alternatives would have negligible adverse impact on archeological resources. No archeological resources in Grand Teton National Park would be impaired.

Alternatives 4, 5, and 6

Analysis

In addition to continued farming on about 2,400 acres of cultivated fields on the refuge (as described under Alternative 1), Alternatives 4, 5, and 6 call for enhanced forage production on the refuge, which would require additional irrigation. Installing new irrigation systems would include ditch digging and the addition of fencing, sprinklers, and pipes, and some of the pipe would be constructed outside cultivated fields on the refuge. Furthermore, approximately 4,500 acres of agricultural lands within Grand Teton National Park would be restored to native vegetation, similar to Alternatives 2 and 3. Installing irrigation pipes and restoring native vegetation in the park would have negligible adverse impacts on archeological resources because most of the land that would be disturbed has already been cultivated.

Alternative 5 would not affect the distribution and abundance of elk any more than what would occur under Alternative 1. Moderate to major reductions in elk numbers under Alternatives 4 and 6 would reduce the potential for impacts to archeological resources. Bison numbers under all alternatives would decline substantially, resulting in less soil disturbance and erosion in localized areas

and the reduced potential for adverse impacts to archeological resources.

Under Alternatives 4 and 6, increased use of native winter range in Bridger-Teton National Forest could increase soil erosion in localized areas, with negligible adverse impacts on archeological resources, similar to Alternatives 2 and 3.

Conclusion

Impacts related to elk and bison numbers would be negligible, similar to Alternative 1. Constructing a sprinkler irrigation system on the refuge could result in negligible adverse effects. Archeological resources in the park would not be impaired under these alternatives.

MITIGATION

Prior to any soil disturbance from new projects, cultural resources within the proposed project area will be assessed for potential effects as well as their significance in accordance with section 106 of the National Historic Preservation Act. Mitigation of adverse effects would be coordinated with the Wyoming State Historic Preservation Office and may include avoidance of the site or data recovery efforts. Significant sites located within the assessment area would be monitored following project implementation to ensure protection from future cumulative effects.

CUMULATIVE EFFECTS

No cumulative effects on archeological resources have been identified.

IMPACTS ON ETHNOGRPAHIC RESOURCES

IMPACT ANALYSIS

The alternatives could impact the tribes in how they view bison and elk in the context of their culture and traditions. Currently, an ethnographic resource study is being conducted that pertains to past treaties and traditional cultural activities that occurred within Grand Teton National Park, Yellowstone National Park, and the National Elk Refuge (Walker in prep.). The final report could influence future cultural resource surveys and management on the National Elk Refuge and in Grand Teton National Park, and it could yield additional information on how tribes used these areas.

Hunting was a tradition practiced by the tribes, who are believed to have used the lands within Grand Teton National Park and the National Elk Refuge as part of their traditions and culture (Walker in prep.). Alternative 1 would not allow for hunting bison on the National Elk Refuge. No hunting would be allowed under Alternative 2. Alternatives 3, 4, and 6 would provide for a reduction of bison by Native Americans the elk reduction program, on the refuge, in recognition of the cultural significance of bison to various tribes. Under Alternatives 2 and 3, efforts to support elk migration to alternative winter range outside Jackson Hole would be consistent with tribal views to let the herds behave naturally (USIECR 2000). Impacts of the alternatives on bison are covered in detail in the "Impact the Jackson Bison Herd" section.

The U.S. Fish and Wildlife Service and the National Park Service are required to consult with American Indian tribes on actions that may affect ethnographic resources, such as the specific means by which tribal reductions would occur. Regardless of whether alternatives call for tribal reductions, tribes and individual members of tribes have previously made requests to collect bison and/or bison skulls throughout the year, to collect plants or other ethnographic resources, and to conduct ceremonies on park and/or refuge lands. These requests will continue to be addressed on a case-by-case basis in accordance with the respective agency policies, and consultation on these and other activities will occur in keeping with federal law and agency policies.

CUMULATIVE EFFECTS

No cumulative effects on ethnographic resources have been identified.

IMPACTS ON HUMAN HEALTH AND SAFETY

Potential threats to human health and safety include vehicle collisions with animals, encounters with elk and bison, hunting accidents, and disease transmission to humans. Brucellosis is currently present in the Jackson elk and bison herds. Bovine tuberculosis and bovine paratuberculosis currently do not affect the herds but are discussed in terms of potential effects if infection occurred. Current evidence does not suggest that chronic wasting disease causes infection in humans; it is discussed here because of human health concerns caused by similar types of diseases (Demarais et al. 2002). Other diseases of elk and bison analyzed in other sections of this document would likely not cause impacts to humans and are not included here.

IMPACTS OF THE ALTERNATIVES

ALTERNATIVE 1

Analysis

Traffic Accidents Caused by Bison and Elk

The potential for traffic accidents caused by elk under Alternative 1 would continue to be low (107 collisions with elk occurred from 1997 to 2001, 97 of which were in Grand Teton National Park). A growing bison population could result in more accidents compared to baseline levels (14 from 1997 to 2001, all in the park) because the population is expected to grow from 800–1,000 bison to 2,000 or more. It is possible that the number of accidents would not change measurably despite higher bison numbers. In Yellowstone National Park, where the bison herd averaged about 3,200 animals from 1997 to 2004, vehicle collisions killed less than 0.5% (0.0047) annually during that period. During the same period, there were about 500 Jackson bison on average yet approximately the same percentage (0.6%) of accidents.

Encounters with Elk and Bison

The number of potential human encounters with elk and bison would remain low, similar to what occurs under baseline conditions because of similar elk numbers and winter feeding levels. However, as bison numbers continued to grow under Alternative 1, more bison in the park and the national forest would likely lead to more encounters with people, particularly recreationists. Encounters could also increase because more bison might wander onto private lands and perhaps into the town of Jackson and nearby subdivisions.

Hunting Accidents

Hunting accidents in both the park and the refuge have been relatively low over the last two decades (Griffin, pers. comm. 2003; Campbell, pers. comm. 2003). Only four non-fatal hunting firearm accidents were reported in Wyoming in 2003 out of 205,000 Wyoming hunting licenses sold. The potential for hunting accidents due to elk hunting under Alternative 1 would remain similar to baseline levels.

Bison hunting would continue to occur outside the refuge and the park. To the extent that bison distribution increased due to higher bison numbers in the long term and more bison leaving the refuge and the park, the potential for hunting accidents would increase.

Disease Transmission to Humans

Brucellosis. Only two cases of brucellosis have been reported where hunters contracted the disease from an elk (Thorne 2001). During the fall when most hunting occurs, the disease is localized in tissues that are removed during field dressing, and under normal circumstances, the risk that humans would contract brucellosis from elk is low (Thorne et al. 1982; HaydenWing and Olson 2003).

The current low risk of brucellosis being transmitted from bison to people would not change in the short or long term under Alternative 1 because no bison hunting or other direct handling of bison would occur on the refuge or in the park any more than in the past. Some elk and bison would likely continue to be periodically tranquilized and handled. A negligible increased risk of brucellosis transmission could occur in the long term due to possible increases in seroprevalence and possible increases in hunter harvest.

Tuberculosis and Paratuberculosis. Neither tuberculosis nor paratuberculosis is present in the Jackson elk and bison herds. The following analysis discusses risk of transmission if the herds became infected. Aerosol transmission is the primary route for transmission of bovine tuberculosis from animals to humans, and direct handling of live elk and bison by people would pose the greatest risk for transmission to humans. No management activities that would require direct handling of elk are proposed under Alternative 1, but monitoring and periodic tranquilizing and handling of some elk and bison would likely continue.

Although bovine paratuberculosis is found in the animal feces and is not transmitted by aerosols, humans could contract either disease during the hunting season because of direct contact with elk and internal tissues. Hunters would not necessarily be able to identify infected elk because these are chronic, slow-developing diseases, and an infected animal may not exhibit any clinical signs. However, the probability that a hunter would be infected is likely low (Demarais et al. 2002).

Risk of transmission would increase during relatively rare immobilization procedures that would require direct contact by USFWS and/or NPS personnel.

There could be a slight risk that humans could contract bovine tuberculosis or paratuberculosis during winter feeding because of close but not direct contact between refuge personnel and animals. Because the feeding program under Alternative 1 would continue at existing levels, levels of risk would be unchanged.

Chronic Wasting Disease. If chronic wasting disease infected the Jackson elk herd and if it is determined that humans could become infected through handling elk, the risk of transmission under Alternative 1 in the long term would be similar to baseline levels of risk.

Conclusion

The number of traffic accidents potentially caused by elk and human encounters with elk under Alternative 1 would remain low due to similar elk numbers, winter feeding levels, and distribution.

The number of accidents caused by bison, as well as human encounters, would likely increase to some extent from very low baseline levels because a larger bison herd would likely be more widely dispersed.

The risk for elk hunting accidents would remain similar to existing conditions. Bison hunting would occur outside the refuge and the park. Higher bison numbers in the long term could increase the potential for hunting accidents.

The potential risk of disease transmission from elk to humans, and primarily to hunters because they would have direct contact with animal tissues, could increase in the long term with present numbers of elk and a substantial increase in bison (2,000+). If prevalence remained unchanged, there would be no change in potential risk.

The risk of brucellosis transmission from bison to people would remain low on the refuge and in the park because there would be no direct contact with bison any more than has occurred in the past. The risk of brucellosis transmission from bison to humans could occur in the long term outside the refuge and the park if seroprevalence increased and more bison were harvested.

If bovine tuberculosis or bovine paratuberculosis infected the Jackson elk and bison herds, there might be a low risk that humans could contract these diseases during winter feeding because of close but not direct contact between refuge personnel and animals.

ALTERNATIVE 2

Analysis

Traffic Accidents Caused by Bison and Elk

The potential for traffic accidents caused by elk under Alternative 2 could increase in the winter compared to existing conditions and Alternative 1 due to the gradual elimination of the refuge winter feeding program. Less feeding would force elk to rely on standing forage, resulting in greater elk distribution and movements, and increasing the potential for traffic accidents, particularly during severe winters. Removing the fence along the southern and western boundaries of the refuge to allow elk to wander more widely could also in-

crease the risk of accidents. Initially elk numbers would be similar to baseline conditions (7,500 at most, with an estimated average of 5,600), but in the long term numbers would range between 1,200 and 6,000.

The potential for traffic accidents caused by elk summering in the park would remain similar to current conditions or could decrease if elk numbers decreased in some years in the park. Park elk numbers would range from an estimated 600–3,000 compared to 2,500–3,200 under baseline conditions and Alternative 1.

Eliminating the elk herd reduction program in the park and hunting on the refuge would likely alter elk movements and distribution in the fall. Elk would likely spend more time in former hunt areas, and night movements would likely become less common compared to baseline conditions and Alternative 1. The potential for traffic accidents in the fall would likely decrease because of the absence of hunting pressure, although elk could stay in the park longer partially offsetting a lower accident potential.

The number of traffic accidents caused by bison during some winters could increase to some extent as some bison, like elk, could increase movements in search of forage the refuge, particularly in severe winters. Lower bison numbers (an estimated 250–500 animals) would reduce overall risk during other seasons.

Human Encounters with Elk and Bison

Compared to Alternative 1, the number of potential encounters with elk and bison under Alternative 2 could increase in the winter because of the gradual elimination of the refuge winter feeding program and greater distribution of animals, particularly in severe winters, as described above.

Potential human encounters in the summer could decrease because fewer elk and bison would be present in the park and the national forest.

The elimination of the elk herd reduction program in the park and elk hunting on the refuge could increase the potential for human encounters with elk in the fall because more elk could remain in the park in former hunt areas rather than moving quickly to safe areas on the southern part of the refuge.

Hunting Accidents

The potential for hunting accidents occurring on the refuge and the park would be eliminated. The potential for accidents in the national forest would remain similar to Alternative 1 because the number of hunters outside the refuge and the park could increase negligibly.

Disease Transmission to Humans

Brucellosis. Transmission risk under Alternative 2 would be lower than under Alternative 1 because hunting would be eliminated on the refuge and in the park. Transmission risk to elk hunters in the national forest would be lower by a negligible amount because fewer elk would be harvested.

There would be no change in the risk for transmission of brucellosis from bison to humans under Alternative 2 because no hunting in the park or the refuge is permitted now. Transmission risk in the national forest could increase if more bison were harvested. There could be a negligible increase in risk to humans handling bison during the contraception program.

Tuberculosis and Paratuberculosis. As described for Alternative 1, the following analysis discusses the risk of disease transmission if either tuberculosis or paratuberculosis became established in the Jackson herds. Stopping elk hunting would eliminate the transmission risk to elk hunters on the refuge and in the park, while the transmission risk in the national forest could decrease or increase slightly depending on harvest numbers.

Any risk that humans could contract bovine tuberculosis or paratuberculosis during winter feeding operations in the short term would be similar to Alternative 1. However, stopping the feeding program would eliminate this risk in the long term.

Chronic Wasting Disease. If chronic wasting disease infected the Jackson elk herd, and if humans could become infected through handling elk, the risk of transmission under Alternative 2 would be substantially lower compared to Alternative 1. The risk of transmission as a result of hunting would

be eliminated in the park and the refuge. Risk of potential transmission in the national forest could be lower or higher than under Alternative 1 depending on the number of elk harvested.

Conclusion

Eliminating the winter feeding program would increase the distribution of elk and bison, which could raise the potential for traffic accidents and human encounters in the winter compared to baseline conditions and Alternative 1 despite lower elk and bison numbers in some years.

The potential for traffic accidents caused by elk summering in the park could remain similar to baseline conditions or decrease in some years if elk numbers fell. The potential for traffic accidents in the fall could also decrease because there would be no hunting pressure, although elk could stay in the park longer, partially diminishing this decreased risk. Fewer bison would reduce the potential for traffic accidents in spring, summer, and fall.

Potential human encounters with elk and bison in the summer would decrease primarily because of fewer animals. Eliminating the elk herd reduction program in the park and hunting on the refuge could increase the potential for human encounters with elk in the fall.

The potential for hunting accidents on the refuge and the park would be eliminated. However, the potential for hunting accidents in the national forest would remain similar to Alternative 1 or could increase slightly.

In the long term the potential risk of disease transmission to humans would be lower under Alternative 2 than any other alternative because of eliminating hunting and winter feeding. Brucellosis and the potential prevalence of other potential diseases would be low with no winter feeding concentrations and fewer elk and bison. The potential transmission risk in the national forest would be reduced compared to Alternative 1.

ALTERNATIVE 3

Analysis

Traffic Accidents Caused by Bison and Elk

The potential for traffic accidents caused by elk under the Alternative 3 could increase in the winter compared to Alternative 1, although not to the same degree as Alternative 2. Reducing the winter feeding program to severe winters (an estimated 2 years out of 10) would cause elk to use standing forage, increasing elk movements, distribution, and the potential for traffic accidents. In the long term fewer elk would winter on the refuge and more elk would winter on native range outside the refuge and the park. The Jackson elk herd size could decrease in some years to 8,000, but numbers would rebound during other years.

The potential for traffic accidents caused by elk summering in the park would decrease because of fewer elk (500–1,000 compared to approximately 2,500 under Alternative 1). Closing hunt areas in the Blacktail Butte / Kelly hayfields area of the park and the northern fifth of the refuge would alter elk movements and distribution in the fall and possibly the potential for traffic accidents. Similar to Alternative 2, elk would no longer attempt to move quickly toward safe areas on the refuge and would spend more time in former hunt areas. However, the presence of more elk in the park for a longer time could continue the possibility of accidents in the fall.

The number of traffic accidents caused by bison could increase from existing levels because 800–1,000 bison would rely on standing forage 8 out of 10 winters and would wander more widely in search of available forage. Bison hunting on the refuge could increase the potential for traffic accidents in the fall if bison increased their movements to avoid hunters.

Human Encounters with Elk and Bison

The number of potential human encounters with elk and bison under Alternative 3 could increase in the winter because reductions of the winter feeding program on the refuge, similar to Alternative 2, but winter feeding would occur on the refuge about 2 out of 10 years. The number of bison would be similar to baseline numbers, but elk

numbers on the refuge would be substantially lower than baseline conditions.

Potential encounters with elk in the summer would decrease compared to baseline conditions and Alternative 1 because there would be fewer elk. The potential for bison encounters in summer would remain the same as baseline conditions because of similar bison numbers and summer distribution, but probably lower than under Alternative 1.

Closing hunt areas in the Blacktail Butte / Kelly hayfields area of the park and the northern fifth of the refuge would alter elk movements and distribution in the fall, possibly increasing the potential for human encounters. Despite fewer elk summering in the park, more elk could remain in the park during the fall in former hunt areas.

Hunting Accidents

Under Alternative 3 the potential for elk hunting accidents would decrease on the refuge and the park because of reduced hunting compared to Alternative 1, but the potential for accidents in the national forest would increase due to minor increases in the number of hunters. One option under Alternative 3 instead of allowing hunting in the southern portion of the refuge would be to open this area to limited public use in the fall; such use would tend to force elk to other areas of the refuge and into hunting areas. This option would further reduce the potential for hunting accidents.

Allowing bison hunting on the refuge would increase the potential for hunting accidents. The number of bison hunters would be somewhat higher than the estimated number of bison to be harvested. Initially an estimated 85 bison would need to be harvested on the refuge, decreasing in the long term to an estimated average of 70 annually. No bison hunting would occur in the park and therefore no potential for hunting accidents in the park.

Disease Transmission to Humans

Brucellosis. In the short term there would be no impact on the risk of transmission with or without implementation of the vaccination program. In the long term and in the absence of a vaccination program, risk would decrease moderately due to reduced prevalence, fewer elk on the refuge, and fewer elk being harvested. With a vaccination program (with a vaccine efficacy of 50% or greater), transmission risk would be substantially lower, even though the risk for transmission from elk to humans is currently very low (Thorne et al. 1982; HaydenWing and Olsen 2003). Potential transmission to elk hunters would be lower than under Alternative 1 because fewer elk would be harvested in the park and the refuge. Transmission risk in the national forest would remain similar to Alternative 1.

In the short term transmission risk of brucellosis from bison to humans under Alternative 3 would increase to a minor degree because of bison hunting on the refuge. If a vaccination program was successfully implemented, the transmission risk to humans would be reduced. If remote methods of vaccine delivery were used, there would be no risk to humans, but if direct handling of bison was required, the risk to humans would increase compared to Alternative 1.

Tuberculosis and Paratuberculosis. As described for Alternatives 1 and 2, the following analysis discusses the risk of disease transmission if either tuberculosis or paratuberculosis became established in the Jackson herds. Under Alternative 3 the risk of transmission of either disease to humans would be lower by a minor to moderate amount compared to Alternative 1 because of fewer animals and a reduced feeding program. Transmission risk to hunters would be lower because fewer elk would be harvested in the park and the refuge. Transmission risk in the national forest would remain similar to Alternative 1.

Transmission risk from bison would be higher by a minor amount compared to Alternative 1 because of hunting on the refuge. If bison were vaccinated by hand, the risk for transmission would be increased by a moderate amount compared to Alternative 1.

The risk of transmission to humans during periodic tranquilizing and handling of some animals would be lower under Alternative 3 compared to Alternative 1 because of smaller herds. Prevalence under Alternative 3 would likely be higher than under Alternatives 2 and 6 and lower than under Alternatives 1, 4, and 5.

Any risk that humans could contract bovine tuberculosis or paratuberculosis during winter feeding through close contact between agency personnel and elk or bison would be greatly reduced because feeding would only occur in an estimated 2 years of 10.

Chronic Wasting Disease. If chronic wasting disease infected the Jackson elk herd, the potential risk of transmission under Alternative 3 would be lower than current conditions because there would be fewer elk, although not as low as under Alternatives 2 and 6 because winter feeding would still be conducted in 2 out of 10 years. The risk of transmission to hunters would also be lower because of reduced harvest numbers. The risk of transmission in the national forest would likely be lower due to a lower prevalence under Alternative 3 compared to Alternative 1, despite negligibly higher numbers of hunters.

Conclusion

The potential for traffic accidents caused by elk and bison under the Alternative 3 could increase in the winter compared to low baseline levels and Alternative 1 because of reducing winter feeding to severe winters (an estimated 2 out of 10 winters), forcing the herds to rely more on standing forage and resulting in a wider distribution. From 800 to 1,000 bison relying on standing forage in most years could increase winter accident potential if they left the refuge.

Fewer elk in the park would lower the potential for accidents in the summer and fall, although elk could stay in the park longer as a result of smaller hunt areas, partially offsetting the decreased accident potential.

The potential for accidents caused by bison in the summer would likely remain similar to baseline conditions and lower than under Alternative 1. Bison hunting on the refuge could increase the potential for traffic accidents if bison increased their movements to avoid hunters.

Potential human encounters with elk and bison under Alternative 3 could increase in the winter due to reduced winter feeding and wider and bison distribution. Potential for encounters with elk in the summer would likely be lower than any other alternative because of fewer elk in the park, although closing hunt areas in the southern part of the park and the northern fifth of the refuge could increase potential encounters in the fall. The potential for bison encounters in summer would remain similar to baseline conditions but would likely be lower than under Alternative 1 because the herd would not be allowed to grow.

Under Alternative 3 the potential for elk hunting accidents would decrease on the refuge and the park. The potential for hunting accidents in the national forest could increase because of slightly more hunters.

Implementing bison hunting on the refuge would increase the potential for hunting accidents.

The prevalence of brucellosis and the potential prevalence of other diseases would be lower than under Alternative 1 but not as low as under Alternatives 2 and 6. A reduced elk hunt under Alternative 3 would lower the transmission risk compared to Alternative 1. If a brucellosis vaccination program (with efficacy of 50% or better) was implemented, transmission risk would be decreased further. If introduced, bovine tuberculosis, paratuberculosis, or chronic wasting disease, potential risk of transmission to humans would be low (although not as low as under Alternatives 2 and 6) because of reduced winter feeding and fewer elk on the refuge.

ALTERNATIVE 4

Analysis

Traffic Accidents Caused by Bison and Elk

The potential for traffic accidents caused by elk in winter under the Alternative 4 could increase compared to Alternative 1, but less than under Alternative 2 because winter feeding would be reduced to an estimated 4–5 years out of 10. This would cause animals to rely more on standing forage, potentially increasing distribution and the potential for traffic accidents. However, greater forage production on the refuge would partially offset the need to search outside the refuge for forage. In the long term fewer elk (4,000–5,000 compared to an estimated average of 5,600 and a maximum of 7,500 under Alternative 1) would winter on the refuge, and more elk would winter

on native range outside the refuge and the park, raising the potential for accidents in other areas.

In summer the potential for traffic accidents caused by elk in the park would decrease because of fewer elk (an estimated 1,300–1,600 compared to approximately 2,500 under Alternative 1).

In winter the potential number of traffic accidents caused by bison could increase somewhat from low existing levels. Even though bison numbers would be lower (450–500 compared to 800–1,000 at baseline levels and possibly 2,000+ under Alternative 1) and forage production on the refuge would be increased, reducing winter feeding to 4–5 winters out of 10 would encourage bison to search more for forage in some non-feeding years. However, it is likely that a smaller bison herd could subsist on standing forage on the refuge and that their movements and distribution would remain similar to baseline conditions.

In summer the potential for traffic accidents caused by bison could remain similar to baseline conditions (although bison numbers would be lower) and less than under Alternative 1. Bison hunting on the refuge in the fall could increase accident potential if animals increased their movements to avoid hunters.

Human Encounters with Elk and Bison

The number of potential winter encounters with elk and bison under Alternative 4 could increase due to fewer years of winter feeding on the refuge, increased reliance on standing forage, and increased elk and bison distribution compared to Alternative 1, but potential increases would not be as great as under Alternative 2. Potential summer encounters with elk would decrease because fewer elk would be present in the park.

Bison hunting on the refuge could increase the potential for encounters with bison in the fall if bison increased their movements to avoid hunters.

Hunting Accidents

Reduced numbers of elk to be harvested under Alternative 4 would lower the potential for hunting accidents. However, the potential for accidents in the national forest would be moderately higher.

Implementing bison hunting on the refuge would increase hunter numbers and the potential for hunting accidents. Initially, hunters would need to harvest an estimated 100 bison annually, which would decrease to an average of 21 annually in the long term.

Disease Transmission to Humans

Brucellosis. In the short term there would be no impact on the risk of brucellosis transmission with or without a vaccination program under Alternative 4. In the long term using Strain 19 to vaccinate elk on the refuge would lower the risk of disease transmission. If a more effective vaccine was found and used, transmission risk would be further reduced. In addition, the risk of transmission to hunters would be lower because of reduced harvest numbers. Although the number of elk harvested in the national forest would be somewhat higher than under Alternative 1, the risk of transmission would continue to be lower because of reduced prevalence.

Because bison hunting would increase direct contact by humans, the transmission risk under Alternative 4 would be higher than under Alternative 1. In the absence of a vaccination program, the transmission risk would be higher by a minor degree. With an effective vaccination program, the risk would only be negligibly higher due. It is possible that a vaccination program could increase the potential for transmission to humans compared to Alternative 1 if direct handling of animals was required. If remote methods of vaccine delivery were used, there would be no risk to humans.

Tuberculosis and Paratuberculosis. As described for the other alternatives, the following analysis discusses the risk of disease transmission if either tuberculosis or paratuberculosis became established in the Jackson herds. Under Alternative 4 the risk of transmission to humans would be lower by a minor to moderate amount compared to Alternative 1 because the number of animals would be reduced. Cutting back the feeding program would also reduce risk to personnel on the refuge. Potential prevalence would likely be greater than

under Alternatives 3, 2, and 6 but less than under the Alternatives 1 and 5.

The risk of transmission to hunters would be lower under Alternative 4 because fewer animals would be harvested. Although moderate increases in the number harvested in the national forest compared to Alternative 1 would increase risk of transmission to hunters, the reduced prevalence under this alternative would decrease the risk.

The prevalence of these diseases in the bison herd under Alternative 4 would likely be intermediate among the alternatives because more frequent winter feeding would counteract the benefits of reduced numbers, similar to Alternative 3. Transmission risk would be somewhat higher than under Alternative 1 because of bison hunting. If bison were vaccinated for brucellosis by hand, the transmission risk would be increased by a moderate amount because of direct contact with live bison.

Any risk that humans could contract either disease during winter feeding would be reduced because feeding would occur in 4–5 years out of 10.

Chronic Wasting Disease. The risk of transmission to humans of chronic wasting disease if it infected the Jackson elk herd would be lower under Alternative 4 than under Alternatives 1 and 5, but not as low as under Alternatives 2, 6, and 3. The number of elk harvested in the national forest would be slightly higher compared to Alternative 1, with a slightly increased risk of transmission.

Conclusion

In winter the potential for traffic accidents caused by elk and bison under the Alternative 4 could increase compared to low baseline levels and Alternative 1 because of reduced winter feeding, but not to the extent of the increased potential under Alternatives 2, 3, and 6. With enhanced forage production on the refuge more animals would be able to remain on the refuge rather than move elsewhere, reducing the accident potential. In the long term fewer elk and bison wintering on the refuge would raise the potential for accidents elsewhere.

In summer the potential for traffic accidents caused by elk in the park could be lower compared to baseline conditions and Alternative 1 because of fewer elk. The potential for traffic accidents caused by bison could remain similar to baseline conditions (although there would be fewer bison) and less than under Alternative 1. Bison hunting on the refuge in the fall could cause more accidents if bison increased their movements to avoid hunters.

Potential human encounters with elk and bison in the summer could decrease compared to baseline conditions and Alternative 1 due to fewer elk summering in the park and a smaller bison herd. Bison hunting on the refuge could increase the potential for encounters in the fall if bison traveled farther to avoid hunters.

The potential for elk hunting accidents under Alternative 4 would decrease because of lower hunting quotas. The potential for elk hunting accidents in the national forest would be somewhat higher. Implementing bison hunting on the refuge would increase the potential for hunting accidents.

Smaller elk and bison herds would reduce the prevalence of brucellosis and other infectious diseases, with an intermediate risk compared to other alternatives (higher than Alternatives 2, 3, and 6, but lower than Alternatives 1 and 5). Any risk that humans could humans could contract bovine tuberculosis or paratuberculosis during winter feeding would be reduced somewhat because feeding would occur in 4–5 years of 10.

ALTERNATIVE 5

Analysis

Traffic Accidents Caused by Bison and Elk

In winter the potential for traffic accidents caused by elk and bison under Alternative 5 would remain similar to Alternative 1. The feeding program would continue to restrict elk and bison distribution to the refuge during winter.

In summer the potential for traffic accidents caused by elk would remain similar to Alternative 1 or decrease slightly in some areas. Although bison movements and summer distribution would likely remain similar to Alternative 1, the potential for traffic accidents could be lower because

fewer bison would be present under Alternative 5. The potential for accidents in the fall could also be lower. Bison hunting on the refuge could partially offset these decreases if bison increase their movements to avoid hunters.

Human Encounters with Elk and Bison

In winter the number of potential encounters with elk and bison under Alternative 5 would remain similar to Alternative 1 as a result of continuing the feeding program, which would encourage elk and bison to stay on the refuge.

In summer potential encounters with elk would be similar or decrease slightly compared to Alternative 1 Although bison movements and summer and spring distribution would likely remain similar to baseline conditions and Alternative 1, fewer bison could decrease the potential for encounters. Bison hunting on the refuge could cause bison to alter their movements in the fall and increase, somewhat increasing the potential for encounters.

Hunting Accidents

Reduced hunting quotas could decrease the potential for elk hunting accidents on the refuge and in the park. The accident potential in the national forest could be higher because of more elk hunters in these areas.

Implementing bison hunting on the refuge would increase hunter numbers and the potential for accidents. The number of bison hunters would be somewhat higher than the estimated number of bison that would need to be harvested. For the first few years hunters would need to harvest an estimated 100 bison annually on the refuge, but over the long term this would decrease to an estimated average of 10 annually.

Disease Transmission to Humans

Brucellosis. The risk for transmission of brucellosis from elk to humans would continue to be very low. Vaccinating elk with Strain 19 or a more efficacious vaccination on the refuge would lower the prevalence of the disease and the risk of transmission. The risk of transmission to hunters on the refuge and in the park would also be reduced because fewer elk would be harvested in these areas and lower disease prevalence. Risk of transmission to hunters in the national forest would likewise be lower.

The risk for brucellosis transmission from bison would be higher by a minor amount due to bison hunting on the refuge compared to Alternative 1 and similar to Alternatives 3, 4, and 6. This higher risk would be reduced to negligible in the long term if a vaccination program successfully reduced disease prevalence in bison. A vaccination program could increase the potential for transmission to humans if direct handling of animals was required. If remote methods of vaccine delivery were used, there would be no risk to humans.

