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# IMPACTS ON OTHER WILDLIFE

## OVERVIEW

The project area is home to a variety of wildlife and considered to be part of the most ecologically intact ecosystem in the lower 48 states. Bison and elk serve as food sources for predators and scavengers and compete for habitat with other ungulates. They could also alter the natural environment in ways that could either compromise or improve another species' ability to survive. Bison and elk management could impact other wildlife species, and, therefore, the effects of the alternatives on threatened and endangered species; other ungulates; predators and scavengers; small mammals; large rodents; Neotropical migratory birds; gallinaceous birds; waterfowl, shorebirds, rails, and cranes; and amphibians are analyzed below.

## THREATENED, ENDANGERED, AND SPECIAL CONCERN SPECIES

The Endangered Species Act (16 USC 1531 et seq.) defines the terms and conditions of the federal status of species in a wildlife refuge or park and requires an examination of impacts on all species federally listed or proposed for listing, and designated critical habitats for threatened or endangered species. In compliance with section 7 of the Endangered Species Act, personnel from the National Elk Refuge and Grand Teton National Park are working with the U. S. Fish and Wildlife Service's Wyoming field office to prepare a biological evaluation of the effects of the preferred alternative on threatened and endangered species. That document will not be completed until a final preferred alternative has been selected after the comment period closes for the draft environmental impact statement. that document will be the official determination of effects on species and will be incorporated by reference into the final environmental impact statement.

Both the U.S. fish and Wildlife Service and the National Park Service are required by their policies to consider potential effects of actions on state or locally listed species. Both agencies are to perpetuate the natural distribution and abundance of these species and the ecosystems on which they depend.

### METHODOLOGY USED TO ANALYZE EFFECTS

The process for assessing impacts to threatened, endangered, and sensitive species is essentially the same as that for other wildlife, except it is focused on the species that have been identified. The following impact intensities include what the effect would be under section 7 of the Endangered Species Act.

- *Negligible* — Sensitive species would not be affected, or the effects would be at or below the level of detection.

  A negligible effect would equate with a "no effect" determination under section 7 of the Endangered Species Act regulations for threatened or endangered species.

- *Minor* — Impacts to sensitive species would be perceptible or measurable, but the severity and timing of changes to parameter measurements are not expected to be outside natural variability and are not expected to have effects on populations of sensitive species. Impacts would be outside critical periods.

  A minor effect would equate with a determination of "not likely to adversely affect" under section 7 of the Endangered Species Act regulations for threatened or endangered species.

- *Moderate* — Impacts to sensitive species would be perceptible and measurable, and the severity and timing of changes to parameter measurements are expected to be sometimes outside natural variability, and changes within natural variability might be long term. Populations of sensitive species might have small to moderate declines, but they are expected to rebound to pre-impact numbers. No species would be at risk of being extirpated from an area. Some impacts might occur during key time periods.

  A moderate effect would in most cases equate with a determination of "likely to ad-

versely effect" under section 7 of the Endangered Species Act regulations for threatened or endangered species.

- *Major* — Impacts to sensitive species would be measurable, and the severity and timing of changes to parameter measurements are expected to be outside natural variability for long periods of time or even be permanent; changes within natural variability might be long term or permanent. Populations of sensitive species might have large declines, with population numbers significantly depressed. In extreme cases, a species might be at risk of being extirpated from an area, key ecosystem processes like nutrient cycling might be disrupted, or habitat for any species might be rendered not functional. Substantive impacts would occur during key time periods. Impacts would be long term to permanent.

  A major effect would equate with an "adversely affect with/without a jeopardy opinion" under section 7 of the Endangered Species Act regulations.

## IMPACTS ON GRAY WOLVES, GRIZZLY BEARS, AND BALD EAGLES

### Impacts of the Alternatives

#### *Impacts Common to All Alternatives*

*Disease Impacts* — Elk and bison make up a substantial portion of the prey base for wolves in Jackson Hole and a portion of the prey base for grizzly bears and bald eagles.

If a new disease (e.g., bovine tuberculosis, bovine paratuberculosis, or chronic wasting disease) was introduced into the Jackson Hole area and reduced elk and/or bison numbers by a moderate to major amount, wolves, grizzly bears, and bald eagles in general could benefit in the short term due to more vulnerable prey and more carcasses available for scavenging. In the long term wolves, grizzly bears, and bald eagles could be negatively impacted due to a decrease in the numbers of available prey. The risk of this happening would increase under Alternatives with high concentrations of animals.

The severity of impacts that could result from the establishment of tuberculosis or paratuberculosis in the Jackson elk or bison herd would be greatest under Alternative 1, followed by Alternatives 5, 4, 3, with the least risk under Alternatives 2 and 6 (approximate equal risk) (HaydenWing and Olson 2003). The severity of impacts that could potentially result from the establishment of chronic wasting disease in the Jackson Hole area would be greatest under Alternatives 1 and 5 (approximately equal risk), followed by Alternatives 4 and 3, with the least risk under Alternatives 2 and 6 (approximate equal risk).

Wolves, grizzly bears, and bald eagles would not be impacted by contracting paratuberculosis, brucellosis, or chronic wasting disease under any of the alternatives because they are not known to be susceptible to these diseases (Williams 2001; Thorne et al. 1982).

If bovine tuberculosis became established in the Jackson Hole area, wolves and grizzly bears could contract the disease from elk and bison. Although individual animals could develop symptoms and die, they would not be able to sustain the disease and pass it along to other members of their species (Roffe, pers. comm. 2002). There are no documented cases of predator or scavenger species in North America maintaining the disease within their populations (Clifton-Hadley et al. 2001).

Wolf and grizzly bear populations are not likely to be impacted by bovine tuberculosis in the short term (Roffe, pers. comm. 2003). In the long term the risk for transmission of this disease from elk or bison to wolves and grizzly bears would continue to increase over time, as prevalence in elk and bison and the number of symptomatic cases increased. Those alternatives with the highest concentrations of animals (Alternatives 1, 5, and 4, in that order) would have the greatest risk of negatively impacting wolves and grizzly bears.

*Human Disturbance* — Bald eagles are often present on the refuge feedgrounds, and in 1999 wolves also were often present on the feedgrounds. Wolves have been less visible in recent years, but they are occasionally seen in the vicinity. The feeding program does not appear to disturb predators and scavengers, but it appears to indirectly attract them as a result of large concentrations of elk and bison. Animals new to the feeding operations could be wary at first, but they

seem to quickly habituate. Therefore, management activities associated with the supplemental feeding program for elk and bison under all alternatives in the short term and under Alternatives 1, 3, 4, and 5 in the long term would have negligible effects on threatened and endangered species. Gradually phasing out supplemental feeding under Alternatives 2 and 6 would eventually eliminate any possible disturbance effects of activities associated with winter feeding.

Wolves, grizzly bears, and bald eagles would not be negatively impacted or would be impacted to a negligible degree by activities associated with elk and bison hunting under all alternatives except 2. Hunters walking and horseback riding through the hunt zones and rifles being fired in the northern portion of the refuge and on the eastern side of the park could disturb wolves, grizzly bears, and bald eagles in the immediate area of each hunting party for a short time. Impacts on populations of threatened species would be negligible. Eliminating hunting under Alternative 2 would remove any associated disturbance on wolves, grizzly bears, and bald eagles.

Farming and irrigation management practices on the refuge in all alternatives and restoring agricultural lands to native vegetation in the park under Alternatives 2–6 could disturb wolves, grizzly bears, and bald eagles, but the effects would be negligible.

Eliminating farming and irrigation practices under Alternative 2 and Option B of Alternative 3 on the refuge would reduce human disturbance on the southern part of the refuge. The benefits to wolves, grizzly bears, and bald eagles would be negligible because the negative impacts of farming and irrigation on these species are considered negligible.

*Hunting Risks to Grizzly Bears* — As the grizzly bear population continues to expand southward, the risk of conflicts between hunters and grizzlies would increase and could result in increased mortality for bears and hunters under Alternatives 1, 3, 4, 5, and 6, which would continue hunting on the refuge and, when necessary, an elk reduction program in the park.

*Other Lands* — Wolves, grizzly bears, and bald eagles on other federal lands and private lands in Jackson Hole, the Green River basin, and the Red Desert would not be affected or would be affected to a negligible degree by actions that are being considered in this planning process. However, Alternatives 2 and 3 and possibly 6 could result in elk spending more time on federal lands in Jackson Hole or migrating to the Green River basin. Wolves, grizzly bears, and bald eagles in these areas could benefit from more available prey and carrion.

#### *Alternative 1*

*Analysis*

Wolves, grizzly bears, and bald eagles could potentially benefit from the growing bison population because more animals could be dispersed outside the park and the refuge onto the national forest and private lands, making them available for hunting. If increasing bison numbers posed a threat to human safety or property and were removed by government authorities, the resulting gut piles and carcasses could benefit bald eagles, grizzly bears, and wolves by providing more food. This situation could also lure grizzly bears and wolves closer to humans in and around Jackson Hole, resulting in increased human-caused mortality of these species, but the effect on the population would be negligible.

Grizzly bears would continue to benefit by preying on elk calves in the spring, and bald eagles and grizzly bears would continue to scavenge elk carcasses opportunistically. Since the numbers of elk would remain similar to baseline conditions, grizzly bears and bald eagles would not be impacted by elk management under Alternative 1 any more than they have been affected in the recent past.

The herd objective of approximately 11,000 elk would be enough to sustain any foreseeable numbers of wolves that would inhabit the Jackson Hole area. (See text box for calculations of number of elk necessary to feed 30–60 wolves.)

No grizzly bears are known to have been killed by elk hunters on the National Elk Refuge or in Grand Teton National Park. The risk of hunters killing grizzly bears while elk hunting under Alternative 1 would be similar to baseline conditions. The risk of bear/human conflicts would continue in all areas open to hunting.

**Nutritional Needs of Wolves**

There is currently one wolf pack in the Jackson Hole area and the Gros Ventre drainage, with approximately 16–18 wolves. Four wolf packs would be the maximum number of packs that could biologically occur in this area (Kaminski, pers. comm. 2003; Jimenez, pers. comm. 2003). In areas where livestock are raised, wolves sometimes come into conflict with ranchers due to depredations, and wolf numbers are kept low by agencies or as a result of shooting by ranchers. It is unlikely that in the Jackson Hole and Gros Ventre areas wolf numbers would grow much beyond 30 wolves (two to three packs) due to these conflicts (Jimenez, pers. comm. 2003). The following analysis uses four packs with a total of 60 wolves as a maximum number for the sake of calculating elk consumption rates. However, this number would be unlikely to inhabit the Jackson Hole and Gros Ventre areas with current human population numbers and livestock operations.

Daily wolf consumption rates vary from 6 to14 pounds per animal, with an average of 10 pounds per day (Boyce and Guillard 1992). Nutritional needs depend on the season, with greater nutrient requirements in winter. Also, hunts in winter are likely to be more successful due to deep snow levels and poorer condition of prey species. Little is known about kill rates in the summer, but wolves appear to select various prey species throughout the year, depending on availability. In Montana researchers found that wolf scat in the summer contained deer, bighorn sheep, and pronghorn remains, while in the winter it contained primarily elk (Jimenez, pers. comm. 2003). During the winter on the northern range of Yellowstone, approximately 90% of the wolf kills were elk (Mech et al. 2001); available information indicates that summer kill rates on elk are less. Multiple wolf prey makes it difficult to calculate how many elk a wolf pack could take in a year, since at certain times they could be taking few elk but still consume an average of 10 pounds of meat per day (Jimenez, pers. comm. 2003).

The average weight of an elk (including the weight of bulls, cows, and calves) is 400 pounds, 10% of which is inedible (B. Smith, pers. comm. 2003). The following calculation estimates the maximum number of elk kills necessary for wolves to survive for a year:

10 pounds meat / wolf / day × 90% of kills × number of wolves × 365 days = pounds of elk meat / wolf / year ÷ 400 pounds x 110% (to include inedible parts of an elk carcass) = number of elk killed / year.

An estimated maximum of 271 elk per year, or 2% of the Jackson elk herd when it is at 11,000, would be more than sufficient to maintain a wolf population of 30 animals. An estimated maximum of 542 elk, or 5% of the Jackson elk herd at a population of 11,000, would be sufficient to maintain a wolf population of four packs with a total of 60 wolves.

*Conclusion*

Compared to baseline conditions, wolves, grizzly bears, and bald eagles on the refuge and in the park could benefit negligibly from increased natural mortality of growing numbers of bison. These species would not be affected by elk numbers and distribution any more than they have been in the recent past. Overall, impacts in the long term would be similar to baseline conditions. This alternative would not result in the impairment of wolves, grizzly bears, and bald eagles in the park.

### *Alternative 2*

*Analysis*

Under Alternative 2 annual winter mortality for elk is estimated to range between 1% and 20% (rarely). Higher winter and early spring mortality in elk and bison, while making more carcasses available for scavenging by wolves, grizzly bears, and bald eagles in the short term, could also increase the risks of conflicts among these predators and with humans.

Wolves, grizzly bears, and bald eagles would be positively affected in years with high numbers of bison and elk and negatively affected in years with low numbers. This would be particularly true in the park, where elk numbers could fall as low as 600 in some years.

In some years, fewer elk and bison under Alternative 2 could negatively impact grizzly bears, bald eagles, and wolves. However, the winter mortality of the elk and bison on the refuge and state feedgrounds is currently artificially low because of supplemental feeding. At present, the most important mortality factor is hunting. Under Alternative 2, increased winter mortality during above average and severe winters would replace to some degree the elimination of hunting. Therefore, more carcasses would be available to scavengers during above-average and severe winters because, although there could be fewer elk and bison on average, more would die in these winters.

Not allowing hunting on the refuge or the elk herd reduction program in the park would eliminate

gut piles, other carcass remains left by hunters, and wounded elk not retrieved by hunters. Conflicts between hunters and grizzly bears would not occur under this alternative because hunting on the refuge and the elk reduction program in the park would be discontinued. Grizzly bears could be negatively impacted by the reduction in gut piles and other carcass remains, which can be a rich source of protein and fat for bears that are preparing for hibernation. Migrating bald eagles that stop at the refuge in the fall to feed on gut piles left from hunting could also be negatively impacted.

The estimated lower numbers of elk and bison under Alternative 2 would still be sufficient to feed any foreseeable number of wolves that could inhabit Jackson Hole (see calculations under Alternative 1). Furthermore, in hard winters, elk would be in poorer condition and easier to prey upon.

In recent winters wolves in the Jackson Hole area have not spent much time on the National Elk Refuge, preferring to hunt in the Gros Ventre River drainage and concentrating on the WGFD feedgrounds. If the Wyoming Game and Fish Department continued feeding operations in the Gros Ventre drainage, wolves could continue to spend much of their time in the winter hunting elk concentrated on these feedgrounds and might not be affected by the phaseout on the refuge.

Although overall numbers of elk and bison could be lower than under Alternative 1, grizzly bears could benefit from more of these ungulates being on native winter range rather than concentrated on the refuge. Carcasses on the refuge are usually entirely consumed within 24–48 hours, leaving nothing for grizzly bears to scavenge in the spring. More elk on native winter range could mean that more winter-killed elk would be available as carcasses in the spring for grizzly bears. However, grizzly bears could be negatively affected by fewer calves available for predation in the spring and summer. If grizzly bears turned to livestock due to fewer elk calves in the spring, more bears could potentially be killed by government authorities and ranchers.

In the long term, if large numbers of elk migrated to the Green River basin and the Red Desert in the winter (assuming that supplemental feeding in the Gros Ventre would end sometime in the future), there could be fewer prey animals for wolves, grizzly bears, and bald eagles in the Jackson Hole area compared to baseline conditions and Alternative 1. However, elk would remain in the Gros Ventre, Buffalo Valley, and other areas of Jackson Hole that contain winter range. Therefore, wolves, grizzly bears, and bald eagles could be negatively affected, but only to negligible degree compared to baseline conditions and Alternative 1. Wolves, grizzly bears, and bald eagles in the Green River basin and the Red Desert would benefit but only to a negligible degree due to the larger number of wintering ungulates and increased number of carcasses.

Impacts of bison fertility control would likely have negligible impacts on wolves and bald eagles on the refuge. If fertility control was carried out in the park, wolves, grizzly bears, and bald eagles could be temporarily disturbed to a negligible degree by biologists walking through various habitats and shooting dart guns. However, their survival and reproduction would not be affected.

As described under Alternative 1, wolf, grizzly bear, and bald eagle populations in Jackson Hole would not be affected or would be affected to a negligible degree by contracting bovine tuberculosis (Roffe, pers. comm. 2003). There would be a moderate reduction in potential for transmission of bovine tuberculosis from elk and bison to wolves, grizzly bears, and bald eagles under Alternative 2 compared to Alternative 1 due to lower prevalence in elk and bison.

Biochemical contraceptives approved for use in free-ranging wildlife do not enter the food chain and therefore would have no negative effects on wolves, grizzly bears, and bald eagles.

There would be no hunting on the refuge or the park under Alternative 2, with no risk of elk or bison hunters killing grizzly bears.

*Conclusion*

Wolves, grizzly bears, and bald eagles would benefit in years of high elk and bison mortality on the refuge and in the park and could be negatively affected in mild years after the elk and bison herd had declined in numbers compared to Alternative 1. Although the overall impacts on wolves, grizzly

bears, and bald eagles could be negative, the intensity would be no more than negligible to minor. This alternative would not result in the impairment of wolves, grizzly bears, and bald eagles in the park.

#### *Alternative 3*

*Analysis*

In some years fewer elk under Alternative 3 could negatively affect scavengers, such as bald eagles and grizzly bears. Gut piles and other carcass remains and wounded animals not retrieved by hunters would provide scavengers with food in the fall/winter because elk and elk hunting would be carried out on the refuge and in the national forest, and the elk reduction program would take place in the park. This food source would increase in the short term on the refuge and in the park as hunting was increased to reduce the Grand Teton elk herd segment. While providing threatened scavenger species with additional food, the increase in gut piles could increase conflict between grizzly bears and humans, resulting in increased bear mortality. In the long term, gut piles would decline due to far fewer elk being harvested on the refuge and in the park.

Compared to Alternative 1, scavengers could be negatively impacted because the bison population would not be allowed to grow without limit under Alternative 3, resulting in fewer bison carcasses to scavenge. However, during the hunting season there could be more gut piles on the refuge and since supplemental feeding would occur only in severe winters and there could be more winter-killed elk and bison throughout Jackson Hole in non-feeding years.

The estimated lower numbers of elk under Alternative 3 would still be sufficient to feed any foreseeable number of wolves that could inhabit Jackson Hole (see calculations in text box in Effects of Alternative 1).

In recent winters wolves in the Jackson Hole area have not spent much time on the National Elk Refuge, preferring to hunt in the Gros Ventre River drainage, concentrating on state feedgrounds. If the Wyoming Game and Fish Department continued to feed in the Gros Ventre drainage, wolves would likely spend much of their time in the winter hunting elk concentrated on these feedgrounds. Therefore, wolves might not be affected by the reduction in elk feeding programs on the refuge.

Even though overall numbers of elk could be lower in some years, grizzly bears could benefit from more of these ungulates being on native winter range rather than concentrated on the refuge. This could mean that more winter-killed elk and bison would be available as carcasses in the spring for grizzly bears. Grizzly bears could also be negatively impacted by the reduction in elk numbers to 500–1,000 in the park, which would result in fewer elk calves as potential prey in the spring. If bears turned to livestock as a result of fewer elk calves, more bears could potentially be killed by government authorities and ranchers.

If large numbers of elk migrated in the long term to the Green River basin and the Red Desert in the winter (assuming that feeding in the Gros Ventre would end sometime in the future), there could be fewer prey animals for wolves, grizzly bears, and bald eagles in the Jackson Hole area compared to baseline conditions and Alternative 1. However many elk would remain in the Gros Ventre, Buffalo Valley, and other areas of Jackson Hole that contain winter range. Therefore, wolves, grizzly bears, and bald eagles could be negatively affected, but only to a negligible degree compared to baseline conditions and Alternative 1. Scavengers in the Green River basin and the Red Desert would benefit, but only to a negligible degree due to the larger number of wintering ungulates and more carcasses.

Effects of disturbance to wolves, grizzly bears, and bald eagles due to elk and bison brucellosis vaccination would be negligible and temporary.

As described under Alternative 1, wolf, grizzly bear, and bald eagle populations in Jackson Hole would not be affected or would be affected to a negligible degree by bovine tuberculosis (Roffe, pers. comm. 2003). There would be a moderate reduction in the potential for transmission of this disease from elk and bison to wolves, grizzly bears, and bald eagles under Alternative 3 compared to Alternative 1 due to reduced prevalence. However, the potential for transmission from bison would be slightly higher than under Alterna-

tive 2 because more bison would be present in the herd.

Compared to baseline conditions and Alternative 1, there would be a decreased risk for hunters killing grizzly bears on the National Elk Refuge. Although there would be both an elk hunt and a bison hunt, fewer elk would be coming to the refuge in the long term, and therefore fewer hunters. Grizzly bears would also have to begin to frequent the refuge in the future in order for there to be any risk.

In the park the risk of hunters killing grizzly bears would be much less than under baseline conditions and Alternative 1 because the Grand Teton elk herd segment would be smaller, so the elk reduction program would likely be changed as a result and fewer hunters would be deputized. In some years, it might not be necessary to have a hunt, in which case the risk of killing grizzly bears would be zero.

*Conclusion*

Most wolves, grizzly bears, and bald eagles on the refuge and in the park would benefit in years of high elk and bison mortality and could be negatively affected in mild years after the elk and bison herds had declined in numbers compared to Alternative 1. However, grizzly bears could benefit from elk and bison being more distributed over the landscape and suffering higher winter mortality. Although the overall impacts on wolves, grizzly bears, and bald eagles could be negative, the intensity would be no more than negligible to minor. This alternative would not result in the impairment of wolves, grizzly bears, or bald eagles in the park.

### Alternative 4

*Analysis*

During the estimated 4–5 out of 10 winters that elk would be supplementally fed on the National Elk Refuge, the effects of Alternative 4 on most wolves, grizzly bears, and bald eagles with regard to elk as a prey species would probably be similar to baseline conditions and Alternative 1.

An estimated 2,000 more elk could be using native winter range compared to baseline conditions and Alternative 1; therefore, a larger number of elk would be subject to higher winter mortality. Grizzly bears could benefit if more winter-killed elk and bison died in areas accessible to bears after they emerged from hibernation in the spring.

In years with no supplemental feeding, the vulnerability and mortality of elk and bison on the refuge could be higher, and wolves, grizzly bears, and bald eagles could benefit compared to baseline conditions and Alternative 1.