Tuberculosis and Paratuberculosis. As described for the other alternatives, the following analysis discusses the risk of disease transmission if either tuberculosis or paratuberculosis became established in the Jackson herds. Potential prevalence of bovine tuberculosis or paratuberculosis in the Jackson elk herd under Alternative 5 would likely be less than under Alternative 1. Although elk numbers and the winter feeding program would be similar under both alternatives, disease prevalence in elk wintering on the refuge would likely be higher under Alternative 1 due to a much larger bison herd. The risk of transmission to hunters on the refuge and in the park would be lower because fewer elk would be harvested in these areas and disease prevalence could be somewhat lower. Risk of transmission to hunters in the national forest would be lower for the same reasons.

Implementing bison hunting on the refuge would increase the potential risk of transmission to humans by a minor amount. However, because disease prevalence in bison would likely be lower because of fewer bison, the risk of transmission would only be negligibly higher. If bison were vaccinated by hand, the risk of transmission would be moderately higher compared to Alternative 1 because of direct human contact. The possibility of humans contracting either disease during winter feeding operations would be similar to Alternative 1.

Chronic Wasting Disease. The risk of transmission of chronic wasting disease under Alternative 5, it is became established, would be similar to Alternative 1. The risk to hunters on the refuge and the

park would be lower because fewer elk would be harvested in these areas and because prevalence could be somewhat lower than under Alternative 1. Risk to hunters in the national forest would also be lower for the same reasons.

Conclusion

The potential for winter traffic accidents caused by elk and bison under Alternative 5 would likely remain similar to baseline conditions and Alternative 1 because of the nearly annual winter feeding program and similar numbers of elk and fewer bison. As a result of the feeding program, elk and bison distribution would likely be restricted to the refuge during winter.

The potential for summer traffic accidents would be similar or could decrease in some areas because of slightly fewer elk and bison. However, bison hunting on the refuge could increase the potential if bison increased their movements to avoid hunters.

The number of potential encounters with elk and bison in the winter would likely remain similar to baseline conditions and Alternative 1 because of the feeding program. Potential summer encounters with elk could decrease if there were fewer elk in the park. Fewer bison in all seasons would decrease potential encounters.

Lower elk hunting quotas on the refuge and in the park would reduce the potential for hunting accidents by a minor amount compared to Alternative 1. Potential hunting accidents in the national forest would be slightly higher. Bison hunting on the refuge would increase the potential for hunting accidents under Alternative 5.

The risk of disease transmission to humans would be lower than under Alternative 1, and higher than under the other alternatives. Reduced levels of brucellosis prevalence due to vaccination, lower potential prevalence of the other non-endemic diseases if herd infection occurred, and fewer elk harvested under Alternative 5 would reduce transmission risk. Transmission risk in the national forest could be slightly higher because of more elk hunters The low risk of humans contracting bovine tuberculosis or paratuberculosis during winter feeding operations would be similar to Alternative 1.

ALTERNATIVE 6

Analysis

Traffic Accidents Caused by Bison and Elk

Similar to Alternative 2, the potential for traffic accidents caused by elk under Alternative 6 could increase in the winter compared to existing conditions and Alternative 1 due to eliminating the refuge winter feeding program. Elk numbers wintering on the refuge would be reduced from a maximum of 7,500 to 1,200–3,200 in the long term. Eliminating supplemental feeding and forcing reliance on standing forage would increase elk movements and the potential for accidents.

The potential for traffic accidents caused by elk in summer in the park would decrease because fewer elk would be present. Elk numbers would range from an estimated 600–1,300 in the short term to 600–1,500 in the long term compared to approximately 2,500 under Alternative 1.

The potential closure of hunt areas in the Blacktail Butte / Kelly hayfields area of the park and the northern fifth of the refuge in the long term could alter elk movements and distribution in the fall and possibly the potential for traffic accidents. As under Alternative 3, elk would likely spend more time in former hunt areas and move more rarely at night, decreasing the potential for traffic accidents. However, more elk in the park for a longer period of time and the continued possibility of accidents would reduce this decrease.

Similar to Alternative 2 but to a lesser extent, the potential for traffic accidents caused by elk wintering on and near the refuge could increase in some years because of wider distribution as they search for standing forage. But increased forage production on the refuge would help reduce movements and accident potential.

The number of traffic accidents caused by bison could increase to some extent from baseline levels because winter feeding would not occur on the refuge. The herd, on average about 400 animals, would increase their winter movements as animals search for additional forage in some years.

If the fence along the southern and western boundaries of the refuge was removed so elk and bison could more easily leave the refuge to find

alternate sources of forage, the potential for traffic accidents would increase in some years, similar to Alternative 2, but the potential would be lower due to greater forage production on the refuge.

Human Encounters with Elk and Bison

Eliminating the refuge winter feeding program could increase human encounters with elk and bison as they searched larger areas for standing forage, particularly in severe winters.

If the refuge fence was removed, encounters could increase in some years because of movements into the town of Jackson and across highways and busy roads.

Potential encounters with elk and bison in the summer could decrease compared to baseline conditions and Alternative 1 because fewer elk and bison would be present in the park and the national forest.

Potentially closing hunt areas in the Blacktail Butte / Kelly hayfields area of the park and the northern fifth of the refuge could increase the potential for human encounters in the fall because more elk could remain in the park in former hunt areas.

Fewer bison could decrease the potential for human encounters in the summer and fall. But bison hunting on the refuge could partially offset these decreases if bison increased their movements to avoid hunters.

Hunting Accidents

Over the long term the potential for elk hunting accidents could decrease on the refuge and in the park because of reduced harvest levels and fewer hunters. The potential for hunting accidents in the national forest could increase because the estimated number of elk hunters in areas outside the refuge and the park would be slightly higher.

Implementing bison hunting on the refuge would increase the potential for hunting accidents. The number of bison hunters would likely be somewhat higher than the number of bison to be harvested. In the first few an estimated 150 bison would be harvested annually on the refuge, plus 50 in the forest. This would decrease in the long term to an average of 10 animals annually. No bison hunting would occur in the park.

Disease Transmission to Humans

Brucellosis. Brucellosis prevalence in elk would be similar to Alternative 2 because of the gradual elimination of the winter feeding program. However, the transmission risk under Alternative 6 would likely be lower because fewer elk would be harvested. Transmission risk in the national forest could also be lower.

Transmission risk of brucellosis from bison under Alternative 6 would increase with a bison hunt on the refuge. This risk could be reduced to negligible with a vaccination program (the vaccine would have to have 50% efficacy or better). If direct handling of animals was required for vaccination, the risk of transmission would increase. If remote methods of vaccine delivery were used, there would be no risk to humans.

Tuberculosis and Paratuberculosis. As described for the other alternatives, the following analysis discusses the risk of disease transmission if either tuberculosis or paratuberculosis became established in the Jackson herds. Transmission risk under Alternative 6 would be lower than under Alternative 1 because of lower numbers of elk and bison, no winter feeding, and increased dispersal. Also, lowering the number of elk harvested on the refuge and in the park and national forest would reduce the risk to hunters. Eliminating the winter feeding program would stop any risk that humans could contract these diseases through close contact with elk and bison.

Chronic Wasting Disease. If chronic wasting disease infected the Jackson elk herd, the risk of transmission to hunters under Alternative 6 would be lower than under Alternative 1 because fewer animals would be harvested. In the short term the potential risk of transmission to hunters would decrease in the national forest because the number of elk harvested in the national forest would decrease by a minor amount compared the number harvested under Alternative 1. In the long term risk would be lower to a greater extent because the number of elk harvested in the national forest would be lower by a moderate amount.

Conclusion

Similar to Alternative 2, the potential for traffic accidents caused by elk and bison under Alternative 6 could increase in the winter due to the elimination of the winter feeding program, forcing animal to increase their movements and distribution in some years in the search for forage. Possible removal of the refuge boundary fence could also increase the potential for traffic accidents. However, greater forage production on the refuge would alleviate the need for animals to search extensively.

The potential for traffic accidents caused by elk summering in the park could decrease with fewer elk. In the fall possibly closing hunt areas in the southern part of the park and the northern fifth of the refuge could lower the potential for accidents during the time that elk are moving into safe areas; but if more elk stayed in the park for a longer period, the possibility of accidents in the park could offset this decrease.

Stopping winter feeding could increase the potential for human encounters with elk and bison as animals searched for forage over a wider area, particularly in severe winters, similar to Alternative 2. However, greater forage production on the refuge and lower elk and bison numbers in some years, would reduce the potential. If the refuge fence was removed, encounters in the town of Jackson and elsewhere could increase.

Potential encounters with elk and bison in summer and fall could decrease because of fewer elk and bison in the park. But encounters in fall could increase if hunt areas in the southern part of the park and the northern fifth of the refuge were closed. and more elk remained in the park in former hunt areas rather than moving quickly to safe areas.

The potential for elk hunting accidents would be lower on the refuge and in the park compared to Alternative 1 because of fewer hunters and reduced hunting quotas. The potential for hunting accidents in the national forest could increase because of slightly more hunters.

Implementing bison hunting on the refuge would increase the potential for hunting accidents on the refuge and possibly in the national forest. No bison hunting would occur in the park.

The potential risk of disease transmission to humans would be lower under Alternative 6 compared to all alternatives except for Alternative 2 due to the elimination of winter feeding concentrations and fewer elk and bison. A brucellosis vaccination program (could further decrease the transmission risk. Because hunting would occur on the refuge and the elk herd reduction program in the park under Alternative 6, the risk of disease transmission would be higher than under Alternative 2. Transmission risk in the national forest would also be lower for the same reasons. Stopping winter feeding would eliminate any risk that humans could contract diseases during feeding operations.

MITIGATION

Guidelines that encourage hunters not to take animals that appear sick, to report any animals that appear sick, and to wear rubber or latex gloves when field dressing game animals would reduce the risk of hunters becoming infected by any diseases.

If it was determined that humans could contract chronic wasting disease from wild ungulates, extreme precautions would be taken to avoid infection. Currently, people hunting in disease-infected herds are encouraged to reduce their risk of infection by (1) not harvesting an animal that appears to be sick, (2) using rubber gloves when field dressing an animal, (3) avoiding contact with the brain and spinal cord tissue, (4) thoroughly washing hands and knives, and (5) deboning meat from the carcass (Williams et al. 2002). If these precautions were taken, the risk to people who harvest animals in chronic wasting disease infected areas would be minimized.

CUMULATIVE EFFECTS

TRANSPORTATION IMPROVEMENTS

Reconstruction of 38 miles of U.S. 26/287 (Togwotee Pass) could increase the number of human injuries due to vehicle collisions with wildlife as traffic volume grows. Upgrading the highway would allow some drivers to exceed the speed

limit more easily than occurs now. Special design features to reduce the potential for vehicle collisions with wildlife include oversized culverts, wildlife underpasses, and seasonal speed restrictions. It is anticipated that effects on human safety would be minimal.

Alternatives 1 and 5 would not result in additional cumulative effects because wildlife distribution, seasonal movements, and mortality rates would remain similar to baseline conditions. Under Alternatives 2, 3, and 6, to a lesser degree under Alternative 4, elk would increase their winter distribution while on native range and more collisions could occur.

Grand Teton National Park Recreation Infrastructure Improvements

Potential use of transit and pathways to serve visitor transportation and access needs could result in fewer vehicles on the roads and decreased potential for collisions with elk or bison in the park. Improved human access to parts of the park could increase the potential for encounters with wildlife. The proposed multi-use trail from Moose to the north Jenny Lake junction could attract additional recreationists along the Snake River corridor during the summer and possible cross-country skiers in the winter. The construction phase would result in site-specific, temporary impacts along planned trail routes during the summer and an increased potential for human/wildlife encounters in the short term.

The Gros Ventre campground improvements would cause site-specific, temporary impacts during construction, resulting in a minor increase in the number of summer campers. These improvements would potentially increase human encounters with wildlife.

Alternatives 1 and 5, in addition to the effects of Grand Teton infrastructure improvements, would not result in cumulative effects. Increased human presence in parts of the park under Alternatives 2–6 during conversion of formerly cultivated areas to native vegetation could increase human/elk encounters.

It is possible that the elimination of the elk reduction program in the park under Alternative 2 could result in more elk remaining in the southern portion of the park, increasing the potential for human / elk encounters or vehicle collisions. Closing the Antelope Flats/Blacktail Butte elk reduction area in the park under Alternative 3, and potentially under Alternative 6, could result in this effect but to a lesser extent. Also, because fewer elk would be present in the park during the summer under these alternatives than under Alternatives 1, 4, and 5, encounter and collisions might not increase.

Federal Land Management Activities

Grand Teton/Yellowstone National Parks and John D. Rockefeller, Jr., Memorial Parkway Temporary Winter Use Plan

The total number of snowmobiles allowed into the park would be similar to historical levels but, because all visitors would be traveling in guided groups, oversnow vehicle collisions with elk or bison would be less likely, and the potential for human injuries would be reduced. Professional guides would be trained in how to avoid causing wildlife displacement or stress, and they would be familiar with likely wildlife locations along the road system.

No changes in the number of vehicle collisions with wildlife on lands outside the parks are anticipated. Because the selected alternative would allow a number of snowmobiles into the parks that are near the historical average daily visitation, it would be unlikely to result in significant visitor displacement to surrounding federal, state, or county land, except during high use periods (Christmas week and Presidents Day weekend).

Alternatives 1 and 5, as well as Alternative 4 in above-average winters, would not result in cumulative impacts to elk from planned winter use activities. Alternatives 2, 3, and 6, as well as Alternative 4 in average or below average winters, would increase the number of elk on native winter range, with a greater potential for elk / human conflicts and displacements of elk from winter habitat. Winter closures in areas designated as crucial elk winter range would continue to prevent potential encounters and collisions.

Bridger-Teton National Forest Travel Management Plan Updates / Moose-Gypsum Projects

The proposed projects in the secondary analysis area would increase off highway vehicle trail opportunities and the potential for human/wildlife encounters. No additional cumulative effects would result from any of the bison and elk management alternatives.

The dispersed recreation camping site plan being considered in the Moose-Gypsum projects includes establishing new campsites while closing some campsites that are in sensitive areas, such as next to stream and river banks. Establishing new campsites could increase the potential for human / elk interactions in the short term, while closing other sites would decrease interactions in the long term, particularly in sensitive wildlife areas. Cumulative effects from the bison and elk management alternatives would not occur.

BLM Snake River Resource Management Plan

Increases in public access or use in areas of sensitive wildlife habitats could result in adverse human / wildlife interactions. While signing or efforts to make the public aware of wildlife issues could help reduce conflicts, the potential for impacts would remain. Maintaining public access to the parcels would continue to increase human / wildlife interactions. Seasonal closures or restrictions would minimize adverse impacts. Cumulative effects would not be expected to occur under Alternatives 1 and 5. Alternatives 2, 3, and 6, as well as Alternative 4 in average or milder than average winters, would increase elk distribution in some years and the potential for disturbance due to human encounters.

BLM Upper Green River Special Recreation Management Area Recreation Project Plan

The proposed *Recreation Project Plan* would be within the secondary analysis area and could contribute to slight increases in human / elk interactions. Campsite relocation would be relatively close to existing facilities, minimizing the expansion of human activity.

No alternatives would result in cumulative effects that could be expected to increase human wildlife encounters with Jackson elk in these areas. Although some elk could potentially move into the upper Green River area to winter under Alternatives 2, 3, and possibly 6, these animals would not be expected to remain in other seasons.

POPULATION GROWTH AND PRIVATE LAND DEVELOPMENT

Primary Analysis Area

Projected population increases in both Teton and Sublette counties and potential private land development in these areas, could lead to more human/wildlife encounters and vehicle collisions with wildlife.

Alternatives 1 and 5, as well as Alternative 4 in above-average and severe winters, would not result in cumulative effects with private land development because supplemental feeding would keep elk and bison on the refuge. Under Alternatives 2, 3, 4 in average or milder than average winters, and potentially 6 elk distribution would likely be increased in some or all years, and more human / wildlife encounters could be expected due to human population growth and development.

Additional development of the private parcels along the Gros Ventre River could affect the movement of elk between Jackson Hole and existing feedgrounds to the east. Under Alternatives 2, 3, and potentially 6, this corridor would also support the movement of elk between Jackson Hole and the upper Green River basin to the southeast, and there would be greater potential for human / elk encounters and vehicle collisions with elk.

Secondary Analysis Area

Within the secondary analysis area in Sublette County, ongoing and future subdivision and development of agricultural lands could increase human / elk encounters and vehicle collisions with elk. Development or activities in these areas would not affect Jackson elk under Alternatives 1, 4, and 5 because elk movements and distribution either would not increase from current distribution (Alternatives 1 and 5) or would increase to a limited extent in some years (Alternative 4).

SOCIAL AND ECONOMIC IMPACTS

IMPACTS ON RECREATIONAL OPPORTUNITIES

Hunting, wildlife viewing and photography, and environmental education and interpretation are five of the six priority public uses of the National Wildlife Refuge System and opportunities for all of these activities are provided on the National Elk Refuge. Providing opportunities for people to view and photograph natural features of the landscape and wildlife, and to learn about nature and cultural resources is also an important part of national parks, and many opportunities are provided in Grand Teton National Park. In some years in the park hunters are deputized to help manage elk when biologists determine it is necessary. Consequently, the elk reduction program in the park is used solely as a wildlife management tool, and any associated recreational opportunities are a by-product. Changes in elk and bison management on the refuge and in the park could affect the need for this management activity and perceived recreational opportunities associated with it.

Changes in elk and bison management on the refuge and park could potentially affect recreational opportunities in the Bridger-Teton National Forest, possibly including the Pinedale and Big Piney ranger districts (Alternatives 2, 3, and 6), and on private lands in the Jackson Hole area. Alternatives 2 and 3 could also affect recreational opportunities on BLM, other federal and state lands, and private lands in the Green River basin.

WILDLIFE VIEWING AND ENVIRONMENTAL EDUCATION OPPORTUNITIES

Methodology for Analyzing Impacts

The evaluation of potential effects of elk and bison management on wildlife viewing and environmental education opportunities relied heavily on the results of a visitor survey conducted in 2002 by Loomis and Koontz (2004), but assessments based on other surveys, monitoring data, and recreation specialists were also used.

The 2002 visitor survey focused on visitor groups (wildlife viewers) who could be affected by bison and elk management actions — sleigh ride visitors on the refuge and summer visitors of Grand Teton National Park. Visitors were asked if they would change the number of trips they would make to the refuge or park if a particular management scenario was implemented. These changes in trip responses were applied to the reported current refuge/ park annual visitation to develop an average percentage change in visitation. The changes in number of trips and visitor days under each alternative were then calculated.

Alternatives for managing elk and bison on the refuge and park would likely not result in measurable changes in the number of people visiting Grand Teton National Park during summer months. From 1992 to 2001 bison numbers nearly tripled, from about 150 to almost 550, but there was no corresponding increase in summer visitors in the park.

As with bison, most of the changes in elk numbers occurred when visitor numbers in the park were fairly constant (e.g., 1984–89 and 1996–2002). During these two periods, visitor numbers fluctuated somewhat, but there were no increasing or decreasing trends, in contrast to major increases and declines in elk numbers on the refuge.).

There is no indication that potential visitors base a decision to visit Grand Teton National Park, Yellowstone National Park, and other destinations on elk numbers in Jackson Hole. However, the visitor survey suggests that visitation to Grand Teton National Park could be measurably affected by a moderate to major change in elk and bison numbers (Loomis and Caughlan 2004). Therefore, potential reductions in visitation are included as "worst-case" scenarios to address this possibility.

Impacts of the Alternatives

Impacts Common to All Alternatives

Under baseline conditions, there would be an average of 93,394 visits to the National Elk Refuge for recreational activities, including an average of about 30,000 visits by people walking, hiking, jog-

TABLE 4-7: ESTIMATED VISITATION — NATIONAL ELK REFUGE AND GRAND TETON NATIONAL PARK

	Baseline Conditions	Alt. 1	Alts. 2, 3, and 6	Alt. 4	Alt. 5
Total Sleigh Ride Visitation	24,367/yr	No change	41%–100% reduction	29%–100% reduction	No change[1]
Park Visitation (May-October)	2,349,069/yr	No change	No change[2]	No change	No change

1. Survey results indicate up to a 14% increase in sleigh ride visitation for Alternative 5. However, elk would not change appreciably, and this would be the only factor that could affect sleigh ride visitation under the alternatives.

2. As explained in the "Methods" discussion for this section, it is likely that May-October visitation to Grand Teton National Park would not measurably change under any of the alternatives.

ging, and biking on refuge roads. Because these visits are likely not influenced to any large degree by the numbers of elk and bison and management activities, numbers would likely not change among alternatives.

For the alternatives that include elk and bison hunting, these activities would not be observable by most refuge visitors during the hunting season because hunting occurs well away from the highway and other major roads and in the early morning. Therefore, there would be little difference among the alternatives in the ability of visitors to see hunting activities, including Alternative 1 (which includes no bison hunting) and Alternative 2 (which includes no elk or bison hunting).

Alternative 1

Analysis

National Elk Refuge. Under existing conditions an estimated 440,000 people annually use vehicle turnouts along U.S. 26/89 to observe elk and other wildlife, an average of 24,367 visitors (including an estimated 22,320 from outside the local area) participate in sleigh rides, and about 2,000 people take part in other environmental education activities conducted by refuge personnel. These numbers of visitors and visits represent baseline conditions and would continue under Alternative 1.

The quality of the viewing experience on sleigh rides would be similar to the recent past. From mid-December until winter feeding operations begin and after winter feeding operations end until the beginning of April (approximately 45 days each year), viewing opportunities vary from day to day and throughout the day. Typically, there are 500–2,000 elk in the viewing area early and late in the season. During feeding operations (about 70 days per year) approximately 1,000–2,000 elk are typically present in the sleigh ride touring area, and large numbers of elk are consistently viewable at close range. On the rare days when no elk are present in the sleigh ride touring area, sleigh rides might be canceled.

Continued increases in the number of bison on the refuge would affect viewing opportunities in at least two ways. In the short term, bison viewing opportunities on the refuge would be limited for most visitors because most to nearly all of the bison occupy the McBride and Poverty Flats areas and the Gros Ventre Hills, which cannot be seen from the highway or the main refuge road. Over the long term bison viewing opportunities on the refuge could increase with a larger bison population that roams over a wider area.

If a non-endemic infectious disease became established in the Jackson elk and/or bison herds under Alternative 1, disease-caused population declines would reduce viewing opportunities and for some parts of the Jackson Hole area, the declines could be more severe because artificially high concentrations of animals due to winter feeding would allow a disease to spread faster. Therefore, the overall decline in elk numbers would likely be more severe than under Alternatives 2, 3, and 6. If winter feeding on the refuge was greatly reduced (with or without concurrent depopulation efforts), sleigh rides might have to be canceled. Any introduction of a disease transmissible to bison (e.g., bovine tuberculosis) would not affect bison viewing opportunities under this alternative because they are not viewable to any large degree now.

Grand Teton National Park. Under baseline conditions about 92% of the visits to Grand Teton National Park, or 2,163,493 visits, are by nonlocal visitors. It is assumed that under Alternative 1 visitation would not differ measurably from baseline conditions in the short or long term.

Despite more elk than bison in the park under baseline conditions, bison provide better viewing opportunities because they congregate in areas along major roadways, and large numbers of bison are commonly seen at the Elk Ranch, Antelope Flats, and Kelly hayfields areas throughout the spring, summer, and fall. Under Alternative 1 a growing bison population would not create any additional viewing opportunities.

In contrast to bison, elk are more solitary and viewing opportunities would continue to be much more limited. Relatively few visitors see elk in the park, and this would continue under Alternative 1. Two exception are in the spring when large numbers of elk move northward and northwestward from the refuge and in the fall when bull elk are bugling and gathering and defending harems. However, even during these limited periods, elk are not nearly as viewable as bison.

Hunting would continue to detract from the viewing experience of some visitors not accustomed to seeing hunters or hunting in a national park.

Elk and bison viewing opportunities in the park would decline if a non-endemic disease became established under Alternative 1. If a disease was introduced that affected bison (e.g., bovine tuberculosis, paratuberculosis), viewing opportunities in the park could decline over time. If elk became infected with chronic wasting disease, viewing opportunities during the spring migration and fall rut could decline substantially in localized areas, although this would affect relatively few park visitors.

Other Areas. Seeing wildlife, especially large species, is an important part of the outdoor experience for nearly half of the people recreating in the Bridger-Teton National Forest and the southern part of Yellowstone National Park. Alternative 1 would not change the quality of the outdoor experiences of people horseback riding, hiking, backpacking, wildlife viewing, fishing, camping, gathering berries, and engaged in other outdoor recreational activities in the national forest and Yellowstone National Park.

Recreational use in the national forest increased by 92% from 1985 to 1996 (from about 1.9 million visitor-days to 3.6 million visitor-days), and this trend would continue under Alternative 1. Total use estimates (as opposed to visitor days) track well with this information; in 2002, the national forest's estimated total use was approximately 3 million visits.

As stated in Chapter 3, nearly half of the forest's 3 million annual visitors a year enjoy seeing wildlife, but it is only one of many activities they participate in, but only 2% (about 60,000 people) say that viewing wildlife is the primary reason for visiting the national forest. Under Alternative 1, wildlife viewing and hunting opportunities would not be expected to change.

Elk and bison viewing opportunities also exist on private lands, but opportunities are more limited.

Wildlife viewing trends described for Bridger-Teton National Forest would also apply to areas south of Jackson and to the Pinedale and Big Piney ranger districts of the national forest. South of Jackson and in the lower Hoback River drainage, elk can occasionally be seen during migration and on south and west-facing slopes during winter. Throughout most of the Green River basin and the Red Desert elk viewing opportunities are very limited or non-existent.

Conclusion

Under Alternative 1 about the same number of people (about 24,367 people per year) would continue to participate in sleigh rides on the refuge each year. An abundance of elk would be observable each day during a large part of each winter due to continued supplemental feeding. Bison would not be observable to most visitors.

Elk would continue to be readily observable in some park areas during the fall rut and spring migration, but most people visiting the park from May through October would not see elk. There would be an abundance of bison viewing opportunities in the park, and they would continue to increase. No changes to park visitation numbers are expected.

Alternatives 2, 3, and 6

Analysis

National Elk Refuge. It is estimated that under Alternatives 2, 3, and 6 up to 2,400 elk would be viewable on the refuge within the sleigh ride touring area (an average of an estimated 700 elk). However, under these alternatives the number of days when no elk are present in the viewing area could be substantially higher than under Alternative 1.

A major reduction in the number of elk wintering on the refuge over the long term could result in a decline in the number of people participating in sleigh rides by 41%. The decrease in sleigh rides in 2002–3, when use fell by 32% because of mild winter conditions and low numbers of elk in the viewing area, could indicate use levels without supplemental feeding.

It is also possible that the inconsistency and unpredictability of elk presence in the sleigh ride touring area could shorten the sleigh ride season or force its cancellation. On days when sleigh rides were offered, the quality of the viewing experience would be similar to what is experienced by visitors now before winter feeding begins and after it has stopped.

Reducing sleigh rides or stopping them altogether would reduce environmental education opportunities for an estimated 225 visitors per day, compared to Alternative 1. If sleight ride operations ceased altogether, a total of 24,367 visitors would be affected.

For some people stopping along U.S. 26/89 to view elk, the absence of elk or very few elk would adversely affect their experiences. However, for other people the experience might be better because the sight of elk would be more natural without supplemental feeding. Bison could be viewable at close to moderate distances on some days.

If vaccination activities were conducted on the feedlines during years when elk were fed under Alternatives 3 and 6, elk in the Nowlin area could be disturbed to the point that they left the area, which could also adversely impact the sleigh ride operation and recreational opportunities. Under Alternative 3 a reduced winter feeding program (2–3 of every 10 winters) could make elk more likely to leave the feeding area if attempts were made to remotely vaccinate elk and bison.

If large numbers of elk began migrating to the Green River basin and the Red Desert, the number of elk wintering on the refuge would result in additional adverse effects on viewing opportunities and would increase the probability that sleigh ride operations would be discontinued.

Under Alternative 2 stopping hunting would potentially increase elk viewing opportunities on the refuge because elk would no longer avoid hunting areas.

Under Alternative 3, potentially opening the southern end of the refuge to elk hunting could affect the viewing experiences of some people by elk being killed near the highway. The effects would be negligible because hunting would occur early in the morning when traffic along the highway is light and relatively few nonlocal visitors are present. Over the long term elk hunting on the southern part of the refuge could adversely affect elk viewing opportunities on the day of the hunt and during the limited hunting season, and possibly beyond because elk would likely leave this part of the refuge on hunting days. Alternatively, opening the southern portion of the refuge to public recreation during the fall and not allowing hunting in this area would enhance opportunities for some visitors, although elk would still tend to avoid the presence of humans.

While winter feeding was being phased out under Alternatives 2 and 6 and reduced under Alternative 3, bison viewing opportunities on the refuge would continue to be limited for most visitors because nearly all bison occupy the McBride and Poverty Flats management areas and the Gros Ventre Hills, which are not easily seen from the highway and the main refuge road (similar to Alternative 1). Over the long term, viewing opportunities on the refuge would improve as bison roamed farther in search of forage. Despite lower numbers of bison, there could be more bison viewing opportunities due to the lack of winter feeding and increased difficulty of keeping bison further north on the refuge. Another complicating factor in the long term would be the occasional or possibly common presence of bison in the sleigh ride touring area, which would increase visitor safety concerns.

If a non-endemic infectious disease became established in the Jackson elk and/or bison herds after winter feeding had been completely phased out (Alternatives 2 and 6), disease-caused declines would reduce viewing opportunities, but probably not to the extent of Alternatives 1, 4, and 5. Declines in elk numbers would likely occur more slowly because animals would not be artificially concentrated.

Grand Teton National Park. Elk numbers in the park would fluctuate much more widely than they do now, which could reduce the quality of outdoor experiences for a few people; most visitors from May through October, however, do not see elk now. In some years elk numbers would be similar to baseline conditions and Alternative 1, but in other years, they could drop below 600 (78% less than the baseline figure of 2,676 elk). Under Alternative 2 elk numbers would range between 500 and 1,000.

During many years large numbers of elk would continue to be observable for several weeks during the spring migration and the fall rut. In other years the number of migrating elk could be reduced by a moderate to major degree, affecting the quality of the experience for some people. Elk viewing opportunities during the fall migration in Blacktail Butte and Kelly hayfields area south to the Gros Ventre River could increase with the elimination of the elk reduction program in this area under Alternative 2 and potentially under Alternative 6. Also, the absence of hunters in the park would enhance the experience for some visitors. In the long term more elk from the Yellowstone and Teton Wilderness segments could migrate through the Blacktail Butte and Kelly hayfields area.

At present few if any potential visitors have inquired about elk numbers before visiting the park, and it is unlikely that changes in the park elk population would affect park visitation because most summer visitors do not see elk, and this does not affect their decision to visit.

Bison viewing opportunities could decrease in the park compared to baseline conditions due to an estimated 40%–75% decline in bison numbers under Alternatives 2 and an estimated 50%–60%; the declines would be even greater in the long-term when compared to Alternative 1. However, viewing opportunities would be similar to those in the late 1990s when about 250–490 bison summered in the park. Fewer bison would likely not affect visitation to any measurable degree because most visitors would not be aware of the change.

Bison viewing opportunities in the park under Alternative 3 would remain similar to baseline conditions. In the long term, however, fewer bison would be observable because reduced supplemental feeding would keep the herd from growing at the same rate as now.

While elk and bison viewing opportunities in the park would decline if a non-endemic disease became established under Alternatives 2, 3, and 6, they would likely not decline to the level that could occur under Alternative 1.

Other Areas. In the long term the number of elk summering in other elk herd segments (e.g., the Yellowstone, Teton Wilderness, and Gros Ventre segments) could be higher or lower than baseline conditions depending on the effects of winter weather on herd sizes. However, seeing elk is only part of the outdoor experience in these other areas, and other wildlife may be just as important as elk to visitor experiences. Fewer elk could reduce the experiences of some visitors, but it is unlikely that this would keep them from deciding to visit at all (Marsh, pers. comm. 2004), and overall effects on national forest visitors would be negligible.

In the long term elk and bison viewing opportunities during winter and early spring could potentially increase in the Jackson area outside the refuge and park, especially during above average and severe winters when elk and bison increased their distribution in search of forage.

Allowing elk to better use their native winter ranges through habitat manipulation in the national forest would also require careful management of recreational uses to prevent displacement, similar to current management of winter uses. For example, some areas in the Gros Ventre drainage and Buffalo Valley are already closed and visitors are required to stay on trails or within a defined corridor while passing through these areas.

If larger numbers of elk began wintering south of Jackson and in the lower Hoback River drainage, it is possible that elk viewing opportunities in these areas would increase. However, most of these elk could end up on a state feedground, offsetting any potential increases in viewing opportunities.

If large numbers of elk began migrating to the Green River basin and the Red Desert, elk viewing opportunities would likely increase in these areas in the winter and during fall and spring migrations, assuming that elk moved beyond the state feedgrounds. For some people, this could improve the quality of the outdoor experience, and it is possible that visitation could increase in areas where elk winter.

Conclusion

The number of people participating in sleigh rides on the refuge could potentially decline by up to 41% under Alternatives 2, 3, and 6. Elk viewing opportunities during winter on the refuge would become much more variable, with no elk within view on some days to well over 2,000 on other days. Consequently, sleigh ride operations could be discontinued due to the unpredictability of elk viewing opportunities. Bison viewing opportunities during winter would likely increase as bison expanded their search for forage, particularly in the southern portion of the refuge.

Based solely on the estimated reduction in elk numbers in Grand Teton National Park, elk viewing opportunities could decline. However, because relatively few visitors currently see elk in the park, reduced elk numbers would likely only affect a small percentage of visitors. Furthermore, eliminating the elk reduction program in the park under Alternative 2 and potentially under Alternative 6, and in the Blacktail Butte / Kelly hayfields area under Alternative 3, could in the long term increase viewing opportunities in these areas. Bison viewing opportunities during spring, summer, and fall would remain similar to baseline conditions. Bison viewing opportunities in the park during spring, summer, and fall could decline somewhat, but the reduction would be similar to levels in the late 1990s, and most visitors would not notice because large numbers of bison would continue to be viewable. It is unlikely that park visitation would change more than a negligible amount due to reductions in elk and bison numbers and changes / elimination of the herd reduction program.

Alternative 4

Analysis

National Elk Refuge. In the first few years elk and bison viewing opportunities on the refuge would change minimally, with the following potential changes. Similar to Alternative 3, possibly opening the southern end of the refuge to a limited elk hunt could directly detract from the viewing experience of some people. The overall level of direct effects would be negligible because hunting would only be allowed a few days a year and would occur early in the morning when traffic along the highway is light and relatively few nonlocal visitors are present.

As described for Alternative 3, hunting on the southern part of the refuge over the long term could adversely affect elk viewing opportunities during the limited hunting season. On hunting days elk would likely leave this part of the refuge. Elk that attempted to stay would likely be more wary of humans, including sleighs, and could remain farther from the highway. Elk migrating later in the season would not be affected to the same degree.

Conducting vaccinations with Strain 19 or another more effective vaccine in association with winter feeding activities could cause some or many elk to vacate the Nowlin feeding area in the short term. However, if the vaccine could be administered remotely through the use of biobullets or orally, there would be little or no disturbance of viewing opportunities.

In the long term the number of people participating in sleigh rides could decline by about 29% compared to baseline conditions (Loomis and Caughlan 2004). It is estimated that up to 2,400 elk would be viewable within the sleigh ride touring area (an average of 700 elk), with a low chance of not seeing any elk on some days. In years when supplemental food was provided (4–5 of 10 winters), several hundred to more than 1,000 elk would likely be present in the viewing area for about 70 days each winter. The number of days when no elk would be present would be higher

than under Alternative 1, but lower than under Alternatives 2 and 3. If there were no elk in the sleigh ride touring area on a particular day, sleigh ride operations would likely be halted, as described for Alternatives 2 and 3.

On days when sleigh rides were offered, the quality of the viewing experience would be similar to what visitors experience now. However, in years with no supplemental feeding, elk would be more widely distributed and chances of no elk being in the sleigh ride touring area would be higher than under baseline conditions. Consequently, the quality of viewing experiences would be adversely affected to a major degree.

Reduced opportunities for viewing elk at close range and learning about elk and wildlife conservation could affect up to 225 people per day when no tours were offered. If the sleigh rides ceased completely, an estimated 17,879 visitors per year under this alternative would lose this recreational and educational opportunity.

For some people stopping along U.S. 26/89 to view elk, the absence of elk or very few elk on some winter days would adversely affect their experience more often than under Alternative 1 and less often than under Alternatives 2 and 3. However, for other people, the quality of the viewing experience could be better because elk would behave more naturally in the absence of supplemental feeding operations.

In the short term bison viewing opportunities on the refuge would continue to be limited because most bison inhabit areas that are not readily viewable from the highway or the main refuge road (similar to Alternative 1). Over the long term viewing opportunities on the refuge would likely increase as animals searched for forage, particularly in winters when supplemental feeding was not conducted. However, feeding bison an estimated 4–5 of 10 winters would tend to keep them concentrated in feeding areas, reducing viewing opportunities in these years as compared to Alternatives 2 and 3. The occasional or possibly common presence of bison in the sleigh ride touring area during years of no supplemental feeding could increase visitor safety concerns.

If a safe and efficacious brucellosis vaccine for bison was found, it would likely not affect viewing opportunities on the refuge because bison are not now fed in areas that are readily viewable by the public and this would continue under Alternative 4.

Disease-caused declines in elk and/or bison numbers would reduce viewing opportunities, but possibly not to the extent of Alternatives 1 and 5. Declines in elk numbers might occur somewhat more slowly and might not decline to the same level as under Alternatives 1 and 5.

Grand Teton National Park. A major reduction in elk numbers (from an estimated baseline of 2,676 to 1,300–1,600) could result in fewer viewing opportunities for a minority of park visitors, potentially reducing the quality of the outdoor experience for some people. The adverse effects would be relatively minor because most visitors from May through October do not see elk. During most years, a moderate to large number of elk (but fewer than under baseline conditions and Alternative 1) would continue to be observable during spring and fall migrations, so viewing opportunities might not change substantially. Furthermore, although elk numbers would be lower than Alternative 1, bull-to-cow ratios would be higher, which means that opportunities for seeing and hearing bugling elk during the fall rut would not decline proportionally. Even with a major reduction in elk numbers, opportunities to see and hear elk during the fall rut would continue to be higher than opportunities in other areas in the Jackson elk herd unit due to hunting pressure.

Hunting in the park would continue to adversely affect the experiences of some visitors during the fall and early winter. Initially the number of elk harvested in the park would be higher than now, but in the long term fewer elk would be taken.

As described for Alternatives 2 and 3, no effect on park visitation is expected as a result of changes in the size of the elk herd. Most visitors from May to October do not see elk, and this does not seem to affect the quality of their visits.

Few changes in viewing opportunities would occur in the park during the first few years. An estimated 40%–50% decline in bison numbers within 10–15 years, as compared to baseline conditions, would decrease bison viewing opportunities somewhat. However, large numbers of bison

would continue to be viewable over the long term during spring, summer, and fall. Viewing opportunities would be similar to those in 1999–2000 when about 440–490 bison summered in the park. As discussed in Alternative 2, reductions in bison numbers would likely not affect visitation to any measurable degree.

While elk and bison viewing opportunities in the park would decline if a non-endemic disease became established under Alternative 4, they might not decline to the level that could occur under Alternative 1.

Other Areas. In the long term, the number of elk summering in the Yellowstone, the Teton Wilderness, and the Gros Ventre River basin segments could be similar to or moderately higher than baseline conditions. The opportunity for viewing elk could increase for some national forest visitors off the main highways during winter, but not to the extent of Alternatives 2, 3, and 6. Auto-based elk and bison viewing opportunities in winter and early spring would remain limited in the national forest due to winter closures and lack of plowing on forest access roads.

Allowing elk to better use native winter ranges through habitat manipulation in the national forest, as described for Alternatives 2 and 3, would require careful management of recreational uses to prevent displacement.

It is unlikely that elk and bison viewing opportunities in the Jackson area outside of the refuge and park would increase to any measurable degree, even during years when supplemental feed was not provided, as compared to baseline conditions and Alternative 1.

Elk viewing opportunities in the Green River basin and the Red Desert would not increase above baseline conditions because of continued winter feeding 4–5 of 10 winters.

Conclusion

The number of people participating in sleigh rides on the refuge could potentially decline by 29% compared to Alternative 1. Sleigh ride operations could also be terminated due to too much variability in elk numbers and movements. Elk viewing opportunities during winter on the refuge would be much more variable in non-feeding years, ranging from no elk within view on some days to over 2,000 on other days. Bison viewing opportunities during some winters would increase to the degree that they searched a larger area for forage, particularly during non-feed years in the southern part of the refuge.

Bison and elk viewing opportunities in the park during spring, summer, and fall would decline somewhat, but it is unlikely that park visitation would decline more than a negligible amount as a result. Large numbers of bison would continue to be viewable in the park during these seasons. Fewer elk in the park could reduce the quality of the experience for some park visitors, but would not affect the majority of park visitors since most do not see elk during their visit.

Alternative 5

Analysis

National Elk Refuge. In the short and long terms, there would be few changes in elk and bison viewing opportunities on the refuge compared to baseline conditions and Alternative 1. Bison viewing opportunities on the refuge would continue to be limited for most visitors because most bison would continue to occupy the McBride and Poverty Flats management areas and the Gros Ventre Hills, away from the highway and the main refuge road.

As described for Alternatives 3 and 4, vaccinating elk with Strain 19 in association with winter feeding activities could cause some or many elk to vacate the Nowlin feeding area in the short term. If a large number of elk left on a particular day, sleigh ride operations could be halted for the day, reducing viewing opportunities. This could affect an average of 225 visitors per day, the same as baseline conditions. If a new vaccine could be administered remotely or orally, there would be little to no disturbance of viewing opportunities.

If an effective way was found to remotely administer RB51 to bison, it would likely be administered during winter feeding operations primarily at the McBride feeding area and at the Poverty Flats feeding area as needed. Viewing opportunities on the refuge would not be affected, and the safety of sleigh riders would not become an issue.

If large numbers of bison vacated the McBride feeding area as a result of the vaccination program, they would be hazed or bated back to the McBride area.

Alternative 5 would not affect participation in sleigh rides any more than under Alternative 1. However, results of the economic survey indicate that participation could increase by 14% (Loomis and Caughlan 2004).

For people stopping along U.S. 26/89 to view elk, the quality of the experience would be similar to Alternative 1.

The effect of disease-caused declines in elk and/or bison numbers would reduce viewing opportunities similar to Alternative 1. Greatly reducing winter feeding on the refuge as a result of chronic wasting disease could decrease elk numbers and wildlife viewing opportunities similar to Alternatives 2, 3, and 6. As a result, sleigh riders could decrease or be stopped completely. Any introduction of a disease transmissible to bison (e.g., bovine tuberculosis) would not affect bison viewing opportunities because of their location.

Grand Teton National Park. Few changes in viewing opportunities would initially occur in the park under Alternative 5. A minor reduction in elk numbers in the Grand Teton National Park herd segment (from an estimated baseline of 2,676 to 2,500) would likely have no effect on elk viewing opportunities because the change would not be large enough to be discernible to most visitors. Furthermore, Alternative 5 would result in a negligible to minor increase in elk numbers in the Yellowstone and Teton Wilderness herd segments. A large number of elk would continue to be observable during spring and fall migrations, as well as during the fall rut. Hunting on the west side of the park would continue to limit elk viewing opportunities during the fall migration.

The elk herd reduction program in the park would continue to detract from the viewing experience of some visitors not accustomed to seeing hunting in a national park.

Changes in elk numbers in the park resulting from Alternative 5 would likely not result in any discernible changes in the number of visitors to the park from May through October.

Reducing bison numbers in the park to 350–400 animals within 10–15 years, as compared to baseline conditions, would decrease bison viewing opportunities. Opportunities would be similar to what they were in the late 1990s.

Elk and bison viewing opportunities in the park would decline if a non-endemic disease became established under Alternative 5, and viewing opportunities could decline over time.

Other Areas. In the long term, the number of elk summering in other elk herd segments could be similar to or higher than baseline conditions by a negligible to minor amount. The probability of seeing elk and the quality of outdoor experiences would be similar to baseline conditions and Alternative 1.

Elk viewing opportunities in the Green River basin and deserts would not increase above baseline conditions.

Conclusion

The number of elk that would be viewable to the visiting public would also be similar to Alternative 1, and the number of people participating in sleigh rides would change little if any. Bison viewing opportunities on the refuge would continue to be limited for most visitors.

Bison viewing opportunities in the park during spring, summer, and fall could decline somewhat, but large numbers of bison would still be viewable during these seasons. Elk viewing opportunities would be similar to Alternative 1. It is unlikely that park visitation would decline more than a negligible amount due to reductions in bison numbers and no changes would be expected in response to possible negligible to minor reductions in elk numbers.

Mitigation

If sleigh ride operations were discontinued, additional vehicle pullouts with covered viewing platforms (with spotting scopes and binoculars) and interpretive signs could be developed along U.S. 26/89 as partial mitigation. This could be supplemented with one or more roving interpreters. Elk and bison ecology and management could potentially be interpreted at the National Wildlife Art

Museum, and interpretation of elk and bison ecology and management at the visitor center could be expanded. Audio tours could be another option to mitigate the discontinuation of sleigh rides. Another possible mitigation measure would be vehicle-based wildlife tours, which could be more flexible, cover greater distances and habitat types, and include other wildlife species (e.g., bison and bighorn sheep). However, this could potentially disturb elk, reducing viewing experiences of visitors along the highway and Refuge Road, damaging habitat, and accommodating relatively few visitors.

Reduced elk viewing opportunities on the refuge under Alternatives 2, 3, 4, and 6 could also be mitigated in part by providing educational and interpretive materials to explain the positive aspects related to lower elk and bison numbers on the refuge. For example, the long-term health benefits to the herds and ability of habitat to recover could be explained in interpretive signs at pullouts and at the visitor center, in pamphlets, and in articles in newsletters and local newspapers. While visitors might still be disappointed by not seeing animals, many would be satisfied knowing that the elk and bison inhabiting Jackson Hole and the refuge's ecosystem were in a healthier condition.

ELK HUNTING

Methodology for Analyzing Impacts

The U.S. Fish and Wildlife Service and the National Park Service would work cooperatively with the Wyoming Game and Fish Department to determine herd segment objectives, bull-to-cow ratios, hunting permits, etc. The following section calculates the number of elk that would need to be harvested and the number of hunters necessary to accomplish herd objectives as outlined in each alternative, given certain hunter success rates.

Potential effects of alternatives on hunting in the Jackson elk herd unit were based on a series of calculations, beginning with estimations of post-hunt numbers of elk on the refuge and in the Grand Teton National Park herd segment and in other parts of the Jackson elk herd unit. The baseline figure was an average of 2,000 elk harvested each year (±10%) (Brimeyer, pers. comm. 2003). The number of hunters under baseline conditions was calculated based on a proportional reduction from the average number of hunters during 1997–2001 to a level that would be allowed when the Jackson elk herd was at the WGFD objective level of 11,029. Table 4-8 summarizes how many elk would be harvested under each alternative, and Table 4-9 the number of hunters.

For the other alternatives the number of elk harvested in each area under each alternative was estimated and then hunter numbers were calculated based on these. Calculations accounted for the following factors, among others:

- changes in distributions of elk among herd units, or alterations to proportions of elk among segments
- a lower harvest rate (8% of the pre-hunt population) when the populations is at a low point and a lower hunter success rate (20%) to allow populations to increase
- A higher harvest rate (15% of the pre-hunt population) and a higher hunter success rate (30%) when the population is near objective to keep it from increasing further

Calculations of hunter numbers, numbers of elk harvested, and other parameters assumed that a minimum of 4,400 elk would no longer winter on the refuge as a consequence of reduced winter feeding under Alternatives 2, 3, and 6 and a major reduction in elk population objectives on the refuge under Alternatives 3 and 6, forcing elk to find adequate winter range to carry them through the winter. This number is based on the lowest number of elk estimated to have wintered out on native winter range during the last 15 years (WGFD population estimates) and is supported by modeling completed by Hobbs et al. (2003). It is also assumed that a minimum of 1,200 elk could winter on the refuge and that 2,500 elk would continue to winter on state feedgrounds, for a total of about 8,100 elk as a minimum population under Alternatives 2 and 6. Under Alternative 3, the minimum population could be slightly less in some years due to a possible minimum of 1,000 elk on the refuge in some winters (based on the refuge objective of 1,000–2,000 elk).

TABLE 4-8: ESTIMATED NUMBER OF ELK HARVESTED — JACKSON HERD ELK UNIT

	1997–2001 (average)	Alt. 1 and Baseline	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Refuge	308	198–242	0	19–105	126–146	<200	24–121
Park	665	432–528	0	43–179	232–287	<448	52–269
Other Areas	1,759	1,170–1,430	655–1,662	624–1,895	1,680–1,761	>1,378	574–1,783
Total Herd	2,732	1,800–2,200	655–1,662	686–2,179	2,038–2,194	2,028 (avg.)	650–2,173

TABLE 4-9: ESTIMATED NUMBER OF HUNTERS — JACKSON ELK HERD UNIT

	1997–2001 (average)	Alt. 1 and Baseline	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt.6
Refuge	975	660–806	0	100–525	420–487	<670	120–403
Park	2,484	1,440–1,760	0	215–895	773–957	<1,494	260–897
Other Areas	6,173	3,900–4,767	3,275–5,540	3,120–6,247	5,600–5,870	>4,593	2,870–5,767
Total Herd	9,632	6,000–7,333	3,275–5,540	3,435–7,667	6,793–7,314	6,757 (avg.)	3,250–7,067

The Wyoming Game and Fish Department tries to manage elk herds within 10% of objectives, so a range of plus and minus 10% is presented in the tables in this section, but comparisons were based on *average* baseline conditions.

Impacts of the Alternatives

Alternative 1

Analysis

It is estimated that, when the Jackson elk herd is at about 11,000 animals, an average of about 6,667 elk hunters would hunt in the Jackson elk herd unit each year, and they would harvest an average of 2,000 elk each year over the long term (Brimeyer, pers. comm. 2004). A long-term average hunter success rate of 30% was assumed for these calculations.

Continued protection of refuge and park lands, the winter feeding program, and flood irrigation on the refuge, in addition to continued protection of other national forest land and the state's feedgrounds in the Gros Ventre River basin, would continue to provide for a large harvestable surplus of elk in the Jackson Hole area.

If a non-endemic infectious disease caused declines in elk numbers, it would likely result in fewer hunters in all areas. If winter feeding was greatly reduced on detecting a new disease, it is possible that the disease would have already reached an elevated level. Under Alternative 1 prevalence would be higher and elk numbers would decline more rapidly and to lower levels than under Alternatives 2, 3, and 6.

Fewer elk would result in lower harvest quotas and more restrictive hunting regulations in some hunt areas. Low elk numbers could also mean a lower success rate, which could result in hunters going elsewhere. Hunter participation might decline further if there was a perception that diseases could be transmitted to people. Therefore, under Alternative 1 the reduction in the number of elk hunters in the Jackson elk herd unit would be larger than under Alternatives 2, 3, and 6.

National Elk Refuge. An estimated average of about 733 elk hunters would use the refuge under this alternative, 638 of whom would be residents and the remainder nonresidents. An estimated average of about 1,500 permits would be issued to hunters each year. It is estimated that an average of 220 elk would be killed each year.

Up to 70 hunters could continue to potentially hunt the open area of the refuge each day during the hunting season, based on the number of permits provided to hunters, which would result in a potential density of approximately 215 acres per hunter. However, fewer hunters would likely hunt the refuge on most days, and many hunters could remain in or near the parking lots, meaning that the density of hunters beyond 0.5–1 mile beyond the parking lots would be much less than 215 acres per hunter.

Grand Teton National Park. Hunters have an unusual opportunity to hunt elk in Grand Teton National Park as part of a legislatively permitted elk herd reduction program when necessary for proper herd management. An estimated 1,600 elk hunters (1,072 of whom would be residents and 528 nonresidents) would use the park under Alternative

1, and it is estimated that they would harvest an average of 480 elk/year.

Other Areas. An estimated average of about 4,334 hunters using all other areas in the Jackson elk herd unit (primarily Bridger-Teton National Forest). An estimated average of about 1,300 elk would be harvested each year. According to a survey of elk hunters within the Jackson herd unit in 2001, local residents spent an average of 3.1 days per hunting trip in the national forest, nonlocal Wyoming residents 5.9 days per trip, and nonresidents 6.3 days per trip.

Alternative 1 would not affect elk hunting opportunities in the Pinedale and Big Piney ranger districts of Bridger-Teton National Forest or within the Pinedale and Green River resource management areas in the Green River basin and the Red Desert.

Conclusion

An estimated average of about 733 hunters would hunt elk on the refuge each year under Alternative 1, about 25% less than the 1997–2001 average when elk numbers in the Jackson herd unit were considerably higher than the herd objective. An estimated annual average of 1,600 hunters would participate in the elk reduction program in the park when needed, which is 36% less than the 1997–2001 average. An estimated annual average of 4,334 hunters would hunt elk in the national forest and other lands. The total number of elk hunters each year would be 6,667 throughout the entire elk herd unit.

Alternative 2

Analysis

No elk hunting would be allowed on the National Elk Refuge or the elk herd reduction program in Grand Teton National Park under Alternative 2; most hunting would take place in Bridger-Teton National Forest.

The number of hunters in the Jackson elk herd unit would decline sharply because hunting would only occur in the national forest and on private and state lands. In years when the number of elk in the herd unit was at or near the objective level, an estimated 5,540 hunters could be accommodated, but when the elk population declined to anticipated lows (due to severe winters and no feeding on the refuge), only 3,275 hunters could hunt in the herd unit. About 6,667 hunters would be allowed under Alternative 1. Under this alternative the Wyoming Game and Fish Department would likely increase the number of limited quota licenses and reduce the period of time that certain hunt areas were open to general license holders. Hunter success would vary from year to year, and during years when the population was near the estimated low of 8,100 elk, hunter success could decline to 20%, although it could be lower in some hunt areas (based on information in Boyce 1989:184). However, hunter participation in the Jackson herd unit might drop substantially in years when elk numbers and hunter success declined markedly and the proportion of limited quota licenses increased (Brimeyer, pers. comm. 2003; Boyce 1989:185).

The number of elk harvested annually by hunters would be reduced to 1,662 in the short term (17% less than the baseline figure of 2,000) and to 655 in the long term (a 67% reduction).

If large numbers of elk began wintering in the Green River basin and the Red Desert, elk hunting opportunities and harvested elk in the Jackson elk herd unit might not decline to the extent described above because of more winter range being available, lower winter mortality, and larger numbers being maintained.

If large numbers of elk did not begin migrating to other areas, elk hunting opportunities in these areas would be similar to current conditions. However, if large numbers of elk did begin wintering in the Green River basin and the Red Desert, hunting opportunities could be expanded in these areas.

A non-endemic infectious disease would reduce hunting opportunities, but likely not to the extent that would occur under Alternatives 1, 4, and 5 in the long term. Elk numbers would likely decline more slowly and probably would not to the same level as under Alternatives 1 and 5. In the long term hunting opportunities in the Jackson elk herd unit might not be substantially different than under Alternative 1.

Several factors could contribute to possible higher hunter opportunities in the long term than under Alternative 1. A key factor would be considerably lower prevalence of infected animals. Also, there would be a lower level of environmental contamination. A lower mortality rate (as compared to Alternative 1) would allow for relatively higher harvest quotas. A much lower prevalence might also cause fewer hunters to not hunt in the Jackson elk herd unit due to health concerns.

Conclusion

Opportunities for elk hunting on the refuge and the elk herd reduction program in the park would be immediately eliminated. Although this would result in lower number of opportunities in the Jackson elk herd unit, reduced numbers of elk in the park would allow for an increase in hunting opportunities in the national forest in some years (an estimated increase to 5,540 hunters/year, a 28% increase over average baseline conditions). However, after a series of above-average or severe winters, resulting in fewer elk, the number of elk hunters outside of the refuge and park could decline to an estimated 3,275, 24% lower than the average baseline figure of 4,334.

Alternative 3

Analysis

The number of hunters that could hunt each year in the Jackson elk herd unit would become much more variable under this alternative, similar to Alternative 2. In the first few years the number of hunting opportunities in the Jackson elk herd unit would be higher than under baseline conditions, with an estimated 700 additional hunters than average baseline conditions (possibly 7,400 hunters as compared to the average baseline figure of 6,667 hunters/year), assuming an additional 200 or more elk would be harvested each year, for a total harvest of 2,200 or more elk in the herd unit as compared to 2,000 under baseline conditions and Alternative 1. Harvest strategies would include reducing the Grand Teton National Park herd segment to a maximum of 1,000 elk within 10–15 years.

In the long term an estimated average of 7,667 hunters could be accommodated in the herd unit in years when the elk herd was at or near the herd objective of 11,029. This estimate assumes a lower success rate in Grand Teton National Park, due to the very low elk population in the park, which would allow more hunters assuming a success rate similar to baseline conditions. However, following a severe winter or series of above-average and severe winters, estimated number of hunters would decline to about 3,435, which is 48% lower than average baseline conditions and Alternative 1. This would be a consequence of reducing the frequency of winter feeding to an estimated 2 years out of 10, reducing the Grand Teton National Park segment to 500–1,000, and reducing elk numbers on the refuge to 1,000–2,000. Hunter success would become much more variable from year to year and, during years when the population was near 7,900 elk, hunter success would decline to an estimated average of 20%, although it could be lower in some hunt areas (Boyce 1989).

The number of elk killed by hunters in the herd unit would fluctuate more than it would under Alternative 1. In years when the herd is at or near the herd objective, the number of elk harvested in the herd unit could potentially increase to an estimated 2,158 (8% over the baseline of 2,000 elk), but after a series of above-average and severe winters, elk harvest could decline to a low of 687 elk/year (a 66% decrease), and it could take 5–10 years to recover from this low.

If a non-endemic infectious disease caused declines in elk numbers, hunting opportunities would be reduced, but probably not to the extent that would occur in the long term under Alternatives 1, 4, and 5. Elk numbers would likely decline more slowly and not to the same level as under Alternatives 1 and 5. Although the number of hunters on the refuge and in the park would decline by a major amount, hunting opportunities in the Jackson elk herd unit as a whole in the long term might not be substantially different than under Alternative 1. It is also possible that the number of hunting opportunities would remain higher under Alternative 3 in the long term.

National Elk Refuge. In the first several years of implementation, it is estimated that the number of hunting opportunities on the refuge (as well as the elk reduction program in the park and possibly Hunt Area 80) would be higher than under baseline conditions and Alternative 1. The purposes of allowing larger harvests would be to reduce the

Grand Teton National Park herd segment from the baseline estimate of 2,676 elk to a maximum of 1,000 elk, so the increase in opportunities would only occur early in the hunting season. It is possible that 300 or more elk would be harvested on the refuge each year for several years (as compared to 220 elk/year harvested under baseline conditions). This would mean an estimated 1,000 hunters on the refuge (compared to 733 hunters under baseline conditions). The possible initiation of a hunt at the south end of the refuge would be important in being able to obtain the estimated harvest rates during the early part of the hunting season. Alternatively, allowing public use in the southern portion of the refuge would cause elk to move back into hunt areas (and in subsequent years elk might not move as quickly to the south end of the refuge).

In the long term elk hunting opportunities on the refuge could decline from an average of 733 hunters to 100–525 hunters per year, primarily due to a much smaller Grand Teton National Park segment, closing the northern fifth of the refuge, and fewer elk due to the major reduction in winter feeding. The number of elk killed by hunters would decline from an estimated average of 220 to 20–105.

After the park segment had been reduced to 500–1,000 elk, the size of the hunt area would likely be cut in half, which would be viewed adversely by some hunters. However, most hunters on the refuge hunt at or near the parking lots, so reducing the size of the hunt area would not have more than a minor adverse affect on the quality of the hunting experience. A small hunt area would potentially be added to the south end of the refuge. Only a small number of hunters would hunt in this area. Whereas hunter success would likely be high initially, hunter success would be sporadic after elk became accustomed to the hunt area.

If large numbers of elk began migrating to the Green River basin and beyond, this would not affect hunting opportunities on the refuge any more than a negligible degree.

Grand Teton National Park. To reach a herd objective of 1,000 elk maximum in the park (compared to a baseline estimate of 2,676), the need for deputized hunters to help with elk reduction could be higher than under baseline conditions and Alternative 1. Increased opportunities would only occur early in the season, and 650 or more elk could be harvested in the park each year for the first several years (as compared to 480 under baseline conditions). The number of hunters would increase from 1,600 hunters under baseline conditions to an estimated 2,200. The park elk reduction program would be managed adaptively, based on a need and reduction strategy. An elk hunt at the south end of the refuge would be important in being able to obtain the estimated harvest rates. Alternatively, allowing public use in the southern portion of the refuge would also cause some elk to move back into hunt areas (and in subsequent years elk in the park might not move as quickly to the south end of the refuge). Hunting regulations in the park would be geared toward increasing harvest of cows. Therefore, the harvest of bulls would not be higher than baseline estimates and could potentially be lower.

In the long term, it is estimated that approximately 215–895 elk hunters would hunt in the park on average under Alternative 3, compared to the baseline figure of 1,600 hunters. An estimated 43–179 elk would be harvested from the park each year.