Scavenging wolves, grizzly bears and bald eagles would benefit in the short term as relatively large numbers of bison were killed to bring numbers down from an estimated 800–1,000 (at the signing of the record of decision) to 450–500. Hunters would leave numerous gut piles on the refuge and the national forest in the first few years as the herd was being reduced. While providing more food for threatened species, more gut piles on the refuge could increase conflict between grizzly bears and humans, which could increase grizzly bear mortality. In the long term, compared to Alternative 1, scavengers would still benefit but to a lesser degree because fewer bison would be in the herd and fewer would need to be harvested, leaving fewer gut piles. Furthermore fewer bison would be destroyed on private lands.

Effects of disturbance to wolves, grizzly bears, and bald eagles due to brucellosis vaccination would be similar to the effects of the feeding program and would be negligible and temporary.

As described under Alternative 1, wolf, grizzly bear, and bald eagle populations in Jackson Hole would not be affected or would be affected to a negligible degree by bovine tuberculosis (Roffe, pers. comm. 2003). There would be a negligible to minor reduction in potential for transmission of bovine tuberculosis from elk or bison to wolves, grizzly bears, and bald eagles under Alternative 4 due to decreased prevalence.

Wolves, grizzly bears, and bald eagles that consume elk would be exposed to brucellosis vaccine, Strain 19. No clinical trials have been conducted to determine if this vaccine is safe for non-target species. However, Cook and Rhyan (2002) noted, "Field experience suggests that S19 is safe in many species of non-target wildlife." The Wyoming Game and Fish Department (2002b) noted

that "no disease or other problem attributable to the vaccine was seen in elk or other species," as a result of vaccinating 23,640 elk from 1985 through 1995. Strain 19 has also been used on WGFD feedgrounds for 17 years, and no disease in nontarget species has been observed. Species that had the greatest potential of being exposed include bears and many scavenging species of birds (Rhyan and Cook 2002). Therefore, Strain 19 would not be expected to have any negative effects on wolves, grizzly bears, or bald eagles in the short or long term.

Numerous studies indicate that RB51 does not effect nontarget species (Kreeger 2002). Species tested include deer mice, ground squirrels, voles ravens, coyotes, dogs, and black bears. Therefore, RB51 would not be expected to have any negative effects on predators or scavengers in the short or long term.

The potential for elk and bison hunters killing grizzly bears on the National Elk Refuge would be less by a major amount compared to baseline conditions and less by a moderate amount compared to Alternative 1 because fewer elk would be on the refuge in the long term. There would also be a bison hunt on the refuge, but in the long term the numbers of animals that would be killed annually would be relatively small. This potential risk assumes that in the future grizzly bears would begin to frequent the National Elk Refuge.

In Grand Teton National Park, the potential risk of deputized elk hunters killing grizzly bears would be less by a major amount compared to baseline conditions and less by a moderate amount compared to Alternative 1 because there would be fewer elk in the park and the elk reduction program would likely be changed as a result.

*Conclusion*

Most wolves, grizzly bears, and bald eagles on the refuge and in the park would benefit due to higher elk and bison mortality and wider distribution of carcasses during years when the refuge did not feed. Wolves, grizzly bears, and bald eagles could benefit by a negligible amount due to higher elk mortality rates. Grizzly bears, which do not normally occur on the refuge, would benefit from wider distribution of winter-killed elk and bison. During supplemental feeding years, the effects on wolves, grizzly bears, and bald eagles would be similar to Alternative 1. This alternative would not result in the impairment of wolves, grizzly bears, or bald eagles in the park.

### *Alternative 5*

*Analysis*

The short- and long-term effects of elk numbers and distribution on wolves, grizzly bears, and bald eagles would be similar to the effects of baseline conditions and Alternative 1 with regard to elk as a prey species. Scavenging wolves, grizzly bears, and bald eagles would benefit in the short term as relatively large numbers of bison were killed to bring numbers down from an estimated 800–1,000 (at the signing of the record of decision) to 400. Hunters would leave numerous gut piles on the refuge and in the national forest in the first few years as the herd was being reduced. While providing more food for threatened species, more gut piles on the refuge could increase conflict between grizzly bears and humans, which could increase grizzly bear mortality. In the long term, compared to Alternative 1, these threatened species would still benefit but to a lesser degree because fewer bison would be in the herd and fewer would need to be harvested, leaving fewer gut piles. Furthermore fewer would be destroyed on private lands.

Effects of disturbance to wolves, grizzly bears, and bald eagles due to brucellosis vaccination would be similar to the effects of the feeding program, which are negligible and temporary.

Strain 19 and RB51 would not be expected to have any negative affects on wolves, grizzly bears, and bald eagles in the short and long terms, as discussed for Alternative 4.

The potential for elk and bison hunters to kill grizzly bears on the National Elk Refuge would be less by a moderate amount compared to baseline conditions and less by a minor amount compared to Alternative 1 because there would be fewer hunters in the field. There would also be a bison hunt on the refuge, but in the long term the numbers of bison that would be killed annually would be relatively small. This potential risk assumes that in the future grizzly bears would begin

to occur on the National Elk Refuge more frequently.

In Grand Teton National Park the potential risk for deputized elk hunters to kill grizzly bears would be less by a moderate amount compared to baseline conditions and less by a minor amount compared to Alternative 1 because there would be fewer elk in the park and the elk reduction program would likely be changed as a result.

*Conclusion*

With regard to elk numbers and distribution, the effects on wolves, grizzly bears, and bald eagles on the refuge and in the park would be similar to the effects of Alternative 1. Scavenging wolves, grizzly bears, and bald eagles would greatly benefit in the short term from gut piles left by hunters as bison numbers were reduced from 800–1,000 animals to 400. While providing more food for threatened species, more gut piles on the refuge could increase conflict between grizzly bears and humans, which could increase grizzly bear mortality. Scavenging threatened species would continue to benefit in the long term from the bison hunt but to a lesser degree because fewer animals would be killed. Overall impacts on wolves, grizzly bears, and bald eagles in the long term would be similar to Alternative 1. This alternative would not result in the impairment of wolves, grizzly bears, or bald eagles in the park.

### Alternative 6

*Analysis*

In some years fewer and more widely distributed elk and bison under Alternative 6 could negatively affect wolves, grizzly bears, and bald eagles. However, grizzly bears do not normally occur on the refuge, and therefore, carcasses that are more distributed across the landscape would be a potential benefit for bears. In hard winters, scavengers both on and off the refuge would benefit by the larger number of winter-killed elk and bison because the winter mortality rate would no longer be kept artificially low by supplemental feeding.

Possible benefits of changes in carcass availability could be offset to an unknown extent by periodic reductions in elk numbers to an estimated 1,200–1,600 in the park. Fewer elk in the park would also result in fewer elk calves for grizzly bears to prey on in the spring. If bears turned to livestock as a result of fewer elk calves in the spring, more bears could potentially be killed by government authorities and ranchers.

As numbers of elk decreased on the refuge and in the park in the long term, the number of elk killed during the hunting season would also decrease; therefore, available gut piles and other carcass remains would decline. Bison hunting would initially provide many gut piles for scavengers, but as the bison herd was reduced to the objective of an estimated 400 post-hunt, the number of gut piles available each hunting season on the refuge would be much less. Scavenging wolves, grizzly bears, and bald eagles would benefit in the short term. While providing more food for threatened species, more gut piles on the refuge could increase conflict between grizzly bears and humans, which could increase grizzly bear mortality. In the long term these threatened species would be negatively affected by a major amount due to fewer gut piles and other remains compared to baseline conditions and Alternative 1.

Alternative 6 would not deter elk and bison hunting in Bridger-Teton National Forest. However, hunting opportunities and the resulting gut piles would fluctuate as elk herd numbers varied. Compared to baseline conditions and Alternative 1, the number of gut piles and other remains would be moderately higher when the elk herd was at the 11,000 objective because as the Grand Teton herd segment decreases, the Teton Wilderness herd segment would represent a greater proportion of the herd. After hard years, when the elk herd numbers could fall to an estimated 8,100, the number of gut piles would be moderately reduced because hunting would be reduced to allow the elk herd to rebound. Therefore, in some years scavenging threatened species would benefit by a moderate amount from more gut piles and other remains compared to baseline conditions and Alternative 1. However, more gut piles could increase grizzly bear mortality as a result of conflicts with hunters. In years when the elk herd was below objective, scavengers would be negatively affected by a moderate to major amount due to fewer available gut piles.

Gut piles would increase in Grand Teton National Park and the refuge in the short term while elk

numbers were being reduced, but would eventually decrease by a major amount in the long term. If the grizzly bear population expanded southward, bears could increase their use of gut piles and other remains compared to current conditions since they do not now use gut piles on the refuge or the southern part of the park. In the long term, whatever use grizzly bears could make of gut piles and carcass remains would be less by a major amount under Alternative 6 than it would be under baseline conditions and Alternative 1 due to fewer elk on the refuge and in the park.

While grizzly bears and bald eagles depend on a variety of food sources, with elk and bison carcasses and/or calves serving as rich fat and protein sources, wolves in the Jackson Hole area rely on large ungulates for most of their sustenance. Major reductions in elk numbers could have negative impacts on wolf populations if other ungulates were not numerous enough to provide an alternate food source.

The estimated lower numbers of elk in some years under Alternative 6 would still be sufficient to feed the foreseeable numbers of wolves that could inhabit Jackson Hole. (See calculations in text box in Alternative 1.) Lower elk numbers would primarily occur in the park, which could limit further expansion of wolves in the park.

Until recently, wolves in the Jackson Hole area have not spent much time on the National Elk Refuge, preferring to hunt in the Gros Ventre River drainage and focusing on the WGFD feedgrounds. Since the Wyoming Game and Fish Department would likely continue to feed in the Gros Ventre drainage, wolves could continue to spend much of their time in the winter hunting elk concentrated on these feedgrounds. Therefore, wolves might not be affected by the elimination of feeding on the refuge.

If large numbers of elk migrated outside the Jackson Hole area in the winter (assuming that feeding in the Gros Ventre would end sometime in the future), fewer elk and bison would die on native winter range in the Jackson Hole area. Therefore less food would be available for wolves, grizzly bears, and bald eagles compared to a situation in which most elk remained in the Jackson Hole area. However, many elk would remain in the Gros Ventre drainage, Buffalo Valley, and other areas of Jackson Hole that contain winter range. Therefore wolves, grizzly bears, and bald eagles could be negatively affected, but only to a negligible degree compared to baseline conditions and Alternative 1. Wolves, grizzly bears, and bald eagles in areas outside the Jackson Hole area could benefit but only to a negligible degree due to more wintering ungulates in these areas.

If grizzly bears continued to expand their range southward and individual bears began to frequent the National Elk Refuge, the risk of hunters killing grizzly bears compared to current conditions could increase because no grizzly bears have been seen on the refuge in more than a decade. Compared to Alternative 1, the short-term risk of killing grizzly bears might also increase if grizzly bears began inhabiting the refuge because elk harvest levels would increase in order to bring the Grand Teton elk herd segment down, so more hunters would be in the field. In the long term the risk of killing grizzly bears could decrease because even though there would be both an elk hunt and a bison hunt, fewer elk would be coming to the refuge and potentially fewer hunters would acquire permits.

In the park the risk of deputized elk hunters killing grizzly bears would be higher in the short term compared to baseline conditions and Alternative 1 due to a higher harvest rate to bring the Grand Teton elk herd segment down to 1,200–1,600 elk. In the long term the risk of killing grizzly bears would be lower than Alternative 1 because the park elk herd segment would be smaller and the elk reduction program would likely be changed as a result.

*Conclusion*

Most wolves, grizzly bears, and bald eagles on the refuge and in the park would benefit in years of high elk and bison mortality and could be negatively affected in mild years after the elk and bison herds had declined in numbers compared to Alternative 1. Although the overall impacts on wolves, grizzly bears, and bald eagles could be negative, the intensity would be no more than negligible to minor. Grizzly bears could benefit from elk and bison being more distributed over the landscape and suffering higher winter mortality. This alternative would not result in the im

pairment of wolves, grizzly bears, and bald eagles in the park.

### Mitigation

Mitigation measures would not be necessary.

## YELLOW-BILLED CUCKOO

Yellow-billed cuckoos, a candidate species, require woody riparian habitat with dense understory. Although the cuckoo has rarely been observed in the Jackson Hole area, changes in riparian and aspen woodland habitats could potentially affect the western population of this species.

### Impacts of the Alternatives

#### *Impacts Common to All Alternatives*

Yellow-billed cuckoos would not be adversely impacted by management activities associated with the supplemental feeding program for elk and bison under Alternatives 1, 3, 4, and 5. Supplemental feeding would be phased out under Alternative 2, Option B of Alternative 3, and Alternative 6. During the phaseout period, management activities associated with supplemental feeding would not adversely impact yellow-billed cuckoos because supplemental feeding occurs during winter when they would have migrated to their winter feeding grounds.

To the extent that yellow-billed cuckoos nest on or migrate through the refuge and the park, they would likely not be adversely impacted by activities associated with elk and bison hunting in all alternatives except 2 because they would have migrated out of the area by the time hunting occurred.

Yellow-billed cuckoos would not be adversely impacted by management activities associated with a brucellosis vaccination program for elk and bison under Alternatives 3, 4, and 5 because this would happen in winter when cuckoos would have already migrated.

#### *Alternative 1*

*Analysis*

Yellow-billed cuckoos could be negatively affected on the refuge in the short and long terms under Alternative 1 by a decline in the amount and condition of cottonwood and willow habitats. Heavy browsing by large numbers of elk and growing numbers of bison would continue to reduce understory plants and prevent regeneration of cottonwood and willow plants, resulting in a loss of an estimated 50 acres of willow habitat and an estimated 220 acres of cottonwood habitat. Also, an estimated 1,450 acres of suppressed willow plants would not recover on the southern part of the refuge and would eventually disappear.

In the park and the national forest some areas of woody riparian habitat that could be yellow-billed cuckoo habitat would be negatively affected by large numbers of elk and growing numbers of bison browsing, trampling, and rubbing.

Potential yellow-billed cuckoo habitat on other federal and state lands and private lands would not be affected by actions being considered under Alternative 1 any differently than they have been affected in the recent past.

*Conclusion*

Yellow-billed cuckoos on the refuge and in the park could potentially be negatively affected due to a loss of acreage and a decline in the condition of woody riparian habitat compared to baseline conditions. This alternative would not result in the impairment of yellow-billed cuckoos in the park.

#### *Alternative 2*

*Analysis*

Yellow-billed cuckoos could potentially be negatively affected on the refuge in the short and long terms under Alternative 2 due to the continued decline in the amount and condition of woody riparian habitats. Heavy browsing by elk and bison would continue to reduce understory plants and prevent regeneration of cottonwood and willow trees, resulting in a loss of an estimated 150–230 acres of willow and cottonwood habitat. In addition, an estimated 1,400 acres of suppressed wil-

low plants would not recover and would eventually disappear from the southern part of the refuge. Compared to Alternative 1, yellow-billed cuckoos under Alternative 2 would be positively impacted in the short and long terms due to an estimated 40–150 more acres of habitat, but the effects would likely be negligible.

In the park, yellow-billed cuckoos could benefit from increased acreage and improved condition of woody riparian habitats due to fewer elk and bison summering in the park compared to baseline conditions and Alternative 1.

To the extent that yellow-billed cuckoos nested on or migrated through the refuge and the park, they would likely not be adversely impacted by activities associated with bison fertility control under Alternative 2. If fertility control took place on the refuge during winter, yellow-billed cuckoos would have already migrated out of the area. If the fertility control program was conducted in the park, any yellow-billed cuckoos present could potentially be disturbed for a short period by the presence of humans in woody riparian habitats. However, the number of people engaged in this activity would be relatively few at any given time, so the extent of disturbance would be negligible.

Yellow-billed cuckoos could be negatively impacted in the long term by the decline in condition and acreage of woody riparian habitats in localized areas of the national forest.

If large numbers of elk did not migrate outside the Jackson Hole area, yellow-billed cuckoos on BLM lands and private lands in the Jackson Hole area could be negatively impacted. Without supplemental winter feeding on the refuge, elk would likely forage more often on private lands, which could result in further habitat degradation, reduced residual vegetation, and loss of acreage in some areas.

If large numbers of elk did migrate outside Jackson Hole in the winter, yellow-billed cuckoos in the Green River basin could be negatively impacted in localized areas. Yellow-billed cuckoos in the Green River basin could be negatively impacted as a result of cottonwood and willow habitats experiencing higher levels of browsing, which could result in habitat degradation and loss of acreage in some areas.

*Conclusion*

Yellow-billed cuckoos on the refuge could potentially benefit under Alternative 2 due to less habitat being lost and a smaller decline in the condition of woody riparian habitat compared to Alternative 1. However, the effects would likely be negligible. In the park, yellow-billed cuckoos could benefit from increased habitat and improved condition of woody riparian habitat compared to Alternative 1. This alternative would not result in impairment of yellow-billed cuckoos in the park.

#### *Alternative 3*

*Analysis*

Yellow-billed cuckoos on the refuge could potentially benefit under Alternative 3, compared to Alternative 1, due to a major increase in willow habitat and no net loss of cottonwood habitat. An estimated 1,450 acres of suppressed willow plants currently in wet meadow habitat would recover to good and fair condition willow stands, and an estimated 220 acres of cottonwood habitat would not convert to other habitat types as a result of fewer browsing elk and bison on the refuge.

Yellow-billed cuckoos in the park could potentially benefit from increased acreage and improved condition of woody riparian habitats due to fewer elk summering in the park compared to current conditions and Alternative 1.

Yellow-billed cuckoos could potentially be negatively impacted in the long term by the decline in condition and acreage of woody riparian habitats in localized areas of the national forest.

The effects of Alternative 3 on yellow-billed cuckoos on BLM lands and private lands in the Jackson Hole area and in the Green River basin would be similar to Alternative 2.

*Conclusion*

Yellow-billed cuckoos on the refuge and in the park could be positively affected due to the improved condition and increased acreage of woody riparian habitat compared to Alternative 1. This alternative would not result in impairment of yellow-billed cuckoos in the park.

#### Alternative 4

*Analysis*

Yellow-billed cuckoos could benefit under Alternative 4, compared to Alternative 1, by an increase in willow habitat and a decreased loss of cottonwood habitat on the refuge. An estimated 250 acres of suppressed willow plants in the short term and an estimated 500 acres in the long term would recover to willow stands. In addition, only an estimated 150 acres of cottonwood habitat would convert to other community types, compared to an estimated 220 acres of cottonwood habitat under Alternative 1.

In the park, yellow-billed cuckoos could potentially benefit by negligible to minor improvements in condition of woody riparian habitats compared to Alternative 1.

Yellow-billed cuckoos could be negatively impacted in the long term by the decline in condition and acreage of woody riparian habitats in localized areas of the national forest.

*Conclusion*

Yellow-billed cuckoos on the refuge could be positively affected due to the improved condition and increased acreage of woody riparian habitat compared to Alternative 1. Yellow-billed cuckoos in the park would likely be positively affected due to negligible to minor improvements in woody riparian habitats compared to Alternative 1. This alternative would not result in the impairment of yellow-billed cuckoos in the park.

#### Alternative 5

*Analysis*

Yellow-billed cuckoos could benefit under Alternative 5, compared to current conditions and Alternative 1, by an increase in willow habitat and a decreased loss of cottonwood habitat on the refuge. An estimated 250 acres of suppressed willow plants would recover to willow stands in the short term and an estimated 500 acres in the long term. In addition, only an estimated 150 acres of cottonwood habitat would convert to other community types, compared to an estimated 220 acres of cottonwood habitat under Alternative 1.

Yellow-billed cuckoos in the park could potentially benefit by a negligible to minor degree due to improvements in the condition of woody riparian habitats, compared to current conditions and Alternative 1.

Yellow-billed cuckoos in the national forest would not be affected by Alternative 5 any differently than they have been in the recent past.

*Conclusion*

Yellow-billed cuckoos on the refuge could be positively affected due to the improved condition and increased acreage of woody riparian habitat compared to baseline conditions and Alternative 1. The effects of Alternative 5 on yellow-billed cuckoos in the park would likely be positive due to negligible improvements in woody riparian habitats compared to Alternative 1. This alternative would not result in the impairment of yellow-billed cuckoos in the park.

#### Alternative 6

*Analysis*

Yellow-billed cuckoos could potentially benefit under Alternative 6 on the refuge, compared to Alternative 1, by an increase in willow habitat. An estimated 1,450 acres of suppressed willow plants currently in wet meadow habitat would recover to good and fair condition willow stands, and an estimated 150 acres of cottonwood habitat would not convert to other habitat types due to fewer browsing elk and bison on the refuge.

Yellow-billed cuckoos in the park could potentially benefit from increased acreage and the improved condition of woody riparian habitats due to fewer elk and bison summering in the park compared to Alternative 1.

Yellow-billed cuckoos could potentially be negatively impacted in the long term by the decline in condition and acreage of woody riparian habitats in localized areas of the national forest due to more elk browsing on native winter range.

If large numbers of elk did not migrate outside the Jackson Hole area, yellow-billed cuckoos on BLM lands and private lands in the Jackson Hole area could be negatively impacted in localized ar-

eas. Elk that were no longer being fed on the refuge in the winter would likely forage more often on private lands compared to Alternative 1, and higher levels of browsing could result in habitat degradation, reduced residual vegetation, and loss of acreage in some areas.

If large numbers of elk did migrate outside the Jackson Hole area in the winter, yellow-billed cuckoos on federal, state, and private lands in other locations could be negatively impacted in localized areas. This could occur if cottonwood and willow communities experienced higher levels of browsing, resulting in habitat degradation and loss of acreage in some areas.

*Conclusion*

Yellow-billed cuckoos on the refuge and in the park could be positively affected due to the improved condition and increased acreage of woody riparian habitat compared to Alternative 1. This alternative would not result in the impairment of yellow-billed cuckoos in the park.

## Mitigation

Measures to mitigate adverse effects on yellow-billed cuckoos would be the same as those for avoiding or lessening adverse impacts to riparian and aspen woodland communities (see "Impacts on Habitat" in this chapter).

## Cumulative Effects

### *Transportation Improvements*

The reconstruction of 38 miles of U.S. 26/287 over Togwotee Pass would result in short-term disturbance and displacement of threatened and endangered species and could affect the movement of threatened and endangered species in the Buffalo Valley area. The total amount of habitat that could be disturbed for each threatened and candidate species is 275 acres for the grizzly bear and the gray wolf, 218 acres for the bald eagle, and 21 acres for the yellow-billed cuckoo. The potential displacement, movement barrier, and mortality impacts from highway construction for the gray wolf, the bald eagle, and the yellow-billed cuckoo would be similar to what currently occurs and is not expected to negatively affect these species. Additional retaining walls and guardrails could result in additional changes to grizzly movements but are not expected to negatively affect grizzly bear populations. By agreement with the U.S. Fish and Wildlife Service, the highway itself, with or without new construction, likely negatively affects individual grizzly bears already, and a biological opinion and incidental take permit will be required.