After 5–10 years the Blacktail Butte and Kelly hayfields area would no longer be open to elk reduction activities.

If large numbers of elk began migrating to the Green River basin and beyond, this would have a negligible effect on reduction opportunities in the park.

Other Areas. For the first several years of implementation, hunting opportunities and the quality of hunting experience would not differ substantially from baseline conditions and Alternative 1. Hunting opportunities could be higher immediately east of the refuge in the first few years. Because a primary purpose of allowing larger harvests would be to reduce the Grand Teton National Park herd segment, the increase in opportunities would occur early in the hunting season. At the outset of the hunting season, hunting activity or public use at the south end of the refuge would cause some of the elk to move into the national forest where they could be harvested.

When elk numbers were at a high point under this alternative, the number of hunters outside the refuge and the park would increase to an estimated 6,247, 44% higher than the baseline figure of 4,334. An estimated 1,895 elk would be harvested, also a 44% increase from baseline conditions 1,315 elk. This increase would primarily be due to the major reduction in the park segment, which would allow elk numbers in the Yellowstone, Teton Wilderness, and Gros Ventre segments to grow. However, elk in these units would need to rely more heavily on native winter range, which could result in elk numbers declining to a point where only about 3,120 hunters could hunt in areas outside of the refuge and park (28% below the baseline figure of 3,900), and an estimated 624 elk would be harvested.

In years when elk numbers in the herd unit were at the low end of the estimated range, hunting regulations would likely become more restrictive in Hunt Areas 70, 71, 74, and 80 (e.g., a much greater reliance on limited quota licenses). The Wyoming Game and Fish Department would likely increase the number of limited quota licenses and reduce the period of time that the areas were open to general license holders. Hunt Areas 78, 81, 82, and 83 would be much less affected (Brimeyer, pers. comm. 2003).

If large numbers of elk began migrating to the Green River basin and beyond, hunters in the Jackson elk herd unit would continue to have opportunities to harvest them within the Jackson elk herd unit. But because they would also be harvested outside of the herd unit, hunting regulations within the herd unit boundaries might become more restrictive.

If large numbers of elk did not begin migrating to the Green River basin and the Red Desert, this alternative would have a negligible effect on hunting opportunities in these areas. However, if large numbers of elk did begin wintering in the Green River basin and the Red Desert, hunting opportunities could be expanded there. A more detailed assessment of potential effects has not been undertaken at this time.

Conclusion

In the long term, the number of elk hunters on the refuge would decline from an annual average of 733 to 100–525. In the park the number of hunters would decline from an average of 1,600 to an estimated 215–895 per year. The number of elk hunters in the national forest and other areas would range from 3,120 to 6,247 per year. There could in the long term be less need for elk reduction in the park in some or all years. Managers would use adaptive management strategies in response to reviewing data on elk numbers, distribution, and objectives agreed upon by the interagency working group. Although the average might not be substantially different than baseline conditions, periodic drops in hunting opportunities would be an adverse impact. Throughout the herd unit, the number of elk hunters could range from an estimated 3,430 to 7,667 per year.

Alternative 4

Analysis

In the short term, few changes would occur in hunting opportunities in the Jackson elk herd unit, except that a higher number of cows would be available for harvest in the park and refuge early in the season. Under this alternative an additional 330–700 hunters could be allowed (possibly 7,000–7,400 hunters as compared to the baseline figure of 6,667 hunters). This is based on allowing 100–200 or more elk to be harvested each year, for a total harvest of 2,100–2,200 elk, as compared to 2,000 under baseline conditions and Alternative 1. The higher level of harvest would be directed at reducing the Grand Teton National Park herd segment to a 1,300–1,600 elk within 10–15 years. Additional details are provided below, in the discussions on each area.

In the long term, the number of hunters and the numbers of elk harvested each year would be similar to baseline conditions and Alternative 1, although the distribution of hunters could change to a minor extent.

If a non-endemic infectious disease caused declines in elk numbers, hunting opportunities would be reduced, but probably not to the same extent as under Alternatives 1 and 5 in the long term. If winter feeding continued in 4–5 of 10 winters, the number of elk hunters could possibly decline further than under Alternatives 2, 3, and 6 because of animals being concentrated.

National Elk Refuge. In the first several years the number of hunting opportunities on the refuge would be higher than under baseline conditions and Alternative 1. The purpose would be to reduce the Grand Teton National Park herd segment from 2,676 elk to a maximum of 1,600 elk, so the increased opportunities would only occur early in the hunting season. As many as 300 elk would have to be harvested on the refuge each year for several years (as compared to 220 elk/year harvested under baseline conditions and similar to Alternative 3). This would mean as many as 1,000 hunters on the refuge (compared to 733 hunters under baseline conditions). The possible initiation of an elk hunt at the south end of the refuge could be important in attaining the estimated harvest rates during the early part of the hunting season. Alternatively, allowing public use in the southern portion of the refuge would cause elk to move back into hunt areas (and in subsequent years elk might not move as quickly to the south end of the refuge).

In the long term elk hunting opportunities on the refuge could decline from an average of 733 to 420–487 hunters per year. The number of harvested elk would decline from an estimated average of 214 to 126–146 elk.

The location and size of the hunt area at the northern end of the refuge would remain the same. A small hunt area would potentially be added to the south end of the refuge. Only a small number of hunters would hunt in this area. Whereas hunter success would likely be high initially, hunter success would be sporadic after elk become accustomed to the hunt area.

If elk from other herd segments attempted to winter on the refuge, and if elk numbers on the refuge rose above 5,000, more elk might have to be harvested on the refuge, but harvest rates would not be higher than baseline levels for the refuge.

Grand Teton National Park. In the first several years the number of opportunities for deputized hunters in the park elk reduction program would be higher than under baseline conditions and Alternative 1 in order to reduce the park herd segment from 2,676 elk to a maximum of 1,600 elk. It is possible that up to as many as about 650 elk would be harvested each year (as compared to 480 elk under baseline conditions). This would mean as many as 2,200 deputized hunters in the park (compared to 1,600 hunters under baseline conditions). A potential elk hunt at the south end of the refuge would be important in causing some elk to move back into areas where they could be hunted. Alternatively, allowing public use in the southern portion of the refuge would cause elk to move back into hunt areas (and in subsequent years elk might not move as quickly to the south end of the refuge).

In the long term an estimated average of 232–287 elk per year would be harvested by 773–957 deputized elk hunters, compared to baseline figures of 1,600 hunters and 480 elk per year.

The location and size of the hunt area would remain the same. Although the quality of the experience would be similar, it could improve for some people if there were fewer deputized hunters in the park on any given day.

Other Areas. In the first several years hunting opportunities and the quality of hunting experience would not differ substantially from baseline conditions and Alternative 1. However, hunting opportunities could initially be higher immediately east of the refuge if a hunt on the southern end of the refuge or public use caused elk to move into this area.

In the long term, there would be an estimated 5,600–5,870 hunters per year outside the refuge and park, compared to a base figure of 4,227 hunters. An estimated 1,680–1,761 elk would be harvested each year in this area, compared to a baseline figure of 1,268 elk. The reduction of elk in the park segment would allow proportionally more elk to be sustained in other herd segments, which would in turn result in an increase in the number of elk that could be harvested.

Similar to Alternative 1, Alternative 4 would not affect elk hunting opportunities in the Green River basin any more than the effects that current management of the refuge and park is having on these opportunities.

Conclusion

In the long term hunting opportunities on the refuge would decline from an average of 733 hunters

per year to 420–487. In the park it is estimated that the number of hunters would decline from an average of 1,600 hunters per year to 773–957. The number of elk hunters in the national forest and other areas outside the refuge and park would increase to an estimated 5,600–5,870 hunters per year, an increase of 29%–35%. For the herd unit as a whole, the number of elk hunters could range from an estimated 6,793 to 7,314 per year, which is an increase of 2%–10% compared to average baseline conditions.

Alternative 5

Analysis

Alternative 5 would maintain winter feeding in nearly every winter, with the same population objectives for the park and refuge as Alternative 1. Consequently, hunting opportunities and numbers of elk harvested in the Jackson elk herd unit and individual areas within the herd unit would be the same as Alternative 1.

Continued protection of refuge and park lands, the winter feeding program, and enhanced irrigation on the refuge, in addition to continued protection of other national forest land and the state's feedgrounds in the Gros Ventre River basin, would continue to provide for a large harvestable surplus of elk in the Jackson Hole area (similar to Alternative 1).

The effects of a potential non-endemic infectious under Alternative 5 would likely be similar to those described for Alternative 1. Disease-caused declines in elk would likely result in lower hunting quotas and fewer hunters. Because of a likely higher disease prevalence, elk numbers would decline more rapidly than under Alternatives 2, 3, and 6. Therefore, there would probably be a larger reduction in the number of elk hunters in the long term under Alternative 5 than under these other alternatives. Differences would be especially apparent in hunt areas outside the refuge and park because hunter numbers under Alternatives 2, 3, and 6 would not decline as markedly in these areas.

National Elk Refuge. In the short term slightly more elk could be harvested early in the season to reduce the number of elk in the park segment, but the difference would be minor. Otherwise, hunting opportunities would be similar to Alternative 1.

In the long term hunting opportunities would decline by a minor amount once the Grand Teton National Park herd segment had been reduced to objective levels. The number of hunters on the refuge could decline from an average of 733 to 670. The number of harvested elk would decline from an average of 220 to less than 200 elk. The majority of elk taken on the refuge would continue to be cows and calves, but a small number of bulls could continue to be harvested during the youth hunt.

Grand Teton National Park. In the short term, slightly more elk could be harvested early in the season to reach objective numbers for the park segment, but the difference would be minor. Otherwise, reduction opportunities would be similar to Alternative 1.

There would be approximately 1,494 elk hunters in the park under Alternative 5, and these hunters would harvest an average of 448 or fewer elk per year, compared to 1,600 hunters harvesting and 480 elk per year.

Other Areas. In the short and long terms, there would be an estimated average of 4,593 or more hunters per year outside the refuge and park, compared to the baseline figure of 4,334. An average of 1,378 elk would be harvested each year in this area, compared to the baseline figure of about 1,300 elk per year. This negligible increase in the estimated number of hunters and harvested elk would primarily be due to the minor reduction in elk numbers in the Grand Teton segment.

Similar to Alternative 1, Alternative 5 would not affect elk hunting opportunities in the Green River basin any more than under current management.

Conclusion

In the long term, the number of elk hunting opportunities on the refuge would decline from an average of 733 hunters to less than 670 hunters per year. In the park the number of hunters would decline from an average of 1,600 to 1,494 per year. The number of elk hunters in the national forest and other areas would increase to an estimated average of 4,593 hunters per year from

4,334. For the herd unit as a whole, the number of elk hunters could range from an estimated average of 6,757 per year, a slight increase over average baseline conditions.

Alternative 6

Analysis

The number of hunters in the Jackson elk herd unit under Alternative 6 would be similar to Alternative 2. In the first several years hunting opportunities would be higher than under baseline conditions. Similar to Alternative 3, this alternative could result in 700 additional hunters or more than baseline conditions (possibly 7,400 hunters compared to the baseline figure of 6,667) to harvest an additional 200 elk or more each year, for a total harvest of 2,200 or more elk in the herd. The higher harvest would be directed at reducing the Grand Teton herd segment to a maximum of 3,200 elk within five years.

Once herd objectives had been reached and winter feeding was stopped on the refuge, the estimated number of hunters would decline to about 3,250. Hunter success would vary more from year to year and, during years when the population was near 8,100 elk, hunter success would decline to an estimated average of 20%, although it could be lower in some hunt areas (Boyce 1989).

The number of elk harvested in the herd unit would fluctuate more than under Alternative 1. In years when the herd was at or near the herd objective, the number of elk harvested in the herd unit could potentially increase to an estimated 2,173, but after a series of above-average and severe winters, elk harvest could decline to a low of 650 elk per year (compared to the baseline figure of 2,000), and it could take 5–10 years to recover from this low.

A non-endemic infectious disease could cause declines in elk numbers and reduce hunting opportunities, but likely not to the extent that would occur in the long term under Alternatives 1, 4, and 5. With a smaller herd and no supplemental feeding, elk numbers would likely decline more slowly and not to the same level as under Alternatives 1 and 5. Although the number of hunters on the refuge and in the park would decline by a major amount under Alternative 6, hunting opportunities in the Jackson elk herd unit in the long term might not be substantially different than under Alternative 1. Hunting opportunities could also remain higher under Alternative 6 in the long term, similar to Alternatives 2 and 3.

National Elk Refuge. In the first several years hunting opportunities on the refuge would be higher than under baseline conditions and Alternative 1 in order to reduce elk wintering on the refuge to a maximum of 2,700 animals (until willow habitat recovered) then increase to 3,200. It is possible that 300 or more elk could be harvested on the refuge each year for several years (as compared to 220 elk/year under baseline conditions). This would mean an estimated 1,000 hunters on the refuge (compared to 733 hunters under baseline conditions). A potential elk hunt at the south end of the refuge, as described for Alternatives 3 and 4, would be important obtaining the needed harvest rates during the early part of the hunting season when elk from the park make up the majority of elk on the refuge. Alternatively, allowing public use in the southern portion of the refuge would cause elk to move back into hunt areas (and in subsequent years elk might not move as quickly to the south end of the refuge).

Once herd objectives had been achieved and winter feeding discontinued, elk hunting opportunities on the refuge would potentially decline from an average of 733 hunters to 120–403. The number of harvested elk would decline from an average of 220 to 24–121 elk. If the elk reduction program in the park was completely eliminated in the long term and elk were instead harvested on the refuge, the number of hunters would vary from an estimated 380 hunters when elk numbers were low and about 1,000 when elk numbers are at or near 11,000.

Once the elk population objective for the refuge was met, the size of the hunt area on the refuge would be reduced in size, which could adversely affect some hunters, but not hunters staying in or near the parking lots.

Grand Teton National Park. In order to reduce elk numbers in the park segment, possibly more than the existing annual average of 665 elk would need to be harvested for the first several years (as compared to 480 elk under baseline conditions). This would mean more than an estimated 2,500

hunters in the park (compared to 1,600 hunters under baseline conditions). It might be necessary to have 100% of the increased harvest level be made of up antlerless tags in order to more quickly reduce the number of elk in the park segment. At the outset of the season, hunting activity at the south end of the refuge or pubic use could cause some elk to move back into hunt areas (and in subsequent years elk in the park might not move as quickly to the south end of the refuge).

Until the park segment reached its objective, all of the area east of the Snake River currently open for elk herd reduction activities would remain open. After 5–10 years biologists and managers would determine if the Blacktail Butte and Kelly hayfields should be closed to elk reduction activities. If herd management did not require elk reduction in these areas, they would be closed. The elk reduction program would continue to be adaptively managed, and whether it occurred in any given year would be based on need.

In the long term it is estimated that 260–897 elk hunters would hunt in the park under Alternative 6 compared to the baseline figure of 1,600 hunters. An estimated 52–269 elk would be harvested each year.

Other Areas. In the first several years hunting opportunities and the quality of hunting experiences would be similar to baseline conditions and Alternative 1. However, hunting opportunities could be higher in Bridger-Teton National Forest east of the refuge in the first few years. At the outset of each hunting season, hunting at the south end of the refuge or public recreation would cause some elk to move into areas where they could be harvested.

Initially the number of hunters primarily in Bridger-Teton National Forest would increase to an estimated 5,767, compared to the baseline figure of 4,334, and 1,783 elk would be harvested. Once elk numbers were reduced and elk in these units were relying more heavily on native winter range, then only about 2,870 hunters would be allowed to hunt in areas outside of the refuge and park, and an average of 574 elk would be harvested.

In years when elk numbers in the herd unit were at the low end of the estimated range, hunting regulations would likely become more restrictive in the national forest (Hunt Areas 70, 71, 74, and 80. The Wyoming Game and Fish Department would likely increase the number of limited quota licenses and reduce the period of time that the areas were open to general license holders. Other hunt areas (78, 81, 82, and 83) would be much less affected (Brimeyer, pers. comm. 2003).

If large numbers of elk began migrating outside of the Jackson Hole area, hunters could harvest them before they left, but because they could also be harvested outside the herd unit, hunting regulations within Jackson Hole could become more restrictive to account for this.

If large numbers of elk did not begin migrating out of the Jackson Hole area, hunting opportunities outside the Jackson elk herd unit would be similar to current conditions and Alternative 1 (at most a negligible effect). However, if large numbers of elk did migrate outside the Jackson Hole area, hunting opportunities could be expanded in surrounding areas. A more detailed assessment of potential effects has not been undertaken at this time.

Conclusion

In the long term, the number of elk hunting opportunities on the refuge would decline from an average of 733 hunters to an estimated 120–403 hunters per year. In the park the number of hunters would likely decline from an average of 1,600 to 260–897. The number of elk hunters in the national forest and other areas would range from 2,870 to 5,767 per year, compared to the average baseline of 4,334. Throughout the herd unit, the number of elk hunters could range from an estimated 3,250 to 7,067 per year, compared to average baseline conditions of 6,667 hunters.

Bison Hunting Opportunities

No bison hunting would be allowed in Grand Teton National Park under any alternative.

Methodology for Analyzing Impacts

The numbers of bison harvested under each alternative in the short and long terms were estimated assuming a 15% growth rate in the absence of

hunting. No bison hunting is currently allowed on the National Elk Refuge.

Impacts of the Alternatives

Alternative 1

Analysis

Bison hunting opportunities in Bridger-Teton National Forest immediately east of the refuge would continue to be affected by elk and bison management on the refuge and park. The refuge's winter feeding program results in low winter mortality, which has allowed the bison population to grow and provide the potential for hunting. During 2001–3, an average of 42 bison were harvested each year by about 50 hunters.

Although the number of bison would continue to grow under Alternative 1, hunting opportunities would not increase correspondingly because most bison would remain on the refuge and in the park during hunting season. Potentially the average number of bison harvested each year could increase to 50 animals per year, allowing approximately 60 hunters in the national forest (Brimeyer, pers. comm. 2002). It is anticipated that the success rate on bull bison would be approximately 80%–90% and the success rate on cows would be about 60%–70%.

Conclusion

An average of 50 bison could be harvested in the national forest each year by approximately 60 hunters, a minor change compared to baseline conditions.

Alternative 2

Analysis

In the short term the harvest of bison in Bridger-Teton National Forest would not be affected under this alternative. In the long term bison hunting opportunities and the number of bison harvested might not decline, even though bison numbers could drop considerably. Without winter feeding on the refuge, bison would likely wander farther during the fall and winter, making them available for hunting in the national forest. If bison roamed onto private lands, they could be harvested or culled. Therefore, for the purposes of this analysis, it is estimated an average of 50 bison would continue to be harvested each year.

Conclusion

Because bison would likely wander onto national forest and private lands searching for forage, opportunities for hunting would be similar to Alternative 1. An average of 50 bison would continue to be harvested each year.

Alternative 3

Analysis

A larger bison herd (between 800 and 1,000 animals, depending on the population when the record of decision is signed) would greatly expand bison hunting opportunities under this alternative and allow a larger number of hunters in Jackson Hole. For the first several years an estimated 120–135 bison would be harvested each year to keep the bison population from growing. It is anticipated that an average of about 50 bison would be harvested in the national forest and 70 bison on the refuge. This would allow an average of about 155–170 hunters each year in the short term.

In the long term the yearly harvest would decline to about 120 bison. It is anticipated that as many as 50 bison would continue to be harvested in the national forest and about 70 on the refuge. This would allow an average of about 150 hunters each year in Jackson Hole.

In addition to the public hunt, this alternative would allow a bison reduction program for American Indians, which would recognize and respond to the cultural significance that bison have for many American Indian tribes. The tribes would remove a minimum of five bison per year, potentially more in some years, depending on a WGFD need assessment.

Conclusion

Alternative 3 would triple bison hunting opportunities on the refuge and in the national forest. An estimated average of 150 bison hunters could be accommodated in Jackson Hole under this alternative because of a larger herd, a major change compared to Alternative 1.

Alternative 4

Analysis

In the short term an estimated 140–150 bison would be harvested each year to reduce bison numbers to a herd size of 450–500. An average of about 50 bison would continue to be harvested in the national forest and the remaining 90–100 bison on the refuge. This would allow an average of about 175–190 hunters in Jackson Hole each year.

In the long term the number of bison harvested each year would decline to about 70 bison. The number of bison harvested on the refuge and the national forest could be equally split, or up to 50 bison could be harvested in the national forest. This would allow an average of about 90 hunters in Jackson Hole each year.

Similar to Alternatives 3 and 6, this alternative would allow for a bison reduction program for American Indians, in recognition of the cultural significance that bison have for many tribes. Tribes would be allowed to remove five bison per year or more, depending on a WGFD need assessment.

Conclusion

In the long term bison hunting opportunities in Jackson Hole would increase to an average of 90 hunters per year, a major increase compared to baseline conditions and Alternative 1.

Alternative 5

Analysis

For the first several years an estimated 150–155 bison would be harvested annually to reduce bison numbers to 350–400 animals under this alternative. About 50 bison would probably continue to be harvested in the national forest and the remaining 100–105 bison on the refuge. This would allow an average of about 190–195 hunters in Jackson Hole each year.

In the long term the annual bison harvest would decline to 60 animals. The number of bison harvested on the refuge and in the national forest could be equally split, or as many as 50 bison could continue to be harvested in the national forest. This would allow an average of 75 hunters in Jackson Hole each year.

No opportunities for a bison reduction program would be specifically provided for American Indians under this alternative. Individual tribal members would have to apply for licenses through the Wyoming Game and Fish Department.

Conclusion

In the long term, bison hunting opportunities in Jackson Hole would increase to an estimated average of 75 hunters per year, a moderate increase over baseline conditions and Alternative 1.

Alternative 6

Analysis

For the first several years an estimated 200 bison could be harvested each year to reduce bison numbers down to an average of 400 bison within five years. About 50 bison would continue to be harvested in the national forest and the remaining 150 bison on the refuge, although greater bison distribution during the fall and winter could allow a larger harvest in other areas. This would allow an average of about 250 hunters in Jackson Hole each year.

In the long term, the number of bison harvested each year would decline to about 60 bison, which is similar to Alternative 5. The bison harvest on the refuge and in the national forest could be equally split, or as many as 50 bison could be harvested in the national forest. This would allow an average of about 75 hunters in Jackson Hole each year. If bison numbers declined below 350 after a series of above-average and severe winters, hunting quotas would have to drop until the bison population had rebounded.

Similar to Alternatives 3 and 4, this alternative would allow a bison reduction program for American Indians in addition to the public hunt. Tribes would be allowed to remove five bison per year or more, depending on a WGFD need assessment.

Conclusion

Similar to Alternative 5, bison hunting opportunities in Jackson Hole would increase to an esti-

mated average of 75 hunters per year, a moderate increase compared to baseline conditions and Alternative 1. In contrast to Alternative 5, however, hunting opportunities could decline after a series of above-average and severe winters if the bison herd fell below 350 animals.

CUMULATIVE EFFECTS

No cumulative effects for recreational opportunities (wildlife viewing, elk and bison hunting) are anticipated as a result of impacts of the alternatives in combination with impacts of reasonable foreseeable actions.

ECONOMIC IMPACTS ASSOCIATED WITH RECREATION

METHODOLOGY FOR ANALYZING IMPACTS

The impact analysis is based on work done at Colorado State University and at the Policy Analysis and Science Assistance program of the Biological Resources Division of the U.S. Geological Survey. Funded by the U.S. Fish and Wildlife Service and the National Park Service, researchers conducted visitor surveys to assess the economic effects related to the bison and elk management plan. The 2002 visitor surveys conducted by Loomis and Koontz (2004) focused on visitor groups (wildlife viewers) that could possibly be affected by activities related to the management plan. Surveys were handed out to 648 sleigh ride visitors during February and March 2002, and the response rate was 78%. Surveys were handed out to 963 park visitors during June and July 2002, and the response rate was 87%. Researchers also worked with the Wyoming Game and Fish Department to survey Jackson herd elk hunters during the 2001 hunting season to assess the economic effects related to elk hunting.

The assessment of potential impacts focuses on long-term effects.

WILDLIFE VIEWING

Methodology for Analyzing Impacts

Economic impacts are typically measured in terms of number of jobs lost or gained, and the associated result on employment income. Economic input-output models are commonly used to predict the total level of regional economic activity that would result from a change in visitor spending. The IMPLAN input-output modeling software was used to analyze the economic impacts associated with visitor and hunter spending.

The local region (and its economy) is typically defined as all counties within a 30–60 mile radius of the travel destination. However, as explained in Chapter 3, to accurately portray the spending of tourists and the respending of local workers salaries, the local area was determined to include Teton County in both Wyoming and Idaho. For the *local* Jackson area analysis, only spending by nonlocal persons (living outside Teton County WY and ID) is considered an infusion of new money into the local economy. This includes the spending of nonlocal Wyoming residents and out-of-state visitors (nonresidents).

Because spending by out-of-state visitors also generates economic benefits in the larger regional statewide economy as they travel to the Jackson area, Wyoming was selected for the *regional* economic impact area to capture this nonresident spending in the state. Spending amounts in Wyoming are the summed expenditures that out-of-state visitors reported spending in the Jackson Hole area plus en route to the Jackson Hole area. Because spending by nonlocal Wyoming residents was included in the local Jackson area impact analysis but was not included in the regional impact analysis, the total spending within the local economy by nonlocal visitors is greater than what is spent regionally by nonresidents.

Over the past five years, an average of 24,367 visitors have annually participated in the winter sleigh rides. Based on the survey, approximately 92% are nonlocal Wyoming residents and out-of-state visitors (Loomis and Caughlan 2004). Therefore, an estimated 22,320 nonlocal sleigh ride visitors was used as the baseline for the economic impact analysis. As discussed in Chapter 3, survey results show that on average nonlocal Wyoming and nonresident sleigh ride visitors spent approximately $98 per person per day locally in the Jackson Hole area (Loomis and Caughlan 2004). Surveys also show that 80% of refuge sleigh ride visitors are from out of state, and they spent on average approximately $108 per person per day in

the Jackson Hole area and elsewhere in the state en route to Jackson (Loomis and Caughlan 2004). Impacts of sleigh ride visitors are summarized in Table 4-10 and Table 4-11.

Results from the park summer visitor survey indicate that 2,163,493 of the visitors (92.1%) are nonlocal Wyoming residents and nonresidents (Loomis and Caughlan 2004), which was used as the annual baseline. Survey results show that on average nonlocal resident and out-of-state visitors spent approximately $83 per person per day locally in the Jackson Hole area. Out-of-state visitors spent approximately $110 per person per day in the Jackson Hole area and elsewhere in the state en route to the Jackson area (Loomis and Caughlan 2004).

Because the overall effects of changes in elk and bison numbers and distribution in Bridger-Teton National Forest and other parts of the Jackson elk herd unit would be no more than negligible under the action alternatives, baseline estimates of the contribution of elk and bison viewing in these areas to the local economy was not necessary.

Impacts of the Alternatives

Alternative 1

Analysis

National Elk Refuge. It is assumed that the high proportion (92%)of nonlocal Wyoming residents and out-of-state sleigh ride visitors would continue under Alternative 1. This means that of the average 24,367 visitors participating in sleigh rides on the refuge each year, an estimated 22,320 are from outside the Jackson Hole area. Spending by this group of visitors is summarized in Table 4-10. Under Alternative 1, these visitors would spend an estimated $1.96 million in the Jackson Hole area annually. Direct and secondary effects would generate over $1.01 million in personal income and 49 jobs annually in the Jackson area economy, representing 0.1% of total local income and 0.19% of employment.

Spending by out-of-state sleigh ride visitors under Alternative 1 would generate approximately $957,000 per year in personal income and 55 jobs in Wyoming, representing 0.01% of total state income and 0.02% of employment. Nonresident visitor spending impacts on the state economy are presented in Table 4-11.

If a non-endemic infectious disease (e.g., chronic wasting disease, bovine tuberculosis) became es-

TABLE 4-10: POTENTIAL LOCAL ECONOMIC IMPACTS OF SLEIGH RIDE VISITORS (NONLOCAL WYOMING RESIDENTS AND OUT-OF-STATE VISITORS)

	Alternative 1	Alternatives 2, 3, & 6	Alternative 4	Alternative 5
Percentage Change from Nonlocal Base Visitation	Baseline	-100%–-41%	-100%–-29%	0%–+14%
Total Spending (millions)	$1.96	$0–$1.09	$0–$1.29	$1.96–$2.34
Total Economic Effects (direct and secondary)				
Income (million/year)	$1.01	$0–$0.56	$0–$0.67	$1.01–$1.19
Number of Jobs	49	0–27	0–33	49–58
Percentage of Total Jackson Area Income	0.10%	0.00%–0.05%	0.00%–0.07%	0.10%–0.12%
Percentage of Total Jackson Area Employment	0.19%	0.00%–0.11%	0.00%–0.13%	0.19%–0.23%

SOURCE: Loomis and Caughlan 2004.

TABLE 4-11: STATEWIDE ECONOMIC IMPACTS OF OUT-OF-STATE SLEIGH RIDE VISITORS

	Alternative 1	Alternatives 2, 3, & 6	Alternative 4	Alternative 5
Percentage Change from Base Visitation	Baseline	-100%–-41%	-100%–-29%	0%–+14%
Total Spending (millions)	$1.75	$0–$1.03	$0–$1.24	$1.75–$3.76
Total Economic Effects (direct and secondary)				
Income (million/year)	$0.96	$0–$0.57	$0–$0.64	$0.96–$1.13
Number of Jobs	55	0–33	0–37	55–65
Percentage of Total State Income	0.01%	0.00%	0.00%	0.01%
Percentage of Total State Employment	0.02%	0.00%–0.01%	0.00%–0.01%	0.02%

SOURCE: Loomis and Caughlan 2004.

tablished in the Jackson elk and/or bison herds under Alternative 1 and caused large declines in herd numbers, sleigh ride visitation would likely be reduced, affecting personal income and jobs in the Jackson Hole economy. Reductions could approach or exceed those under Alternatives 2, 3, and 6 without a non-endemic disease.

Grand Teton National Park. Under baseline conditions about 92% of park visits (2,163,493 visits) are by nonlocal visitors (nonlocal Wyoming residents and nonresidents). This alternative would not result in any additional effects on park visitation. Although bison numbers would continue to grow annually by an estimated 10%–14%, this is not expected to affect park visitation. Potential effects on the Jackson area economy of spending by nonlocal resident and out-of-state summer park visitors are presented in Table 4-12. Under Alternative 1 these visitors would spend approximately $589.91 million annually in the local Jackson Hole area, directly accounting for $200.7 million in personal income and 10,658 jobs in the local economy, representing 19% of total local income and 42% of local employment. As shown in Table 4-12, including the direct and secondary effects, visitor spending accounts for over $306.4 million annually in personal income and 14,200 jobs in the local economy. Current summer visitation to Grand Teton National Park accounts for almost 30% of total personal income and 56% of total employment in the Jackson Hole area (including the direct and secondary effects), a substantial impact on the local economy.

Spending by out-of-state summer park visitors in Wyoming would generate annually approximately $391.77 million in personal income and 21,588 jobs in the state, accounting for almost 3% of total annual personal income and 6.6% of total annual employment in the state (see Table 4-13).

A decline in elk and/or bison numbers as a result of a non-endemic infectious disease would likely not cause park visitation to decline. If elk and bison numbers did affect visitation, then fewer people visiting the park would contribute to lower amounts of personal income and jobs in Jackson Hole. This effect could potentially approach or exceed what is projected under Alternatives 2, 3, and 6 without a non-endemic disease.

Other Areas. Estimates are unavailable on the economic contributions of elk viewing in Bridger-Teton National Forest. Elk likely contribute minimally to visitation, and thus the local economy, on BLM lands in the Pinedale and Green River Resource Management Areas.

TABLE 4-12: POTENTIAL LOCAL ECONOMIC IMPACTS OF SPENDING BY PARK VISITORS (NONLOCAL WYOMING RESIDENTS AND OUT-OF-STATE VISITORS)

	Alternative 1	Alternatives 2, 3, & 6	Alternative 4	Alternative 5
Percentage Change in Visitation (from baseline)	baseline	-7%–0%	-3%–0%	0%
Total Spending (millions)	$589.91	$547.90–$589.91	$570.75–$589.91	$589.91
Total Economic Effects (Direct and Secondary)				
Income (million/year)	$306.47	$286.37–$306.47	$297.30–$306.47	$306.47
Jobs	14,265	13,329–14,265	13,839–14,265	14,265
Percentage of Total Local Income	29.8%	27.9%–29.8%	28.9%–29.8%	29.8%
Percentage of Total Local Employment	55.7%	52.1%–55.7%	54.0%–55.7%	55.7%

SOURCE: Loomis and Caughlan 2004.

TABLE 4-13: POTENTIAL STATEWIDE ECONOMIC IMPACTS OF SPENDING BY OUT-OF-STATE SUMMER PARK VISITORS

	Alternative 1	Alternatives 2, 3, & 6	Alternative 4	Alternative 5
Percentage Change in Visitation (from baseline)		-7%–0%	-3%–0%	0%
Total Spending (millions)	$729.82	$677.86–$729.82	$706.11–$729.82	$729.82
Total Economic Effects (Direct and Secondary)				
Income (million/year)	$391.77	$365.98–$391.77	$380.00–$391.77	$391.77
Jobs	21,588	20,167–21,588	20,940–21,588	21,588
Percentage of Total State Income	2.90%	2.71%–2.90%	2.81%–2.90%	2.90%
Percentage of Total State Employment	6.57%	6.14%–6.57%	6.37%–6.57%	6.57%

SOURCE: Loomis and Caughlan 2004.

Conclusion

Sleigh ride visitation under Alternative 1 would continue at baseline levels. The direct and secondary impacts of visitor spending would continue to generate an estimated $1.01 million dollars in personal income and 49 jobs annually in the Jackson Hole economy. Visitation to Grand Teton National Park from May through October would generate an estimated $306.47 million in personal income and 14,265 jobs annually in the local economy.

Alternatives 2, 3, and 6

Impacts on the local and state economies from changes in wildlife viewing opportunities would be similar under Alternatives 2, 3 and 6, even though elk and bison numbers on the refuge and in the park would differ somewhat between the alternatives. Elk numbers would be lowest under Alternative 3 (from 1,000 to 2,000 would be overwintered on the refuge) and potentially highest under Alternative 2 (from 1,200 to 6,000 on the refuge). Bison numbers would be lowest under Alternative 2 and potentially highest under Alternative 3. However, even when bison numbers were low, they would be similar to the number of bison in Grand Teton National Park during the late 1990s. No correlation has been established between bison numbers and park visitation, and no economic impacts are expected.

Analysis

National Elk Refuge. Alternatives 2. 3, and 6 would result in a major reduction in the number of elk wintering on the refuge in some years and would greatly increase the variability of how many elk could be seen from sleighs and other locations, as compared to baseline conditions and Alternative 1. Under these alternatives refuge visitors would be able to view bison at fairly close distances on some days, which would not be possible under Alternative 1. Sleigh ride attendance by nonlocal visitors could decline by 41% (9,215 visitors) from 22,320 nonlocal visitors under baseline conditions and Alternative 1 to 13,105 nonlocal visitors. As shown in Table 4-10, this would result in average personal income of $560,000 (a decrease of $450,000 compared to Alternative 1) and 27 jobs (a loss of 22 jobs compared to Alternative 1). Spending in Wyoming by out-of-state sleigh ride visitors would generate up to approximately $565,800 in personal income and 33 jobs in the state (Table 4-11), a decrease of approximately $391,000 in personal income and 22 jobs, compared to Alternative 1.

The absence of elk in the sleigh ride touring area on a particular day would likely force sleigh ride operations to be halted. A small number of cancellations would be expected under Alternative 1, but under Alternatives 2, 3, and 6 there could be many more days when sleigh ride operations could not be offered due to no viewable elk. With fewer operating days, it would be more difficult for the operator to cover the costs of employee salaries and other expenses. Additionally, the inconsistency in elk numbers would likely result in a decline in people driving out to the National Museum of Wildlife Art to attempt to ride on the sleighs. The sleigh ride operator would still need to pay salaries of three to five employees (about $400/day) and the U.S. Fish and Wildlife Service would need to pay salaries of interpretive staff (an estimated $240/day). In total, it is estimated that the operator would lose about $1,791 per day, and an estimated $583 less per day would go to the Fish and Wildlife Service and the National Museum of Wildlife Art (USFWS 2002a).

If sleigh ride operations on the refuge had to be stopped completely (Griffin, pers. comm. 2003), no personal income or jobs would be generated. Although some of the lost sleigh ride opportunities could be replaced by other opportunities (e.g., elk viewing from platforms), this analysis assumes no replacement of opportunities. Because the economic impacts associated with sleigh ride visitation under Alternative 1 represent well under 1% of the Jackson Hole economy, even the complete cessation of sleigh ride operations would have a negligible impact on the local and state economies.

If a non-endemic infectious disease became established in the Jackson elk and/or bison herds in the long term under Alternatives 2, 3, and 6, a decline in elk and/or bison numbers could be considerably less than under Alternative 1 if winter feeding had already been eliminated under Alternatives 2 and 6 or curtailed under Alternative 3 (feeding 2 out or 10 winters). Therefore, adverse impacts to sleigh ride visitation might not be any greater than described above. If, however, a disease became established early in the implementation phase, potential impacts would be similar to those described in Alternative 1.

Grand Teton National Park. As previously discussed, it is anticipated that reductions in elk and bison numbers in Grand Teton National Park would not measurably affect visitation. Therefore, Alternatives 2, 3, and 6 would likely not reduce park visitation or to only a negligible degree, as compared to Alternative 1 (Table 4-12 and Table 4-13).

However, if substantially fewer elk caused potential park visitors to change their travel plans, park visitation from May through October could decline by a maximum of 5%–7% compared to baseline conditions and Alternative 1 (Loomis and Caughlan 2004). A 7% decline in visitation would result in an estimated average of 2,058,153 nonlocal Wyoming residents and out-of-state visitors coming to the park during this period. Estimated spending would be $42.0 million less than the baseline figure of $589.91 million. Direct and secondary effects would result in a decrease of $20.1 million in personal income and 936 jobs annually (Table 4-12). This would be a decrease from baseline conditions of 2% in total personal income and 3.7% in total employment in the Jackson area economy.

The direct and secondary effects of visitor spending in Wyoming by out-of-state visitors under Alternatives 2, 3, and 6 would decrease by $25.79 million in personal income and 1,421 jobs annually, as compared to baseline conditions and Alternative 1 (Table 4-13). This represents a decrease from baseline conditions of 0.2% in total personal income and 0.4% in total employment in the state. However, a reduction of up to 7% in May-October visitation of Grand Teton National Park is likely overstated because as described under recreational opportunities, most park visitors do not see elk during this period, and this apparently does not affect their decision about coming to the park.

If large numbers of elk began migrating to areas beyond Jackson Hole, elk numbers in the park might not decline to the extent estimated because more forage would be available on the refuge for park elk, allowing higher numbers of park elk to be sustained. This would further reduce any possible reduction in visitation as a result of elk numbers.

As described for the refuge, a non-endemic infectious disease under Alternatives 2, 3, and 6 could result in considerably smaller declines in elk and bison than under Alternative 1 if winter feeding had already been eliminated or curtailed. Therefore, adverse impacts to park visitation might not be any greater than described above. If a new disease became established early in the implementation phase, potential impacts would be similar to those described in Alternative 1.

Other Areas. If large numbers of elk began migrating to the Green River basin and the red Desert, elk-viewing opportunities during spring and fall in the Jackson and Buffalo ranger districts would likely not change enough to increase visitation. However, if large numbers of elk began moving through the Pinedale and Green River resource management areas, more visitors could be attracted to the Green River basin or people traveling through the area could stay longer. This would benefit the local economies of Pinedale and other towns. Economic impacts have not been calculated.

Conclusion

Anticipated reductions to sleigh ride operations on the National Elk Refuge as a result of fewer elk under Alternatives 2, 3, and 6 could reduce personal income to $560,000 per year (a loss of $450,000 from Alternative 1) and employment to 27 jobs (from 49). If management changes resulted in the discontinuation of sleigh rides (and assuming no other viewing opportunities compensated for the loss), then the loss would amount to $1.01 million in personal income and 49 jobs.

If reductions in elk numbers caused park visitation from May through October to decline by as much as 7%, personal income in Jackson Hole would be an estimated $286.4 million per year (a decrease of $20.1 million from Alternative 1) and employment would amount to 13,329 jobs (a loss of 936 jobs). However, reductions in elk numbers are not expected to affect park visitation more than negligibly.

Alternative 4

Analysis

Some effects of Alternative 4 would be similar to those described for Alternative 3 due to the major reduction in winter feeding and lower elk numbers on the refuge and park, although elk num-

bers would not be as low as under Alternative 3 (1,000 to 2,000 elk on the refuge under Alternative 3 compared to 4,000 to 5,000 under Alternative 4). Furthermore, bison numbers would be considerably lower under Alternative 4 (450–500 under Alternative 4 compared to 800–1,000 under Alternative 3).

National Elk Refuge. A minor to moderate reduction in the number of elk wintering on the refuge could affect how many elk would be viewable on sleigh rides, as compared to baseline conditions and Alternative 1. Based on responses to the visitor survey, Alternative 4 could result in nonlocal sleigh ride attendance declining about 29% or 6,488 visitors per year, resulting in an average of 15,832 nonlocal visitors per year (Loomis and Caughlan 2004). As shown in Table 4-10, this would result in an estimated average spending of $1.29 million in the Jackson Hole area annually ($667,500 less than the baseline figure of $1.96 million). This would generate $671,900 in personal income and 33 jobs annually in the Jackson area economy (Table 4-10), a decrease from baseline conditions of $334,200 in personal income and 16 jobs annually. Spending in Wyoming by out-of-state visitors would generate approximately $641,300 in personal income and 37 jobs in the state, a decrease from baseline conditions of $315,600 in personal income and 18 jobs per year (Table 4-11).

Similar to the other alternatives, if there were many days when sleigh rides could not be offered due to no viewable elk, it would be difficult for the operator to cover the costs of employee salaries and other expenses. Additionally, fewer people could drive to the National Museum of Wildlife Art to attempt to ride on the sleighs. However, the variability in elk numbers under Alternative 4 would not be as large as under Alternative 2, so adverse impacts would not be as great.

If sleigh ride operations had to cease, associated personal income and jobs would be lost. However, the economic impacts associated with sleigh ride visitation currently is less than 1% of the Jackson Hole economy, so stopping sleigh ride operations would have a negligible impact on the local economy.

A non-endemic infectious disease in the Jackson elk and/or bison herds could cause declines in animal numbers, but somewhat less than under Alternative 1 if winter feeding had already been reduced to 4–5 of 10 winters and if elk numbers on the refuge had been reduced to 4,000–5,000 prior to the disease outbreak. However, adverse impacts to the local economy could approach or exceed those under Alternatives 2, 3, and 6 without the introduction of a non-endemic disease. If a new disease became established early in the implementation phase of Alternative 4, potential impacts would be similar to those described in Alternative 1.

Grand Teton National Park. Anticipated reductions in elk and bison numbers in Grand Teton National Park would not measurably affect the number of people visiting the park because they are not major criteria that nonlocal visitors use in deciding whether to travel to the park. However, if a substantial number of potential park visitors did revise their travel plans based on the number of elk, it is estimated that May-October visitation to the park could decline by an average of 2%–3% compared to baseline conditions and Alternative 1 (Loomis and Caughlan 2004). As shown in (Table 4-12), a maximum 3% decline in visitation would result in estimated spending in the Jackson Hole area of $570.75 million (a decline of $19.16 million annually compared to Alternative 1). Personal income would amount to $297.3 million per year (a decrease of $9.17 million or 0.9%), and employment would total 13,839 jobs (a decrease of 426 or 1.7%).

The direct and secondary effects of spending in Wyoming by out-of-state visitors would result in a statewide decrease by $11.76 million in personal income (0.1%) and 648 jobs (0.2%) annually (Table 4-13).

A non-endemic infectious disease in the Jackson elk and/or bison herds could cause declines in elk and/or bison numbers, but they would be somewhat less than under Alternative 1 if winter feeding and elk numbers had been reduced, as described for the refuge. If elk and bison numbers did in fact affect visitation, a nonnative infectious disease in the herds could result in fewer people visiting the park, reducing personal income and jobs in Jackson Hole. Under this scenario, reductions could approach or exceed those under Alternatives 2, 3, and 6 without the introduction of a non-endemic disease.

Other Areas. Effects of elk viewing on the local economies of communities outside of the Jackson Hole area would not be affected by elk and bison management in Jackson Hole any more than would occur under Alternative 1.

Conclusion

Anticipated changes to sleigh ride visitation on the National Elk Refuge under Alternative 4 could reduce personal income to an estimated $671,500 (a decrease of $334,200 per year from Alternative 1) and employment to 33 jobs (a loss of 16).

If reductions in elk numbers caused park visitation from May to October to decline by as much as 3%, annual personal income in Jackson Hole would be an estimated $297.3 million (a decrease of $9.17 million compared to Alternative 1) and employment would total 13,839 jobs (a loss of 426). However, reductions in elk numbers are expected to have a negligible impact on park visitation.

Alternative 5

Analysis

National Elk Refuge. In the short and long terms, there would be few changes in elk and bison viewing opportunities on the refuge as compared to baseline conditions and Alternative 1, and economic impacts would be similar to Alternative 1 (see Table 4-10 and Table 4-11).

However, the sleigh ride visitor survey indicated that visitation could increase with more elk. This scenario projects a 14% increase in nonlocal visitor participation in sleigh rides (Loomis and Caughlan 2004). This would generate $2.34 million in total annual spending (an increase of $379,100 compared to Alternative 1), annual personal income of $1.19 million (an increase of $186,900), and 58 jobs (an increase of 9), as compared to baseline conditions and Alternative 1 (Table 4-10). The direct and secondary effects of spending in Wyoming by out-of-state visitors would generate approximately $1.13 million in personal income (an increase of $173,100) and 65 jobs (an increase of 10), as compared to baseline conditions and Alternative 1 (Table 4-11). However, these effects are likely overstated since the number of elk viewable from sleighs would likely be indistinguishable from Alternative 1 and bison would not be viewable from sleighs.

A non-endemic infectious disease in the Jackson elk and/or bison herds would have effects similar to Alternative 1.

Grand Teton National Park. It is anticipated that the number of people visiting the park from May to October would not change measurably under Alternative 5, compared to baseline conditions and Alternative 1, despite major reductions in bison numbers in the park (from an estimated 800–1,000 to 350–400) and minor reductions in elk numbers (from an estimated baseline of 2,676 to 2,500 or fewer). This analysis is based on data that show elk and bison numbers are not major criteria used by nonlocal visitors in deciding whether to travel to the park.

A minor reduction in elk numbers in the Grand Teton elk herd segment under Alternative 5 could be partially offset by a negligible to minor increase in the Yellowstone and Teton Wilderness segments (compared to baseline conditions). More elk in these other two segments could potentially result in more elk migrating through Grand Teton National Park during the spring and fall.

However, if wildlife numbers were an important factor for potential park visitors in deciding whether to travel to the park, it is estimated that Alternative 5 would have a negligible impact on the local and state economies.

A non-endemic infectious disease in the Jackson elk and/or bison herds while Alternative 5 was being carried out would have potential effects similar to Alternative 1.

Other Areas. Effects of elk viewing on the local economies outside Jackson Hole would not be affected by elk and bison management in Jackson Hole any more than under Alternative 1.

Conclusion

It is anticipated that contributions of sleigh ride visitation on the refuge and visitation of the park to the local economy under this alternative would be similar to Alternative 1.

Mitigation

Applicable mitigation measures would be the same as discussed for the "Wildlife Viewing and Environmental Education Opportunities," page 455.

ELK HUNTING

Methodology for Analyzing Impacts

A survey of elk hunters within the Jackson elk herd units during the 2001 hunting season was conducted by the U. S. Geological Survey and Colorado State University, in cooperation with the Wyoming Game and Fish Department. Surveys were mailed to 3,747 elk hunters, and the response rate was 56%. The objective of the survey and analysis was to quantify the amount of money elk hunters spent in the local and regional economies and the associated economic impacts such as changes in income and employment (Koontz and Loomis 2005). Spending by elk hunters in the Jackson area generates considerable economic benefits for the local and regional economy. An elk hunter usually buys a wide range of goods and services during a hunting trip. Major expenditure categories include outfitter / guide fees, hunting licenses, supplies, game processing, lodging, food, and gasoline.

Results from the elk hunter survey show that in addition to hunting license fees, nonlocal Wyoming resident elk hunters who live in Wyoming but outside Teton County spent an average of $422 per trip and out-of-state elk hunters spent $1,728 per trip locally in the Jackson Hole area (Koontz and Loomis 2005). Elk hunters were further classified by the federal land area where they hunted. Table 3-14 shows the average amount spent per hunter per trip (excluding hunting license fees) for each federal land area. Nonlocal Wyoming residents who hunted on the refuge spent more on in-town services (restaurants, grocery stores, and hotels) than those hunting in the park and national forest. The most noticeable difference between spending by elk hunters among federal land areas was that nonresidents hunting in the national forest spent an average of almost $1,500 per trip on outfitter/guide fees. Wyoming hunting regulations require nonresident elk hunters to be accompanied by an outfitter or guide when hunting in national forest wilderness areas. Additionally, nonresident hunters spent money elsewhere in Wyoming while traveling to the Jackson Hole area. On average the total amount spent by nonresident hunters in the Jackson Hole area and en route to the Jackson area totaled approximately $1,305 per trip when hunting on the refuge, $1,201 per trip when hunting in the park, and $2,452 per trip when hunting in other areas in the Jackson elk herd unit.

Besides local and regional expenditures, hunters also spent money purchasing WGFD hunting licenses. Fees for a 2001 WGFD hunting license were $38 for a resident bull elk tag, $33 for a resident cow/calf tag, $410 for a nonresident bull elk tag, and $160 for a nonresident cow/calf tag. Survey results show the average amount spent on a 2001 WGFD elk hunting license was $37 for local residents, $43 for nonlocal Wyoming residents, and $387 for nonresident hunters. This analysis did not incorporate hunting license fees because various types of licenses with different fee amounts would overly complicate the analysis.

Changes in hunter numbers and elk harvested for each alternative are described under recreational opportunities.

The economic impact analysis of hunter spending by Koontz and Loomis (2004) accounted for the average number of hunting trips taken per hunter to the Jackson area and the proportion of hunters by residential groups. For the analysis of each alternative, it was assumed that the proportion of hunters from the Jackson area, other parts of Wyoming, and outside of Wyoming, and that the number of trips taken per hunter would stay the same. From WGFD hunter harvest records and refuge hunting permit records, it was estimated that (1) 42% of hunters on the refuge are local residents, 44% are nonlocal Wyoming residents, and 14% are from out of state; (2)12% of hunters in the park are local residents, 50% are nonlocal Wyoming residents, and 38% are from out of state; and (3) 21% of hunters in Bridger-Teton National Forest are local residents, 54% are nonlocal Wyoming residents, and 25% are from out of state.

All of the alternatives assume that the Jackson elk herd would be at the WGFD objective level of 11,029 animals and that it would be maintained at or near this level. Economic impacts include both

direct and secondary effects. Comparisons are to baseline conditions as reflected in Alternative 1.

Impacts of the Alternatives

Alternative 1

Analysis

Under Alternative 1 an estimated average of 6,667 elk hunters would annually hunt in the Jackson elk herd unit, which is lower than the average number of hunters from 1997 to 2001. Nonlocal and nonresident hunter spending impacts on the Jackson area economy are presented in Table 4-14. The direct and secondary effects of hunter spending (nonlocal Wyoming residents and out-of-state residents) under Alternative 1 would generate an estimated $3.39 million annually in personal income and 186 jobs in the local Jackson area economy, representing less than 1% of total local income (0.3%) and employment (0.7%).

The economic impacts at the state level from nonresident hunter spending in the Jackson Hole area as well as elsewhere in the state (e.g., areas visited by nonresident hunters on their way to the Jackson area) are presented in Table 4-15. Under Alternative 1 spending would annually generate an estimated average of $2.82 million in personal income and 179 jobs in the state. This represents only 0.01% of total income and 0.05% if employment in the state.

National Elk Refuge. An average of 733 elk hunters would hunt on the refuge each year under Alternative 1, based on estimated annual harvest records and hunter success. Spending by nonlocal Wyoming residents and out-of-state hunters would annually generate an estimated average of over $272,400 in personal income and 12 jobs in the local Jackson area economy, representing about 8% of the personal income and 7% of the jobs (Table 4-14). Spending in Wyoming by out-of-state hunters would annually generate (direct and secondary effects) an average of over $84,000 in personal income and 4 jobs in the state.

Grand Teton National Park. An average of 1,600 elk hunters would use the park annually under Alternative 1. Spending by nonlocal Wyoming residents and out-of-state hunters would annually generate an estimated $976,800 in personal income and 45 jobs in the local Jackson area economy. This would account for about 29% of the personal income and about 24% of the jobs generated under Alternative 1 (as shown in Table 4-14). Spending in Wyoming by out-of-state hunters would annually generate an average of $680,000 in personal income and 39 jobs in the state.

TABLE 4-14: POTENTIAL LOCAL ECONOMIC IMPACTS OF SPENDING BY NONLOCAL WYOMING RESIDENT AND OUT-OF-STATE ELK HUNTERS

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Estimated Number of Elk Hunters	6,667 (Average)	3,275–5,540	3,435–7,667	6,793–7,314	6,757 (Average)	3,250–7,067
Total Economic Effects (Direct and Secondary)						
Personal Income (million/year)	$3.39	$1.62–$2.74	$1.71–$3.83	$3.39–$3.66	$3.43	$1.62–$3.54
Number of Jobs	186	97–165	100–220	195–210	190	95–203
Percentage of Total Local Income	0.33%	0.16%–0.27%	0.17%–0.37%	0.33%–0.36%	0.33%	0.16%–0.35%
Percentage of Total Local Employment	0.73%	0.38%–0.64%	0.39%–0.86%	0.76%–0.82%	0.74%	0.37%–0.79%

Koontz and Loomis 2005.

TABLE 4-15: POTENTIAL STATEWIDE ECONOMIC IMPACTS OF SPENDING BY OUT-OF-STATE ELK HUNTERS

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Estimated Number of Elk Hunters	6,667 (Average)	3,275–5,540	3,435–7,667	6,793–7,314	6,757 (Average)	3,250–7,067
Total Economic Effects (Direct and Secondary)						
Personal Income (million/year)	$2.82	$1.55–$2.63	$1.58–$3.40	$3.03–$3.25	$2.89	$1.49–$3.16
Number of Jobs	179	103–174	104–221	197–210	184	97–205
Percentage of Total State Income	0.01%	0.01%–0.02%	0.01%–0.03%	0.02%–0.02%	0.02%	0.01%–0.02%
Percentage of Total State Employment	0.05%	0.03%–0.05%	0.03%–0.07%	0.06%–0.06%	0.06%	0.03%–0.06%

Koontz and Loomis 2005.

Other Areas. An average of about 4,334 elk hunters use all other areas in the Jackson elk herd unit, primarily Bridger-Teton National Forest. Spending by nonlocal Wyoming residents and out-of-state hunters would annually generate an average of $2.14 million in personal income and 129 jobs in the Jackson area economy. This would account for 63% of the personal income and 69% of the jobs generated by elk hunters in the Jackson elk herd unit (Table 4-14). Of the 129 jobs generated, 59% (79 jobs) would primarily represents jobs for outfitters and hunting guides. Spending in Wyoming by out-of-state hunters would annually generate an average of $2.06 million in personal income and 136 jobs in the state.

Conclusion

Elk hunting in Jackson Hole would continue to contribute a negligible amount to the local economy. The direct and secondary effects of spending by nonlocal Wyoming residents and out-of-state hunters would annually generate an estimated $3.39 million in personal income and 186 jobs in the local Jackson area economy, representing 0.33% of total local income and 0.73% of employment.

Alternative 2

Analysis

The number of elk hunters would decline sharply and become much more variable because elk hunting would only occur in Bridger-Teton National Forest and on private and state lands. In years when the number of elk in the herd unit is at or near the objective level, an estimated high level of 5,540 hunters could be accommodated, but when the elk population declined to anticipated lows (due to severe winters and no feeding on the refuge), only an estimated 3,275 elk hunters could be accommodated, compared to 6,667 elk hunters per year now. Assuming an average number of 4,408 elk hunters per year (the midpoint of the estimated range), spending by nonlocal Wyoming residents and out-of-state hunters would annually generate an average of $2.18 million in personal income and 131 jobs in the Jackson area economy. This would represent an annual average decrease of $1.21 million in personal income (up to a decline of $1.77 million in some years) and 55 jobs in the Jackson area economy, compared to Alternative 1 (see Table 4-14 and Table 4-15).

Of the estimated average 131 jobs, 59% (77 jobs) would primarily represent jobs for outfitters and hunting guides. This represents a decrease of 2 jobs from baseline conditions. In years that hunting levels dropped to the anticipate low, 97 jobs would be generated, 57 of which would be for outfitters and guides.

Average spending in Wyoming by out-of-state hunters would annually generate an estimated $2.09 million in personal income and 138 jobs in the state each year. Compared to Alternative 1, this would be an annual decrease of $729,000 in personal income and 41 jobs in the statewide Wyoming economy.

Conclusion

Elk hunting in Jackson Hole would contribute a negligible amount to the local economy. The average number of nonlocal Wyoming resident and out-of-state elk hunters in the Jackson elk herd unit under Alternative 2 would generate an estimated annual average of $2.18 million in personal income and 131 jobs in the Jackson area economy. This represents an annual average decrease of $1.21 million in personal income (or about 0.1% decline in personal income) and 55 jobs in the Jackson area economy, compared to Alternative 1.

Alternative 3

Analysis

The number of elk hunters in the Jackson elk herd unit would become much more variable under this alternative, similar to Alternative 2. In the long term the number of hunters would range from 7,667 in good years (when the elk herd is at or near the herd objective of 11,029) to 3,435 after a severe winter or series of above-average and severe winters. The associated local and statewide economic impacts stemming from this range of hunter numbers in the Jackson herd unit under Alternative 3 are presented in Table 4-14 and Table 4-15. An average of 5,551 hunters is used for the analysis, compared to a baseline figure of 6,667 hunters.

Spending by an average of 5,551 hunters would annually generate an average of $2.77 million in personal income and 160 jobs in the Jackson area economy. This represents an annual average decrease of $621,000 in personal income and 26 jobs in the Jackson area economy, as compared to Alternative 1.

Estimated spending in Wyoming by out-of-state hunters would annually generate an estimated annual average of $2.49 million in personal income and 162 jobs in the state. This is an annual decrease of $326,000 in personal income and 17 jobs in the statewide Wyoming economy, as compared to Alternative 1.

National Elk Refuge. In the long term, annual elk hunting opportunities on the refuge would decline from an average of 733 per year to about 100–525 (an average of 313 hunters). Spending in the Jackson Hole area would annually generate an average of $116,000 in personal income and 5 jobs, a decrease from baseline conditions of $156,000 in personal income and 7 jobs. Spending in Wyoming by out-of-state hunters would annually generate $36,000 in personal income and 2 jobs, a decrease of $156,000 in personal income and 7 jobs in the statewide economy.

Grand Teton National Park. In the long term an estimated 215–895 elk hunters (an average of 555 hunters) would participate in the park elk herd reduction program, compared to a baseline figure of 1,600 elk hunters. Spending would annually generate an estimated $339,000 in personal income and 16 jobs in the Jackson area. This is an annual decrease from park hunter baseline conditions of $638,000 in personal income and 30 jobs. Spending by out-of-state hunters in Wyoming would annually generate $236,000 in personal income and 13 jobs, a decrease of $444,000 in personal income and 25 jobs statewide.

Other Areas. Numbers of hunters in other areas (primarily Bridger-Teton National Forest) would range from a high of 6,247 to a low of 3,125 (an average of 4,684), compared to a baseline figure of 4,334. Spending would annually generate an average of $2.31 million in personal income and 139 jobs in the Jackson area economy. This would be an annual increase of $173,000 in personal income and 10 jobs, as compared to baseline conditions and Alternative 1. Of the 139 jobs, 59% (82 jobs) would be primarily for outfitters and hunting guides. This would be a 3 job increase compared to baseline conditions. If hunting levels dropped to the anticipated low due to periodic declines in the elk population, 93 jobs would be generated by elk hunters in the national forest, with 54 (a loss of 25 jobs) for outfitters and guides.

Spending in Wyoming by out-of-state hunters would annually generate an estimated $2.22 million in personal income and 147 jobs in the state. This represents an annual increase of $166,000 in personal income and 11 jobs in the overall Wyoming economy, compared to baseline conditions.

Conclusion

Elk hunting in Jackson Hole would contribute a negligible amount to the local economy. The average number of nonlocal Wyoming resident and nonresident elk hunters in the Jackson elk herd unit under Alternative 3 would annually generate an estimated $2.77 million in personal income and 160 jobs in the Jackson area economy. This represents an annual average decrease of $621,000 in personal income (or less than 0.1% decline in personal income) and 26 jobs in the Jackson area economy, compared to Alternative 1.

Alternative 4

Analysis

In the long term the number of elk hunters and the numbers of elk harvested each year in the Jackson elk herd unit would not change substantially from baseline conditions or under Alternative 1, although the distribution of elk hunters could change to a minor extent. Under this alternative there would be an estimated 6,793–7,314 elk hunters per year (an average of 7,054) in the Jackson elk herd unit. Estimates of spending impacts are summarized in Table 4-14 and Table 4-15.