The planned highway improvements could disturb and displace threatened, endangered, and candidate species during construction. In the long term changes to the highway could decrease habitat and potentially increase mortality due to greater numbers of vehicle collisions with grizzly bears and wolves if traffic volumes increased. The highway improvement plan recommends reducing the posted speed limit from 65 to 55 mph, which might prevent at least some accidental deaths. Upgrading an existing highway is not expected to result in extensive effects in terms of blocking movement corridors.

Cumulative effects would not occur under Alternatives 1 and 5 considered in this environmental impact statement because elk distribution, movements, and mortality rates would remain similar to baseline conditions; therefore, the effects on grizzly bears, wolves, and bald eagles would remain similar to baseline conditions. Cumulative effects on grizzly bears, wolves, and bald eagles under Alternatives 2, 3, 4, and 6 would likely be negligible. Cumulative effects on the yellow-billed cuckoo would also likely be negligible given the small amount of habitat (21 acres) affected.

### *Federal Land Management Activities*

*Grand Teton National Park Fire Management*

Mechanical treatments could result in a small reduction in threatened and endangered species habitat, reduced habitat quality, and short-term disturbance effects that could displace animals near the Wildland Urban Interface (WUI) areas. However, these actions are not expected to adversely affect endangered or threatened species at a population level because habitat effectiveness in WUI areas and immediately surrounding areas has already been reduced. WUI areas represent a small part of the habitat available to park wildlife, and the vast majority of wildlife habitat in Grand

Teton National Park occurs outside developed areas.

Prescribed fire can be used to maintain and restore more diverse vegetative communities in landscapes where natural fire regimes have been disrupted. Prescribed fires could, in the short and long terms, alter plant communities and displace threatened or endangered species from some habitat areas, but the long-term effects could create vegetative diversity, thus improving foraging opportunities (grizzly bears and yellow-billed cuckoos) and nesting and migrating habitat (yellow-billed cuckoos).

Alternative 1 would not result in cumulative effects as a result of Grand Teton National Park fire management. Alternatives 2–6 would convert formerly cultivated areas in the southern portion of the park to native vegetation. These conversion activities could disturb and displace threatened or endangered species in the short term from nearby habitat and could add to short-term habitat losses caused by park fire management. These activities would likely affect few threatened or endangered species because they are widely dispersed in the park during the summer.

*Grand Teton National Park Recreation Infrastructure Improvements*

Potential construction of a multi-use trail extending from Moose to the north Jenny Lake junction would result in site-specific, temporary impacts along planned trail routes during the summer. The finished trail would attract additional recreationists along the Snake River corridor during the summer and possibly cross-country skiers in the winter. The range and specific details of the improvements and their effects are unknown at this time.

Improvements to the Gros Ventre campground would result in site-specific, temporary impacts during construction and would result in a minor increase in the number of summer campers and the potential for displacement of threatened or endangered species. These improvements would potentially increase disturbance to threatened or endangered species in summer and alter distribution and habitat use, although effects would likely be negligible because habitat effectiveness in these areas is already reduced.

Alternative 1, in combination with the effects of Grand Teton infrastructure improvements, would not result in cumulative effects. Alternatives 2–6 could result in additional displacement of threatened or endangered species as a result of greater human presence in southern portions of the park during conversion of formerly cultivated areas to native vegetation.

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

The *Temporary Winter Use Plan Environmental Assessment* identifies wolves and grizzly bears as the threatened and endangered species most likely to be affected by disturbance and displacement due to winter motorized recreation. Yellow-billed cuckoos have already migrated to their winter feeding grounds by the time that winter recreation begins. Oversnow motorized vehicles are not expected to disturb bald eagles in Grand Teton National Park or John D. Rockefeller, Jr., Memorial Parkway because the travel corridor does not closely follow the Snake River. Although most grizzly bears are in their dens by December 15 and most dens in the park are located in remote areas, grizzly bears that emerge from their dens prior to March 15 could be disturbed by winter recreational activities.

While the total number of oversnow vehicles allowed in the parks would approximate the historical average, all users would be led by professional guides trained in how to avoid causing wildlife displacement or stress, and familiar with likely wildlife locations along the road system. Under such conditions, recreational users would be less likely to interact with wildlife, causing less stress, less displacement, and fewer population-level impacts. The impacts would not be of sufficient magnitude to constitute impairment of threatened or endangered species.

No impacts to threatened or endangered species on adjacent lands outside the park units are anticipated. Because the selected alternative would allow a number of snowmobiles into the park that is near the historical average daily visitation, it is 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, and Alternative 4 in above-average winters, would not result in cumulative impacts to wolves and grizzly bears from planned winter use activities. Alternatives 2, 3, 4 in average or below average winters, and Alternative 6 would increase the number of elk on native winter range and the number of winter-killed elk carcasses. Grizzly bears and wolves feeding on these carcasses could be disturbed and displaced with greater frequency due to oversnow vehicles. Areas designated as crucial elk winter range would not be affected because closures would continue.

*Bridger-Teton National Forest Fuels Management Projects*

Bridger-Teton National Forest has identified 15 fuels reduction projects in the primary analysis area, and several others in the secondary analysis area in the upper Green River watershed. These projects would alter about 9,400 acres of national forest lands and could temporarily disturb and displace threatened or endangered species. In the long term, however, most of these projects would improve transition and winter habitats for ungulates, which would benefit threatened or endangered predator species that prey on elk and other ungulates. More diverse woody riparian areas would also benefit yellow-billed cuckoos. The bison and elk management alternatives considered in this environmental impact statement are not anticipated to result in cumulative effects on threatened or endangered species relative to the planned fuels management projects.

*Bridger-Teton National Forest Recreation Planning / Moose-Gypsum Projects*

The dispersed recreation camping site plan could result in beneficial cumulative effects to yellow-billed cuckoos due to improved nesting habitat in the Green River basin plus improved habitat on the refuge under Alternatives 3–6.

*BLM Snake River Resource Management Plan*

Greater public access or use in areas of sensitive wildlife habitats, including overnight camping, would likely increase the potential for more human / wildlife conflicts along the Snake River. Impacts to woody riparian habitat that yellow-billed cuckoos depend on could occur if livestock grazing was allowed by the acquiring or managing agencies or entities. The retention of conservation easements and continued management for open space and wildlife habitat would protect threatened and endangered species habitat. Pursuit of a long-term protective withdrawal to prohibit the staking and development of mining claims would also benefit yellow-billed cuckoos by preventing potential adverse impacts to foraging or nesting habitats.

Cumulative effects are not expected under Alternatives 1 and 5 because these alternatives would not affect the amount of browsing by elk in woody riparian habitats. Alternatives 2, 3, and 4 in average or milder than average winters, as well as Alternative 6, would increase elk distribution in some years and increase the potential for heavy browsing that could reduce the quality of habitat for yellow-billed cuckoos.

*Pinedale Anticline Oil and Gas Exploration and Development Project*

Oil and gas development activities in the Pinedale anticline project area are not likely to adversely affect the black-footed ferret, bald eagle, whooping crane, or Canada lynx; nor are they likely to jeopardize the mountain plover or the candidate swift fox, provided that surveys are conducted and that reasonable and prudent protective measures are implemented. The bison and elk management alternatives are not anticipated to result in cumulative effects on threatened or endangered species relative to the Pinedale anticline project.

#### Snake River Restoration Activities

The Snake River restoration project by the U.S. Army Corps of Engineers could impact habitat for various wildlife species, including the yellow-billed cuckoo, along the Snake River. This project would prevent further degradation of habitat and facilitate habitat recovery.

Cumulative effects are not expected under Alternatives 1 and 5 primarily because these alternatives would not increase or alter elk distribution and the potential for heavy browsing in woody riparian habitats. Alternatives 2, 3, and 4 in average or milder than average winters, as well as Alternative 6, would increase elk distribution in some or all years, with the potential for heavy

browsing in yellow-billed cuckoo habitat, which could offset the benefits of restoration.

#### *Population Growth and Private Land Development*

*Primary Analysis Area*

Projected population increases in both Teton and Sublette counties will continue to create development pressure for private land. Habitat loss, more encounters and conflicts between threatened / endangered species and humans, vehicle collisions, and changes to animal movements could occur.

The loss of woody riparian habitat under Alternatives 1 and 2, combined with loss of habitat to private development, would likely have negative cumulative effects on yellow-billed cuckoos. Although the amount of woody riparian habitat on the refuge would increase under Alternatives 3–6, the beneficial cumulative effects would be negligible when combined with the negative effects of loss of habitat on private lands.

Although the loss of habitat on some private lands would negatively affect threatened and endangered species, cumulative effects on wolves, grizzly bears, and bald eagles under all alternatives would not occur because the refuge and the park would continue to preserve approximately 358,000 acres of habitat, most of which would continue to be available to these species.

## MAMMALS

### OTHER UNGULATES

The analysis of potential effects of management alternatives on mule deer, moose, bighorn sheep, and pronghorn is of particular importance in this planning process because providing a refuge and grazing habitat for these other ungulate species are major purposes of the National Elk Refuge, and mule deer, moose, and bighorn sheep populations are declining in the Jackson Hole area (Minta and Campbell 1991; Brimeyer, pers. comm. 2003; Berger, pers. comm. 2004). Analyzing the potential effects on these species is generally important given the requirement to conserve all native wildlife species on national wildlife refuges and in national parks, as well as the requirement under the National Environmental Policy Act to analyze potential effects on affected resources.

The way that elk and bison are managed in Jackson Hole influences the health and viability of other ungulate species, especially mule deer and bighorn sheep. Where winter ranges overlap, elk and bison can outcompete mule deer and bighorn sheep (Murie 1951; Nelson 1982; Miller 2002).

#### Impacts of the Alternatives

##### *Impacts Common to All Alternatives*

*Habitat and Forage Competition Effects* — The distribution of elk, bison, and other ungulates overlaps extensively during summer and fall. However, the diets of elk and bison differ from the diets of mule deer and moose during these seasons (Nelson 1982; Miller 2002), and forage and habitat resources could be partitioned among elk, bison, mule deer, bighorn sheep, moose, and pronghorn in areas where their distributions overlap (Houston 1982). Elk primarily graze on grasses during summer and fall, and mule deer and moose primarily forage on forbs and browse during these seasons. Furthermore, forage used by mule deer and moose during summer and fall is not limiting. Although the distribution of bison also overlaps with the distribution of mule deer and moose in some areas during the summer and fall, habitat use and diet are substantially different.

Elk distribution and habitat use is substantially different than that by pronghorn and bighorn sheep, and the diets of elk and pronghorn are much different during summer and fall. Therefore, direct competition for forage is minimal. Although the distribution of bison overlaps extensively with the distribution of pronghorn during summer and early fall in the park, the diet of bison overlaps little with the diet of pronghorn. Bison primarily eat grass, and pronghorn primarily eat forbs during their stay in Jackson Hole. Furthermore, bison can enhance the availability and production of forbs for pronghorn in some locations (Houston 1982; Yoakum et al. 1996), although this has not been studied in the park. Therefore, differences in bison numbers among alternatives would likely not adversely affect pronghorn in Jackson Hole. The distribution of bison and bighorn sheep do not overlap during summer and fall.

Marshland habitat is not used by other large ungulates, except moose in some locations. However, the marshland habitat used by moose would not be affected by any of the alternatives.

The range of bighorn sheep in the park only minimally overlaps with the distribution and habitat use of elk, and there is little overlap in winter range. The distributions of bison and bighorn sheep do not overlap in the park. Therefore, none of the alternatives would affect bighorn sheep in the park.

*Effects of Documented Microparasitic Diseases* — Brucellosis is not expected to directly adversely impact populations of mule deer, whitetailed deer, pronghorn, moose, or bighorn sheep because serologic surveys for brucellosis in other ungulates have only found a fraction of a percent that were seropositive, and these species are likely dead-end hosts (Thorne et al. 1982, 1997b; Disease Expert Meeting 2002; Davis 1990a; Adrian and Keiss 1977; Foreyt, Evermann, and Heimer 1983).

Pasteurellosis has been observed in mule deer, pronghorn, and bighorn sheep and could have substantial impacts on bighorn sheep populations in some cases (Thorne et al. 1982; Peterson 2003). However, the potential for transmission of septicemic pasteurellosis from elk to these other ungulate species is unknown, but is likely low because behaviorally these species typically segregate or occupy different types of habitat and are rarely in contact with one another.

Although other wild ungulates (bighorn sheep, mule deer, pronghorn) may be susceptible to forms of necrobacillosis (Petersen 2003), these species are not expected to be impacted under any of the management alternative as a result of necrotic stomatitis (Disease Expert Meeting 2002).

*Effects of Documented Macroparasitic Diseases* — Psoroptic scabies is a condition found only in mammals. Scabies is widespread in Wyoming among free-ranging populations of bighorn sheep, Rocky Mountain bighorn sheep, whitetailed deer, and elk. Transmission from species to species does not occur (Murie 1951). Hence, other non-elk ungulate species, all other wildlife species, and livestock (Hepworth and Thomas 1962) would not be impacted by the presence of psoroptic mites in the Jackson elk herd under any of the alternatives.

Lungworm species are specific to their particular host species (Petersen 2003; Disease Experts Meeting 2002), and the risk of interspecies transmission is low. Therefore, other ungulates would not be affected by elk lungworms under any of the alternatives.

*Effects of Undocumented Viral Microparasites and Prion Diseases* — As previously discussed for elk, vesicular stomatitis is not likely to cause any impacts in ungulates under any of the alternatives (Disease Experts Meeting 2002). Foot-and-mouth disease and rinderpest are also not analyzed in detail because neither disease is present in the United States, and if they were introduced, the national response would be major and very aggressive (Disease Experts Meeting 2002).

Soil conditions do not appear to be conducive to maintaining the infectious anthrax endospores in the environment, as previously discussed for elk, so anthrax is not expected to measurably affect mule deer, moose, pronghorn, or bighorn sheep populations under any alternative. Risk of anthrax becoming established in Jackson Hole appears to be low under all alternatives.

Potential for other ungulates species to become infected by malignant catarrhal fever would be highest under Alternative 1 given the higher number of bison (followed by Alternatives 5, 4, 3, 2, and 6). However, because mule deer, moose, pronghorn, and bighorn sheep would rarely develop clinical signs and would rarely die (Heuschele and Reid 2001; Zarnke, Li, and Crawford 2002; Petersen 2003), populations of these species in the Jackson Hole area would be adversely affected to a negligible to minor degree at most under any of the alternatives.

Moose, bighorn sheep, and pronghorn would not be directly impacted by chronic wasting disease, if it became established in Jackson Hole, under any of the alternatives because they do not appear to be susceptible to the disease (Williams, Kirkwood, and Miller 2001).

*Effects of Management Actions* — Pronghorn and bighorn sheep would not be directly affected by hunting activities on the refuge or in the park, or

the elimination of hunting in the two areas, because they are not found in hunt areas during the hunting season.

Winter feeding operations and the elimination of winter feeding would not directly affect mule deer, moose, pronghorn, or bighorn sheep because they do not inhabit the feeding sites on the refuge.

#### *Alternative 1*

*Analysis*

*National Elk Refuge* — During the spring, summer, and fall a small number of mule deer can be found in the Gros Ventre Hills and along the Gros Ventre River, but this use of the northern end of the refuge appears to be depressed compared to historical use of the area. This situation would likely not change in the short term, but over the long term, as aspen stands continued to disappear, use of the northern refuge would likely decline further.

Moose have likely been most affected by the loss of more than 1,000 acres of willow habitat along lower Flat Creek on the refuge, a result of heavy annual browsing by elk in association with winter feeding. This willow habitat would not be restored under Alternative 1, and the feasibility of future restoration of willow habitat would decline substantially, permanently eliminating an estimated 1,500 acres of moose habitat. Moose numbers along the Gros Ventre River would not be affected in the short term because this habitat is not expected to change. Declining acreage of aspen on the Gros Ventre Hills over the long term could potentially negatively affect the moose population but probably only to a negligible extent due to the already poor condition of these stands. The degradation of 220 acres of cottonwood habitat along the upper portion of Flat Creek has reduced the amount of moose habitat on the refuge, but only to a negligible degree, and this would not change under this alternative.

Under Alternative 1, direct competition between elk, bison, mule deer, and moose for forage in sagebrush shrublands on the refuge would continue to be minimal or non-existent because few if any mule deer would continue to winter on the refuge and because moose use sagebrush shrublands during winter in the northern portion of the refuge where wintering use by elk and bison is minimal. The number of mule deer wintering on Miller Butte, the main wintering area on the refuge, increased to highs of about 100–110 during the mid-1960s, but steadily declined to less than 30 by 1990 (Matson 2000), and no mule deer have wintered on Miller Butte the last several years. USFWS and WGFD biologists feel that the decline and eventual disappearance of mule deer on the butte could have been due in part to a major decline in the condition of browse species, which has in large part been due to heavy elk browsing. As a general rule, elk outcompete mule deer on winter ranges that are limited in size and forage since elk are more opportunistic than mule deer in their diet selection, more easily digest low quality forage, and are more mobile (Wisdom and Thomas 1996). Nelson (1982) noted that mule deer may leave or avoid areas that are heavily used by elk even if forage was available. Elk are fed within ½-mile of the butte. Miller Butte was identified by Minta and Campbell (1991) as one of three important mule deer wintering areas in Jackson Hole, and the only one that occurs completely on federal land.

Up to a dozen mule deer winter on Boucher Hill above the fish hatchery and along the Gros Ventre River in some winters, although in some winters no deer winter in these areas. Although browse conditions appear to be better than they are on Miller Butte, they have also been adversely affected by elk due to the proximity to the feedgrounds on the refuge.

Direct competition between elk, bison, and wintering bighorn sheep for forage would continue to be minimal because few elk graze on the eastern side of Miller Butte, especially after winter feeding operations begin each winter. An average of 31 bighorn sheep have been observed on the refuge during the last five winters. It is anticipated that the refuge could continue to support 20–36 bighorn sheep or more each winter under Alternative 1. However, bison could increase grazing pressure on Miller Butte as their population continued to grow under this alternative, which could lower the carrying capacity for bighorn sheep.

Cultivated fields on the refuge would be anticipated to continue to receive only minimal use by pronghorn and mule deer, and this low level of use would continue. Most of this use occurs during the

summer when elk and bison are not on the refuge; therefore, increases in bison numbers would not affect the use of cultivated fields by ungulates during the summer unless the bison population grew so large that it was not possible to move all bison off the refuge during the summer. Under natural conditions the sagebrush shrubland and grassland habitat that occurred in areas that are now under cultivation likely contributed to a greater extent to sustaining populations of mule deer, moose, pronghorn, and possibly bighorn sheep.

While mule deer move from summer habitat to wintering areas about the same time as the refuge hunting season, elk hunting activities on the refuge could displace mule deer from parts of the northern end of the refuge. Deer movement off the refuge appears to roughly correspond to the initiation of elk hunting on the refuge (Brock, pers. comm. 2003). It does not appear that hunting activities have more than negligible or minor effects on moose distribution, survival, and production.

The fence along U.S. 26/89, which was constructed to block the movement of elk and bison onto the highway, would continue to also block the movement of bighorn sheep to East Gros Ventre Butte (just to the west of the refuge), thereby forcing them to remain on Miller Butte. Occasionally, bighorn sheep are observed pacing up and down the fence looking for a way to cross over to East Gros Ventre Butte. The fence could also block the movement of mule deer between East Gros Ventre Butte and Miller Butte.

*Grand Teton National Park* — Direct competition between elk and other ungulates for forage in riparian and aspen woodlands in the park occurs seasonally in localized areas. Elk and moose distributions overlap to a small extent during winter along the Buffalo Fork, Spread Creek, and Gros Ventre River, but the highest concentrations of elk are associated with upland sites (where willow and cottonwood are not present), and moose tend to concentrate in the bottoms (Singer and Zeigenfuss 2003). Although elk use some of the same areas where moose winter, competition between the two species for browse appears to be minor in most of the park. An exception is in the Elk Ranch reservoir area where elk that graze in surrounding upland areas spend much of their time in the willows. These situations would continue under Alternative 1.

A 2002 study by McCloskey and Sexton concluded that as much as half of the aspen habitat in the park could disappear in the long term, in part due to heavy browsing by elk, but primarily due to fire suppression and encroachment by conifers. The park's new *Fire Management Plan* (NPS 2004b) aims to ensure that, unless a natural result of plant succession, fire continues to play its role in influencing vegetation patterns on much of the park landscape. Under Alternative 1 it is likely that high numbers of elk would continue to be regularly sustained in Jackson Hole as a result of supplemental winter feeding, and heavy continued browsing by elk would contribute to the loss of aspen habitat for mule deer and moose. Willow and cottonwood habitats used by mule deer and moose do not appear to be heavily browsed by elk in the park; therefore, animals in these habitats would be affected to a negligible degree.

Direct competition between elk, bison, and other ungulates in agricultural, native grassland, and sagebrush shrubland habitats in the park appears to be minimal, except seasonally in localized areas. Previous agricultural lands in the park would continue to be minimally used by mule deer, moose, and pronghorn both in the short and long terms. The distribution of elk only minimally overlaps with the distributions of mule deer and moose in sagebrush shrubland and grassland habitats during winter; therefore, the opportunity for direct competition for forage would be localized and negligible. Elk do not appear to be damaging sagebrush or other shrubland habitats in the park.

The overlap between the distribution and dietary needs of bison and other ungulates during winter is even more limited; therefore, no more than a negligible amount of direct competition would occur. Overgrazing and wallowing by bison in localized areas, which would increase as the population continued to grow, could potentially affect forage availability for other ungulates, but the effects would be negligible relative to the amount of forage available in the park. For example, there is some evidence that plant species diversity is lower in bison wallows (Collins and Uno 1980, as cited in Shaw 1996).

The elk herd reduction program in the park does not appear to adversely impact mule deer and moose populations, although hunting could have short-term effects on the distribution and habitat use of mule deer. The number of deputized hunters involved and the intensity of hunting activities can be high in some park areas. To the extent that mule deer prematurely left the refuge and park for their wintering grounds, they would be more subject to harvest outside these two areas.

*Bridger-Teton National Forest* — On elk winter range in the national forest, elk compete directly for browse with mule deer and moose in riparian and aspen woodlands, and many years of high levels of browsing by elk and other ungulates has depleted available browse in some areas. Under baseline conditions, an estimated 2,900–5,200 elk would winter on native winter range (as compared to 4,400–7,900 during the last 15 years), and these elk would continue to contribute to the degradation of willow, aspen, and cottonwood habitat in the national forest, which would adversely affect mule deer and moose.

Under baseline conditions on elk winter range in the national forest, an estimated 2,900–5,200 elk would have the potential to compete directly for forage with mule deer, moose, and bighorn sheep in grassland, sagebrush, and other upland shrubland habitats. Elk could compete with mule deer and moose for browse such as bitterbrush, serviceberry, and sagebrush in a variety of habitats and areas. Elk also compete with bighorn sheep for bunchgrasses in localized areas in low-elevation bighorn wintering areas in the Gros Ventre River drainage, such as Crystal Creek, Red Hills, Lightning Creek, and Russold Hill (Brimeyer, pers. comm. 2003). On higher elevation bighorn winter ranges there is less potential for competition. Competition between elk and bighorn sheep could also occur in Curtis Canyon, which is adjacent to the refuge. It is not clear whether or how this competition is affecting mule deer, moose, and bighorn sheep populations, but the potential impacts would continue in the long term. Bison do not appear to be competing with other ungulates for forage in the national forest, except possibly to a negligible degree on south- and west-facing slopes immediately east of the refuge and park.