An estimated average of 7,054 elk hunters per year would annually generate an average of $3.53 million in personal income and 202 jobs in the Jackson area economy. This would be an annual increase of $139,000 in personal income and 16 jobs, as compared to Alternative 1.

Estimated spending in Wyoming by out-of-state hunters would annually generate an estimated $3.14 million in personal income and 203 jobs in the state, an annual increase of $230,000 in personal income and 24 jobs statewide.

National Elk Refuge. In the long term the number of elk hunting opportunities on the refuge would decline by a moderate to major amount, from the baseline average of 733 to 340–487 elk hunters per year (with an average of 420). Spending would annually generate an estimated average of $169,000 in personal income and 8 jobs in the Jackson area economy, an annual decrease of $104,000 in personal income and 5 jobs, as compared to Alternative 1. Spending by out-of-state hunters would annually generate an estimated $52,000 in personal income and 3 jobs in the state, an annual decrease of $32,000 in personal income and 2 jobs.

It is possible that if elk from the Yellowstone, Teton Wilderness, and Gros Ventre segments attempted to winter on the refuge, then more elk might be harvested on the refuge, but not be higher than the baseline harvest level.

Grand Teton National Park. In the long term spending by 773–957 elk hunters per year (an average of 865 elk) would annually generate an average of $528,100 in personal income and 25 jobs in the Jackson area economy. This would be an annual decrease of $448,800 in personal income and 21 jobs compared to Alternative 1. Spending by out-of-state hunters would generate an estimated $367,600 in personal income and 21 jobs in the state, an annual decrease of $312,400 in personal income and 18 jobs statewide.

Other Areas. In the long term an estimated 5,600–5,870 elk hunters per year (with an average of 5,735) would hunt outside the refuge and park, compared to the base figure of 4,334 elk hunters per year. Spending in the Jackson Hole area would annually generate an estimated $2.83 million in personal income and 170 jobs, an annual increase of $691,600 in personal income and 42 jobs compared to Alternative 1. Of the estimated 170 jobs, 59% (100 jobs) would be primarily for outfitters and hunting guides, and increase of 21 jobs. If hunting levels dropped due to declines in the elk population, 166 jobs (a decrease of 19) would be generated, with 98 (a decrease of 2 jobs) for outfitters and guides. Even during years of estimated low elk numbers, the increase in elk hunters in the national forest would more than offset the overall reduction in elk numbers.

Estimated spending in Wyoming by out-of-state hunters would generate $2.72 million in personal income and 180 jobs in the state, an annual increase of $664,700 in personal income and 44 jobs statewide.

Conclusion

Elk hunting in Jackson Hole would contribute a negligible amount to the local economy. The average number of nonlocal Wyoming resident and out-of-state elk hunters under Alternative 4 would generate an estimated annual average of $3.53 million in personal income and 202 jobs in the Jackson area economy. This represents an annual average total increase of $139,000 in personal income in the local economy (an increase of 0.03%) and 16 jobs, as compared to Alternative 1.

Alternative 5

Analysis

Because Alternative 5 would maintain winter feeding nearly every winter, its economic effects would be nearly identical to Alternative 1.

Under Alternative 5 there would be an estimated average of 6,757 elk hunters per year in the Jackson herd unit, compared to the baseline figure of 6,667. Spending in the local economy would generate $3.43 million in personal income and 190 jobs, nearly the same as Alternative 1. Estimated spending in Wyoming by out-of-state hunters would generate $2.89 in personal income and 184 jobs statewide, or less than 1% of total income and employment (see Table 4-14 and Table 4-15).

National Elk Refuge. In the long term the annual number of elk hunters on the refuge could decline from an average of 733 to 670 or fewer hunters. Spending would annually generate an estimated $249,000 in personal income and 11 jobs in the Jackson area economy, an annual decrease of $23,400 in personal income and 1 job in the Jackson area economy compared to Alternative 1. Spending in Wyoming by out-of-state hunters would generate an estimated $76,900 in personal

income and 4 jobs, an annual decrease of $7,200 in personal income and less than 1 job statewide.

Grand Teton National Park. Approximately 1,494 elk hunters would hunt in the park under Alternative 5 in the long term, compared to the baseline figure of 1,600. Spending would annually generate an estimated $912,100 in personal income and 42 jobs in the Jackson area economy. This would be an annual decrease of $45,100 in personal income and 3 jobs in the local economy. Spending in Wyoming by out-of-state hunters would annually generate an estimated $367,600 in personal income and 21 jobs in the state, an annual decrease of $45,100 in personal income and 3 jobs statewide.

Other Areas. In the short and long terms spending by an estimated average of 4,593 elk hunters (compared to the baseline figure of 4,334) would annually generate an estimated $2.27 million per year in personal income and 136 jobs in the Jackson area economy. This would be an annual increase of $127,900 in personal income and 8 jobs in the local economy. Of the estimated average 136 local jobs, 59% (80 jobs or an increase of 1 job compared to Alternative 1) would be primarily for outfitters and hunting guides.

Spending in Wyoming by out-of-state hunters would annually generate an average of $2.18 million in personal income and 144 jobs in the state, an annual increase of $122,900 in personal income and 8 jobs statewide.

Conclusion

Elk hunting in Jackson Hole would contribute a negligible amount to the local economy. The number of elk hunters and the numbers of elk harvested each year in the Jackson elk herd unit under Alternative 5 would not change substantially from baseline conditions or Alternative 1, although the distribution of elk hunters could change to a negligible to minor extent. Spending in the local economy would generate $3.43 million in personal income and 190 jobs, nearly the same as Alternative 1. Estimated spending in Wyoming by out-of-state hunters would generate $2.89 in personal income and 184 jobs statewide, or less than 1% of total income and employment.

Alternative 6

Analysis

The number of hunters under Alternative 6 would range from a high of 7,067 to a low of 3,250, with an average of 5,192 hunters, compared to the baseline figure of 6,667. Spending by elk hunters would annually generate an estimated $2.60 million in personal income and 150 jobs in the Jackson area economy, an annual average decrease of over $793,100 in personal income and 36 jobs, compared to Alternative 1. Average spending in Wyoming by out-of-state hunters would annually generate an estimated $2.35 million in personal income and 153 jobs, an annual decrease of almost $466,400 in personal income and 26 jobs statewide (see Table 4-14 and Table 4-15).

National Elk Refuge. The number of elk hunters on the refuge could potentially decline from the baseline average of 733 to 120–403 elk hunters per year (with an average of 234). Related spending in the Jackson Hole area would annually generate an estimated $86,900 in personal income and 4 jobs, an annual decrease of $793,100 in personal income and 36 jobs. Average spending in Wyoming by out-of-state hunters would generate an estimated $26,800 in personal income and 1 job in the state, an annual decrease of $57,200 in personal income and 3 jobs statewide.

Grand Teton National Park. In the long term approximately 260–897 elk hunters per year (with an average of 519) would hunt in the park under Alternative 6, compared to the baseline figure of 1,600. Spending would annually generate an estimated $316,900 in personal income and 15 jobs in the Jackson area economy, an annual decrease of $660,000 in personal income and 31 jobs in the Jackson area economy. Estimated spending in Wyoming by out-of-state hunters would generate an estimated $220,600 in personal income and 13 jobs in the state, an annual decrease of $459,400 in personal income and 26 jobs statewide.

Other Areas. An estimated 2,870–5,767 elk hunters per year (with an average of 4,440) would hunt primarily in Bridger-Teton National Forest, compared to a base figure of 4,334 elk hunters per year. Spending by nonlocal Wyoming residents and out-of-state hunters would annually generate an estimated $2.19 million in personal income and 132 jobs, an annual increase of $52,300 in personal

income and 3 jobs, as compared to Alternative 1. Of the estimated average 132 jobs, 78 jobs (an increase of 1 job) would primarily be for outfitters and hunting guides. With a large decline in the elk population, 85 jobs would be generated, 50 of which would be for outfitters and guides, a decrease of 27 jobs from baseline conditions.

Estimated spending in Wyoming by out-of-state hunters would annually generate $2.11 million in personal income and 139 jobs in the state, an annual increase of $50,300 in personal income and 3 jobs in the overall Wyoming economy.

Conclusion

Elk hunting in Jackson Hole would contribute a negligible amount to the local economy. The average number of nonlocal Wyoming resident and nonresident elk hunters in the Jackson elk herd unit under Alternative 6 would generate an estimated annual average of $2.60 million in personal income and 150 jobs in the Jackson area economy. This represents an annual decrease of over $793,100 in personal income (or less than a 0.1% decline in personal income) and 36 jobs in the Jackson area economy, compared to Alternative 1.

Mitigation

No mitigation measures would be necessary.

BISON HUNTING

Methodology for Analyzing Impacts

Bison hunting was allowed on the National Elk Refuge during the 1989–90 season and for a short time in the fall of 1990. A total of 39 bison were taken during these two seasons. Bison hunting was then stopped by a lawsuit, as discussed in Chapter 1. According to the 2001 Jackson elk hunter survey bison hunting on the refuge is still very desirable, with 76% of local Wyoming residents, 80% of nonlocal Wyoming residents, and 61% of out-of-state hunters stating they would apply for a bison tag (Koontz and Loomis 2005).

From 1997 through December 2002, hunters harvested 122 bison in Bridger-Teton National Forest east of the refuge. Similar to elk hunting, bison hunting would have an economic impact on the local economy through expenditures made by hunters during their stay in the area. In addition to local hunter spending, license fee revenue would be generated for the Wyoming Game and Fish Department to partially offset the cost of administering the hunt.

Because no specific expenditure information was collected for bison hunting, estimates developed by the Wyoming Cooperative Extension Service for the 1996 *Jackson Bison Herd Long-term Management Plan and Environmental Assessment* (NPS and USFWS 1996) were used to determine economic impacts, and they should be considered low. These estimates were based on WGFD elk hunter expenditure data, plus personal communication with WGFD personnel. The anticipated number of bison hunters that would hunt under each alternative would be negligible compared to the number of elk hunters, ranging from a low of 45 bison hunters to a high of 150. Besides the estimates of spending by local bison hunter provided by the Wyoming Cooperative Extension Service, bison hunters would also spend money purchasing WGFD hunting licenses. Fees for a 2004 hunting license were $330 for a resident bison tag and $2,100 for a nonresident bison tag. According to WGFD personnel, 90% of bison hunters are residents and 10% are nonresidents. This percentage split between resident and nonresidents was used to estimate hunting license revenue across the management alternatives.

No bison hunting opportunities would be provided in Grand Teton National Park under any alternative.

Impacts of the Alternatives

Alternative 1

Analysis

Opportunities for bison hunting would not be provided on the refuge under this alternative, which is the same as baseline conditions.

Bison hunting opportunities in Bridger-Teton National Forest immediately east of the refuge would continue. The refuge's winter feeding program would continue to result in low winter mortality, allowing the bison population to grow and provide potential for hunting. An average of about 50 hunters have hunted east of the refuge each year during the 2001–3 hunting seasons. Although

TABLE 4-16: BISON HUNTER SPENDING IMPACTS

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Estimated Average Number of Hunters	60	50	150	90	75	75
Total Economic Effects (Direct and Secondary)						
Personal Income (dollars/year)	$9,726	$8,105	$24,315	$14,589	$12,158	$12,158
Jobs	0.76	0.64	1.90	1.20	1.00	1.00

the number of bison would continue to grow, hunting opportunities would not correspondingly increase because most bison would remain on the refuge and park during hunting season as a result of the supplemental feeding program. It is estimated that the average number of bison harvested each year could potentially increase to 50 animals per year, which would result in approximately 60 hunters being able to hunt bison each year in the national forest (Brimeyer, pers. comm.). Based on estimates provided the 1996 bison management plan by the Wyoming Cooperative Extension Service, 60 bison hunters would spend an estimated total of $40,530 per year in the local area, which would generate $9,726 in personal income and 0.76 job (see Table 4-16. In addition to the amount hunters spend in the local area, an average of $30,420 would go to the Wyoming Game and Fish Department for license fees.

Conclusion

The economic impacts of bison hunting would be negligible. Assuming an average of about 60 bison hunters per year in the national forest in the long term, these hunters would spend an estimated average of $40,530 per year in the local area, which would generate $9,726 in personal income and 0.76 job annually in the local economy.

Alternative 2

Analysis

Bison hunting would not be permitted on the refuge, the same as Alternative 1.

Even though bison numbers would drop considerably under this alternative (to 250–500), continued bison hunting immediately to the east of the refuge in Bridger-Teton National Forest might not result in a long-term decline in bison numbers. No supplemental winter feeding on the refuge would force bison to wander farther during the fall and winter and onto national forest lands during hunting season. Bison could also wander onto private lands, where they could be harvested or culled. It is estimated that an average of less than 50 bison would be harvested each year, compared to 60 under Alternative 1. Based on estimates provided for the 1996 Jackson bison plan by the Wyoming Cooperative Extension Service, 50 bison hunters would spend on average $33,775 in the local area, which would generate $8,105 in personal income and 0.64 job annually in the local economy (Table 4-16). This represents an annual decrease of $1,621 in personal income and 0.12 of a job compared to Alternative 1. In addition, an average of $25,350 would go to the Wyoming Game and Fish Department for license fees.

Conclusion

The economic impacts of bison hunting would be negligible. An average of 50 bison hunters hunting in the national forest each year in the long term would spend on average $33,775 in the local area, generating an average of about $8,105 in personal income and less than 1 job annually in the local economy.

Alternative 3

Analysis

In the long term, the number of bison harvested each year would increase to an estimated average of about 120 bison. As many as 50 of the bison would continue to be harvested in the national forest and about 70 on the refuge. An average of about 150 hunters annually could hunt bison under this alternative. Spending would amount to an average of $101,325 in the local area, which would annually generate $24,315 in personal income and 1.9 jobs (Table 4-16). This would be an annual increase of $14,589 in personal income and 1.14 jobs in the Jackson area economy, as compared to Alternative 1. In addition to the amount, hunters would spend an average of $76,050 for state license fees.

Conclusion

This alternative would generate the largest amount of personal income and jobs in the Jackson area in the long term, but the economic impacts would still be negligible. An estimated average of 150 bison hunters would spend an average of $101,325 in the local area, which would annually generate $24,315 in personal income and 1.9 jobs. This would represent an annual increase of $14,589 in personal income and 1.14 jobs in the Jackson area economy compared to Alternative 1.

Alternative 4

Analysis

The number of bison harvested each year in the long term would decline to about 70 animals. The number of bison harvested on the refuge and in the national forest could be equally split, or as many as 50 bison could continue to be harvested in the forest. An average of about 90 hunters would spend on average $60,795 in the local area, annually generating $14,589 in personal income and 1.2 jobs (Table 4-16). This would be an annual increase of $4,863 in personal income and 0.44 job in the Jackson area economy, as compared to Alternative 1. In addition, an average of $45,630 would go to the state for license fees.

Conclusion

The economic impacts of bison hunting would be negligible. In the long term an estimated average of about 90 bison hunters would spend on average $60,795 in the local area, which would generate $14,589 in personal income and 1.2 jobs annually in the local economy. This would be an annual increase of $4,863 in personal income and 0.44 job in the Jackson area economy, as compared to Alternative 1.

Alternative 5

Analysis

In the long term, the number of bison harvested each year would decline to an estimated average of about 60 bison. The number of bison harvested on the refuge and in the national forest could be equally split, or up to 50 bison could continue to be harvested in the forest. An average of about 75 hunters would spend on average $50,663 in the local area, annually generating $12,158 in personal income and one job (Table 4-16). This would represent an annual increase of $2,432 in personal income and 0.24 job, as compared to Alternative 1. In addition, an average of $38,025 would go to the state for license fees.

Conclusion

The economic impacts of bison hunting would be negligible. An estimated 75 bison hunters would spend on average $50,663 in the local area in the long term, which would generate $12,158 in personal income and one job annually. This would represent an annual increase of $2,432 in personal income and 0.24 job in the Jackson area economy, as compared to Alternative 1.

Alternative 6

Analysis

The number of bison harvested each year would decline to an estimated average of about 60 bison in the long term. An equal number of bison could be harvested on the refuge and in the national forest, or 40–50 bison could continue to be harvested in the forest. An average of 75 hunters would spend an estimated $50,663 in the local area, generating $12,158 in personal income and one job annually (Table 4-16). This would represent an annual increase of $2,432 in personal income and 0.24 job, as compared to Alternative 1. In addition, an average of $38,025 would go to the state for license fees.

Conclusion

The economic impacts of bison hunting would be negligible. Similar to Alternative 5, an estimated 75 bison hunters would spend on average $50,663 in the local area in the long term, generating $12,158 in personal income and one job annually in the local economy. This would represent an annual increase of $2,432 in personal income and 0.24 job compared to Alternative 1.

Mitigation

No mitigation measures would be necessary.

CUMULATIVE EFFECTS

No cumulative effects on the economic impacts of recreational opportunities would be expected.

OTHER ECONOMIC IMPACTS

ANTLER SALES

Methodology for Analyzing Impacts

The annual auctioning of elk antlers, which have been collected every spring on the National Elk Refuge by the Boy Scouts, has benefited the refuge as well as the Boy Scouts. The refuge receives 80% of the money and the Boy Scout troop retains 20%. Over the past 10 years the auction has raised as much as $108,000, with an average of $89,800 per year. Changes in elk and bison management on the refuge could potentially affect the number of antlers collected and, therefore, the amount of money that both the refuge and the boy scouts would gain from this activity.

The following analysis assumes for all alternatives that bull elk foraging on the National Elk Refuge would drop their antlers on the refuge, making them available for collection. However, many factors affect whether elk remain on the refuge throughout the antler-dropping season, even when supplemental feeding occurs. When weather is mild and snow levels are low, elk often leave the refuge and forage in the surrounding forest. Disturbance by antler poachers or other people illegally accessing refuge lands could cause elk to leave the refuge. In addition, wolves stalking the herd could cause some elk to seek shelter in the forest or move onto park lands (weather permitting). Often these animals return to the refuge, but the more time elk spend outside the refuge boundaries, the greater the chance that they will drop their antlers on national forest, park, or private lands. Although this might represent a financial loss to the National Elk Refuge and the Boy Scouts, private individuals who collect antlers in the national forest and on private lands could benefit from greater distribution of elk antlers throughout the area.

Impacts of the Alternatives

Because the analyses are concise, they also function as conclusion statements.

Alternatives 1 and 5

Proceeds from Boy Scout antler sales under Alternatives 1 and 5 would be lower than current conditions because elk numbers on the refuge would range from 5,000 to 7,500 and the Jackson elk herd would total 11,029 animals. In the past 10 years elk numbers on the refuge have often exceeded 7,500 animals due to the Jackson herd being over objective; therefore, antler sales have been more profitable than they would be once the herd was reduced to an estimated 11,000 animals. Proceeds from antler sales would range from an estimated $59,700 to $89,600, and average $66,600, a 26% decrease compared to current conditions. The National Elk Refuge's share of the antler sales would average an estimated $53,300 under Alternatives 1 and 5, and the Boy Scouts' share an estimated $13,300.

Alternative 2

Elk numbers on the refuge would range between 1,200 and 6,000 animals under Alternative 2. Proceeds from the Boy Scout antler auction would range from an estimated $14,300 to $71,700, and average $43,000, a 26% loss in revenue as compared to baseline conditions and Alternative 1. The National Elk Refuge's share of the antler sales would average $34,400, and the Boy Scouts' share $8,600.

Alternative 3

Under Alternative 3 the elk herd on the refuge would number between 1,000 and 2,000 animals; consequently, there would be fewer antlers to collect. Proceeds from the Boy Scout antler auction would range from an estimated $11,900 to $23,900, and average $17,900, a 54% loss in revenue as compared to baseline conditions and Alternative 1. The National Elk Refuge's share of the antler sales would average $14,300, and the Boy Scouts' share $3,600.

Alternative 4

Under Alternative 4 the elk herd on the refuge would range between 4,000 and 5,000 animals. Proceeds from the Boy Scout antler auction would range from an estimated $47,800 to $59,700 and average $53,700, a 14% loss in revenue as compared to baseline conditions and Alternative 1.

The National Elk Refuge's share of the antler sales would average $43,000, and the Boy Scouts' share $10,700.

Alternative 6

Under Alternative 6 the elk herd on the refuge would range between 1,200 and 3,200 animals. Proceeds from the antler auction would range from an estimated $28,700 to $38,200, and average $33,400, a 37% loss in revenue as compared to baseline conditions and Alternative 1. The National Elk Refuge's share of the antler sales would average $26,800, and the Boy Scouts' share $6,700.

Mitigation

No mitigation measures would be undertaken.

IMPACTS ON LANDSCAPING

Large numbers of elk and bison browsing and grazing in urban, suburban, and rural neighborhoods could negatively impact landscaping in the Jackson Hole area and the Green River basin in those alternatives that reduce or eliminate supplemental feeding on the National Elk Refuge and under Alternative 1, which would allow bison numbers to grow unchecked.

Impacts of the Alternatives

Alternatives 1 and 5

Analysis

Currently, the Wyoming Game and Fish Department receives about a dozen calls a year regarding elk damaging landscaping in the Spring Gulch area. In those years when supplemental feeding of elk on the refuge is delayed, the problem is likely to be worse than in years when feeding begins early (B. Long, pers. comm. 2004). Under Alternative 1 supplemental feeding would continue in almost all years, and therefore, most elk would remain on the refuge through the winters. Landscaping on private property in the Jackson Hole area and the Green River basin would not be impacted by elk browsing and grazing any more than has occurred in the recent past.

As bison numbers continued to grow under Alternative 1, some bison could leave the refuge, and private property could experience more damage than has occurred in the past. However, bison would likely be hazed away from populated areas.

Under Alternative 5 landscaping damage caused by bison would be less than under Alternative 1 because bison numbers would be around 400 animals, and feeding would occur every year or nearly every year.

Conclusion

Landscaping in the Jackson Hole area and the Green River basin would not be impacted by elk browsing and grazing any more than has occurred in the recent past. As bison numbers continued to grow under Alternative 1, some areas could experience more bison damage to private property than has occurred in the past. Fewer bison under Alternative 5 would reduce the level of potential impacts.

Alternatives 2 and 6

Analysis

Supplemental feeding would be phased out under Alternatives 2 and 6, resulting in many elk dispersing to other areas to forage. In addition to elk inhabiting native winter range, some elk would likely forage in suburban, urban, and rural neighborhoods in the Jackson Hole area and in the Green River basin, which would result in damage to trees and shrubs in yards, golf courses, and city parks. Damage to landscaping on private property would be heaviest during severe winters. As compared to baseline conditions and Alternative 1, negative economic impacts to some home and business owners could be substantial. During mild winters, large numbers of elk could continue to be supported on the National Elk Refuge even without supplemental feeding, and landscaping damage on private property would be reduced but it might be more than under baseline conditions and Alternative 1. Elk that became habituated to feeding in suburban and urban areas during severe winters could return to these areas even in mild winters rather than stay on the refuge. Damage would likely be greatest during severe winters.

After phasing out supplemental feeding, bison numbers would grow or decline in response to natural conditions. In years when bison numbers were high, damage to landscaping in the Jackson Hole area could be substantial compared to Alternative 1. However, herd numbers would likely be less than under Alternative 1, so damage to landscaping in the Jackson Hole area would likely be less than what might occur under Alternative 1.

Conclusion

As compared to Alternative 1, damage to landscaping on private property in the Jackson Hole area and the Green River basin would likely be heaviest during severe winters under Alternatives 2 and 6. During mild winters large numbers of elk could continue to be supported on the National Elk Refuge even without supplemental feeding, and landscaping damage in suburban, urban, and rural neighborhoods would be much less, although it would likely be more than under Alternative 1. Landscaping damage by bison could be reduced because bison numbers would probably number from 250 to 500.

Alternative 3

Analysis

Supplemental feeding would occur only during severe winters under Alternative 3. In non-feeding years many elk would likely disperse to other areas to forage, and during above-average winters more elk would forage on private property in suburban, urban, and rural neighborhoods. Landscaping on private property in the Jackson Hole area and the Green River basin would be damaged, resulting in negative economic impacts to home and business owners as compared to baseline conditions and Alternative 1. However, landscaping damage would not be as great as under Alternative 2 because the refuge would supplementally feed in severe winters.

With a relatively large bison herd (an estimated 800–1,000 animals), some bison could leave the refuge and forage in suburban areas and golf courses in the Jackson Hole area. Although potential landscaping damage would not be as great as under Alternative 1, negative economic impacts to some home and business owners could be substantial.

Conclusion

Landscaping on private property in suburban, urban, and rural neighborhoods in the Jackson Hole area and the Green River basin would be damaged, resulting in negative economic impacts to home and business owners as compared to Alternative 1. Although potential landscaping damage due to bison would not be as great as under Alternative 1, negative economic impacts to some home and business owners could be substantial.

Alternative 4

Analysis

Supplemental feeding would occur an estimated 4–5 of 10 years on average under Alternative 4. In non-feeding years some elk would disperse to other areas to forage, and landscaping on private property in suburban, urban, and rural neighborhoods in the Jackson Hole area could be damaged in localized areas, resulting in negative economic impacts to some home and business owners.

A smaller bison herd under Alternative 4, along with supplemental feeding about half the time could result in some bison leaving the refuge and forage on private property in suburban areas and golf courses in the Jackson Hole area. Although potential landscaping damage would not be as great as under Alternative 1, negative economic impacts to some home and business owners could be substantial.

Conclusion

Landscaping on private property in the Jackson Hole area could be damaged in localized areas, resulting in negative economic impacts to some home and business owners as compared to Alternative 1. Although potential landscaping damage due to bison would not be as great as under Alternative 1, negative economic impacts to some home and business owners could be substantial.

Mitigation

Several mitigation measures could be implemented to minimize the extent of depredation of landscaping and other property damage. For example, home and business owners could better protect trees and gardens through the use of exclosures. Hazing, depredation hunts, and agency

culling might be needed to keep elk and bison away from trees, gardens, and other areas where they could potentially damage private property (e.g., fences). It might be possible for the U.S. Fish and Wildlife Service and the National Park Service to assist in these activities, either through funding or staff assistance.

In areas where the chances of landscaping and property damage would be especially high (under Alternatives 2, 3, 4, and 6), habitat improvement projects could be specifically located and designed to help draw elk and bison away from these areas. The enhancement of forage production under Alternative 4 and possibly Alternative 6 would also help to attract elk and bison away from private lands as winter feeding was scaled back or eliminated. By enhancing habitat near areas of potential conflict, there would be a destination for hazing animals, and it would be more likely that targeted animals could be kept away from private lands. Conservation easements in some areas might be used to provide forage for large ungulates.

IMPACTS ON LIVESTOCK OPERATIONS

Livestock operations could be affected by one or more of the following factors: numbers of elk and bison, animal density, frequency and intensity of supplemental feeding, animal distribution, elk and bison migrations, habitat improvements, and potential for contact between elk/bison and livestock. All of these factors, individually or in combination, have the potential to impact cattle operations, the predominant form of livestock enterprise in the Jackson Hole area.

METHODOLOGY FOR ANALYZING IMPACTS

Areas that were examined for possible direct impact included risk of disease transmission, testing, and vaccinations, modification of public land grazing allotments, private land acquisitions and easements, damage to agricultural crops, and depredation of stored hay. Indirect effects might include the perception by out-of-state buyers that Wyoming cattle could be compromised by disease-exposed elk and bison emigrating from the National Elk Refuge.

Where data were available, estimates of impacts were presented in dollar ranges. Where dollar estimates were not available, qualitative or relative assessments were made.

The analysis of disease-related impacts was based on a synthesis of information from two primary sources: (1) a disease experts meeting held November 12–14, 2002, and including representatives from the U.S. Fish and Wildlife Service, National Park Service, U.S. Geological Survey, Animal and Plant Health Inspection Service, Wyoming Game and Fish Department, and the Wyoming Livestock Board; and (2) published scientific literature.

OVERVIEW OF POTENTIAL DISEASE EFFECTS ON LIVESTOCK

Brucellosis

Brucellosis is by far the principal disease of concern to cattle producers, given its prevalence in the Jackson elk and bison herds. The potential transmission of brucellosis from elk and bison to cattle is the most significant issue being addressed in terms of potential effects on agricultural production in the Jackson Hole area and Green River basin.

Risk of Transmission

One cattle herd in eastern Idaho recently contracted brucellosis from infected elk (Hillman 2002). In Wyoming elk presumably infected a cattle herd in Sublette County in 2003 and at least one of two Teton County herds infected in 2004. Transmission from elk or bison to cattle would likely only occur when (1) infected pregnant elk or bison shared the same feedground with cattle in winter (Thorne 2001) and (2) cattle contacted an aborted fetus and/or fluids, or contacted vegetation or soil that was contaminated by infected birthing material (from February to June for elk, or from mid-December to mid-June for bison). Transmission of brucellosis from elk to cattle is very unlikely to occur during normal live births because elk are meticulous about cleaning their birth sites (Thorne 2001). Also, elk tend to isolate themselves when giving birth under normal conditions, reducing the chance that cattle would contact any contaminated material.

The Greater Yellowstone Interagency Brucellosis Committee (GYIBC 1997) has identified several factors that affect the risk of brucellosis transmission from elk and bison to livestock, as listed on page 128. Factors reducing risk include spatial and temporal separation and vaccination. Factors increasing risk include high density of animals, and association of susceptible animals with infected animal. The risk of transmission is affected by environmental factors because the *Brucella* organism has limited viability outside its host. The risk of transmission from elk or bison to cattle is almost certainly confined to contamination by a birth / abortion event by adult females. Susceptibility varies with species, and some individual animals may be naturally resistant to infection.

Elk and bison in Jackson Hole are free-ranging and could come into contact with livestock during migration in the fall and spring, and on summer ranges. During above-average or severe winters bison could leave the refuge in search of forage (the case under Alternatives 2 and 3, and possibly 6).

Limited cattle grazing occurs in Grand Teton National Park in the Kelly hayfields, Antelope Flats, and Hunter-Talbot areas during summer, and elk and bison could come into contact with cattle during late spring and early summer in these areas. Cattle grazing in the park occurs from about May 30 to October 31, when permitted. A cattle driveway from Blacktail Butte to the Elk Ranch area is used from June 25 to July 1. Because elk abortions may occur through June (Thorne et al. 1982), and because there is some overlap of elk calving grounds and cattle grazing allotments, cattle could be exposed to brucellosis for a short period on the West Elk Ranch, East Elk Ranch, and adjacent private lands.