*Other Lands* — On BLM and private lands in the Jackson Hole area there is minimal competition between elk and other ungulates for winter browse and forage in most locations. This low level of competition has been heavily influenced by supplemental feeding of elk on the refuge and state feedgrounds in the Jackson Hole area; elk would continue to be drawn away (or hazed) from private lands to the refuge (or a state feedground) under Alternative 1.

*Potential Effects of Bovine Tuberculosis and Paratuberculosis* — Mule deer, moose, and bighorn sheep are susceptible to paratuberculosis, and most if not all are susceptible to bovine tuberculosis (Williams 2001; Petersen 2003). If these diseases became established in the Jackson elk and bison herds, the risk of transmission to other ungulates under Alternative 1 would continue to increase over the long term as prevalence and the number of clinical cases increased, which is expected due to high concentrations of elk and bison on the refuge. Although the majority of infected animals do not develop clinical symptoms, those that do eventually die (Williams 2001). Because mule deer and moose are not unnaturally concentrated in the study area, the disease would not likely become self-sustaining in the populations. If the winter feeding of elk and bison and no population control of bison on the refuge continued after tuberculosis or paratuberculosis became established in the herds, the elevated prevalence in the herds would provide a continual source of infection for mule deer, moose, and bighorn sheep. However, occurrences of mule deer and moose developing clinical symptoms and eventually dying from the disease would likely not be high enough to markedly affect the populations. However, the more gregarious nature of bighorn sheep and a greater propensity for bighorn sheep to maintain the disease (Williams 2001), could result in bighorn sheep being adversely affected by an outbreak of these diseases in the elk and bison herds.

*Potential Effects of Chronic Wasting Disease* — Based on current information, only elk, mule deer, and white-tailed deer are susceptible to chronic wasting disease, which is always fatal (Williams and Miller 2002). Given the current pattern and rate of spread of chronic wasting disease in Wyoming, the likelihood of the disease reaching Jackson Hole is high.

Transmission of chronic wasting disease appears to be related to the density of susceptible hosts. Environmental contamination could potentially be another key mode of transmission, which can be affected by animal density as well as duration and repetition of use. The introduction of chronic wasting disease into the mule deer population in the Jackson Hole area would have an adverse impact on the population, irrespective of elk management in Jackson Hole. The prevalence of chronic wasting disease in infected mule deer herds in southeastern Wyoming and north-central Colorado can be as high as 15%. Modeling suggests that chronic wasting disease in free-ranging mule deer associated with free-ranging, non-fed elk could have detrimental impacts to mule deer populations (M. W. Miller et al. 2000; Gross and Miller 2001). The elk population in the area of the subject population of mule deer had a prevalence of less than 1% (i.e., prevalence in elk likely had a relatively minor influence on the mule deer population). The artificially high concentrations of large numbers of elk on the same ground for several months each year under Alternative 1 would likely lead to a prevalence level somewhere between that observed in non-fed elk populations (1%–4%) and that found in game farms (up to 90%). This assumes that winter feeding would continue each winter and that high elk numbers would be maintained even after chronic wasting disease was discovered in refuge elk. If the prevalence of chronic wasting disease in refuge elk approached levels recorded on infected game farms, this could result in a prevalence level in mule deer that would exceed the level that would occur if elk were not fed on the refuge. It is possible that a high prevalence of chronic wasting disease in elk could result in increased transmission from elk to mule deer and/or increased environmental contamination, which could potentially increase the prevalence in mule deer. Conversely, it is also possible that an elevated prevalence in elk would have relatively little effect on the prevalence in mule deer. Alternative 1 would rank highest in the risk of potential adverse impacts to the mule deer herd and would be similar to Alternative 5 (see Table 4-6).

*Conclusion*

Alternative 1 would continue to limit the ability of the Jackson mule deer population to recover due to (1) continued degradation and loss of key habitats on the refuge and in the park, (2) a high level of competition for forage on the refuge, and (3) potential disease risks associated with the high concentrations of elk and bison that would occur nearly every year under this alternative (e.g., chronic wasting disease, tuberculosis). Alternative 1 would also continue to contribute to the decline in moose habitat in the Jackson Hole area, although only to a minor degree, due to the continued degradation and loss of riparian and aspen woodland habitat on the refuge and in the park. Elk would continue to compete directly with bighorn sheep for forage on the refuge, and it is possible that bison could begin competing with bighorn sheep in the long term as the bison population continued to grow. The fence along U.S. 26/89 would continue to restrict bighorn sheep movements, but long-term impacts would likely be minor. Due to continued large concentrations of elk on refuge feedlines and growing numbers of bison on feedlines, the potential for mule deer and moose populations to be infected by a non-endemic infectious disease that was transmitted from the elk or bison herds would increase. Alternative 1 would not impair mule deer, moose, bighorn sheep, or pronghorn populations in the park.

#### *Alternative 2*

*Analysis*

*National Elk Refuge* — In the short term (within the next 15 years) under this alternative, competition between elk and other ungulates in willow, aspen, and cottonwood habitats on the northern part of the refuge and eastern part of the park could be higher in some years soon after implementation of this alternative due to the elimination of elk hunting in these areas.

If elk in the Jackson elk herd unit did not begin wintering in the Green River basin, the degradation and loss of willow, aspen, and cottonwood habitat on the refuge would be similar to Alternative 1, although slightly less riparian and aspen woodland habitat would be lost under Alternative 2. Despite lower numbers of elk in some years, the elimination of winter feeding and hunting might not result in any measurable reductions in the use of woody vegetation by elk. It is likely that the refuge would not be able to winter all of the elk and bison that could potentially migrate to the

refuge in above-average and severe winters, which would result in more severe use of browse in some locations. In other years browsing pressure could be lower due to fewer animals and milder winters. On average, therefore, adverse impacts to mule deer and moose might not be substantially different than Alternative 1.

If large numbers of elk did begin wintering in the Green River basin and the Red Desert, willow habitat on the refuge could increase by an estimated 1,500 acres in the long term, which would benefit moose on the refuge by a moderate to major amount and would benefit the Jackson Hole moose population to a negligible degree. This increase in willow habitat on the refuge would offset the adverse impacts to moose associated with the loss of aspen habitat.

In the short term (within the next 15 years) competition between elk and other ungulates in sagebrush shrubland and grassland habitat on the northern part of the refuge and eastern part of the park could begin increasing within a few years of implementation due to the elimination of elk hunting in these areas. Otherwise, no measurable changes in competition would be anticipated in the short term.

Despite fewer elk and bison, direct competition between elk, bison, mule deer, moose, and bighorn sheep for forage in sagebrush shrubland and grassland habitat on the refuge would increase in many years over the long term due to the higher reliance of elk and bison on standing forage with the eventual elimination of winter feeding. No feeding of elk and bison (after 10–15 years), no irrigation, and no hunting on the refuge or herd reduction in the park would result in elk and bison being more widely dispersed on the refuge throughout more of the winter, which would result in a higher proportion of refuge elk and bison using sagebrush shrubland and grassland habitat in the northern portion of the refuge. In addition to increased competition for browse, Alternative 2 would probably also reduce the amount of sagebrush and other upland shrubs due to heavy browsing and hoof action in localized areas, which would further reduce the amount of browse available to mule deer and moose. However, periodic declines in elk numbers following above-average and severe winters (possibly as low as 1,200 elk) would provide periods when shrubs on Miller Butte and other areas could recover and increase production.

If large numbers of elk began wintering in the Green River basin and the Red Desert, direct competition of elk and bison with mule deer, moose, and bighorn sheep would be lower than the potential effects described above.

Converting cultivated fields on the refuge to native vegetation and eliminating flood irrigation could increase the use of these habitats by mule deer, pronghorn, and bighorn sheep in the long term as compared to Alternative 1.

To the extent that mule deer are being displaced from key habitats on the refuge and park under baseline conditions due to elk hunting on the refuge and the elk herd reduction program in the park, eliminating hunting in the two areas would benefit mule deer by reducing disturbance and movements. If mule deer are currently leaving the refuge and park prematurely due to hunting activities, which could lead to increased mortality (because deer can be legally harvested outside the refuge and park), then eliminating elk hunting would reduce this mortality factor.

The fence along U.S. 26/89 would continue to block the movement of bighorn sheep to East Gros Ventre Butte, thereby forcing them to remain on Miller Butte. The fence could also continue to block the movement of mule deer between East Gros Ventre Butte and Miller Butte. Removing the fence under this alternative would allow bighorn sheep to cross over to East Gros Ventre Butte. However, elk would also be able to cross, which would result in substantial competition for forage. Furthermore, removing the fence could increase mortality of bighorn sheep due to vehicle collisions.

*Grand Teton National Park* — Direct competition between elk and other ungulates for forage in riparian and aspen woodlands of the park could increase in localized areas during some years in the long term as the number of elk wintering on native range in the park increased due to the eventual elimination of winter feeding on the refuge.

Direct competition between elk, bison, and other ungulates in agricultural, native grassland, and

sagebrush shrubland habitats in the park during summer and fall would have the potential to decline to some degree due to the major reduction in elk numbers in some years and the major reduction in bison numbers in the park. Eliminating the elk reduction program in the park would result in elk, including elk from other segments, moving more slowly through grassland and sagebrush habitat in the park during fall and early winter, which could offset reductions in competition. However, these habitats receive little use by other ungulates during the fall. Converting agricultural lands to native vegetation would further reduce competition by increasing the amount of native grassland and sagebrush habitat.

More bison wintering in the park under this alternative, as compared to Alternative 1, would result in little or no competition with other ungulates because bison and elk would be the only grazing ungulates at lower elevations of the park during winter.

*Bridger-Teton National Forest* — Larger numbers of elk, as compared to Alternative 1, would use winter range in the national forest, which would increase already heavy browsing pressure on aspen, willow, cottonwood, and sagebrush shrubland habitats and would increase competition between elk and other ungulates, further contributing to degradation and loss of these habitats. Damage to vegetation caused by higher numbers of elk on native grasslands would also reduce the amount of forage available to other ungulates. Competition could also increase on higher elevation bighorn sheep winter ranges. Therefore, there could be adverse impacts to mule deer, bighorn sheep, and moose in the national forest. These impacts would be lessened substantially over the long term if large numbers of elk migrated to the Green River basin and the Red Desert.

*Other Lands* — On BLM and private lands in the Jackson Hole area, direct competition between elk and other ungulates for forage would increase in localized areas after winter feeding was eliminated on the refuge. On some lands grazing and browsing pressure by elk could be heavy, which would substantially increase the competition between elk, mule deer, and moose on private lands in Buffalo Valley, Jackson Hole, and possibly Hoback Canyon. If the fence along U.S. 26/89 was removed, browsing pressure on private lands on East Gros Ventre Butte and areas to the north and west would increase markedly. Aspen and cottonwood habitat on these private lands are already used by mule deer and moose; therefore, competition for forage would increase.

If large numbers of elk migrated to the Green River basin and the Red Desert in the long term, direct competition between elk and other ungulates for forage could increase in riparian and aspen woodland, agricultural, native grassland, and sagebrush shrubland habitats on federal, state, and private lands in the basin.

*Potential Effects of Bovine Tuberculosis and Paratuberculosis* — If tuberculosis or paratuberculosis became established in the elk and bison populations under Alternative 2 after elk and bison numbers on the refuge and park had already declined to anticipated levels and winter feeding had been eliminated, there would be a moderate reduction in the risk of these diseases being transmitted from elk and bison to other ungulates compared to Alternative 1 due to reduced prevalence. Because tuberculosis and paratuberculosis would likely not pose a major problem to mule deer and moose under Alternative 1, the reduced risk under Alternative 2 (similar to Alternative 6) would result in only negligible potential benefits to these two species. Of the alternatives being considered in this process, Alternative 2 would provide the least amount of risk to other ungulate species.

*Potential Effects of Chronic Wasting Disease* — Alternative 2 (and Alternative 6) would have the least potential for adversely impacting mule deer in the Jackson Hole area because fewer elk would winter on the refuge, eliminating artificial concentrations of elk. If chronic wasting disease became established after Alternative 2 was fully implemented, disease prevalence would likely be representative of other infected populations of elk, such as those in southeastern Wyoming and north-central Colorado. This would result in a lower chance, as compare to Alternative 1, that the prevalence of chronic wasting disease in mule deer in Jackson Hole would exceed the prevalence in other infected mule deer populations. This alternative, as well as Alternatives 3 and 6, would have the lowest level of potential adverse impacts to mule deer in the Jackson Hole area. Regardless

of how elk are managed in Jackson Hole, the mule deer population would still be adversely impacted by the introduction and spread of chronic wasting disease, but Alternatives 2, 3, and 6 would not add to the severity of the adverse impacts, in contrast to Alternatives 1, 4, and 5, which would add to the severity.

*Conclusion*

Of the alternatives being considered, Alternative 2 (together with Alternatives 3 and 6) would have the least amount of adverse impacts to other ungulates on the refuge, except that competition between bighorn sheep, elk, and bison could increase compared to Alternative 1. Alternative 2 (together with Alternative 6) would have the lowest risk of any of the alternatives in terms of the severity of an outbreak of a non-endemic infectious disease in elk and/or bison that could adversely impact the population health of other ungulates.

In the park aspen habitat would improve in many areas that are now being heavily grazed by elk. In areas where winter use by elk increased, competition with moose for browse could increase during some winters. Because of attempts to maintain natural densities of elk and bison, Alternative 2 (and 6) would have the lowest potential for adverse impacts to other ungulate populations in the park. Alternative 2 would not result in the impairment of park resources.

### *Alternative 3*

*Analysis*

*National Elk Refuge* — Compared to Alternative 1, elk numbers on the refuge would decline to a low enough level that willow habitat could increase by an estimated 1,500 acres in the southern part of the refuge in the long term, which would increase the amount of moose habitat by a major amount. Up to 1,000–2,000 elk on the refuge would maintain a high level of competition between elk and moose in the restored willow habitat, but there would be net benefit to moose. Similar to Alternative 2, the degradation and loss of aspen and cottonwood habitat on the refuge would be similar to Alternative 1, although slightly less riparian and aspen woodland habitat would be lost if elk in the Jackson elk herd unit did not begin wintering in the Green River basin and the Red Desert. Even if large numbers of elk began wintering in the Green River basin and the Red Desert, aspen habitat on the northern part of the refuge would continue to decline in condition and acreage due to a major reduction in the frequency of winter feeding and the closure of the part of the hunt zone.

Under this alternative competition between elk and other ungulates in some sagebrush shrubland, native grassland, and agricultural habitats in part of the hunt zone on the refuge and in the Blacktail Butte and Kelly hayfields areas of the park (Hunt Area 76) could begin increasing within a few years of implementation due to eliminating of elk hunting or the reduction program in these areas.

Competition from elk and bison with mule deer, moose, and bighorn sheep for forage in sagebrush shrubland and grassland habitat on the refuge would increase due to the higher reliance of elk and bison on standing forage due to a major reduction in winter feeding (similar to Alternative 2). No hunting on the part of the current hunt zone on the refuge and no irrigation (Option B of Alternative 3) would also contribute to elk and bison being more widely dispersed throughout more of the winter, impacting ungulates in more areas. Because there would be far fewer elk on the refuge, competition for browse could potentially be lower than under Alternative 1. If large numbers of elk began wintering in the Green River basin, direct competition between elk and mule deer, moose, and bighorn sheep would be lower than the potential effects described above.

Under Option A of Alternative 3 cultivated fields on the refuge would probably continue to receive only minimal use by pronghorn sheep and mule deer, and this low level of use would continue (similar to Alternative 1). Most of this use would occur during the summer; therefore, changes in elk and bison numbers on the refuge would not affect the use of cultivated fields by ungulates.

The effects of Option B on other ungulates with respect to restored cultivated fields would be similar to the effects of Alternative 2.

Maintaining the fence along U.S. 26/89 would continue to block the movement of bighorn sheep to East Gros Ventre Butte, thereby forcing them to

remain on Miller Butte. The fence would also continue to block the movement of mule deer between East Gros Ventre Butte and Miller Butte.

*Grand Teton National Park* — Many of the aspen stands that have been heavily browsed by elk would benefit from the major reduction in the Grand Teton segment of the elk herd. The park's new *Fire Management Plan* (NPS 2004b) aims to ensure that, unless a natural result of plant succession, fire would continue to play its role in influencing vegetation patterns on much of the park landscape. Under Alternative 3 fewer elk, and the park's fire management program, would contribute to less aspen habitat loss, with direct benefits to mule deer and moose. Direct competition between elk and other ungulates for forage in riparian and aspen woodlands in the park during winter would increase in localized areas if winter use of the park by elk increased as compared to baseline conditions and Alternative 1. The major reduction in winter feeding on the refuge could result in a larger proportion of park elk wintering off the refuge, including areas in the park. Even though there were far fewer elk in the park segment, use of the park by wintering elk could increase. This would in part be due to elk from the Yellowstone and Teton segments, which would remain high in numbers in many years, increasing their winter use of western parts of the park such as the Spread Creek/Uhl Hill area.

Direct competition between elk/bison and other ungulates in native grassland and sagebrush shrubland habitats in the park would likely not increase to any measurable degree despite the major reduction in winter feeding on the refuge because the number of elk in the park segment would decline by a major degree. Although the bison population would remain large and a larger number of bison would winter in the park, no other grazing ungulates (aside from elk) would winter in the same areas in the park.

To the extent that mule deer would be displaced from key habitats in the park compared to Alternative 1 due to eliminating the elk reduction program in the Blacktail Butte and Kelly hayfields areas would benefit mule deer by reducing disturbance and movements.

*Bridger-Teton National Forest* — Larger numbers of elk compared to Alternative 1 would use winter range in the national forest, which would increase already heavy browsing pressure on aspen, willow, and cottonwood, and sagebrush shrubland habitats, as well as competition between elk and other ungulates, further contributing to degradation and loss of these habitats. Damage to vegetation caused by higher numbers of elk on native grasslands would also reduce the amount of forage available to other ungulates. Competition could also increase on higher elevation bighorn sheep winter ranges. Therefore, mule deer, bighorn sheep, and moose in the national forest could be adversely affected. These impacts would be lessened substantially over the long term if large numbers of elk migrated to the Green River basin and the Red Desert.

*Other Lands* — On BLM and private lands in the Jackson Hole area the direct competition between elk and other ungulates for forage would increase in localized areas after winter feeding was reduced on the refuge. On some lands grazing and browsing pressure by elk could be heavy, which would substantially increase competition between elk, mule deer, and moose on private lands in Buffalo Valley, Jackson Hole, and possibly Hoback Canyon. Removing the fence along U.S. 26/89 this would likely markedly increase the amount of browsing pressure on private lands on East Gros Ventre Butte and areas to the north and west. Aspen and cottonwood habitat on these private lands are already used by mule deer and moose, and therefore, competition for forage would increase.

If large numbers of elk migrated to the Green River basin and the Red Desert in the long term, this could result in direct competition between elk and other ungulates for forage in riparian and aspen woodland, agricultural, native grassland, and sagebrush shrubland habitats on federal, state, and private lands in localized areas, resulting in degradation of habitat.

*Potential Effects of Bovine Tuberculosis and Paratuberculosis* — Potential effects of tuberculosis and paratuberculosis on mule deer, moose, and bighorn sheep, if the diseases became established in the elk and bison populations under Alternative 3, would be similar to those discussed for Alternative 2, except that the chances and extent of effects would be somewhat higher due to a larger number of bison and winter feeding during

severe winters. Under Alternative 3 there would be a moderately lower risk of the diseases being transmitted from elk or bison to other ungulate populations.

*Potential Effects of Chronic Wasting Disease* — Given the major reductions in elk numbers and concentrations on the refuge in the long term and the reduction of winter feeding to severe winters only, the adverse impacts associated with an outbreak of chronic wasting disease would be lower than under Alternative 1. If chronic wasting disease became established after Alternative 3 was fully implemented, the prevalence of the disease would likely be representative of other infected populations of elk, such as those in southeastern Wyoming and north-central Colorado. This would result in a lower chance, as compared to Alternative 1, that the prevalence of chronic wasting disease in mule deer in Jackson Hole would exceed the prevalence in other infected mule deer populations. Regardless of how elk are managed in Jackson Hole, the mule deer population would still be adversely impacted by the introduction and spread of chronic wasting disease, but Alternative 3 would not add to the severity of adverse impacts. The severity of impacts would be much less than under Alternatives 1, 4, and 5.

*Conclusion*

Of the alternatives being considered, Alternative 3 (similar to Alternatives 2 and 6) would have the least amount of adverse impacts to other ungulates on the refuge, except that competition between bighorn sheep, elk, and bison could potentially increase under these alternatives compared to Alternative 1. This alternative would have the second largest amount of riparian and aspen woodland habitat available to mule deer and moose on the refuge, especially if large numbers of elk began migrating out of the Jackson Hole area. Alternative 3 would have the third lowest risk of any of the alternatives in terms of the severity of an outbreak of a non-endemic infectious disease in elk and/or bison that could adversely impact the population health of other ungulates. High bison numbers under Alternative 3 would cause a comparatively higher potential of major adverse impacts to mule deer and moose if a disease such as bovine tuberculosis became established in the elk and/or bison herds (which would increase the potential risk of other ungulates being infected).

In the park aspen habitat would improve in many areas that are now being heavily grazed by elk. In areas where winter use by elk increased, competition with moose for browse could increase during some winters. Alternative 3 would not result in the impairment of park resources.

### Alternative 4

*Analysis*

*National Elk Refuge* — In the long term on the refuge the level of competition between elk, mule deer, and moose would increase due to increased use of the northern end of the refuge by elk in non-feed years (despite a moderate reduction in elk numbers) and the exclusion of nearly 1,000 acres of aspen habitat. Excluding ungulates from the exclosure would result in more browsing by ungulates outside the exclosure, which would directly increase competition and result in a more rapid degradation and loss of aspen stands in the long term as compared to Alternative 1.

Additionally, elk would be excluded from these large areas and migrating elk would be forced to move around the aspen exclosure, resulting in a higher level of browsing pressure by elk in nearby aspen and willow habitats and accelerating the rate of degradation and loss of these habitats. Although fewer bison would slow the decline of woody plant communities outside of exclosures on the refuge as compared to Alternative 1, impacts would continue to occur (primarily due to elk browsing). Therefore, the net effect on mule deer and moose would be detrimental as compared to Alternative 1. Adverse impacts to moose using the northern end of the refuge would not be as intense as the impacts to mule deer because the cottonwood community along the Gros Ventre River receives proportionally more use by moose than aspen communities, and the Gros Ventre cottonwood community would not be adversely impacted to any large degree.

Elk and bison would be more widely dispersed and would make greater use of standing forage and browse during non-feeding winters and for longer periods during winters when supplemental forage was provided. This would result in a

greater use of forage by elk and bison in sagebrush shrubland and grassland habitat in the northern part of the refuge. Actual impacts to mule deer would be negligible due to the low number of mule deer wintering on the refuge under baseline conditions.

Use of Miller Butte by elk would likely increase as compared to Alternative 1, which could adversely affect bighorn sheep and reduce the likelihood of mule deer resuming their use of Miller Butte as a wintering area. Because long-term bison numbers would be substantially lower under Alternative 4 than under Alternative 1, Alternative 4 could potentially result in less competition between bison and bighorn sheep on Miller Butte. Increased forage production in cultivated fields would help offset any increased use of Miller Butte by elk and bison under Alternative 4.

The increase in forage production in areas newly equipped with sprinkler irrigation systems on the refuge would not affect other ungulates to any measurable degree because pronghorn generally do not use meadows and pastures that produce tall grasses, bighorn sheep do not use cultivated fields, and the vegetation that would be encouraged in these fields is not favored by mule deer and moose. Changes in elk and bison numbers on the refuge would not affect the use of cultivated fields by ungulates because most of the use these fields receive from other ungulates occurs when elk and bison are not present.

Disturbance effects of hunting on mule deer and moose on the northern portion of the refuge and the eastern side of the park would be similar to Alternative 1. It is possible that mule deer have been displaced from preferred habitats on the refuge and in the park and that some mule deer leave the refuge and park prematurely, which could increase the harvest of refuge and park deer. It does not appear that hunting activities have more than negligible or minor effects on moose distribution, survival, and production. Pronghorn and bighorn sheep would not be affected.

The fence along U.S. 26/89 would continue to block the movement of bighorn sheep to East Gros Ventre Butte, thereby forcing them to remain on Miller Butte. The fence would also continue to block the movement of mule deer between East Gros Ventre Butte and Miller Butte.

*Grand Teton National Park* — It is not clear whether Alternative 4 would have a net beneficial or detrimental effect on mule deer and moose in the park. The number of elk in the park herd segment would decline to an estimated 1,300–1,600, which would reduce direct competition and heavy browsing of woody vegetation in riparian and aspen woodlands. As previously described, the park's new *Fire Management Plan* (NPS 2004b) aims to ensure that, unless a natural result of plant succession, fire would continue to play its role in influencing vegetation patterns on much of the park landscape. Under Alternative 4 fewer elk, and the park's fire management program, would contribute to less aspen habitat loss, with direct benefits to mule deer and moose.

Direct competition between elk, bison, and other ungulates on agricultural lands, native grassland, and sagebrush shrubland habitats in the park during summer and fall would decline by a negligible degree as a consequence of moderately reducing elk numbers and substantially reducing bison numbers, and because only a minor amount of competition occurs at present due to differing habitat and dietary requirements. Converting agricultural lands to native vegetation would further reduce competition by increasing native grassland and sagebrush habitat. This would primarily benefit pronghorn in the short term due to the conversion of nonnative grassland habitat to native grassland habitat, which would include a diversity of forbs. As bitterbrush, sagebrush, and other shrubs increased in cover and height, mule deer and moose would begin to benefit.

*Bridger-Teton National Forest* — Larger numbers of elk would use winter range in the national forest, which would increase already heavy browsing pressure on aspen stands. The increase in elk use of winter range would be less under this alternative than under Alternatives 2 and 3; therefore, the net benefits to other ungulates would be slightly higher. Larger numbers of elk using native winter range in the Buffalo Valley area and the Gros Ventre River drainage, as compared to baseline conditions and Alternative 1, would increase competition between elk and moose for browse in willow and cottonwood habitats and would contribute to further degradation and loss of these habitats, but the increase would be negligible or minor (similar to Alternatives 2 and 3). Therefore, impacts to mule deer and moose

using willow and cottonwood stands (as opposed to aspen stands) in the national forest would be adverse.

Competition between elk and moose might also increase in areas supporting bitterbrush and other upland shrub species in the Gros Ventre River drainage and Buffalo Valley. Damage to vegetation caused by higher numbers of elk on native winter range would also reduce the amount of forage available to other ungulates. It is not clear whether the moderate reduction in winter feeding, a moderate reduction in elk numbers on the refuge, and a major reduction in bison numbers would result in increased or decreased use of south- and west-facing slopes immediately east of the refuge.

*Other Lands* — On BLM and private lands in the Jackson Hole area direct competition between elk and other ungulates for forage could increase in localized areas. It is not anticipated that many elk would leave the refuge in winter because elk and bison numbers would be reduced, they would be fed an estimated 4–5 winters out of 10 on average, and sufficient standing forage would be available to them in average and below-average winters. Potential adverse impacts on riparian and aspen woodlands on BLM and private lands would be considerably less than the effects of Alternatives 2 and 3, but could be slightly higher than those of Alternative 1.

*Potential Effects of Bovine Tuberculosis and Paratuberculosis* — If bovine tuberculosis or paratuberculosis became established in the elk or bison population under Alternative 4, the potential adverse impact to other ungulates would be lower by a negligible to minor extent, as compared to Alternative 1. This would be due to the minor to moderate reduction in elk numbers, a major reduction in bison numbers, and reduced winter feeding to an estimated 4–5 winters of 10. Potential adverse impacts to other ungulates would be higher under Alternative 4 than under Alternatives 2, 3, and 6, but less than under Alternatives 1 and 5.

*Potential Effects of Chronic Wasting Disease* — Alternative 4 would lower the potential adverse impacts associated with chronic wasting disease, if it became established in the Jackson Hole area, as compared to Alternative 1. However, because large numbers of elk would continue to winter on the refuge (4,000–5,000 compared to 5,000–7,500 under Alternative 1) and because winter feeding would continue in about half the winters, potential adverse impacts would not be reduced nearly to the extent that they would be under Alternatives 2, 3, and 6. The prevalence of chronic wasting disease in elk would likely be between prevalence under Alternatives 1 and 3, as would potential impacts to mule deer.

*Conclusion*

Alternative 4 would be more detrimental to mule deer, moose, and bighorn sheep on the refuge than Alternative 1 and possibly more detrimental than any other alternative. Alternative 4 would result in a higher level of adverse impacts to mule deer and moose because it would immediately exclude nearly 1,000 acres of aspen habitat from use by mule deer and moose, and it would accelerate the degradation of habitat and increase competition for browse outside the exclosure. The potential adverse impacts of some diseases (e.g., chronic wasting disease) to mule deer would only be slightly lower under Alternative 4 than under Alternative 1, but higher than under Alternatives 2, 3, and 6. Competition between elk, bison, and other ungulates on Miller Butte could potentially be higher than baseline conditions, but would be lower than under Alternative 1 if the burgeoning bison population under that alternative began grazing on Miller Butte.

It is not clear whether Alternative 4 would have a net beneficial or detrimental effect on mule deer and moose in the park. However, the changes would be negligible to minor. Alternative 4 would not result in the impairment of other ungulate populations in the park.

#### Alternative 5

*Analysis*

*National Elk Refuge* — In the long term aspen habitat outside the exclosure on the refuge would disappear at a faster rate than they would under Alternative 1 because the exclosure would concentrate browsing in other areas. As aspen habitat became more and more scarce, direct competition between elk, mule deer, and moose would

increase until aspen habitat outside the exclosure was no longer available.

Similar to Alternative 4, the condition and amount of willow, aspen, and cottonwood habitat available to mule deer and moose on the refuge under this alternative would decline faster than under Alternative 1, despite the major improvement in the condition of willow and aspen stands inside exclosures on the refuge, because these areas would not be available to mule deer and moose. Elk would also be excluded from these large areas, and the aspen exclosure would force migrating elk around its periphery, causing a higher level of browsing pressure in nearby aspen and willow habitat, which would accelerate the rate of degradation and loss of these habitats. Increasing willow habitat by about 500 acres and cottonwood habitat by 100 acres on the refuge would not benefit moose because they would be excluded from these areas. Although the reductions in bison numbers would slow the decline of woody plant communities outside exclosures on the refuge to a small degree as compared to Alternative 1, impacts would continue to occur (primarily due to elk browsing). Therefore, the net effect on mule deer and moose would be adverse compared to Alternative 1. Adverse impacts to moose using the northern end of the refuge would not be as severe as the impacts to mule deer because the cottonwood community along the Gros Ventre River receives proportionally more use by moose than aspen communities, and the Gros Ventre cottonwood community would not be adversely impacted to any large degree.

The major reduction in bison numbers on the refuge (and no change in elk numbers under Alternative 5) would result in no more than a negligible increase or decrease in direct competition between elk, bison, mule deer, moose, and bighorn sheep for forage in sagebrush shrubland and grassland habitat on the refuge, as compared to baseline conditions. The winter diets of mule deer and moose do not overlap with the winter diet of bison. Under baseline conditions bison do not graze on Miller Butte, and the reduction in bison numbers under Alternative 5 would further ensure that bison would not graze on Miller Butte in the future (as compared to Alternative 1 under which bison grazing on the butte could increase substantially). Alternative 5 would not result in any measurable changes in competition between elk, bison, and bighorn sheep.

Similar to Alternative 4, the increase in forage production in areas newly equipped with sprinkler irrigation systems on the refuge would not affect other ungulates to any measurable degree. Pronghorn under baseline conditions are few in number and the amount of forage already available to pronghorn during summer months far exceeds the needs of the population. Furthermore, pronghorn generally do not use meadows and pastures that produce tall grasses. Thus, increasing the height and density of grass in cultivated fields would tend to discourage use by pronghorn. The cultivated fields that would be sprinkler irrigated have been infrequently used by mule deer and are not used by moose or bighorn sheep. The vegetation that would be encouraged in cultivated fields is not favored by mule deer or moose. Changes in elk and bison numbers on the refuge would not affect the use of cultivated fields by ungulates because most of the use these fields receive from other ungulates occurs when elk and bison are not present.

Disturbance effects of hunting on mule deer and moose on the northern portion of the refuge and the eastern side of the park would be similar to Alternative 1. Mule deer may have been displaced from preferred habitats on the refuge and in the park, and some mule deer could leave the refuge and park prematurely, which could increase the harvest of refuge and park deer. It does not appear that hunting activities have more than negligible to minor effects on moose distribution, survival, and production. Pronghorn and bighorn sheep would not be affected because they are not present in hunt areas when hunting is occurring.

The fence along U.S. 26/89 would continue to block the movement of bighorn sheep to East Gros Ventre Butte, thereby forcing them to remain on Miller Butte. The fence would also continue to block the movement of mule deer between East Gros Ventre Butte and Miller Butte.

*Grand Teton National Park* — Alternative 5 would have negligible beneficial effects on mule deer and moose in the park as compared to baseline conditions and Alternative 1 due to the minor reduction in elk numbers in the park. This could

negligibly reduce browsing pressure in riparian and aspen woodlands.

Direct competition between elk, bison, and other ungulates in agricultural, native grassland, and sagebrush shrubland habitats in the park during summer and fall would decline by a negligible degree because of a negligible to minor reduction in elk numbers and a major reduction in bison numbers, and because present competition is minimal due to differing habitat and dietary requirements. Converting agricultural lands to native vegetation would further reduce competition by increasing the amount of native grassland and sagebrush habitat. The conversion to native habitat would primarily benefit pronghorn in the short term due to the conversion of nonnative grassland habitat to native grassland habitat, which would include a diversity of forbs. As bitterbrush, sagebrush, and other shrubs increased in cover and height, mule deer and moose would begin to benefit.

*Bridger-Teton National Forest* — The downward trend in condition of riparian and aspen woodlands in the national forest would not be altered by this alternative, as the effects would be similar to Alternative 1. Elk would continue to compete directly for browse with mule deer and moose in riparian and aspen woodlands, and continued high levels of browsing by elk and other ungulates would continue to deplete available browse in some areas.

Competition between elk and other ungulates in sagebrush shrubland and grassland habitats in the national forest would not be altered by Alternative 5. The effects would be similar to Alternative 1. Elk would continue to compete directly for browse with mule deer and moose in riparian and aspen woodlands, and browsing by elk and other ungulates would continue to deplete available browse in some areas. Although there could be a large reduction in the amount of bison grazing on south- and southwest-facing slopes immediately east of the refuge, bison currently are not competing with other ungulates for forage on these slopes.

*Other Lands* — Competition between elk and other ungulates in riparian and aspen woodlands on BLM and private lands in the Jackson Hole area would continue to be minimal, as under Alternative 1.

No additional effects would be anticipated on BLM and private lands in the Green River basin and the Red Desert (similar to Alternative 1).

Competition between elk and other ungulates in sagebrush shrublands, grasslands, and agricultural habitats on BLM and private lands in the Jackson Hole area would continue to be minimal, as under Alternative 1.

*Potential Effects of Bovine Tuberculosis and Paratuberculosis* — If bovine tuberculosis or paratuberculosis became established in the elk or bison herd, impacts of Alternative 5 on the potential transmission to other ungulates would be lower by a minor amount due to fewer bison. The potential for the diseases to be transmitted from elk to other ungulates under Alternative 5 would be similar to that under Alternative 1. Potential adverse impacts to other ungulates would be higher than under Alternatives 2, 3, 4, and 6.

*Potential Effects of Chronic Wasting Disease* — Given the similarity in elk numbers and winter feeding practices on the refuge, Alternatives 1 and 5 would sustain a similar high potential for producing or facilitating high prevalence rates of the chronic wasting disease in elk and deer. If chronic wasting disease became established in Jackson Hole, the artificially high concentrations of elk would facilitate a higher prevalence of chronic wasting disease in the herd than occurs in non-fed populations. This would result in an elevated potential for transmission to mule deer and the potential for increased adverse impacts to the deer herd (see the potential effects of Alternative 1).

*Conclusion*

Alternative 5 would immediately exclude mule deer and moose from nearly 1,000 acres of aspen habitat and would accelerate the degradation of willow and aspen habitat outside the exclosures on the refuge as compared to Alternative 1. However, adverse impact would not be as large as they would be under Alternative 4. Competition between elk and other ungulates would not differ appreciably from the level of competition that would occur under Alternative 1.

Alternative 5 would have negligible beneficial effects on mule deer and moose in the park as com-

pared to baseline conditions and Alternative 1 due to the minor reduction in elk numbers in the park. This could potentially reduce browsing pressure in riparian and aspen woodlands by a negligible amount. Alternative 5 would be similar to Alternative 1 from the standpoint of an elevated potential of mule deer and moose populations being affected if a non-endemic infectious disease became established in Jackson Hole. Alternative 5 would not result in the impairment of other ungulate populations in the park.

#### *Alternative 6*

*Analysis*

*National Elk Refuge* — In the first few years of implementing this alternative, the level of competition between elk and other ungulates in willow, aspen, and cottonwood habitat at the north end of the refuge would increase somewhat, despite declining numbers of elk, because of the erection of the first aspen exclosures (totaling up to 600 acres). After five years, winter feeding would cease completely, a second 600-acre aspen exclosure would be constructed, and the northern portion of the refuge would be closed to hunting; these actions would contribute to higher levels of browsing by elk, especially if an elk hunt at the south end of the refuge forced animals north. However, the major reduction in elk numbers and dismantling of the first aspen exclosure (estimated to occur within 10 years) would mitigate adverse effects to some extent.

Elk numbers on the refuge would decline further as a result of above-average and severe winters, which would provide periodic relief to willow, aspen, and cottonwood habitat (thereby enhancing their health and productivity and reducing elk competition with mule deer and moose). After an estimated 25–30 years, all aspen habitat would again be available to mule deer and moose on the refuge. If good and fair condition aspen habitat was maintained in most aspen stands over the long term, it is possible that increased browse, along with elk numbers below 3,200 on the refuge, could mitigate the effects of eliminating winter feeding and closing part of the refuge to hunting.

In the short term habitat conditions within aspen stands outside exclosures would not change appreciably. In the long term most of the acreage of aspen habitat (about 1,850 acres) would be restored to Class I or II condition, which would benefit mule deer and moose. This contrasts with Alternative 1, where aspen habitat would continue to decline in condition and most stands on the refuge would eventually disappear. Alternative 6 would result in the largest amount of woody vegetation in healthy conditions and the largest amount of this habitat that would be available to mule deer and moose.

There would be few if any measurable changes in habitat conditions or competition between elk, bison, and other ungulates in sagebrush shrubland, grassland, and agricultural habitats on the refuge and park under this alternative.

Despite fewer elk and bison, direct competition between elk, bison, mule deer, moose, and bighorn sheep for forage in sagebrush shrubland and grassland habitat on the refuge would increase in many years over the long term due to the higher reliance of elk and bison on standing forage because winter feeding would be eliminated. No feeding of elk and bison (after 5–10 years) and no hunting on the northern fifth of the refuge would result in elk and bison being more widely dispersed throughout more of the winter, with a higher proportion of refuge elk and bison using sagebrush shrubland and grassland habitat in the northern part of the refuge. In addition to increased competition for browse, it would also be anticipated that Alternative 6 could result in a reduction in the amount of sagebrush and other upland shrubs due to overbrowsing and hoof action, which would further reduce the amount of browse available to mule deer and moose. Actual impacts to mule deer would be negligible due to the low number of mule deer wintering on the refuge under baseline conditions.

Once elk numbers had been reduced to a maximum of 2,400–2,700 animals, the overall use of Miller Butte by elk could be lower. While heavy use of shrubs by elk could occur in some years, the lower maximum number of elk under this alternative and periodic reductions in elk numbers after above-average and severe winters (down to as low as an estimated 1,200 elk due to higher mortality) would provide periods when shrubs could recover on Miller Butte and mule deer could winter on other areas on the refuge. Therefore, some improvement in habitat conditions on the butte and

lowered competition with mule deer for browse would be possible under Alternative 6.

Use of Miller Butte by bison would be higher, which in combination with continued use by elk (albeit possibly at lower levels in some years), could adversely affect bighorn sheep in some winters, as compared to baseline conditions. In most winters, a sufficient amount of forage would likely exist in areas used by bighorn sheep on the butte. Increased forage production in cultivated fields would help offset the increased use of Miller Butte by elk and bison under Alternative 6. As compared to Alternative 1 in the long term, competition between elk, bison, and bighorn sheep for forage on Miller Butte could be lower under Alternative 6 if large numbers of bison began grazing on Miller Butte under Alternative 1 (due to refuge staff no longer being able to control the distribution of the bison herd). If large numbers of elk began wintering outside of the Jackson Hole area, direct competition between elk, bison, mule deer, moose, and bighorn sheep could be lower than the potential effects described above.

Competition between elk, bison, mule deer, moose, and bighorn sheep for forage in sagebrush and grassland would not reach the level that it would under Alternative 2 (where elk numbers could be higher in some years and irrigation would be eliminated), but it could be higher than all other alternatives due to higher elk and bison numbers than under Alternative 3 and the lack of winter feeding. Effects of sprinkler irrigated fields would be similar to those of Alternative 4.

To the extent that mule deer are being displaced from key habitats on the refuge and park under baseline conditions due to elk hunting on the refuge and the elk herd reduction program in the park, the eventual elimination of hunting on part of the refuge and in the Blacktail Butte and Kelly hayfields area would benefit mule deer by reducing disturbance and movements.

Maintaining the fence along U.S. 26/89 would continue to block the movement of bighorn sheep to East Gros Ventre Butte, thereby forcing them to remain on Miller Butte. The fence would also continue to block the movement of mule deer between East Gros Ventre Butte and Miller Butte.

*Grand Teton National Park* — Although the number of elk in the park segment would be lower than the baseline level by a major amount, winter use by elk could increase after winter feeding on the refuge was eliminated and as a larger amount of potential winter habitat in the park was converted to early seral plant communities. More elk wintering in the park could increase direct competition with moose, but because elk numbers in the summer would be considerably lower than under Alternative 1, overall competition between elk and other ungulates in willow, aspen, and cottonwood habitats would be lower. Lower elk numbers in the park following above-average and severe winters would provide periods when aspen and other habitats could recover. In most areas of the park where the condition of aspen stands has been affected by heavy elk browsing, the condition of the stands would improve somewhat due to fewer elk in the park segment. Also, the park's new *Fire Management Plan* (NPS 2004b) aims to ensure that, unless a natural result of plant succession, fire would continue to play its role in influencing vegetation patterns on much of the park landscape. Benefits on mule deer and moose would likely be greater than under Alternative 1.

Direct competition between elk, bison, and other ungulates in agricultural, native grassland, and sagebrush shrubland habitats in the park during summer and fall would have the potential to decline to some degree due to the major reduction in elk and bison numbers in the park. The closure of the Blacktail Butte/Kelly hayfields area to the elk reduction program (and possibly elimination the program in the park) would result in elk, including elk from other segments, moving more slowly through grassland and sagebrush habitat during fall and early winter, which could offset the decline in competition to some extent. However, these habitats receive little use by other ungulates during fall. Furthermore, elk and bison have different habitat and dietary requirements than other ungulate species during winter. Converting agricultural lands to native vegetation would further reduce competition by increasing the amount of native grassland and sagebrush habitat.

Direct competition between elk, bison, and other ungulates in grassland and sagebrush shrubland habitats in the park could increase during winter in the long term due to the eventual elimination of winter feeding on the refuge and the resulting

increase in winter use of park habitats. This would result in competition between elk and moose for browse (e.g., bitterbrush) in the sagebrush shrubland habitat. More bison wintering in the park under this alternative, as compared to baseline conditions and Alternative 1, would result in little or no competition with other ungulates because bison and elk would be the only grazing ungulates at lower elevations of the park during winter.

*Bridger-Teton National Forest* — Larger numbers of elk would use winter range in the national forest, which would increase already heavy browsing pressure on aspen stands. More elk using native winter range in the Buffalo Valley area and the Gros Ventre River drainage would increase competition between elk and moose for browse in willow and cottonwood habitats, contributing to further degradation and loss of these habitats. Therefore, there could be a net adverse impact to mule deer and moose using willow and cottonwood stands (as opposed to aspen stands) in the national forest, assuming that elk numbers in the Jackson elk herd unit remained near the herd objective of about 11,000 animals.

Potential effects on mule deer, moose, and bighorn sheep in the national forest would be similar to those under Alternative 2. Because the number of elk on native winter range in the national forest would increase under Alternative 6, direct competition would increase between elk, mule deer, moose, and bighorn sheep in grassland, sagebrush, and other upland shrubland habitats, assuming that elk numbers remained near the elk herd objective of about 11,000 animals.

*Other Lands* — On BLM and private lands in the Jackson Hole area direct competition between elk and other ungulates for forage would increase in localized areas after winter feeding was eliminated on the refuge. On some lands browsing and grazing pressure by elk could be heavy, which would substantially increase competition between elk, mule deer, and moose on private lands in Buffalo Valley, Jackson Hole, and possibly Hoback Canyon.