Bison calving grounds overlap more fully with livestock grazing allotments in the park, and there are several allotments where cattle could come into contact with aborted fetuses, infected birthing material, or contaminated vegetation or soil. The peak of the bison calving period is from May 1 through mid-June. While 95% of all births occur by the third week of July, births can occur well outside the normal birthing period (Cain et al. 2001). Mid-December through mid-June would be the most likely time period that brucellosis would cause bison to abort their calves (Meyer and Meagher 1995). Therefore, this period would have the greatest risk of transmission to livestock. As long as brucellosis is present in the free-ranging Jackson bison herd, there is some level of risk that livestock could contract the disease from bison under any of the alternatives.

Elk and cattle could also come into contact with each other on private lands adjacent to the National Elk Refuge and Grand Teton National Park, and for a short period at the end of the elk calving season in active livestock grazing allotments in the national forest that overlap with elk calving areas (see the "Elk Calving Areas" map). Most cattle are turned out onto the allotments in mid-June. Clause et al. (2002) found there was limited interaction between elk and cattle in 11 of 12 risk areas on public grazing allotments from late May to mid-June. Behavioral differences keep elk and cattle separate under normal conditions in calving areas and summer ranges. The chance for transmission of brucellosis from elk to cattle on national forest grazing allotments during late spring and early summer is low. Nonetheless, there have been recommendations that livestock grazing in elk calving areas be delayed until late June or July to avoid any risk of disease transmission to cattle (Long et al. 1980; Smith and Robbins 1994).

Testing and Vaccinating for Brucellosis

Regardless of alternative selected, livestock producers in western Wyoming would continue to test and vaccinate cattle in accordance with state law and regulations. It is expected that testing will be required for at least some Wyoming cattle when the state reattains its brucellosis-free status. Although the details of the required testing (e.g., number of cattle to be tested) have not yet been determined, Jackson Hole producers could be required to perform the tests. However, many producers would likely continue to perform the tests voluntarily to enhance the value of the cattle they sell.

Whether or not producers in the Jackson Hole area voluntarily altered their current vaccination and testing practices or would be forced to by more stringent state requirements would likely depend on the perception of the risk of transmission, regardless of the actual risk. Since brucellosis would not be eradicated from the elk and

bison herds in Jackson Hole under any of the alternatives being considered, there would be a perceived risk to producers under all alternatives.

Potential Economic Effects of Brucellosis Outbreak on Cattle Producers

The presence of brucellosis in cattle would have following consequences for ranchers:

- *Abortions* — A cow that aborts or has a calf that does not survive because of the debilitating effects of brucellosis has, in effect, been maintained for a year without financial return.
- *Decreased weight gain by calves* — Calves from infected cows may have less than normal weight gains, since milk production from infected cows may be inadequate. Affected calves at the time of sale may weigh 100 pounds less than calves from healthy cows.
- *Delays in calf production* — Brucellosis would result in some infected cows being difficult to breed, resulting in fewer market cattle each year.
- *Increased rates of culling and replacement* — Brucellosis-affected cows are usually culled at a faster than normal rate because of reproductive deficiencies.

The recent brucellosis outbreaks in Wyoming demonstrate the non-production-related consequences that could happen in the future if elk or bison transmitted brucellosis to cattle (after Wyoming regained brucellosis-free status).

A future outbreak of brucellosis in cattle in the Jackson Hole area would likely not result in major cost increases for testing. However, an outbreak would have other non-production-related consequences: current incomes of cattle producers would be disrupted because of quarantines, and future incomes would be lost due to animal depopulations. Depopulation costs could be somewhat mitigated by the sale of affected cattle and indemnity payments.

Even if Wyoming is able to re-attain class-free status, the state will still need to continue an acceptable level of surveillance testing to maintain that status and to satisfy its trading partners.

Other Documented Diseases

None of the following diseases in the Jackson elk and bison herds would pose threats to the livestock industry.

- Livestock appear to be resistant to strains of *Pasteurella multocida* (M. W. Miller 2001; Disease Expert Meeting 2002).
- Livestock would not be impacted by the presence of necrotic stomatitis, psoroptic mites, or elk lungworms in the Jackson elk herd under any of the alternatives.
- Viral microparasites (e.g., bovine viral diarrhea, parainfluenza virus-3, and bovine respiratory syncytial virus) are relatively common in domestic livestock populations and can be serious in cattle. These viral microparasites are not likely to result in detectable impacts to livestock (Disease Expert Meeting 2002).

Undocumented Diseases

Some diseases do not now occur in the Jackson elk and bison herds, but they could have major adverse impacts to the livestock industry if they became established. The risk of transmission to livestock would likely correspond closely with elk and bison population levels in Jackson Hole. (Alternatives 1 and 5 would generally have a higher risk, while Alternatives 2, 3, and 6 would have a lower risk, and Alternative 4 an intermediate risk.)

Bovine tuberculosis and paratuberculosis are both of concern to the livestock industry (Thorne et al. 1982). Currently, bovine tuberculosis is nearly eradicated from domestic cattle (Demarais et al. 2002), and no captive cervid herds in the United States are known to carry it. However, because of the perceived risk to eradication programs for bovine tuberculosis in cattle, wildlife populations that sustain tuberculosis are of concern (Clifton-Hadley et al. 2001). Mortality rates in domestic cattle herds due to paratuberculosis can range up to 25% annually (Thorne et al. 1982).

The most likely way bovine tuberculosis and bovine paratuberculosis could come to Jackson Hole would be through domestic livestock (Disease Expert Meeting 2002) or wild cervids contacting infected captive cervids (Thorne et al. 1992). The probability of either disease reaching Jackson

Hole is unknown, but is expected to be low, and the alternatives considered in this document do not pose a substantial risk of introducing the diseases into the Jackson Hole area. The potential risk involves the prevalence these diseases would reach under different management scenarios, which could in turn result in increased risk for livestock.

The chance of tuberculosis and paratuberculosis becoming established could be reduced through monitoring, early detection, and control of the disease in domestic livestock and captive cervids. In general, reduction of winter feeding, which would reduce animal concentrations, would do more to reduce the risk of these diseases becoming established than would reducing the number of animals on the refuge. A secondary factor would be the number of animals wintering on the refuge.

There would probably not be any livestock impacts associated with vesicular stomatitis, chronic wasting disease, foot-and-mouth disease, or rinderpest (Disease Expert Meeting 2002), so these diseases are not analyzed in detail with respect to livestock. Based on current information, only elk, mule deer, and white-tailed deer are susceptible to chronic wasting disease (Williams et al. 2002). It appears highly unlikely that chronic wasting disease would have a direct effect on cattle.

Anthrax has not been observed in the Jackson elk and bison herds, but it has been observed in cattle and moose in the Green River basin. The probability of anthrax appearing in the Jackson elk and bison herds is unknown. Anthrax is not transmitted from animal to animal, so the management alternatives would do little to alter the chance of its introduction. Bison are very susceptible to anthrax (Disease Expert Meeting 2002). If anthrax was suspected in the Jackson elk or bison herds, all appropriate regulatory agencies would become involved in order to protect human and domestic animal health. Initially, livestock would be just as likely to contract anthrax as wildlife (Disease Expert Meeting 2002).

Malignant catarrhal fever is associated with sheep and the closest location to Jackson Hole where domestic sheep grazing occurs is the west slope of the Teton Range.

Impacts of the Alternatives

Impacts Common to All Alternatives

Livestock Grazing Practices and Competition for Forage. None of the alternatives would impact the status of cattle grazing allotments in Grand Teton National Park or in other federal areas, including the Bridger-Teton National Forest and BLM lands in the Green River basin and the Red Desert. However, increased use of certain areas by wintering elk within the national forest and in the Green River basin and the Red Desert under some alternatives could result in livestock grazing management plans having to be revised to account for higher levels of forage utilization by native ungulates.

Requiring adjustments to livestock grazing operations in Grand Teton National Park and other federal areas is beyond the scope of this planning effort, and none of the alternatives would require a conversion from cow-calf to steer or spayed heifer enterprises.

Under all alternatives current permittees would be requested to modify their grazing practices so as to minimize the potential for contact between elk/bison and cattle, thereby minimizing the potential for disease transmission. Permittees would be requested to delay turn-out dates and/or truck cattle between pastures where conflicts could occur. Although permittees would not be required to adopt the recommended modifications, some might do so voluntarily. A delay in turning out cattle onto allotments would mean that permittees would incur additional costs for feed.

Competition for forage between elk, bison, and cattle in Grand Teton National Park, Bridger-Teton National Forest, and some private lands in Jackson Hole, Buffalo Valley, and the Gros Ventre River basin would continue. The degree of competition would depend on numbers of animals, winter feeding, winter distribution, and movement patterns.

Land Acquisition within the National Elk Refuge. Under all alternatives, efforts to acquire additional private inholdings within the refuge would continue as opportunities arose and as funds allowed.

Alternatives 1 and 5

Analysis

Risk of Brucellosis Transmission to Livestock. *Risk of Transmission from Elk* — Near total separation between elk and livestock during winter has been maintained in the Jackson Hole area and would continue into the future under these alternatives. In the long term the number of elk on the National Elk Refuge would remain similar to baseline levels, but some elk could begin leaving the refuge, increasing the chances of elk transmitting brucellosis to cattle. If elk and livestock commingled during the period when abortions in elk usually occur, the risk of brucellosis transmission to livestock could increase. However, the refuge's winter feeding program, along with nearby state feedgrounds, has effectively kept elk off private lands in the Jackson Hole area. To the extent that elk stayed on the refuge, there would continue to be minimal risk of transmission from elk to livestock until April when elk leave the refuge.

In spring elk begin migrating up through Grand Teton National Park and into Bridger-Teton National Forest. From April until the end of June it is possible for elk that had wintered on the refuge to overlap in distribution with cattle on active livestock grazing allotments in the park and the national forest, as discussed earlier. Under normal circumstances elk tend to isolate themselves, and the risk on summer ranges would be lower than risk during the winter or spring.

Risk of Transmission from Bison — Currently, the potential for transmission of brucellosis from bison to livestock is low in the Jackson Hole area (National Academy of Sciences [NAS] 1998; Disease Expert Meeting 2002). Current efforts to spatially segregate bison and livestock would continue. Cattle are not allowed onto the park until June 1 (except Gros Ventre allotment, May 15; and Teton Valley Ranch, May 1). All cattle permitted in the park must be vaccinated for brucellosis, but brucellosis vaccines used in cattle are not 100% effective.

In the short term Alternatives 1 and 5 would not result in any increase in the risk of brucellosis transmission from bison to livestock. In the long term a growing bison population under Alternative 1 (a 10%–14% annual rate increase) could increase the transmission risk, depending on the success of the refuge's winter feeding program in keeping bison on the refuge in winter. However, if bison began dispersing onto agricultural lands during the calving period when bison abortions occur, the risk of livestock being infected could increase (e.g., in the Spring Gulch area, west of the National Elk Refuge and north of Jackson). However, the Wyoming Game and Fish Department would presumably continue to take action to reduce or avoid commingling of livestock and bison (e.g., hazing, culling) during the bison calving period, which would lower or eliminate the actual threat of any increased risk.

Under Alternative 5 if bison did leave the refuge, the risk of transmission would be reduced by a moderate amount because of reduced prevalence of brucellosis in bison due to fewer bison and RB51 vaccination and less chance of contact with livestock.

During the summer the risk of transmission in Grand Teton National Park could be reduced a minor to moderate degree due to fewer bison and RB51 vaccinations. The contribution of RB51 would depend on how efficacious the vaccine was in a field setting and the extent to which continued winter feeding would offset any benefits.

Grazing allotments in Grand Teton National Park would continue to be the area with greatest risk of transmission during the spring and early summer because cattle are brought onto grazing allotments starting May 1. The extent to which bison calving occurs in livestock grazing allotments is unknown.

Bison inhabiting private lands adjacent to the refuge and park during the calving period also pose a risk to livestock, and this would continue under Alternative 1.

Perception of Risk of Transmission — Alternative 1 would probably have little or no impact on the perception of risk in the short term. Over the long term, however, Alternative 1 could increase the perception of risk simply because of more bison.

The perceived risk of transmission would likely be somewhat lower under Alternative 5 than under Alternative 1 due to fewer bison and vaccination programs for both bison (with RB51) and elk

(with Strain 19). Nearly annual winter supplemental feeding (9 out of 10 years) would encourage elk and bison to remain on the refuge and away from livestock during winter.

Testing and Vaccinating —Testing and vaccinating female calves in the Jackson Hole area would continue, and related costs would be a small portion of total production costs in the long term. Because the perception of risk would increase over the long term as bison numbers continued to grow, a small number of producers could modify their current testing and vaccination practices. Because bison inhabiting the refuge and park only overlap in distribution with a handful of livestock operators, the potential effects would be negligible.

Competition for Forage. The diets of elk, bison, and cattle overlap substantially (Shaw 1996; Wisdom and Thomas 1996). In one study cited by Miller et al. (2002), dietary overlap between elk and cattle was 31% and in another study, it ranged from 37% to 88%, depending on forest type and timing.

Hobbs et al. (1996, as cited by Miller 2002) demonstrated that heavy elk grazing in the winter and early spring (in one location in Colorado) can create a less suitable situation for cattle, possibly affecting cattle growth rates. While the effects on livestock of early-spring elk grazing could apply to the Jackson Hole area, the effects of winter grazing are probably of little consequence under Alternative 1 due to winter feeding of elk on the refuge and on state feedgrounds, which would continue to effectively draw most elk away from native winter range.

Under Alternative 1 elk could continue to compete to a limited extent with livestock for forage during summer in Grand Teton National Park and Bridger-Teton National Forest, but the effect is expected to be minimal (Miller 2002; Haynes, pers. comm. 2004). The use of livestock grazing allotments by elk in the park could be reduced to some extent during cattle grazing (Zeigenfuss et al. 2003b) because researchers have documented an aversion by wild ungulates to the presence of livestock (Wisdom and Thomas 1996, which cited four supporting studies). No studies are known that show an aversion by livestock to the presence of wild ungulates (Wisdom and Thomas 1996). Crucial elk winter range in Bridger-Teton National Forest does not overlap substantially with areas grazed by cattle in the summer (Hobbs et al. 2003). Later turnout dates for cattle would further reduce any potential competition (by June, cattle are able to forage on green-up vegetation, not residual vegetation).

Under Alternative 1 an estimated 800–1,000 bison under baseline conditions would result in considerable competition between bison and livestock in some areas of Grand Teton National Park due to the overlap in habitat use and diet during spring and summer, and competition would increase with a growing bison herd. However, as noted for elk, bison might avoid the use of livestock grazing allotments in the park when cattle are present. This would reduce direct competition to some extent during much of the growing season. However, as bison numbers rose, bison might be less affected by the presence of cattle; possible effects on livestock production have not been quantified. Under Alternative 5, 350–400 bison would likely reduce competition for forage in the park by a moderate amount.

Under baseline conditions there is minimal competition between elk and cattle for forage in the Green River basin and the Red Desert because elk are shortstopped by state feedgrounds, and elk straying from these feedgrounds are hazed back to the feeding sites. An exception is the Steamboat elk herd east of Farson, where some competition between elk and cattle could occur. The amount of forage removed by elk in the Pinedale and Green River resource management areas is a small fraction of what is removed by livestock. Alternative 1 would not alter this situation.

Elk grazing has resulted in minimal competition with livestock on private lands in Jackson Hole, Buffalo Valley, the Gros Ventre River and Hoback River drainages, and Green River basin.

Conservation Easements. Under Alternatives 1 and 5 there would be a long-term commitment to winter feeding on the refuge, so there would be little need for the Fish and Wildlife Service and the Park Service to acquire conservation easements outside the refuge and park with respect to elk and bison winter range.

Property Damage and Depredation of Stored Hay. The Wyoming Game and Fish Department reimburses landowners for certain damages caused by elk depredating agricultural lands. According to the agency, almost all damage to private property in the Jackson Hole area is caused by elk, and mostly to stored hay that has either been eaten or trampled by elk. Between 1999 and 2002 the state reimbursed property owners a total of $15,197 for damages caused by elk in the Jackson Hole area (B. Smith, pers. comm. 2003). If it were not for the winter feeding program on the refuge and state feedgrounds, losses to ranchers and annual reimbursements to ranchers would be considerably higher.

Under Alternatives 1 and 5 property damage caused by elk would be expected to continue and presumably at the same levels experienced in the past. Property damage caused by bison, now minimal, could increase with a larger bison herd that dispersed onto private agricultural lands in search of forage. Impacts overall would be relatively minor, but individual ranchers could experience moderate to major adverse impacts. Under Alternative 5 a smaller bison herd would likely result in minimal damage.

Depredation of stored hay in the Green River basin has been minimized through the use of state feedgrounds for elk and the fact that most of the hay produced in the Farson area is trucked to other locations (Lewis, pers. comm. 2004).

Potential Economic Effects. For Jackson Hole area cattle producers, any additional impact of Alternative 1 beyond baseline-level impacts would likely stem from increasing numbers of bison over time. Property damage and depredation of stored hay could increase due to continued growth in the herd, but effects would likely be minimal since WGFD personnel would presumably continue to respond quickly to incidences or potential incidences of depredation and damage. However, some producers could be affected to a moderate or major degree, especially since the state has not reimbursed property owners for damages caused by bison. The economic impact of increased competition for forage in the park is unknown, but would likely be negligible. Under Alternative 5 a smaller bison herd would result in less potential for depredation of stored hay, property damage, competition with cattle for forage, and risk of brucellosis transmission to cattle. However, differences would probably not be measurable.

Escalating bison numbers would increase the risk of brucellosis transmission from bison to cattle, although the risk of transmission would remain low.

Conclusion

The risk of elk and bison transmitting brucellosis to livestock would remain low under Alternative 1 due primarily to near annual winter feeding that maintains separation between elk/bison and livestock, even though winter feeding is responsible for maintaining brucellosis in elk and elevated brucellosis levels in bison. Under Alternative 5 the risk of transmission from bison to livestock would be lower, similar to Alternatives 3 and 4, and higher than Alternatives 2 and 6. For cattle producers, an additional adverse impact beyond baseline impacts under both alternatives would likely stem from increasing numbers of bison. Eventually more bison and elk could leave the refuge during winter, increasing the risk of disease transmission to livestock. Of all of the alternatives considered, Alternative 1 would result in the highest level of long-term risk, although it would result in less risk than Alternatives 2, 3, 4, and 6 in the short term due to continued winter feeding.

Property damage and depredation of stored hay caused by elk would be negligible in the short term because of continued winter feeding. However, in the long term the growing bison population could result in bison and elk moving off the refuge during winter, which could increase property damage and depredation of stored hay in Jackson Hole, but impacts are expected to be negligible. Competition between bison and livestock under Alternative 1 would continue to increase in the park as the bison population grew; effects on livestock production are unknown. Continuing supplemental feeding on the refuge nearly every winter would minimize the potential for animals to wander off the refuge and cause property damage and depredation of stored hay, similar to Alternative 1. Competition between bison and livestock under Alternative 5 would be lower by a major amount in the park compared to Alternative 1 (similar to Alternatives 2, 4, and 6).

Alternative 2

Analysis

Risk of Brucellosis Transmission to Livestock. *Risk of Transmission from Elk* — While the winter feeding program on the refuge was being phased back under Alternative 2, the risk of brucellosis transmission to livestock could increase as elk began seeking new winter range or decrease because elk would be more dispersed and less likely to overlap with livestock use. Although most of these elk would find winter range in the national forest, some animals might find their way to private lands where livestock are being fed on feedlines. This could become more problematic as winter feeding was phased out and above-average and severe winters occurred. Normally, elk avoid feeding with cattle if these areas are fenced and food is available on the refuge or state feedgrounds. However, if more elk began wintering outside the refuge, their use of cattle feedlines could increase. Even a small number of infected elk on a cattle feedline could substantially increase the probability of brucellosis transmission in the short term.

If large numbers of elk began migrating to the Green River basin and the Red Desert and were not shortstopped by state feedgrounds, the potential for transmission to livestock in these areas would initially increase. Currently, state feedgrounds around the perimeter of the Green River basin keep elk from going onto private lands where they could come into contact with cattle being fed on feedlines. WGFD personnel would presumably help keep elk off cattle feedlines, but they would not be able to completely prevent commingling.

In the long term brucellosis seroprevalence would decline without supplemental feeding on the refuge, and the probability of transmission to cattle would also decrease. However, the decline in risk might only be minor over the 15–20 year life of the management plan because there would be a greater chance for contact between elk and cattle under Alternative 2 as winter feeding was gradually eliminated.

Risk of Transmission from Bison — In the short and long terms, the present low risk of transmission of brucellosis from bison to livestock would be further reduced due to a lower prevalence and fewer bison. However, seroprevalence of brucellosis in bison would remain relatively high, possibly similar to what is evident in Yellowstone National Park bison (e.g., 30%–33%; Meyer and Meagher 1997). Furthermore, the propensity of some bison to spend a portion of the winter outside the refuge (Cain et al. 2001) would likely increase as winter feeding on the refuge was gradually eliminated. However, fewer bison would reduce the likelihood that large numbers of bison would leave the refuge and park in search of forage. Also, WGFD personnel would presumably continue to haze bison, cull select animals, and work with landowners to discourage bison from using their property. Nevertheless, if only one domestic animal became infected, the impact on the livestock industry could be substantial. Areas of highest risk during the winter could include private lands west of the refuge in the Spring Gulch area.

Perception of Risk of Brucellosis Transmission — The perception of brucellosis transmission risk would likely remain similar to baseline conditions during the first few years as winter feeding was being gradually eliminated. However, over the years more elk and bison would likely begin venturing onto private lands (while the prevalence of brucellosis in the herds was still relatively high), which in turn could increase the perception of risk in the Jackson Hole area. However, after the seroprevalence rate dropped to low single digits for elk, the perceived risk of transmission could decline substantially.

The perception of risk of transmission from bison to livestock could increase in the long term because the prevalence of brucellosis in bison would decline by a moderate amount in the long term, but it would remain relatively high (comparable to the prevalence in Yellowstone National Park bison). In terms of perceived risk, the reduction in seroprevalence might very well be outweighed by the fact that bison would no longer be drawn to the refuge through artificial feeding and by the actual or perceived increase in winter distribution.

Testing and Vaccinating — Testing and vaccinating of livestock could increase in the short term as a consequence of a greater perceived risk associated with the potential for brucellosis transmission from elk. However, once prevalence in elk had declined to a negligible level, testing

and vaccination would likely return to baseline levels. Nevertheless, it is also possible that livestock testing and vaccination could remain higher than now because of the perceived risk of transmission from bison. Because only a small number of ranchers could potentially be affected, the long-term effects would be negligible to minor.

If cattle producers modified their current testing and vaccination practices in response to increased elk and bison distribution, the economic impact on producers over the long run would be relatively minor. Table 4-17 shows cow-calf production costs in 2000 and 2001for the U.S. region that includes western Wyoming. In years of very low cattle prices, however, a producer's profit margin might be less than the costs of vaccination and testing.

Competition for Forage. As winter feeding was gradually eliminated and as elk increased their use of native winter range in the national forest, some winter ranges could receive substantially higher use by elk. Impacts on livestock production would be negligible. Many elk would find their way to state feedgrounds or would be hazed to them. For elk that did not end up on a state feedground, some could winter in areas not typically grazed by livestock. Delaying turnout dates for cattle would further reduce potential effects of increased numbers of elk on native winter range because by June cattle are able to forage on green-up vegetation, not residual vegetation. Therefore, even if numbers of elk using native winter range in the Buffalo Valley area, the Gros Ventre River drainage, areas south of Jackson, and the lower Hoback River drainage increased, use would likely not have any measurable effects on livestock production.

Spring grazing by elk on federal and private lands in the Jackson Hole area, including Buffalo Valley and the Gros Ventre River drainage, might not be affected any more than under Alternative 1 because elk currently leave winter feedgrounds as soon as green-up allows. However, the distribution of elk during early spring might change with the shift to reliance on native winter range. Also, the continued growth of grass through early summer could offset any impact that elk had on vegetation in early spring (Miller 2002).

Minimal current competition between elk and livestock for summer forage in Bridger-Teton National Forest and Grand Teton National Park would likely not change under Alternative 2 (Wisdom and Thomas 1996; Miller 2002), and elk numbers would not decline to the point where it would affect forage availability for livestock. However, if bison numbers declined to 250 animals, more forage could be available to livestock in some park areas during summer. Restoring native vegetation on previously cultivated fields in the park, but not on grazing allotments, would not affect the amount of forage available to livestock (Haynes, pers. comm. 2004).

If large numbers of elk began migrating to the Green River basin and the Red Desert under this alternative, livestock production could be affected by the added grazing pressure from elk during winter and early spring on national forest and BLM lands, as well as private lands. On range-

TABLE 4-17: COW-CALF PRODUCTION COSTS — BASIN AND RANGE FARM RESOURCE REGION (INCLUDING WESTERN WYOMING), 2000–2001

	Dollars per Bred Cow	
	2000	2001
Operating Costs		
Purchased Cattle	$ 97.70	$ 97.40
Feed	263.71	286.24
Veterinary and Medicine	16.85	17.82
Other Operating Costs	82.96	80.39
Total Operating Costs	461.22	481.85
Overhead Costs		
Opportunity Cost of Unpaid Labor	401.10	420.34
Capital Recovery Costs of Machinery and Equipment	63.09	69.53
Other Allocated Overhead	87.06	89.04
Total Allocated Overhead	551.25	578.91
Total Costs	**$ 1,012.47**	**$ 1,060.76**

SOURCE: USDA, Economic Research Service.

lands that have relatively low productivity and that are already fully grazed by cattle, competition could be high (Wisdom and Thomas 1996). Although elk grazing during the dormant season would not likely adversely impact understory vegetation and might not affect the amount of forage available to livestock during summer (BLM 1981), winter grazing by elk could reduce forage available to cattle during spring and early summer (Wisdom and Thomas 1996). Given the vast acreages involved and unknown numbers and distributions of elk, potential effects cannot be determined beyond this broad assessment at this time.

Conservation Easements. To the extent that the U.S. Fish and Wildlife Service and National Park Service worked with partners to acquire conservation easements on key elk winter and transition ranges under this alternative, livestock production could be sustained in some areas where land use would otherwise change from agriculture to housing developments if the purpose of the easement was to conserve agricultural practices. However, helping sustain livestock grazing on private lands in the Jackson Hole area and other areas could perpetuate the risk of disease transmission, depending on timing of livestock grazing.

Property Damage and Depredation of Stored Hay. Relative to Alternative 1, property damage under this alternative would likely increase as winter feeding was phased out and elk potentially migrated to wintering areas outside Jackson Hole. In the Jackson Hole area elk and bison could depredate haystacks, damage property (e.g., fences, facilities), and eat forage on cattle feedlines. However, damage and depredation by bison might not increase to the extent of Alternative 1 because of fewer bison. Damage to agricultural crops is not anticipated in the Jackson Hole area. To the extent that property damage and depredation of hay increased under Alternative 2, costs to ranchers would increase, negating one of the purposes of the winter feeding program.

Aside from the possible transmission of brucellosis to livestock, the depredation of stored hay by elk might be the largest effect of increased winter distribution outside Jackson Hole. Costs to the Wyoming Game and Fish Department would likely increase assuming continued reimbursements to property owners; however, some landowners might not be fully reimbursed for lost hay.

Grazing by elk on early green-up vegetation could increase on private lands, potentially causing damage in localized areas, especially in alfalfa fields (Bennett, pers. comm. 2004). However, elk generally move fairly quickly from wintering areas to transitional and summer range (Anderson 1958; BLM 1981; Irwin 2002); so the effects of spring grazing would likely be negligible. During winter vegetation in irrigated fields would probably already have been harvested, baled, and stored or trucked to another location by fall. so there would be nothing to attract elk (Bennett and Lewis, pers. comm. 2004).

In the Green River basin it is likely that use of cattle feedlines by elk would increase if large numbers migrated to this area. As previously discussed, various techniques would be used to minimize this occurrence, but these efforts would probably not be completely successful. Therefore, the consumption of cattle feed by elk could increase costs to ranchers to a negligible or minor degree.

Potential Economic Effects. Gradually eliminating winter feeding on the refuge would lead to increase competition for forage on federal lands, increased use of private lands by elk and bison, and greater depredation of stored hay and crops, with adverse impacts to ranchers and agricultural communities in the Jackson Hole area. Overall effects to agricultural production would be negligible, but some ranchers could be impacted by a moderate or major amount. Some losses and damages would likely be compensated, but some individual ranchers could incur some costs.

In the short term the risk of brucellosis transmission to cattle would increase under Alternative 2 compared to Alternative 1 due to more elk and bison using private lands before the prevalence of the disease had declined in elk. Once disease prevalence had declined, the risk would also decline. Producer costs for brucellosis testing and vaccination in the Jackson Hole area and Green River basin would likely be negligible, similar to Alternative 1.

Conclusion

Overall, Alternative 2 would reduce the already low risk of brucellosis being transmitted from elk/bison to livestock more than the other alternatives (except for Alternative 6). However, until disease prevalence in elk was reduced, there could be an increased risk of transmission, compared to Alternative 1, due to more elk and bison using private lands. This would especially be true in the Green River basin if large numbers of elk began to migrate there and were not shortstopped by state feedgrounds.

Alternative 2 would have the greatest possibility of elk and bison causing damage to private property (including crops) and depredation of stored hay. This would increase costs to ranchers and the Wyoming Game and Fish Department, which would generally reimburse ranchers for damage caused by elk. Competition between bison and livestock would be lower by a major amount in the park compared to Alternative 1 (similar to Alternatives 4, 5, and 6).

Direct impacts on cattle producers would generally be minor, similar to the other alternatives. Costs for testing and vaccinating female calves in the Jackson Hole area would be a small portion of total production costs.

Alternative 3

Analysis

Risk of Brucellosis Transmission to Livestock. *Risk of Transmission from Elk* — There would be a minor to moderate reduction in the risk of brucellosis transmission in the short and long terms because (1) prevalence in the elk herd would be lowered, resulting in fewer abortions; (2) elk would be fed during the most severe winters, encouraging them to stay on the refuge; and (3) winter range improvements adjacent to the refuge and in the Gros Ventre River and Buffalo Valley areas would encourage elk to use these areas rather than private lands. Nevertheless, some animals could wander onto private lands where livestock were being fed on feedlines, increasing transmission risks in localized areas. If a vaccination program was implemented, the risk of transmission during the winter would be reduced substantially.

As described for Alternative 2, if large numbers of elk began migrating to the Green River basin and the Red Desert and were not shortstopped by state feedgrounds, the potential for brucellosis transmission to livestock in these areas would initially increase. Although WGFD personnel would help keep elk off of cattle feedlines, they could not completely prevent commingling. If a vaccine was located in the short term that would be effective at reducing the level of brucellosis in elk before they began finding other wintering areas, the risk to livestock could be avoided or greatly minimized.

The risk of brucellosis transmission from elk to cattle on spring and summer ranges would only be slightly lower if vaccination occurred under Alternative 3 because only a small proportion of the Jackson elk herd (up to an estimated 18%) would be available to be vaccinated on the refuge during an estimated 2 out of every 10 winters.