If large numbers of elk migrated to areas outside Jackson Hole, this could result in an increase in direct competition between elk and mule deer and/or moose for forage on federal, state, and private lands in areas where elk began wintering.

*Potential Effects of Bovine Tuberculosis and Paratuberculosis* — If bovine tuberculosis or paratuberculosis became established in the elk and bison populations after Alternative 6 was fully implemented, there would be a moderate reduction in the risk of these diseases being transmitted from elk and bison to other ungulates compared to Alternative 1 and similar to Alternative 2. Although tuberculosis and paratuberculosis are typically not sustained in free-ranging populations of ungulates that are not artificially concentrated (Williams 2001), they have been sustained in some free-ranging situations (Peterson 2003). Nonetheless, it would be much less likely that these diseases would be sustained in the elk herd, and the prevalence in the bison herd would be much less under Alternative 6. Consequently, the herds would not provide a continual source of potential transmission to bighorn sheep on winter range. Because tuberculosis and paratuberculosis would likely not pose a major problem to mule deer and moose under Alternative 1, the reduced risk under Alternative 6 would result in only negligible potential benefits to these two species. Of the alternatives being considered, Alternative 6 would provide the least amount of risk to other ungulate species.

*Potential Effects of Chronic Wasting Disease* — Alternative 6 (and Alternative 2) would have the least potential for adversely impacting mule deer in the Jackson Hole area because of a low number of wintering elk on the refuge and the elimination of artificial concentrations of elk on the refuge, as described for Alternative 2.

*Conclusion*

Of the alternatives being considered, Alternative 6 (similar to Alternatives 2 and 3) would have the least amount of adverse impacts to other ungulates on the refuge, except that competition between bighorn sheep, elk, and bison could increase under these alternatives compared to baseline conditions. Alternative 6 (along with Alternatives 2 and 3) would have the largest amount of riparian and aspen woodland habitat available to mule deer and moose on the refuge, especially if large numbers of elk began migrating out of the Jackson Hole area. Alternative 6 (along with Alternatives

2 and 3) would have the lowest risk of any of the alternatives in terms of the severity of an outbreak of a non-endemic infectious disease in the elk or bison herd that could adversely impact the population health of other ungulates.

In the park aspen habitat would improve in many areas that are now being heavily grazed by elk, but some aspen stands could potentially degrade faster (e.g., in areas where winter use by elk would increase). In areas with more winter use by elk, competition with moose for browse could increase during some winters. Prescribed fire could offset increased levels of elk grazing in aspen habitat if aspen suckers were protected from ungulate grazing. While it is difficult to determine whether changes in habitat conditions and level of competition under Alternative 6 would result in a net improvement or detriment to mule deer and moose in the park, the changes would be negligible to minor. Because of attempts to maintain natural densities of elk and bison, Alternative 6 (together with Alternative 2) would have the lowest potential for other ungulate populations in the park to be infected by a non-endemic disease transmitted from elk or bison. Alternative 6 would not result in the impairment of park resources.

### Mitigation

In areas where elk are limiting the recruitment of willow, aspen, and cottonwood seedlings and suckers on refuge and national forest lands, exclosures could be used constructed or electric fences could be used during critical periods to allow the seedlings and suckers to reach heights that would enhance their survival. While costs could be high if this mitigation was used in conjunction with treatments in aspen habitats in the national forest (i.e., large areas), it might be necessary at least on a small scale near elk feedgrounds or on heavily used winter range. Alternatives 4–6 include long-term exclosures. Other efforts to restore willow and cottonwood habitat damaged by large numbers of elk wintering on native winter range in the Buffalo Valley area and Gros Ventre River drainage would benefit mule deer and moose in these areas.

To offset adverse impacts of elk on aspen habitat in the park, prescribed burning of large acreages of aspen habitat being encroached by conifer trees could be undertaken to restore fire's natural role. This could better maintain a natural diversity within and among aspen stands in the park and would benefit mule deer and moose.

To alleviate potentially higher levels of competition between elk, bison, and bighorn sheep on Miller Butte under alternatives that reduced the frequency of winter feeding on the refuge, exclosures or wing fences could be constructed.

To reduce the potentially significant adverse impacts on mule deer and moose from the introduction of a non-endemic infectious disease under alternative where winter feeding continued (thereby compounding the adverse effects that would occur if a non-endemic infectious disease was introduced), winter feeding could be immediately reduced by a major amount or eliminated, and/or elk and bison numbers could be reduced in order to reduce the potential of transmission. Reducing the potential for transmission would result in a lower prevalence in elk and bison, which would reduce the extent to which the disease can be transmitted to other ungulate species, which in turn could result in a lower prevalence in these other ungulate populations. These mitigation measures are addressed in Alternatives 2 and 3, although under these alternatives the measures are intended to be preventive, rather than reactionary.

Although stopping winter feeding and reducing elk numbers if chronic wasting disease was discovered in the elk population could alleviate some of the adverse impacts to mule deer, it would not be as effective as reducing winter feeding and elk numbers prior to an outbreak of chronic wasting disease. It takes more than 15 months to detect chronic wasting disease in mule deer (Williams et al. 2001) and presumably about the same amount of time in elk. Furthermore, the prevalence would be so low during the first few years, that the chance of detecting the disease would be low. This would give the disease at least a few years to spread, increase in prevalence, and become well established in the population before any action could be taken in response to detecting it.

The impact analysis conducted for each alternative assumes that winter feeding would already have been fully phased back to anticipated levels prior to any introduction of a non-endemic infec-

tious disease. It is quite possible that chronic wasting disease could become established in the elk and mule deer herds inhabiting the Jackson Hole area during the initial stages of implementation. Mitigation measures under this scenario could include the following:

- phase out winter feeding completely within two to four years
- reduce the population through public hunting, agency culling, or a combination of both
- depopulate the herds through agency culling

The effects of phasing winter feeding out within a few years as an emergency action would be similar to the effects described under Alternatives 2 and 3, except that hunting would be used in some alternatives to reduce numbers at the same time that winter feeding was being curtailed. If any of these options was implemented, the effects would materialize much quicker than identified under Alternatives 2 and 3. It is unlikely that winter feeding would be phased out without a concerted effort to reduce numbers and vice versa.

## Cumulative Effects

### *Transportation Improvements*

The reconstruction of U.S. Highway 26/287 would disturb about 117 acres of "crucial" moose habitat, 24 acres of moose seasonal range (Jackson herd), and 12 acres of seasonal mule deer habitat (Sublette herd) along the existing road corridor. The reconstruction might also increase ungulate mortality due to vehicle collisions as traffic volume grows. Along some portions of the highway retaining walls, guardrails, and passing lanes would create both short- and long-term barriers to movement. Upgrading the existing highway is not expected to result in extensive effects in terms of blocking migration routes or movement corridors. It is anticipated that cumulative effects on overall mule deer and moose herd dynamics would be negligible.

### *Federal Land Management Activities*

*Grand Teton National Park Fire Management*

Mechanical treatments could result in a small reduction in ungulate habitat, reduced habitat quality, and short-term disturbance that could displace animals in proximity to wildland urban interface (WUI) areas. However, these actions are not expected to adversely affect ungulates at a population level because WUI areas and their immediate vicinity already have reduced habitat effectiveness. WUI areas represent a small part of habitat available to park wildlife, and the vast majority of wildlife habitat in Grand Teton National Park occurs outside developed areas.

Prescribed fire could be used to maintain and restore more diverse vegetative communities in landscapes where natural fire regimes have been disrupted. Prescribed fires could, in the short and long terms, alter plant communities and displace individual ungulates from certain portions of habitat, but the long-term effects could create vegetative diversity that would benefit moose and mule deer.

Negative impacts due to the loss of habitat and inaccessible habitat on the refuge and in the park under Alternatives 1, 4, and 5 could be offset to some extent by improved habitat conditions for ungulates due to the park's fire management program. Alternatives 2, 3, and 6 would have beneficial cumulative effects due to improved habitat on the refuge, combined with improved habitat in the park as a result of the fire management program.

*Grand Teton National Park Recreation Infrastructure Improvements*

Potential construction of a multi-use trail extending from Moose to the north Jenny Lake junction would result in site-specific, temporary impacts along planned trail routes during the summer. The finished trail would attract additional recreationists along the Snake River corridor during the summer and possible cross-country skiers in the winter.

The trail construction phase would likely displace mule deer and moose within or near work areas in the short term and make habitat unavailable. If pathways were separate from existing roads, long-term impacts to mule deer and moose could include loss of habitat, loss of the use of habitat near the new pathways, and changes in movements and distribution. Improved human access to parts of the park could increase levels of disturbance to mule deer and moose and could alter distribution and habitat use. The range and spe-

cific details of the improvements are unknown at this time.

Improvements to the Gros Ventre campground would result in site-specific, temporary impacts during construction, with a minor increase in the number of summer campers and the potential for displacement of mule deer and moose. These improvements would potentially increase disturbance to moose and mule deer in summer and alter distribution and habitat use, although effects would likely be negligible because the areas already have reduced habitat effectiveness.

Negative impacts on mule deer and moose habitats on the refuge and in the park under Alternatives 1, 4, and 5 could be compounded to some extent by loss of habitat for mule deer and moose due to infrastructure improvements. The beneficial effects of improved habitat on the refuge under Alternatives 2, 3, and 6 could be offset by habitat being lost due to the park's infrastructure improvements, but the effects would likely be negligible.

*Bridger-Teton National Forest Fuels Management Projects*

Bridger-Teton National Forest has identified 15 fuels reduction projects in the primary analysis area and several others in the secondary analysis area. These projects would alter about 9,400 acres of national forest land and could temporarily diminish forage opportunities immediately after various fuel reduction treatments. In the long term, however, most of these projects would improve ungulate transition and winter habitats.

Long-term, enhanced forage in fuels reduction areas would benefit all ungulates. Because of reduced or eliminated winter feeding on the refuge, Alternatives 2, 3, and 6 would result in more elk wintering on native range and potentially heavy browsing in fuels reduction areas, reducing the amount of forage available to mule deer and moose.

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

The management projects planned in the secondary analysis area would alter existing ungulate habitat. The projects could temporarily diminish forage opportunities in some areas due to reductions in forage areas immediately after various fuel reduction treatments and increased trail opportunities. In the long term, however, the projects could result in enhanced forage opportunities for ungulates due to regeneration of nutrient-rich undergrowth. The benefits of increased forage for ungulates could be less for mule deer and moose under Alternatives 2, 3, and 6 if Jackson elk migrated to the Green River basin, increasing competition for forage that would result from the Moose-Gypsum project.

*BLM Snake River Resource Management Plan*

Greater public access could increase conflicts with mule deer and moose and negatively impact woody riparian habitats that provides browse for ungulates. Continued management of conservation easements for open space and wildlife habitat would help protect foraging habitat. Pursuit of a long-term protective withdrawal to prohibit the staking and development of mining claims would also benefit mule deer and moose by preventing potential adverse impacts to habitats.

Cumulative effects would not be expected under Alternatives 1 and 5 because competition between elk and other ungulates would not increase. Alternatives 2, 3, and 4 in average or milder than average winters, as well as Alternative 6, would increase elk distribution in some years, resulting in greater potential for competition between elk and other ungulates and possible cumulative effects on other ungulates along the Snake River.

*Pinedale Anticline Oil and Gas Exploration and Development Project*

Oil and gas development activities in the Pinedale anticline project area could impact crucial winter range for deer and antelope. Seasonal and location restrictions would protect wintering big game. Cumulative effects would not be expected under Alternatives 1 and 5 because these alternatives would not affect competition between elk and other ungulates. Alternatives 2, 3, and 4 in average or milder than average winters, as well as Alternative 6, would increase elk distribution in some years, resulting in greater potential for competition between elk and other ungulates in the secondary analysis area and increasing the

possibility for cumulative effects on other ungulates in the Pinedale anticline study area.

*Jonah Infill Drilling Project*

The pronghorn antelope is the only big game species that regularly inhabits the Jonah infill project area. The degree of habitat fragmentation within the project area at current levels is high and is expected to increase with the proposed project under any of the action alternatives. The proposed action for the Jonah infill drilling project would result in an estimated increase (over present conditions) of 16,200 acres of new initial disturbance, for a total of 20,409 acres of project-related surface disturbance. Cumulative effects would not be expected to occur under Alternatives 1 and 5 for bison and elk management because these alternatives would not affect competition between elk and other ungulates. Alternatives 2, 3, 4 in average or milder than average winters, as well as Alternative 6, would increase elk distribution in some years, raising potential competition between elk and other ungulates in the secondary analysis area and increasing the possibility for cumulative effects on other ungulates in the Jonah infill project area.

#### *Snake River Restoration Activities*

Restoration of the Snake River channel the U.S. Army Corps of Engineers could affect woody riparian habitat for a variety of wildlife species, including mule deer and moose along the Snake River. This environmental restoration project would prevent further degradation of habitat and facilitate habitat recovery.

Cumulative effects as a result of bison and elk management alternatives would not be expected under Alternatives 1 and 5 because these alternatives would not affect competition between elk and other ungulates. Alternatives 2, 3, and 4 in average or milder than average winters, as well as Alternative 6, would increase elk distribution in some years, raising potential competition for forage between elk and other ungulates along the Snake River and lessening the benefits of improved habitat.

#### *Population Growth and Private Land Development*

*Primary Analysis Area*

Projected population increases in both Teton and Sublette counties would continue to create a demand for private land development in these areas. Habitat loss, increases in other ungulate/human encounters and conflicts, vehicle collisions with mule deer and moose, and changes to movements could occur.

Some of the most important wintering area in Jackson Hole (East and West Gros Ventre buttes) occurs on private lands. This area is immediately adjacent to major developments such as residential and commercial areas that continue to grow. Furthermore, the encroachment of private development continues to be the largest threat to mule deer winter range on East and West Gros Ventre buttes (Clark and Campbell 1981; Minta and Campbell 1991). Few parts of this winter range complex are protected by conservation easements and by out-holdings of the National Elk Refuge (across the highway from the refuge on East Gros Ventre Butte), which would provide long-term protection to small portions of the winter range.

Proximity to high-density housing areas and highways has resulted in indirect harassment by people, disturbance and mortality caused by dogs, and vehicle-caused mortality along highways and roads (Clark and Campbell 1981; Minta and Campbell 1991). Ongoing home construction on top of East Gros Ventre Butte could increasingly affect use of east-facing slopes by mule deer. It is possible that residential development in Jackson Hole has cut off migration routes of mule deer between summer and traditional winter areas.

Another key factor affecting mule deer wintering in Jackson Hole is that habitat quality of winter ranges is in a deteriorated condition. Because most of the mule deer winter range in Jackson Hole is close to the town of Jackson and residential developments, and the majority of mule deer winter range on East and West Gros Ventre buttes is privately owned, there is a low probability that the habitat would be burned or otherwise treated in the future. Without such treatment, habitat would continue to decline in condition.

Additional development near or adjacent to the Snake River is subject to the Natural Resource

Overlay (NRO) zoning district requirements (see Chapter 1, "Reasonably Foreseeable Actions"), which will help sustain migration in these areas by protecting migration routes and crucial winter ranges. Residential development of platted and zoned parcels to the south and west of the Jackson Hole Airport, within the primary analysis area, has greatly reduced the potential for ungulate migration between Grand Teton National Park and habitat on private lands.

Two narrow corridors of open land near Gros Ventre Junction could sustain the major east-west migration in the Jackson Hole Airport area. The northernmost area is protected by conservation easements, while the narrow corridor to the south is partially included in the NRO district and appears to be a private open space component of the Bar-B-Bar Meadows subdivision. These protected lands could continue to support a migration corridor through the area, although it is not known whether there is sufficient habitat to sustain such a corridor for the long term.

Additional development on private lands in the Buffalo Valley area would be outside of or on the perimeter of the winter range for ungulates and is subject to the NRO district requirements. Such development, if it occurred, is not expected to adversely affect ungulate use of the winter range in the area.

Because elk would continue to be fed on the refuge under Alternatives 1 and 5, and under Alternative 4 in above-average and severe winters, competition between elk and other ungulates would not increase on native winter range. Alternatives 2, 3, and 4 in average or milder than average winters, and potentially Alternative 6, would increase elk distribution in some or all years. This, combined with human population growth and development, would likely affect increase competition between mule deer, moose, and elk.

*Secondary Analysis Area*

Within the secondary analysis area in Sublette County, ongoing and future subdivision and development of agricultural lands could disrupt migration routes and reduce the availability of ungulate winter range in the upper Green River valley. Many of the mule deer that summer in the Jackson Hole area winter in the Green River basin, and parts of the migration route are threatened by residential development in the Pinedale area (Madson 2001). Development or activities in these areas would not increase competition between other ungulates and 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). Under Alternatives 2, 3, and 6 the combination of Jackson elk migrating to the Green River basin and increased development in Sublette County would result in greater competition between elk and other ungulates for winter range.

Potential Jackson elk migration to the Green River basin under Alternatives 2 and 3 would help protect the corridor and would bring added recognition to the importance of the corridor, which would benefit mule deer. However, a large influx of elk would increase competition for browse. Under Alternative 4, no effort would be made to restore elk migrations to the Green River basin, but the protection of migration corridors for pronghorn and mule deer would be supported, which would benefit mule deer.

## Predators and Scavengers

In the study area elk are the primary prey of large predators, such as black bears, cougars, and coyotes. Scavengers such as coyotes, ravens, and magpies feed on dead elk and bison when carcasses are available. Therefore, predators and scavengers would be affected by changes in the number of elk and bison and their mortality rates. Factors that affect elk and bison numbers and distribution include a change in the population objectives of elk and bison on the refuge and in the park that would redistribute animals to other areas, a reduction in winter supplemental feeding on the refuge (which would also redistribute elk and bison to other areas and possibly increase winter mortality), and the introduction of new diseases, such as chronic wasting disease or tuberculosis.

Impacts on gray wolves, grizzly bears, and bald eagles are discussed under "Threatened, Endangered, and Species of Special Concern." Lynx, and wolverines are not expected to be affected by bison and elk management, and therefore, are not

analyzed. The effects of each alternative on black bears are expected to be generally similar to effects on grizzly bears, and the effects on coyotes similar to the effects on wolves.

## Impacts of the Alternatives

### *Impacts Common to All Alternatives*

*Long-tailed Weasels, Mink, Red Foxes, Striped Skunks, and Bobcats* — Red foxes and striped skunks are common predators that can thrive in a variety of habitats and feed on a variety of food sources. Bobcats and long-tailed weasels, although less common, can also live in various habitats and feed on numerous food sources, but tend to focus on small mammals and birds. Mink occur in marshes and along watercourses and feed on fish and small mammals. Accurate data on population numbers for these species is not available. They could feed on elk or bison carrion opportunistically, but ungulate carrion is probably a negligible to minor part of their diets. Long-tailed weasels, mink, red foxes, striped skunks, and bobcats are not addressed in detail because actions being considered in the alternatives would have negligible to minor effects on their population numbers if there are any effects at all.

*Disease Impacts* — If a new disease (e.g., bovine tuberculosis, paratuberculosis, or chronic wasting disease) was introduced into the Jackson Hole area and caused a moderate to major reduction in elk and/or bison numbers, predators and scavengers in general would benefit in the short term due to more vulnerable prey and more carcasses available for scavenging. In the long term predators and scavengers could be negatively impacted due to a decrease in available prey. The risk of this happening would increase in alternatives with high concentrations of animals, which would tend to foster the spread of an infectious disease.

The severity of impacts on predators and scavengers that could result from tuberculosis or paratuberculosis substantially decreasing the Jackson elk and bison populations would be greatest under Alternative 1, followed by Alternatives 5, 4, and 3, with the least risk under Alternatives 2 and 6 (approximate equal risk) (HaydenWing and Olson 2003). The severity of impacts from chronic wasting disease would be greatest under Alternatives 1 and 5 (approximately equal risk), followed by Alternatives 4 and 3, with the least risk under Alternatives 2 and 6 (approximate equal risk).

Predators and scavengers would not be impacted by contracting paratuberculosis, brucellosis, or chronic wasting disease under any of the alternatives because they are not known to be susceptible to these diseases (Williams 2001; Thorne et al. 1982).

If bovine tuberculosis became established in the Jackson Hole area, predators and scavengers might be able to contract the disease from elk and bison. Although individual animals might develop symptoms and die directly, the disease could not be sustained within the population and passed along to other members of the species (Roffe, pers. comm. 2002). There are no documented cases of predator and scavenger species in North America maintaining the disease within their populations (Clifton-Hadley et al. 2001).

*Direct Effects of Human Disturbance* — Some species of predators and scavengers, such as coyotes, ravens, and magpies, are attracted to the feedgrounds as a result of large concentrations of elk and bison. Animals new to the feeding operations might be wary at first, but they seem to habituate quickly. Therefore, predators and scavengers would be negligibly impacted by management activities associated with the supplemental feeding program in all alternatives in the short term and Alternatives 1, 3, 4, and 5 in the long term. Supplemental feeding on the refuge would be gradually phased out under Alternatives 2 and 6, which would eventually eliminate any possible disturbance effects of activities associated with winter feeding. Under Alternative 3 feeding would only occur in the severest winters.

Predators and scavengers would be impacted to a negligible degree by activities associated with elk and bison hunting in all alternatives except 2. Hiking and horseback riding and the firing of rifles in the northern portion of the refuge and the eastern side of the park could temporarily disturb predators and scavengers in the immediate area. However, these impacts would not affect survival and reproduction. The long-term net effect of adding a bison hunt and reducing elk hunting opportunities would be a reduction in human disturbance during the hunting season under Alternatives 3, 4, and 6.

Under Alternative 2 no hunting on the refuge or an elk herd reduction program in the park would be allowed. Therefore, predators and scavengers would not be disturbed by associated human activities.

Alternatives 1, 3, 4, 5, and 6 include cultivation of 2,400 acres on the refuge and either flood irrigation or flood and sprinkler irrigation. Under Alternatives 2 through 6, 4,500 acres of agricultural lands in the park would be restored to native vegetation, which could take up to 30 years to complete. Farming and irrigation management practices on the refuge and restoration activities on the agricultural lands in the park could disturb predators and scavengers during the day, but impacts would be negligible in the short and long terms.

Under Alternative 2 and Option B of Alternative 3 farming and irrigation practices would be eliminated on the refuge, so less human disturbance would occur on the southern part of the refuge, with negligible, beneficial impacts.

*Impacts on Other Lands* — Predators and scavengers on other federal and private lands in Jackson Hole and the Green River basin would not be affected or would be affected to a negligible degree by actions that are being considered in this planning process. An exception to this could occur under Alternatives 2, 3, and 6. If elk spent more time on BLM lands in Jackson Hole or if large numbers of elk migrated to the Green River basin and the Red Desert, predators and scavengers in these areas could benefit from more available prey animals and more winter-killed carcasses.

#### *Alternative 1*

*Analysis*

Black bears scavenge ungulate carcasses and prey on elk calves. They occur in the park and may rarely be seen on the refuge. While black bear numbers are unknown, their population is considered stable.

Cougar numbers are estimated at 28 resident adults, and cougars have been regularly sighted on the refuge and in the park. They prey primarily on large ungulates and could be affected by changes in elk numbers.

The most common predators and scavengers on the refuge and in the park are ravens, magpies, coyotes, and badgers. They prey on small mammals and birds, as well as scavenge elk and bison carcasses and gut piles left by hunters. Coyotes also prey on elk calves. Ravens, magpies and coyotes often occur in large concentrations on the refuge feedgrounds in the winter and would be affected by changes in supplemental feeding and hunting. Badgers could be affected by habitat changes in native grassland and sagebrush shrubland communities. Golden eagles are also occasionally seen scavenging on ungulate carcasses.

*Elk and Bison Numbers and Distribution* — Predators and scavengers could potentially benefit from a growing bison population, and eventually bison would become so numerous that at some point they could disperse outside the park and the refuge into the national forest or private lands, making them available for hunting. The resulting gut piles and carcass remains could benefit coyotes, ravens, golden eagles, magpies, and black bears. This situation could also lure bears and coyotes into closer proximity to people, resulting in increased human-caused mortality; however, the effect on a species population would be negligible.

Black bears and coyotes would continue to benefit by preying on elk calves in the spring and scavenging elk carcasses opportunistically. Since the numbers of elk would remain similar to baseline conditions, these predator species would not be impacted by elk management under Alternative 1 any more than they have been affected in the recent past.

Cougars would not be affected by elk management in the short or long terms anymore than they have been affected in the recent past. Baseline elk numbers are considered sufficient to sustain a healthy population of cougars. A study in Yellowstone National Park and Gardner Basin analyzed kills by cougars, with an ungulate being killed on average every 9.4 days (Murphy 1998). Annual predation rates ranged from a combined total of 34 elk and mule deer killed by adult female cougars without cubs to 52 elk and mule deer killed by family groups. Elk were the most important prey item, comprising approximately 61% of 302 confirmed and probable cougar kills. Approximately 68% of the elk killed were calves.

*Effects of Habitat Changes* — Badgers on the refuge could benefit compared to baseline conditions because their native grassland and sagebrush shrubland habitats would expand by a negligible amount in the short term and a minor amount in the long term. Badgers in the park and on other federal and private lands in Jackson Hole would not be affected by actions under Alternative 1.

*Conclusion*

Compared to baseline conditions, many predators and scavengers on the refuge and in the park could benefit from increased mortality of growing numbers of bison due to natural mortality. Predators and scavengers would not be affected by elk numbers and distribution any more than they have been in the past. Badgers could benefit from the expansion of native grassland and sagebrush shrubland habitats on the refuge but would not be affected in the park any more than they have been in the past. This alternative would not result in the impairment of predators and scavengers in the park.

### Alternative 2

*Analysis*

*Elk and Bison Numbers and Distribution* — After cessation of bison fertility control and in the absence of hunting on the refuge and in the park, elk and bison populations would likely go through cycles, increasing in mild years and experiencing high mortality during severe winters. Under Alternative 2 annual winter mortality for elk is estimated to range between 1% and 20%. The higher the mortality, the more carcasses would be available for scavenging by predators and scavengers. If fertility control was not successful in reducing bison numbers to levels that the habitat could support, reductions in winter feeding (and higher mortality) would be used to reduce their numbers on the refuge, which would greatly benefit scavengers in the short term.

Many predators and scavengers would be positively impacted in years when bison and elk numbers rose and negatively impacted in years when they fell. This would be particularly true in the park where elk numbers could fall to as low as 600 in some years. Elk and bison numbers would be lower than under baseline conditions after severe winters and lower than the short and long-term projections for this alternative initially as a result of bison fertility control and stopping supplemental feeding and farming on the refuge. The bison and elk herds would also be more distributed throughout winter range than under Alternative 1.

In some years fewer elk and bison under Alternative 2 could affect scavengers, such as coyotes, black bears, golden eagles, magpies, and ravens. In the long term scavengers might be adversely affected in mild winters because even though the mortality rate could be comparable to baseline conditions, there could be fewer elk and bison, and they would be distributed more widely throughout the Jackson Hole area, making carcasses harder to find compared to baseline conditions and Alternative 1. However, winter mortality of the elk and bison on the refuge and the WGFD feedgrounds is currently artificially low because of supplemental feeding. At present, the most important mortality factor is hunting. Under Alternative 2 increased winter mortality during above-average and severe winters would make more carcasses available to scavengers. Because hunting on the refuge and the elk reduction program in the park would be eliminated, no gut piles or other carcass remains left by hunters would be left for scavengers. Black bears could be negatively impacted through the loss of a rich source of protein and fat for bears that are preparing for hibernation.

Although overall numbers of elk and bison could be reduced, some predators could benefit from more of these ungulates being on native winter range rather than concentrated on the refuge. This could mean that more winter-killed elk would be available as carcasses in the spring for black bears, which do not normally occur on the refuge. However, black bears and coyotes could be negatively affected by fewer calves available for predation in the spring and summer. If bears turned to livestock due to lower numbers of elk calves in the spring, more bears could potentially be killed by government authorities and ranchers. The impact of fewer calves on coyotes would probably be negligible because coyotes eat a large variety of foods and are more adaptable than many other predators.

Fewer elk in some years in the long term could mean reduced prey for cougars compared to baseline conditions and Alternative 1. Fewer elk in some years could either increase the amount of time cougars spent hunting, increase reliance on other prey species, or reduce cougar numbers. Elk numbers under Alternative 2 might be able to support the existing cougar population, similar to baseline conditions. In addition, in winter elk would be more widely distributed on native range, which could mean that more prey would be available, increasing winter survival for cougars whose territories do not include the refuge.

In the long term, if large numbers of elk migrated to the Green River basin and the Red Desert, there might be fewer prey animals for predators and scavengers in the Jackson Hole area compared to baseline conditions and Alternative 1. However many elk would remain in the Gros Ventre, Buffalo Valley, and other areas of Jackson Hole. Therefore, predators and scavengers might be negatively affected, but to a negligible degree compared to baseline conditions and Alternative 1. Predators and scavengers in the Green River basin and the Red Desert would benefit but only to a negligible degree due to more wintering ungulates and increased numbers of carcasses.

*Direct Effects of Human Disturbance* — Under Alternative 2 fertility control would be used to help reduce bison numbers in the short term. Bison would likely be contracepted on feedlines. Predators and scavengers, such as coyotes, ravens, and magpies have become accustomed to human activities associated with feeding elk and bison, so it is likely that they would eventually become accustomed to contraception activities carried out simultaneously. If fertility control was carried out in the park, predators and scavengers could be temporarily disturbed to a negligible degree by humans walking through various habitats searching for bison and shooting dart guns. Predators and scavengers on other federal lands and private lands in Jackson Hole would not be affected by fertility control activities because they would only be carried out on refuge and park lands.

On the refuge, an estimated 2,400 acres of cultivated fields would be restored to native vegetation under Alternative 2. Predators and scavengers could be temporarily disturbed by associated activities; impacts would be negligible.

*Effects of Habitat Changes* — Under Alternative 2 badgers on the refuge could benefit, compared to baseline conditions, because native grassland and sagebrush shrubland habitats would expand by a minor amount in the short term and a moderate amount in the long term. In the park badgers could benefit in the long term because 4,500 acres of agricultural lands would be converted to sagebrush shrubland and native grassland habitats.

If large numbers of elk did not migrate outside Jackson Hole, badgers on private lands in Jackson Hole could experience negative impacts in localized areas. Elk that were no longer being fed on the refuge in the winter would likely forage more often on private lands compared to baseline conditions, resulting in further habitat degradation, reduced residual vegetation, and loss of acreage in some areas.

If large numbers of elk did migrate outside Jackson Hole, badgers on BLM lands and private lands in the Green River basin could be negatively affected in localized areas as a result of native grassland and sagebrush shrubland communities experiencing higher levels of grazing and browsing. This could result in habitat degradation and loss of acreage in some areas, negatively affecting small mammals that badgers prey on.

*Biosafety of Wildlife Contraceptives* — A fertility control program would be carried out on bison involving surgical sterilization or biochemical contraceptives. Biochemical contraceptives approved for use in free-ranging wildlife do not enter the food chain and therefore would have no adverse affects on predators and scavengers.

*Conclusion*

Many predators and scavengers would benefit in years of high elk and bison mortality on the refuge and in the park and would likely be adversely affected in mild years after the elk and bison herd had declined, compared to Alternative 1. Some predators and scavengers such as black bears and cougars could benefit from elk and bison being more widely distributed over the landscape and suffering higher winter mortality. Fewer calves born in the spring due to fertility control could

adversely affect some predators and scavengers, such as bears and coyotes. Badgers on the refuge and in the park could benefit due to the expansion of their preferred habitats. This alternative would not result in impairment of predators and scavengers in the park.

#### *Alternative 3*

*Analysis*

*Elk and Bison Numbers and Distribution* — In some years fewer elk under Alternative 3 could affect scavengers, such as golden eagles, coyotes, black bears, magpies, and ravens. In the long term, scavengers might be adversely affected during mild and average winters because even though the mortality rate might be comparable to baseline conditions, there would be fewer elk. However, the winter mortality of the elk and bison on the refuge and state feedgrounds is currently artificially low because of supplemental feeding. At present, the most important mortality factor is hunting. Under Alternative 3 gut piles and other carcass remains and wounded animals not retrieved by hunters would provide scavengers with food in the fall and winter. This food source would increase in the short term on the refuge and in the park as hunting increased in order to reduce the Grand Teton elk herd segment. However, gut piles would decline in the long term due to a reduced elk harvest.

Compared to Alternative 1, scavenger numbers could be lower because the bison population would not be allowed to grow without limit under Alternative 3 and there could be fewer bison carcasses to scavenge. However, during the hunting season there could be more gut piles on the refuge, and since supplemental feeding would occur an estimated 2 out of 10 winters, there could be more winter-killed elk and bison throughout Jackson Hole in non-feeding years.

Although overall numbers of elk could be lower in some years, some predators and scavengers could benefit from more of these ungulates being on native winter range rather than concentrated on the refuge. This could mean that more winter-killed elk and bison would be available as carcasses in the spring for black bears, which do not normally occur on the refuge. The impact of fewer calves on coyotes would probably be negligible, because coyotes eat a large variety of foods and are more adaptable than many other predators.

Fewer elk in some years in the long term could reduce potential prey for cougars in the Jackson Hole area compared to baseline conditions and Alternative 1. This means that fewer elk in some years could either increase the amount of time spent hunting, increase reliance on other prey species, or reduce cougar numbers. Elk numbers under Alternative 3 might be able to support the existing cougar population to a similar extent as baseline elk numbers. In addition, elk would be more widely distributed on native winter range, which could mean more prey and increased winter survival for cougars whose territories do not include the refuge.

In the long term, if large numbers of elk migrated to the Green River basin and the Red Desert, there could be fewer prey animals for predators and scavengers in the Jackson Hole area compared to baseline conditions and Alternative 1. However many elk would remain in the Gros Ventre, Buffalo Valley, and other areas of Jackson Hole that contain winter range. Therefore, predators and scavengers could be negatively affected, but to a negligible degree. Predators and scavengers in the Green River basin and the Red Desert would benefit a negligible degree due to more wintering ungulates and carcasses.

*Direct Effects of Human Disturbance* — Disturbance effects of a brucellosis vaccination program would be similar to the effects of a fertility control program carried out on the feedlines or in the park. These effects would be negligible and temporary.

*Effects of Habitat Changes* — Compared to Alternative 1, badgers could be negligibly affected under Option A by changes in native grassland and sagebrush shrublands habitats. Under Option B badgers would benefit by a minor amount due to more acres in native grassland and sagebrush shrubland habitats. Badgers in the park could benefit due to the restoration of 4,500 acres of agricultural lands to native grassland and sagebrush shrubland communities.

The effects of Alternative 3 on badgers on BLM lands and private lands in Jackson Hole and the

Green River basin would be similar to the effects of Alternative 2.

*Conclusion*

Most predators and scavengers on the refuge and in the park would benefit in years of high elk and bison mortality and would likely be adversely affected in mild years after the elk and bison herd had declined in numbers compared to Alternative 1. However, some predators and scavengers, such as black bears, could benefit from elk and bison being more distributed over the landscape and suffering higher winter mortality. Badgers could be negligibly adversely impacted on the refuge by a slight decline in their preferred habitats. Badgers in the park could be positively affected due to an expansion of their preferred habitats. This alternative would not result in impairment of predators or scavengers in the park.

### Alternative 4

*Analysis*

*Elk and Bison Numbers and Distribution* — In years when the refuge would continue to supplementally feed elk and bison, the effects on predators and scavengers would be similar to baseline conditions and Alternative 1.

During average and below-average winters when elk would not be supplementally fed on the refuge and would rely on native winter range, elk and bison mortality and vulnerability would likely be higher than under baseline conditions and Alternative 1. Some predators and scavengers could benefit from more widely distributed and vulnerable prey. Black bears could benefit if more winter-killed elk and bison died in areas that are accessible to bears after they emerge from hibernation in the spring. Cougars whose territories do not include the refuge could also benefit from more widely distributed and vulnerable prey.

Scavengers would benefit in the short term as relatively large numbers of bison were killed to bring numbers down from an estimated 800–1,000 (at the signing of the record of decision) to 450–500. Hunters would leave numerous gut piles on refuge and national forest lands in the first few years as the herd was being reduced. In the long term, compared to Alternative 1, scavengers would still benefit but to a lesser degree because fewer bison would be in the herd and fewer would need to be harvested, leaving fewer gut piles.

*Direct Effects of Human Disturbance* — Brucellosis vaccination disturbance effects to predators and scavengers would be similar to the effects of the feeding program, which are negligible and temporary.

*Effects of Habitat Changes on Predators and Scavengers* — Changes in sagebrush shrubland and native grassland habitat acreage on the refuge would have minor, negative effects on badgers in the long term compared to baseline conditions and Alternative 1. Badgers could benefit from farming practice changes under Alternative 4 because the improved irrigation system, together with increased forage production in cultivated fields, could result in more small mammals for badgers to prey upon. Badgers in the park would likely benefit from the restoration of 4,500 acres of agricultural lands to native grassland and sagebrush shrubland communities.

All predators that feed on small mammals, such as hawks, badgers, and coyotes, could benefit if more small mammals inhabited the cultivated fields due to changes in the irrigation system and higher forage production.

*Biosafety of Strain 19 Vaccination for Brucellosis* — Predators and scavengers would be exposed to Strain 19 and RB51 after consuming elk and bison but would not be expected to experience any negative effects (Cook and Rhyan 2002;WGFD 2002b).

*Conclusion*

Most predators and scavengers in the park and refuge would benefit due to higher elk and bison mortality and wider distribution of carcasses and prey during years when the refuge did not provide supplemental feed. In particular, black bears that do not normally occur on the refuge would benefit from a wider distribution of winter-killed elk and bison. In years when the refuge did feed, there would be no effect on most predators and scavengers compared to Alternative 1. Badgers could be adversely impacted by a minor decline in the amount of their preferred habitat on the refuge. Badgers in the park could be positively af-

fected due to expansion of their preferred habitats because of habitat restoration. This alternative would not result in impairment of predators and scavengers in the park.

#### Alternative 5

*Analysis*

*Elk and Bison Numbers and Distribution* — The effects of elk numbers and distribution on predators and scavengers under Alternative 5 would be similar to the effects under baseline conditions and Alternative 1.

Scavengers would benefit in the short term as relatively large numbers of bison were killed to bring numbers down from an estimated 800–1,000 (at the signing of the record of decision) to 400. Similar to Alternative 4, hunters would leave numerous gut piles on refuge and national forest lands in the first few years as the herd was being reduced. In the long term, compared to Alternative 1, scavengers would still benefit, but to a lesser degree because fewer bison would be in the herd and fewer would need to be harvested, leaving fewer gut piles. Furthermore, fewer would be destroyed on private lands.

*Direct Effects of the Human Disturbance* — Elk would be vaccinated against brucellosis on feedlines by means of biobullets. Effects of disturbance to predators and scavengers would be similar to the effects of the feeding program, which appear to be minimal. Therefore, any disturbance of predators and scavengers due to the vaccination program would be negligible and temporary.

*Effects of Habitat Changes* — The effects of habitat changes on predators and scavengers due to changes in farming practices on the refuge and restoration activities in the park would be similar to the effects of Alternative 4.

*Biosafety of Strain 19 and RB51 Vaccination for Brucellosis* — Predators and scavengers would be exposed to Strain 19 and RB51 after consuming elk and bison but would not be expected to experience any negative effects (Cook and Rhyan 2002; WGFD 2002b; Kreeger 2002).

*Conclusion*

With regard to elk numbers and distribution, the effects on predators and scavengers on the refuge and in the park would be similar to the effects of Alternative 1. Most scavengers would greatly benefit in the short term from gut piles left by hunters as bison numbers were reduced from 800–1,000 animals to 400 animals. Scavengers would continue to benefit in the long term from the bison hunt but to a lesser degree because fewer animals would be killed. Badgers on the refuge could be adversely impacted in the long term by a minor decline in the amount of their preferred habitat. Badgers in the park could be the positively affected due to habitat restoration. This alternative would not result in impairment of predators and scavengers in the park.

#### Alternative 6

*Analysis*

*Elk and Bison Numbers and Distribution* — In some years, fewer and more widely distributed elk and bison under Alternative 6 could affect predators and scavengers, such as golden eagles, magpies, ravens, coyotes, cougars, and black bears. In the long term, some species of scavengers might be adversely affected in mild and average winters compared to baseline conditions and Alternative 1 because they would be distributed more widely throughout the Jackson Hole area, making carcasses harder to find. However, black bears do not normally occur on the refuge, so the wider distribution of carcasses would be a potential benefit. In hard winters scavengers both on and off the refuge would benefit from a larger number of winter-killed elk and bison because the winter mortality rate would no longer be kept artificially low by supplemental feeding.

Possible benefits of changes in carcass availability could be offset to an unknown extent by periodic reductions in elk numbers to an estimated 600–1,600 in the park and an estimated minor reduction in elk numbers in the Yellowstone and Teton Wilderness herd segments. Fewer elk in the park would also result in fewer elk calves for black bears, cougars, and coyotes to prey upon in the spring. If black bears turned to livestock as a result of lower numbers of elk calves in the spring and fewer winter-killed elk, more bears could potentially be killed by government authorities and

ranchers. The impact of fewer calves and carcasses on coyotes would probably be negligible, because coyotes prey on a large variety of species and are more adaptable than many other predators. Although black bears greatly benefit from the protein that elk provide, the degree to which black bears would be impacted by reduced calf numbers and by reduced carcasses is unknown. Cougars would not likely be affected by fewer elk calves and carcasses because they are capable of taking healthy adult elk.

Gut piles and carcass remains left by hunters and wounded animals not retrieved by hunters could be an important source of protein for scavengers, such as ravens, coyotes, and black bears. Under Alternative 6 elk hunting would continue on the refuge and the elk herd reduction program in the park (which could be discontinued if not needed in the long term), and bison hunting would begin on the refuge. As numbers of elk decreased on the refuge and in the park in the long term, the number of elk killed during the hunting season would also decrease, and therefore available gut piles would decrease. Bison hunting would initially provide many gut piles for scavengers, but as the bison herd was reduced to the objective of an estimated 400 post-hunt, the number of gut piles available each hunting season would be much less. Scavengers on the refuge and in the park would benefit in the short term, but in the long term scavengers would be negatively affected by a major amount due to lower number of gut piles and other remains available compared to baseline conditions and Alternative 1.

Elk and bison hunting would continue in the national forest. However, hunting opportunities and the resulting gut piles would fluctuate depending on the size of the herd and hunting quotas. Compared to baseline conditions and Alternative 1, the number of gut piles and other remains would be moderately higher when the elk herd was at the 11,000 objective because as the Grand Teton herd segment decreased, the Teton Wilderness herd segment would represent a greater proportion of the herd. After hard years, when elk herd numbers could fall to an estimated 8,100, the number of gut piles would be moderately reduced because hunting would be reduced to allow the elk herd to rebound. Therefore, in some years scavengers would benefit by a moderate amount from the increase in gut piles and other remains, and in years when the elk herd was below objective, they would be negatively affected by a moderate to major amount due to fewer available gut piles.

Fewer elk in some years in the long term could mean fewer prey for cougars in the Jackson Hole area compared to baseline conditions and Alternative 1. Fewer elk in some years could potentially increase the amount of time spent hunting, increase predation on other prey species, or reduce cougar numbers. It is also possible that elk numbers under Alternative 6 would be able to support the existing cougar population to a similar extent as baseline elk numbers. In addition, in the winter, elk would be more widely distributed on native winter range, so more prey could be available to cougars, and winter survival for cougars whose territories do not include the refuge would increase. However, elk number reductions of up to 80% in some years in the park would likely reduce cougar numbers in that area.

If large numbers of elk migrated outside the Jackson Hole area in the winter, fewer elk and bison would die on native winter range in this area, so less food would be available for predators and scavengers compared to a situation in which most elk remain in the Jackson Hole area. However, many elk would remain on the Gros Ventre feedgrounds or on winter range in the Gros Ventre drainage, Buffalo Valley, and other areas of Jackson Hole that contain winter range. Therefore predators and scavengers could be negatively affected, but only to a negligible degree compared to baseline conditions and Alternative 1. Predators and scavengers in areas outside the Jackson Hole area could benefit to a negligible degree due to larger numbers of wintering ungulates in those areas.

*Effects of Habitat Changes on Predators and Scavengers* — The effects of habitat changes on predators and scavengers due to changes in farming practices on the refuge and restoration activities in the park would be similar to the effects under Alternatives 4 and 5.

Badgers on BLM lands and private lands in Jackson Hole, the Green River basin, and the Red Desert would not be affected by actions that are being considered under Alternative 6.

*Conclusion*

Most predators and scavengers on the refuge and in the park would benefit in years of high elk and bison mortality and would likely be adversely affected in mild years after the elk and bison herds had declined in numbers compared to Alternative 1. However, some predators and scavengers, such as black bears and cougars, could benefit from elk and bison being more distributed over the landscape and suffering higher winter mortality. Badgers on the refuge could be adversely impacted in the long term due to a minor decline in their preferred habitats. Badgers in the park could be positively affected due to habitat restoration on the agricultural lands. This alternative would not result in impairment of predators and scavengers in the park.

### Mitigation

Mitigation measures would not be necessary.

### Cumulative Effects

No cumulative effects on predators and scavengers are expected as a result of impacts of the alternatives in combination with the impacts of reasonably foreseeable actions.