Risk of Transmission from Bison — In the absence of any vaccination, brucellosis prevalence in the bison herd would be reduced by a minor to moderate amount in the long term compared to Alternative 1 because of reduced winter feeding and bison densities (800–1,000 animals compared to 2,000 under Alternative 1). A vaccination program would decrease the risk by a moderate degree because reduced disease prevalence.

Under Alternative 3 the chances of bison leaving the National Elk Refuge during winter would not be as high as under Alternative 2 because supplemental feeding would be provided in severe winters. Some bison could leave during less severe winters, although enhanced forage on refuge and adjacent national forest lands could encourage bison to remain on federal lands during mild and average winters. Bison that had not been vaccinated could increase the risk of brucellosis transmission to livestock compared to Alternative 1 (assuming that bison would not leave the refuge during winter under that alternative).

Maintaining the bison herd at 800–1,000 animals, as compared to unrestricted growth under Alternative 1, would result in a minor to moderate reduction (with an effective vaccine) in transmission risk during summer.

Perception of Risk of Brucellosis Transmission — The perception of brucellosis risk would likely be similar to baseline conditions while winter feeding was phased out. However, with less winter feeding on the refuge, the increased potential for elk and bison to wander onto private lands could increase the perception of risk in the Jackson Hole area, pending the development of an effective vaccine.

With respect to elk, the perception of risk would likely be higher for the next 15–20 years, while prevalence declined naturally and assuming no vaccination. Once the seroprevalence rate in elk dropped to low single digits, the perceived risk of transmission from elk to livestock could decline substantially.

The perception of transmission risk from bison to livestock could increase in the long term because prevalence in bison would remain relatively high (similar to the rate in the Yellowstone herd) and because bison could be more inclined to wander onto private land.

Testing and Vaccinating — Similar to Alternative 2, if cattle producers modified their current testing and vaccinating practices in response to increased elk and bison distribution in Jackson Hole and increased elk distribution in the Green River basin, the resulting increases in the cost of testing and vaccinating would have a relatively minor economic impact over the long run. (See Table 4-17.)

Competition for Forage. Competition between elk/bison and livestock would be similar to that described under Alternative 2, with the following exceptions. Competition between elk and livestock in Grand Teton National Park would decline at most by a negligible amount due to lower elk numbers under Alternative 3, and competition between bison and livestock would decline under Alternative 3, but not to same extent as under Alternative 2.

Conservation Easements. Potential effects of conservation easements on agricultural production would be similar to Alternative 2 (as well as Alternatives 4 and 6).

Property Damage and Depredation of Stored Hay. Property damage and depredation of stored hay under this alternative would likely be similar to Alternative 1 in the short term. However, as the numbers of elk on the refuge and park were reduced under Alternative 3 over a 10–15 year period, impacts could increase, similar to Alternative 2. However, feeding elk and bison in severe winters would tend to reduce potential conflicts. Compared to Alternative 1, the potential for bison to damage property and eat stored hay could be much lower under Alternative 3 in the long term.

Potential Economic Effects. Similar to Alternative 2, ranchers and agricultural communities in the Jackson Hole area and in the Green River basin could be adversely economically impacted under Alternative 3 due to increased competition for forage on federal lands, greater use of private lands by elk and bison, and more depredation of stored hay and crops. Overall effects to agricultural production in the Jackson Hole area and the Green River basin would be negligible, but some ranchers could be impacted to a moderate or major degree. The state would reimburse ranches for some losses and damages caused by elk, but some ranchers would incur costs.

The low risk of brucellosis transmission from elk or bison to cattle would result in negligible local economic impacts (similar to all alternatives). Producer costs for brucellosis testing and vaccination in the Jackson Hole area and the Green River basin would not be substantially affected under Alternative 3, as discussed previously.

Conclusion

The risk of brucellosis transmission from elk to livestock would be lower than under Alternatives 1 and 5, but the risk of transmission from bison to livestock would be higher than all other alternatives, except Alternative 1 (all seasons) and Alternatives 4 and 5 (in late spring and early summer). Eventually the prevalence of brucellosis in elk would decline, but until then the risk of transmission would be higher in winter and early spring than under Alternative 1. This would especially be true in the Green River basin if large numbers of elk began to migrate there and were not shortstopped by state feedgrounds.

The possibility of damage to private property (including crops) and depredation of stored hay would be similar to Alternative 2 because of

greater elk and bison use of private lands in the Jackson Hole area and the Green River basin. Costs to ranchers and the Wyoming Game and Fish Department would increase. Competition between bison and livestock would be similar to baseline conditions, but would not increase to the same extent as under Alternative 1.

Alternative 4

Analysis

Risk of Brucellosis Transmission to Livestock. *Risk of Transmission from Elk* — In the short term seroprevalence of brucellosis would not be expected to change appreciably under Alternative 4 compared to Alternative 1. In the long term reducing the frequency of winter feeding to above-average winter (estimated to occur 4–5 out of 10 years) and vaccinating a minimum of 80% of elk calves with Strain 19 vaccine would moderately reduce disease prevalence in elk. Nevertheless, the long-term risk of brucellosis transmission from elk to livestock during winter and early spring could increase by a negligible to minor degree compared to Alternative 1 because fewer elk would winter on the refuge and more elk could wander onto private land in search of forage (e.g., west and south of the refuge). To prevent commingling with livestock, the Wyoming Game and Fish Department would likely take immediate action to haze elk to other areas. Also, habitat improvements in the national forest would encourage elk to use winter forage on native ranges, thereby reducing direct contact with livestock. To the extent that elk remained on federal lands and private lands that were not wintering livestock, risk would remain very low, similar to baseline conditions and Alternative1.

The risk of brucellosis transmission from elk to livestock during the late spring and early summer would be reduced by a minor to moderate amount because of a minor reduction in disease prevalence in the herd compared to Alternative 1. Using Strain 19 to vaccinate elk would likely have a minimal impact because the efficacy of the vaccine is low (an estimated 25%–30%), it could only be administered in an estimated 4–5 out of every 10 winters, and continued high concentrations of elk during winter feeding would offset benefits.

If a more efficacious vaccine for elk was developed and could be delivered effectively without having elk concentrated on feedlines, then prevalence in elk could be further reduced, along with the risk of transmission to livestock.

Risk of Transmission from Bison — Reduced frequency of winter feeding, reduced bison densities, and lower numbers would contribute to a lower prevalence of brucellosis. Compared to Alternative 1, the long-term risk of brucellosis transmission to livestock during winter would be moderately lower because of fewer bison. The risk would be slightly lower than under Alternative 3 without vaccination because feeding fewer bison in fed 4–5 out of 10 years would reduce the chance of bison leaving the refuge during above-average to severe winters.

If a highly efficacious, safe vaccine for bison was developed and could be delivered effectively, the risk for transmission to livestock during winter would be moderately reduced. The chances of bison using food in areas where cattle are fed in the winter would probably be lower than under Alternative 3 because of more supplemental feeding.

Even though the chances of bison leaving the refuge during winter are not considered as high under this alternative as under Alternatives 2 and 3, some animals could leave during mild to average winters. Without vaccination, these bison could increase the risk of transmission compared to Alternative 1 because of the greater chance for intermingling with livestock. However, forage enhancements on the refuge could encourage bison to remain during mild and moderately severe winters. Furthermore, WGFD personnel would likely react quickly to any reports of bison getting near livestock feeding operations, and they would presumably haze, cull, or take other actions to prevent commingling.

During summer the risk of transmission would be lower by a negligible to minor degree because of reduced prevalence in bison and fewer animals. A successful vaccination program would further decrease prevalence and moderately reduce the risk to livestock.

Perception of Risk of Disease Transmission — Pending the development of more effective vac

cines for elk and bison, the perception of risk to livestock during winter under Alternative 4 could be higher than under Alternative 1. This perception would be related to elk and bison being more apt to come into contact with livestock feeding operations as a result of reducing winter feeding to 4–5 out of 10 winters, despite actions that would minimize commingling. The perception of risk during late spring and early summer could somewhat decline due to a moderate, long-term reduction in brucellosis prevalence in elk, lower numbers of elk in the Grand Teton segment, and the much lower numbers of bison.

Testing and Vaccinating — In the absence of a positive find in a herd, current brucellosis vaccination and testing practices would likely continue under this alternative. The perception of an increased risk of brucellosis transmission could prompt more ranchers to test and vaccinate their livestock. If cattle producers modified their current testing and vaccinating practices in the long term in response to this alternative, the increased cost of testing and vaccinating would have a negligible effect on producers over the long term (see Table 4-17).

Competition for Forage. As winter feeding was gradually reduced and as elk increased their use of native winter range in the national forest, some winter ranges could receive substantially higher use compared to baseline conditions, but not as high as under Alternatives 2, 3, and 6. As explained in Alternative 2, increased use of native winter range by elk in Jackson Hole, Buffalo Valley area, and Gros Ventre River drainage would likely have only a negligible effect on livestock production.

Similar to Alternatives 2 and 3, spring grazing by elk on federal and private lands in the Jackson Hole area might not be affected to any large degree because elk currently leave winter feedgrounds as soon as spring growth allows.

Also similar to Alternatives 2 and 3, competition between elk and livestock for summer forage in Bridger-Teton National Forest and Grand Teton National Park under Alternative 4 would be minimal (Miller 2002) and elk numbers would not decline enough to affect forage availability for livestock. A major reduction in bison numbers in the Jackson herd could result in more forage being available to livestock in some areas during summer.

Conservation Easements. Potential effects of conservation easements on agricultural production would be similar to those discussed under Alternative 2, as well as Alternatives 3 and 6.

Property Damage and Depredation of Stored Hay. In the short term the risk of property damage and the depredation of stored hay would remain similar to baseline conditions because elk and bison would continue to be fed in most winters and their numbers would be declining. In the long term, after the frequency of winter feeding on the refuge had declined to 4–5 of 10 winters, occurrences of property damage and depredation of stored hay could increase by a negligible to minor amount, but not to the extent that could occur under Alternatives 2, 3, and 6. Under Alternative 4 measures that would minimize the need for elk and bison to roam off the refuge in search of food would include reducing elk numbers by a minor amount and bison numbers by a major amount, making sufficient forage available to sustain elk and bison inhabiting the refuge, providing supplemental feeding in above average and severe winters, and enhancing winter and transitional range in the national forest. For the purposes of this analysis, it is assumed that Alternative 4 would potentially result in a higher level of property damage and depredation of stored hay than under Alternatives 1 and 5, but less damage than under Alternatives 2, 3, and 6. No increased property damage or hay depredation in the Green River basin would be expected.

Potential Economic Effects. Ranchers and agricultural communities in Jackson Hole and adjacent areas could be adversely impacted under Alternative 4 due to possible increases in competition for forage on federal lands, increased use of private lands by elk and bison, and increased depredation of stored hay and crops. Overall effects to agricultural production in the Jackson Hole area would be negligible at most, but individual ranchers could be impacted to a moderate or major degree (although it is unlikely that moderate to major impacts would occur). Economic effects, if any, would be less than under Alternatives 2, 3, and 6. Some losses and damages by elk would likely be compensated by the state, although some ranchers could incur some costs.

A low risk of brucellosis transmission from elk or bison to cattle would have minimal economic impacts (similar to all alternatives). Costs for brucellosis testing and vaccination in the Jackson Hole area would likely not be substantially affected under Alternative 4.

Conclusion

The risk of brucellosis transmission from elk to livestock during winter would be among the lowest of the alternatives in the long term, with an intermediate risk during late spring and early summer (lower than Alternatives 1 and 5). The risk of transmission from bison to livestock would also be intermediate. The short-term risk of transmission could increase during winter and early spring to a small degree, compared to Alternative 1, because a small number of elk and bison could make use of private lands before the prevalence of brucellosis had declined.

With reduced winter feeding, elk and bison could increase their use of private lands in the Jackson Hole area, resulting in damage to private property and depredation of stored hay, but not to the extent that could happen under Alternatives 2, 3, and 6. Alternative 4 would likely not result in increased damage to crops in the Jackson Hole area, and competition between bison and livestock would be lower by a major amount in the park compared to Alternative 1 (and similar to Alternatives 2, 5, and 6).

Alternative 6

Analysis

Risk of Brucellosis Transmission to Livestock. *Risk of Transmission from Elk* — In the short term, as the winter feeding program on the refuge was being phased back under Alternative 6, the risk of brucellosis transmission from elk to livestock would increase because some elk would begin seeking new winter range. While most of these elk would find winter range in the national forest, some animals could wander onto private lands where livestock were being fed on feedlines (e.g., Gros Ventre River drainage, Buffalo Valley, Jackson Hole, and possibly the lower Hoback River drainage). Potential contact with livestock could become increasingly problematic during above-average and severe winters.

The risk of brucellosis transmission would increase somewhat during late winter and early spring, but several factors would help reduce the likelihood of this actually occurring. For example, elk numbers on the refuge would be reduced relatively quickly under this alternative so the herd size would be commensurate with the amount of forage being provided on the refuge, which in turn would reduce the likelihood of elk searching elsewhere for forage. Also improving winter range in the Buffalo Valley area, Gros Ventre drainage, and areas immediately to the east of the refuge would provide additional forage away from cattle ranches. Furthermore, immediate action (e.g., hazing, culling) would likely be taken whenever it appeared that elk were beginning to commingle with livestock or were about to move onto private land where livestock were being fed. In many cases elk could be hazed to the nearest state feedground, but if elk began wintering on private lands in the Buffalo Valley area or in Idaho, there might not be an established state feedground.

In the long term brucellosis prevalence would decline in elk, decreasing the probability of disease transmission to livestock. Within 15–20 years the risk of transmission would likely decline more than it would under Alternatives 2 and 3 because of enhanced forage on and near the National Elk Refuge, which would make it less necessary for elk to search for winter range in other areas, and a major reduction in seroprevalence in bison, which would reduce the possibility of elk being reinfected by bison. Therefore, Alternative 6 would result in the largest reduction of seroprevalence in elk (and, therefore, the largest reduction in risk to livestock) of any alternative being considered. If a moderately or highly efficacious vaccine was developed for elk that could be used without having to supplementally feed elk, the seroprevalence of brucellosis in elk could be further reduced over the long term.

Risk of Transmission from Bison — In the short and long terms a major reduction in prevalence and fewer bison in the herd would substantially reduce an already low risk of transmission of brucellosis from bison to livestock.

In the short term the risk of disease transmission to livestock could temporarily increase during late winter and early spring if bison left the refuge in search of food. WGFD personnel would presuma-

bly continue to haze bison, cull select animals, and work with landowners to discourage bison use of their property. The area of highest risk during the winter might include private lands west of the refuge in the area of Spring Gulch.

In the long term the risk of disease transmission to livestock during late winter and early spring would be lower under Alternative 6 than Alternative 1. Alternative 6 would have the most aggressive control programs for brucellosis of any of the alternatives, resulting in the lowest level of risk to livestock of any of the alternatives being considered.

Perception of Risk of Disease Transmission — In the short term the perception of risk to livestock during winter could be higher than under Alternative 1 if ranchers believed elk and bison would be more apt to come into contact with livestock feeding operations, despite factors that would minimize commingling. Once the prevalence of brucellosis in elk and bison had substantially declined, the perception of risk would be lower than under Alternative 1.

The perception of risk during late spring and early summer could decline somewhat in the short term due to fewer bison and declining prevalence of brucellosis in elk and bison. In the long term a major reduction in bison numbers and seroprevalence in elk and bison would substantially reduce the perception of risk.

Testing and Vaccinating — An increased perception of brucellosis risk could prompt more ranchers to test and vaccinate their livestock. The amount of testing and vaccinating of livestock herds could return to baseline levels in the long term after brucellosis prevalence in elk and bison had declined to a negligible level. Only a small number of ranchers could potentially be affected, and long-term effects would be negligible.

Competition for Forage. Competition between elk/bison and livestock under Alternative 6 would be similar to Alternatives 2 and 3. However, Alternative 6 would not affect livestock production in the Green River basin to the same degree as Alternatives 2 and 3 because elk that wandered toward the Green River basin would likely be shortstopped by one of several state feedgrounds for elk.

Conservation Easements. To the extent that the U.S. Fish and Wildlife Service and the National Park Service worked with partners to acquire conservation easements on key elk winter and transitional ranges under this alternative (and Alternatives 2, 3, and 4), future livestock production could be sustained, as described for Alternative 2.

Property Damage and Depredation of Stored Hay. Increased winter distribution of elk and bison in the Jackson Hole area could increase property damage and depredation of stored hay in the short term because supplemental feeding on the refuge would be phased out within 5–10 years under Alternative 6, as opposed to 10–15 years under Alternative 2.

In the long term potential property damage and depredation of hay in the Jackson Hole area would likely be higher than under Alternatives 1 and 5, but lower than under Alternatives 2 and 3 for several reasons. Elk and bison numbers would be controlled under Alternative 6, in contrast to Alternative 2 where they would not be. Therefore, it would be unlikely for large numbers of elk and bison to leave the refuge in search of forage. The Jackson bison herd would be much smaller under Alternative 6 than under Alternative 3.

Potential Economic Effects. Similar to Alternatives 2 and 3, ranchers and agricultural communities in the Jackson Hole area and in some adjacent areas could be adversely impacted by Alternative 6 due to major reductions in winter feeding on the refuge and subsequent increases in competition for forage on federal lands, increased use of private lands by elk and bison, and increased depredation of stored hay and crops. Overall effects to agricultural production would be negligible, but some ranchers could be impacted to a moderate to major degree. Some losses and damages by elk would likely be compensated by the state, but some individual ranchers could incur some costs.

A low risk of brucellosis transmission from elk or bison to cattle would have minimal economic impacts (similar to all alternatives). However, the risk of brucellosis being transmitted from elk or bison to cattle could increase in the short term under this alternative compared to Alternative 1 due to more elk and bison possibly wandering onto private lands before disease prevalence had

declined in elk. In the long term, the risk of transmission would decline due to the reduction in prevalence in elk. Producer costs for brucellosis testing and vaccination in the Jackson Hole area and surrounding areas would likely not be substantially affected under Alternative 6, for the reasons discussed previously.

Conclusion

Overall, Alternative 6 would reduce the already low risk of brucellosis being transmitted from elk/bison to livestock more than the other alternatives, similar to Alternative 2. However, in the short term, the risk of transmission would increase, compared to Alternative 1, if more elk and bison used private lands before the prevalence of brucellosis had declined.

Eliminating winter feeding on the refuge could cause elk and bison to increase their use of private lands in the Jackson Hole area, increasing the possibility of damage to private property and depredation of stored hay. This effect would be greater under this alternative and Alternatives 2 and 3. Costs to ranchers and the Wyoming Game and Fish Department could increase as a result. Competition between bison and livestock would be lower by a major amount in the park compared to Alternative 1 (similar to Alternatives 2 and 4).

Mitigation

Risk of Brucellosis Transmission

Measures to mitigate the risk of brucellosis being transmitted from elk and bison to livestock that are included in the alternatives include spatial separation and reduced seroprevalence in elk and bison. For the purposes of this analysis, it is assumed that brucellosis will not be eradicated from elk and bison in the Jackson Hole area in the foreseeable future under any of the management alternatives.

Risk of Transmission of Other Diseases

For some diseases (e.g., tuberculosis), livestock could be vaccinated, but this might not be possible for all diseases. Measures could be taken to separate elk/bison and livestock, but livestock would need to be separated year-round. This option could involve not allowing livestock to graze on federal grazing allotments. Other mitigation measures could include immediately stopping winter feeding and undertaking major population reductions or depopulation of the elk and bison herds if a non-endemic infectious disease appeared.

No mitigation measures would be necessary if chronic wasting disease became established in the Jackson elk herd because livestock do not appear to be susceptible.

Property Damage and Depredation of Stored Hay

Ranchers could better protect stored hay through the use of exclosures and stack yards. Hazing, depredation hunts, and WGFD culling might also be needed to keep elk and bison away from areas where they could damage private property.

As discussed under some alternatives, habitat improvement projects could be specifically located and designed to help draw elk and bison away from certain areas. It might also be possible to set up a program to pay landowners to provide forage for large ungulates and to reduce livestock grazing on their properties. Conservation easements could be used for this purpose in some areas.

Cumulative Effects

No cumulative effects on livestock operations are anticipated as a result of the impacts of the alternatives in combination with impacts of reasonably foreseeable actions.

IRREVERSIBLE AND IRRETRIEVABLE RESOURCE COMMITMENTS

Irreversible commitments are those that cannot be reversed, except perhaps in the extreme long term. The extinction of a species would be an irreversible loss of a resource.

In contrast, irretrievable commitments are those that are lost for a period of time, perhaps a long period of time. A highway built through a forest represents an irretrievable loss of forest habitat for the time that the highway remains.

HABITAT RESOURCES

Irreversible losses could occur in willow habitat on the National Elk Refuge under Alternatives 1, 2, 5, and 4 (in that order) due to the loss of root stock as continued heavy browsing by elk in the winters prevented suppressed willow plants in wet meadow habitat from recovering to Class I and II condition. The refuge could lose the following amount of potential willow habitat: Alternative 1, an estimated 1,500 acres; Alternative 2, an estimated 1,400 acres; and Alternatives 4 and 5, an estimated 1,010 acres. Although it is possible for willow plants to sprout from seeds, this type of regeneration rarely occurs. Alternatives 3 and 6 are not projected to result in the loss of any willow habitat because the low numbers of ungulates under these alternatives would not prevent suppressed willow plants in wet meadow communities from regenerating and growing into mature willow stands. In addition, irretrievable losses could occur in aspen habitat on the refuge that was not protected by fencing under all alternatives except 6 due to continued browsing by elk. The refuge could lose the following amount of aspen habitat in the long term: Alternatives 1–3, an estimated 1,850 acres; and Alternatives 4 and 5, an estimated 760 acres. Alternative 6 would preserve all aspen habitat occurring on the refuge.

In Bridger-Teton National Forest there could be irretrievable losses of aspen habitat in localized areas in the long term under Alternatives 1 and 5 due to heavy browsing by elk in combination with conifer encroachment as a result of fire suppression.

ELK

The potential exists for irretrievable commitments of elk resources if chronic wasting disease became established in the Jackson Hole area and substantially reduced the elk population. While this even is beyond the control of wildlife managers, the potential effect would be greatest under those alternatives where large numbers of animals were concentrated on feedgrounds. The loss would be irretrievable because in addition to always being fatal to infected animals, chronic wasting disease contaminates the environment for long periods of time. Soil on the refuge feedgrounds could become a reservoir of chronic wasting disease that would continue to infect animals many years into the future. This situation is considered an irretrievable loss (loss for a period of time) rather than an irreversible loss (cannot ever be reversed) because it is not known how long contamination of the environment would persist. Decontamination methods used on game farms and research facilities have been unsuccessful, and animals introduced to these facilities years after a chronic wasting disease outbreak and depopulation have subsequently become infected. Alternatives 1 and 5 would pose the greatest risk for irretrievable loss of elk resources due to large concentrations of elk on the feedgrounds occurring in every year or almost every year. Alternatives 4 and 3 would pose the next highest risk because feeding, although reduced, would still occur in some years and if chronic wasting disease arrived during a feeding year, the potential exists for rapid spread of the disease and extensive contamination of the environment. Alternatives 6 and 2 would present the least amount of risk because supplemental feeding would be phased out completely.

OTHER UNGULATE SPECIES

Mule deer and moose on the refuge could undergo irretrievable losses under Alternatives 1, 2, 4, and 5 due to the loss of willow habitat as a result of browsing by large numbers of elk. In addition, as-

pen habitat on the refuge would be lost under Alternatives 1 through 5, and fenced aspen habitat under Alternatives 4 and 5 would no longer be available to mule deer and moose. In the long term no aspen habitat would be available on the refuge for mule deer and moose under Alternatives 1 through 5. (See "Habitat Resources" above for amount of willow and aspen habitat lost under each alternative.)

Elk could infect mule deer with chronic wasting disease, either directly or through habitat contamination, which could potentially result in high prevalence of this disease among mule deer and an irretrievable commitment of mule deer resources. The risk would be highest under Alternatives 1 and 5, followed by Alternatives 4 and 3, due to concentrations of animals on the refuge feedgrounds. (See "Impacts on Other Ungulates" in Chapter 4.)

PREDATORS AND SCAVENGERS

The potential exists for irretrievable commitments of predator and scavenger resources to occur if chronic wasting disease became established in the Jackson Hole area and substantially reduced the elk population. Although, in the short term predators and scavengers would benefit from larger numbers of sick and dead animals, if elk numbers were reduced to low levels and remained suppressed for a long time, predator and scavenger populations could also be reduced. The greatest risk for predators and scavengers undergoing irretrievable losses would occur under Alternatives 1 and 5, followed by Alternatives 4 and 3. Alternatives 6 and 2 present the least amount of risk. Some predators, such as wolves, cougars, grizzly bears, and black bears could resort to other ungulate species for alternate prey. However, some of these species, such as moose, mule deer, and bighorn sheep have experienced population declines in recent years and might not be numerous enough to sustain the predator and scavenger population in the Jackson Hole area.

RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

Long-term productivity for the National Elk Refuge and Grand Teton National Park / John D. Rockefeller, Jr., Memorial Parkway refers to the capability of the land to provide resources into the future. The short term use of maintaining high numbers of elk on the refuge in the winter (e.g., Alternatives 1 and 5, and to some degree Alternative 4) for the purpose of providing the public with opportunities to view and harvest large numbers of animals, could potentially compromise the refuge's ability to provide habitat and elk resources in the future. Woody vegetation, which provides habitat for other ungulates and Neotropical migratory birds, cannot be sustained outside exclosures under alternatives that maintain large numbers of elk on the refuge. However, exclosures could deny access to other ungulates rendering most woody vegetation on the refuge unavailable to moose and mule deer.

Concentrating large numbers of elk on feedgrounds could reduce the ability of the environment to produce elk in the future if a disease, such as chronic wasting disease, became established in the Jackson Hole area. In addition, this disease poses risks not associated with other diseases because of its ability to contaminate the environment for long periods of time. Although animals infected with chronic wasting disease may be shedding the infectious agents of the disease anywhere they travel or anywhere they die, concentrating large numbers of elk in a specific area, such as a feedground, would concentrate the infectious agents in an area where many elk would potentially come in contact with them. The feedgrounds are located in the southern part of the refuge, which receives the least amount of snow, and therefore, has the most available forage in the winters. Even under those alternatives where supplemental feeding would be phased out (e.g., Alternatives 2 and 6), substantial numbers of elk would continue to forage in the feedground areas, albeit not at the densities that occur during winter feeding. Once these areas became contaminated with infectious agents of chronic wasting disease, elk would potentially become infected years into the future. Even depopulation and reintroduction of elk would not solve the problem because introduced elk would contract the disease from the soil on the feedgrounds.

UNAVOIDABLE ADVERSE EFFECTS

Implementing the alternatives could result in adverse environmental effects that could not be avoided even with mitigation measures. These adverse effects are related to chronic wasting disease. Although the alternatives considered in this planning process would have no effect on whether or not chronic wasting disease arrived in the Jackson Hole area, concentrating large numbers of elk on the feedgrounds could affect the speed at which the disease spreads and the prevalence that it reaches in the elk population. Phasing out supplemental feeding could mitigate these effects. However, if chronic wasting disease were to arrived prior to phasing out feeding, it might be too late to reduce the speed of infection and prevalence rate. Environmental contamination concentrated on the feedgrounds could continue to infect elk for many years into the future.

POSSIBLE CONFLICTS WITH AGENCY, TRIBAL, COUNTY OR STATE PLANS OR POLICIES

Actions considered in this environmental impact statement do not appear to conflict with tribal and national forest goals, objectives, policies, or plans, and they do not conflict with the 1994 *Jackson / Teton County Comprehensive Plan*. The county plan emphasizes the importance of wildlife and other natural and scenic resources to community character and the economic well-being of the community. Protection of wildlife habitat, particularly crucial winter range and migration corridors used by ungulates, is the first objective mentioned in the plan. Alternatives 3–6 support the objectives in the plan by preserving and restoring riparian and aspen woodland habitats on the refuge and, to some extent, in the park either by erecting exclosures or reducing elk numbers. In addition, Alternatives 2, 3, and 6 support the preservation of ungulate migration corridors by reducing or phasing out supplemental feeding and encouraging a wider distribution of elk on native winter range. Presumed habitat improvements in Bridger-Teton National Forest under Alternatives 2–6 would preserve and restore habitat on crucial winter range in the Gros Ventre drainage and the Buffalo Valley area. Furthermore, formerly cultivated agricultural lands in the park would be restored to native vegetation under Alternatives 2–6, thereby providing native habitat for Neotropical migratory birds, small mammal populations, and other species.

The *Jackson / Teton County Comprehensive Plan* identifies elk as a premier species that has significant biological, ecological, economic, educational, and aesthetic values to Teton County. It states that elk and their habitat must be protected to assure their continued survival in the county. Alternatives that phase out (Alternatives 2 and 6) or reduce (Alternatives 3 and 4) supplemental feeding would support the long-term survival of elk by reducing the risk of serious impacts to the elk population due to non-endemic disease. Alternatives that maintain high levels of elk in the Jackson Hole area through supplemental feeding every year or nearly every year (Alternatives 1 and 5) would support the objective of providing large numbers of elk for consumptive and non-consumptive uses. The introduction of a non-endemic disease, such as chronic wasting disease, would negate the advantages of supplemental feeding and could result in substantial declines in the elk population.

Alternatives 1 and 3–6 would contribute to Teton County's economic well-being by providing for an elk and bison hunt on the refuge. Although hunting is not directly addressed in the county plan, maintaining outdoor recreation and adventure opportunities is included in the county's vision statement.

Restoring elk migrations to historical wintering areas in the Green River basin and the Red Desert would conflict with current land uses and policies of the Wyoming Game and Fish Department. Some of the main reasons that the Wyoming Game and Fish Department does not foresee pursuing this effort include the following: (1) lingering questions about whether elk from Jackson Hole historically migrated to the Green River basin and the Red Desert; (2) doubts about whether a portion of the elk population could be "trained" to migrate to the basin; (3) the attraction of elk onto state feedgrounds, making feedground management more difficult and costly; (4) no plans to phase out feeding on state feedgrounds; (5) large elk movements from the Jackson elk herd to other herd units would complicate herd management; (6) the reality that elk would be drawn into cattle feedlines on private lands in key parts of the potential migration corridor; (7) the potential for elk with high levels of brucellosis to intermingle with cattle on feed-lines and other situations; (8) the need for the Bureau of Land Management to reallocate forage; and (9) the likelihood of increased wildlife-vehicle collisions on highways in the Green River basin.

Implementation of the strategy would also require the support of the U.S. Forest Service and the Bureau of Land Management, since elk migrations and winter grazing would predominantly occur on lands under their jurisdiction.