## SMALL MAMMALS

### Methodology Used to Analyze Effects

*Composition of Small Mammal Communities* — The analysis of potential effects of alternatives on small mammal populations is based primarily on the relationship of small mammal communities to different habitat types. Many small mammal species occur in several different habitats. However, an individual species tends to do better in some plant communities, where it will occur at higher densities, than in less optimal habitats, where it will occur at lower densities. Therefore, the composition of the small mammal community in one habitat type will differ from the composition of the small mammal community in another habitat type, although both habitats will contain many of the same small animal species (See "Small Mammals" in Chapter 3). Small mammal populations also vary seasonally and annually, depending on factors such as precipitation, grazing pressure, and predation (Douglass, pers. comm. 2003).

*Some Generalities about Habitat Relationships of Small Mammals* — Small-mammal population research is complex and may at times be contradictory because small mammal communities are extremely dynamic, and research findings can be influenced by the timing of the study.

Therefore, general principles pertaining to small mammal populations and habitat relationships are given below, based on the professional opinion of Dr. Rick Douglass (biologist with Montana Tech of the University of Montana in Butte, Montana):

- Deer mice persist in a large variety of habitats. They could decline if sedges and grasses became very thick.
- Voles are most abundant where litter cover is high. In areas where grasses remain ungrazed and litter builds, a threshold phenomenon could occur, where numbers of voles begin to fluctuate, while below that threshold, numbers remain low. Above the threshold, vole numbers could become very high, but would still crash at times.
- Shrews tend to occur in wet environments, but also occur on dry sites.
- When some types of grasslands are heavily grazed, the density of small mammals might not change, but the turnover rate of individual animals might be completely altered (i.e., the mortality rate is high ). This probably occurs because predation increases, but reproduction and immigration keep up with the removal.

The following summary of the possible changes in small mammal populations due to habitat conversions is based on the professional opinion of Mitchell Hannon (Yellowstone Ecological Research Center and the University of Nevada in Reno, Nevada). His opinions are based on a knowledge of species distributions and data collected during small mammal surveys conducted in Yellowstone in 1992–93 and again in 2001–2. Data from the 1992–93 season can be found in Johnson and Crabtree (1999).

- Generally speaking, wetter environments with more herbaceous vegetation would have greater small mammal diversity.
- All species of small mammals that occur in native grasslands in Jackson Hole can also

occur in sagebrush shrublands. When native grassland communities convert to sagebrush shrubland communities and vice versa, the effects on the small mammal community would depend on the quality of the grass understory. Lush grasses growing beneath shrubs promote vole and ground squirrel populations. Sparsely growing grasses would result in low densities of small mammal species.

- Deer mice, meadow voles, montane voles, and ground squirrels tend to live at high densities in lush grassland. As grasses become sparser in native grassland habitat and sagebrush shrubland habitat, deer mice, meadow voles, montane voles, and ground squirrel populations would become less dense and, therefore, more dramatically affect the total numbers of animals present in the area. Shrews and jumping mice tend to live at low population densities wherever they are found. Therefore, total numbers of small mammals in sagebrush shrublands or native grasslands would not be greatly affected by changes in numbers of shrews and jumping mice.
- Conversion between native grassland habitat and sagebrush shrubland habitat can affect the level of cover available. Small mammals species that use sagebrush as cover would tend to increase in abundance when sagebrush shrubland habitat increases. Species that need open areas to view approaching predators tend to decrease in abundance when sagebrush shrubland increases.
- Between native grassland and sagebrush shrubland habitats, the highest species diversity is likely to be in a sagebrush shrubland habitat that has a patchy distribution of intermingling grassland and sagebrush. Conversion of dry native grassland to a more or less homogenous sagebrush shrubland habitat that has a good grass understory is likely to result in an increase in small mammal diversity. However the densities of each species would be affected in different ways. Deer mice, rabbit, vole (meadow, montane and long-tailed) populations might not change much in density. Shrew, chipmunk, and sagebrush vole populations would likely increase in density, while gopher and ground squirrel populations would probably decrease in density.
- Conversion of aspen woodland communities to native grassland and sagebrush shrubland habitats would likely change the small mammal community in major ways. There would be increases in deer mouse and ground squirrel population densities but loss of flying squirrel and red squirrels. Overall species diversity would decrease.

## Impacts of the Alternatives

### *Impacts Common to All Alternatives*

*Direct Effects of Human Disturbance* — Small mammals on the refuge would not be adversely impacted or would be impacted to a negligible degree by management activities associated with the supplemental feeding program for elk or bison under Alternatives 1, 3, 4, and 5. Supplemental feeding would be phased out under Alternatives 2 and 6. During the phaseout period, management activities associated with supplemental feeding would not adversely impact small mammals or would impact them to a negligible degree. The effects would be negligible or nonexistent because supplemental feeding would occur during winter in the cultivated fields where there are a low number of small mammal species (Swanekamp, pers. comm. 2002). The reasons that there are few small mammals on cultivated fields probably relates to soil compaction from 90 plus years of thousands of ungulates on feedlines for an average of 70 days per year. In alternatives where supplemental feeding would be reduced or eliminated, small mammals might be able to colonize these areas in the long term.

Small mammals on the refuge would not be adversely impacted or would be impacted to a negligible degree by activities associated with elk and bison hunting in all alternatives except 2, which would not allow hunting on the refuge or an elk reduction program in the park. Hiking and horseback riding and the firing of rifles could temporarily disturb small mammals in the immediate area. However, these effects would not affect survival and reproduction.

Small mammals on the refuge would not be adversely impacted or would be impacted to a negligible degree by management activities associated

with a brucellosis vaccination program for elk and bison under Alternatives 3, 4, and 5. Elk and bison would be vaccinated on the feedlines. Small mammals would not be affected beyond those effects already associated with supplemental feeding.

*Impacts on Marshland Habitats* — Small mammal communities that are associated with marshlands in the Jackson Hole area and the Green River basin would not be affected under any of the alternatives any more than they have been affected in the recent past; any effects would be negligible.

*Impacts on Conifer Forest Habitats* — Small mammal communities that tend to do better in conifer forests habitats in the Jackson Hole area and the Green River basin would not be affected under any of the alternatives or would be affected to a negligible degree.

#### *Alternative 1*

*Analysis*

*National Elk Refuge* — The composition of small mammal communities associated with willow, cottonwood, and aspen habitats on the refuge would shift toward a composition of small mammal species that tend to do better in wet meadow, native grassland, and sagebrush shrubland habitats as riparian and aspen woodland habitats decline by an estimated 360 acres in the short term and by an estimated 2,120 acres in the long term compared to baseline conditions. Woodland riparian and aspen zones support a greater diversity of small mammals than other habitat types. As a result of an estimated minor acreage decline in the short term in riparian and aspen woodland habitats and a major acreage decline in the long term (Cole, pers. comm. 2003), small mammal diversity would likely decline. Red squirrels and flying squirrels would be lost due to the eventual disappearance of aspen woodland habitat over the long term.

Small mammal communities associated with refuge sagebrush shrubland and native grassland habitats would expand as their habitats increased by an estimated 310 acres in the short term and an estimated 2,070 acres in the long term compared to baseline conditions. Both of these habitat types would increase as riparian and aspen woodland communities converted to sagebrush shrubland and native grassland communities. Grazing by unlimited numbers of bison in this alternative could reduce residual grass cover in localized areas, which would adversely affect some small mammal species that depend on tall grass cover to avoid predators.

Impacts to small mammal communities associated with cultivated fields on the refuge would remain similar to baseline conditions in the short and long terms. Because plant species diversity and vegetation structure is much lower in cultivated fields, the diversity of small mammals would remain low compared to the diversity in sagebrush shrubland and native grassland habitats under natural conditions. Heavy grazing in the fall and winter and hoof action of large concentrations of ungulates associated with feeding activities further reduces vegetation structure. Uinta ground squirrels and other small mammals would continue to be adversely impacted by flood irrigation activities that would fill their burrows.

Small mammal communities associated with wet meadow habitats on the refuge would expand slightly as their habitat increased by an estimated 50 acres in the short and long terms compared to baseline conditions due to reductions in willow habitat. However, increasing numbers of bison in this alternative would likely cause adverse effects to wet meadow environments through hoof damage and reduction of residual grass cover, which would affect some small mammal species that depend on tall grass cover to avoid predators.

*Grand Teton National Park* — The composition of small mammal communities in the park, that are associated with riparian and aspen habitats would shift towards small mammal communities that tend to due well in sagebrush shrubland habitats because elk and bison are contributing to a minor decline in riparian and aspen woodland habitats.

Small mammal communities associated with agricultural lands and wet meadow habitats would likely not be affected under Alternative 1. However, if a substantial amount of wet meadow plant communities shifted to nonnative plant species due to heavy grazing by ungulates, small mammal diversity could decline.

*Bridger-Teton National Forest* — Small mammal communities that tend to do well in wet meadow, riparian and aspen woodland, sagebrush shrubland, and native grassland habitats in the national forest would not likely be affected under Alternative 1. However, to the degree that elk are contributing to the decline in riparian and aspen woodland habitats in localized areas, that trend would continue. Small mammals that tend to do well in riparian and aspen woodland communities would be negatively affected, and those that tend to do well in sagebrush shrubland communities could expand due to habitat conversion.

*Conclusion*

Management of elk on the refuge over the last 90 years (e.g., winter feeding and cultivation and flood irrigation of nonnative plant species), and more recently bison, has resulted in moderate to major changes in habitats in some areas of the refuge and park and could have substantially altered the composition of small mammal communities in some areas. Small mammal communities associated with sagebrush shrubland, native grassland, and wet meadow communities on the refuge would expand compared to baseline conditions, while small mammal communities associated with riparian and aspen woodlands would be reduced by a negligible amount. Overall diversity of small mammal species on the refuge could decline further, but the change would likely be negligible.

Overall diversity of small mammal species in the park could decline because some riparian and aspen woodlands would convert to conifer forest and sagebrush shrubland communities. This alternative would not result in impairment of small mammal communities in the park.

### Alternative 2

*Analysis*

*National Elk Refuge* — Under Alternative 2 the composition of small mammal communities on the refuge associated with good and fair condition willow, cottonwood, and aspen habitats would shift toward a composition of small mammal species that tend to do better in wet meadow, native grassland, and sagebrush shrubland habitats as riparian and aspen woodland habitats decreased by an estimated 310 acres (10%) in the short term and an estimated 1,980 acres (60%) in the long term compared to baseline conditions. Woodland riparian and aspen zones support a greater diversity of small mammals; therefore, Alternative 2 would cause a decrease in small mammal diversity in the short and long terms. Red squirrels and flying squirrels would disappear from the estimated 1,850 acres of aspen habitat that would convert to sagebrush shrubland and native grassland communities. Alternative 2 would have more small mammal diversity on the refuge than Alternative 1 because it would contain an estimated 150 more acres of riparian and aspen woodland habitat in the short term and an estimated 40 more acres in the long term. However, a 40-acre difference in habitat would result in a negligible difference in the composition of small mammal communities in the long term.

Small mammal communities on the refuge associated with sagebrush shrubland and native grassland habitats would expand as these habitats increased to an estimated 18,810 acres (17%) in the short term and an estimated 20,680 acres (28%) in the long term from the current estimated 16,100 acres. In the long term an estimated 85% of this 20,680 acres would be sagebrush shrubland habitat. Whether small mammal diversity increased with conversion of native grassland habitat to sagebrush shrubland habitat would depend on the lushness of the grass understory, which would depend on aspect and the amount of utilization by elk and bison. Grazing by elk and bison reduces residual grass cover. Fewer elk and bison under this alternative would leave taller vegetation, which would benefit small mammal species that rely on vegetation cover to avoid predators.

The diversity of small mammals on the refuge would increase with the conversion of cultivated fields (approximately 2,400 acres) to native grassland communities in the short term and to sagebrush shrubland habitats in the long term as compared to Alternative 1. Habitat changes under Alternative 2 would probably result in more small mammal species due to the greater variety of plant life and reduced concentrations of elk and bison for long periods. Cessation of flood irrigation would also benefit small mammals, such as Uinta ground squirrels, because their burrows would no longer be flooded.

Compared to Alternative 1, Alternative 2 would have an estimated 100 fewer acres of wet meadow habitats, resulting in slightly fewer small mammals who are dependent on wet meadow communities. Lower numbers of elk and bison in this alternative would likely benefit wet meadow environments and the small mammals that depend on them, as there would be less bison hoof damage and more residual grass cover.

If large numbers of elk migrated out of Jackson Hole in the winters, riparian and aspen woodlands on the refuge could improve in condition and increase in acreage by an estimated 1,720 acres (53%). This would benefit small mammals that tend to do better in woody habitats. Also, riparian and aspen woodland habitats would not convert to native grassland and sagebrush shrubland habitats, which would adversely affect small mammal communities that tend to do well in these habitats.

With a large elk migration out of Jackson Hole, an estimated 1,450 acres of wet meadow habitat would convert to willow habitat, and small mammal communities that tend to do well in wet meadows would be negatively impacted.

Small mammals on the refuge would not be adversely impacted or would be impacted to a negligible degree by management activities associated with a fertility control program for bison under Alternative 2. If the program was conducted on the refuge feedlines, small mammals would not be affected beyond those effects already associated with supplemental feeding.

*Grand Teton National Park* — Small mammal communities associated with good and fair condition willow, cottonwood, and aspen habitats in the park would likely benefit as good and fair condition riparian and aspen habitat increased by a negligible to minor amount compared to Alternative 1.

Small mammal species that tend to do well in sagebrush shrubland and native grassland habitats would benefit as an estimated 4,500 acres of agricultural lands were restored to native communities, and small mammal communities that tend to do well in agricultural lands would be negatively affected. However, small mammal diversity would likely increase compared to baseline conditions and Alternative 1.

Small mammal communities associated with wet meadow habitats in the park would not be affected under Alternative 2. However, if a substantial amount of wet meadow plant communities shifted to nonnative species in those years when elk numbers were high, small mammal diversity could decline.

If the bison fertility control program under Alternative 2 was conducted in the park, probably in the spring and summer (while most small mammals are breeding and raising young), small mammals would be disturbed for a short period of time by individuals hiking through a variety of habitats. However, few people would be engaged in this activity at any given time, with a negligible impact, especially since many areas of the park are already open to hiking.

*Bridger-Teton National Forest* — In the long term larger numbers of elk would graze and browse in the national forest, which could lead to reduced residual vegetation and decline of willow, cottonwood, and aspen woodland, as well as sagebrush shrubland, native grassland, and wet meadow habitats in some locations. This conversion would negatively affect small mammal communities in these areas. In contrast, if large numbers of elk migrated out of Jackson Hole, habitats in the national forest would improve in condition and grasses would remain tall, with benefits to small mammals.

*Other Lands* — If large numbers of elk did not migrate outside Jackson Hole, small mammal communities on riparian and aspen woodland, sagebrush shrubland, native grassland, and wet meadow habitats on BLM lands and private lands in Jackson Hole could experience negative impacts in localized areas. Elk that were no longer being fed in the winter would likely forage more often in habitats outside the refuge. Higher levels of browsing and grazing on BLM and private lands could result in habitat degradation and reduced residual vegetation, which would negatively affect small mammal communities associated with these habitats.

If large numbers of elk did migrate outside Jackson Hole, small mammal communities that tend to do well on riparian and aspen woodland, sagebrush shrubland, native grassland, and wet meadow habitats on BLM lands and private lands

in the Green River basin could experience negative impacts in localized areas. Small mammal communities associated with these habitats in the Green River basin could be negatively impacted as a result of higher levels of grazing and browsing, which could result in habitat degradation and reduced residual vegetation.

*Conclusion*

Small mammal communities associated with sagebrush shrubland communities and riparian and aspen woodlands (where there would be a negligible change) would expand on the refuge in the long term compared to Alternative 1, while small mammal communities associated with cultivated fields and native grasslands would be reduced. It is unclear how overall small mammal diversity on the refuge would be affected. If large numbers of elk migrated to wintering areas outside Jackson Hole, small mammal diversity on the refuge would likely more closely approximate natural diversity under Alternative 2 compared to Alternative 1 because more habitat would remain in healthier riparian and aspen woodland habitats and because cultivated fields would be converted to native vegetation.

Small mammal communities in the park would more closely approximate a natural level of diversity as under Alternative 1 due to converting agricultural lands to native vegetation and a potential increase in the health of riparian and aspen woodland habitat. This alternative would not result in impairment of small mammal communities in the park.

### Alternative 3

*Analysis*

*National Elk Refuge* — Small mammal diversity under Alternative 3 would likely be greater than under Alternative 1 because Alternative 3 would have an estimated 1,000 more acres (31%) of riparian habitat in the short term and an estimated 1,720 more acres (50%) in the long term. Despite the reduction of aspen habitat on the refuge, small mammal communities associated with cottonwood and willow habitats would benefit in the lower and upper Flat Creek areas, where willow habitat would recover and cottonwood habitat would persist. Adverse impacts would primarily be associated with the disappearance of aspen. Red squirrels and flying squirrels would disappear from the aspen woodland communities that would convert to sagebrush shrubland habitats.

Compared to Alternative 1, Option A of Alternative 3 would likely have a slightly lower abundance of small mammals on the refuge that tend to do well in native grassland and sagebrush shrubland habitats in the short and long terms because there would be an estimated 220 fewer acres (1%) of native grassland and sagebrush shrubland habitats. The difference would likely be negligible. Under Option B of Alternative 3, the effects on small mammals in sagebrush shrubland and native grassland habitats on the refuge would be similar to the effects of Alternative 2 because forage production would be phased out.

Under Option A of Alternative 3, small mammal communities associated with cultivated fields on the refuge would remain similar to baseline conditions and Alternative 1 in the short and long terms. The diversity of small mammals would remain low compared to the diversity that would occur in sagebrush shrubland and native grassland habitats under natural conditions due to lower plant species diversity in cultivated fields. Uinta ground squirrels and other small mammals would continue to be adversely impacted by flood irrigation activities. Under Option B the effects on small mammals in cultivated fields on the refuge would be similar to the effects of Alternative 2.

Compared to Alternative 1, wet meadow habitat under Alternative 3 would have an estimated 780 fewer acres (45%) in the short term and an estimated 1,500 fewer acres (87%) in the long term, resulting in a reduced small mammal community dependent on wet meadow habitats. Lower numbers of elk in this alternative would likely result in more residual grass cover on the remaining 270 acres of wet meadows, which would benefit small mammal species that depend on tall grass cover to avoid predators.

*Grand Teton National Park* — Small mammal communities associated with good condition willow, cottonwood, and aspen habitats in the park would likely benefit as good condition riparian and aspen woodland habitat increased by a minor

amount compared to baseline conditions and Alternative 1.

Small mammal species that tend to do well in sagebrush shrubland and native grassland habitats would benefit, as an estimated 4,500 acres of agricultural lands would be restored to native communities. Small mammal diversity would likely increase compared to baseline conditions and Alternative 1.

In the park small mammal communities in wet meadows would not be affected due to actions being considered under Alternative 3.

*Bridger-Teton National Forest* — The effects of Alternative 3 on small mammal communities in the national forest would be similar to the effects of Alternative 2.

*Other Lands* — If large numbers of elk did not migrate outside Jackson Hole, small mammal communities on riparian and aspen woodland, sagebrush shrubland, native grassland, and wet meadow habitats on BLM lands and private lands in Jackson Hole could experience negative impacts in localized areas. Elk that are no longer being fed in the winter would likely forage more often in habitats outside the refuge. Higher levels of browsing and grazing on BLM and private lands could result in habitat degradation and reduced residual vegetation, which could negatively affect associated small mammal communities.

If large numbers of elk did migrate outside Jackson Hole, small mammal communities that tend to do well on riparian and aspen woodland, sagebrush shrubland, native grassland, and wet meadow habitats on federal, state, and private lands the Green River basin could experience negative impacts in localized areas. Small mammal communities associated with these habitats could be negatively impacted as a result of higher levels of grazing and browsing, which could result in habitat degradation and reduced residual vegetation.

*Conclusion*

Small mammal diversity on the refuge would likely be greater under Option A of Alternative 3 compared to Alternative 1 because there would be more acreage and improved condition of riparian and aspen woodland habitats, which tend to have more diverse small mammal communities (and because this has been the habitat most impacted by large concentrations of elk). Small mammal communities associated with wet meadows and native grasslands would be reduced and small mammal communities associated with sagebrush shrubland would expand. Impacts of Option B would be similar to Alternative 2 with regard to expanded sagebrush shrubland and native grassland habitats and reduced cultivated fields.

Small mammal communities in the park would more closely approximate a natural level of diversity than Alternative 1 due to conversion of agricultural lands to native vegetation and a potential increase in the health of riparian and aspen woodland habitats. Alternative 3 would not result in the impairment of small mammal communities in the park.

#### *Alternatives 4 and 5*

*Analysis*

*National Elk Refuge* — Compared to Alternative 1, Alternatives 4 and 5 would have an estimated 340 more acres (10%) of riparian and aspen woodlands in the short term and an estimated 1,590 more acres (50%) in the long term. Because woodland riparian and aspen zones support a greater diversity of small mammals than do other habitat types, Alternatives 4 and 5 would have a more diverse small mammal community than under Alternative 1. However, red squirrels and flying squirrels found in aspen stands outside the exclosure would disappear because this unprotected aspen habitat would convert to a sagebrush shrubland community.

Small mammal communities on the refuge that are associated with sagebrush shrubland and native grassland habitats under Alternatives 4 and 5 would likely remain similar to baseline conditions and Alternative 1 in the short and long terms because changes in these habitats would be negligible to minor.

Cultivated fields on the refuge would produce an estimated 50% more vegetation than under baseline conditions and Alternative 1, and approximately 1,100 acres would be sprinkler irrigated rather than flood irrigated. This increase in vege-

tation production and reduction in flood irrigation, which can drown small mammals, would likely result in more rodents and insectivores in the cultivated fields compared to baseline conditions and Alternative 1.

The composition of small mammal communities associated with wet meadow habitats on the refuge would shift toward small mammal communities that do better in willow habitats as an estimated 270 acres (16%) of wet meadow habitats converted to willow habitats in the short term, and an estimated 520 acres (30%) in the long term. In wet meadow habitats outside the exclosure, the numbers of elk and bison in these alternatives would likely reduce the amount of residual cover, which would adversely affect small mammal species that depend on tall grass cover to avoid predators.

*Grand Teton National Park* — In the park small mammal communities associated with good and fair condition aspen communities could benefit by a negligible to minor degree due to fewer browsing elk in Alternatives 4 and 5 compared to baseline conditions and Alternative 1. Small mammal species that tend to do well in sagebrush shrubland and native grassland habitats would benefit under these alternatives, as an estimated 4,500 acres of agricultural lands would be restored to native communities. Small mammal diversity would likely increase compared to baseline conditions and Alternative 1.

Small mammal communities associated with wet meadows would likely not be affected under Alternatives 4 and 5. However, under Alternative 5 if a substantial amount of wet meadow plant communities shifted to nonnative species due to large numbers of ungulates grazing in these areas, small mammal diversity could decline.

*Bridger-Teton National Forest* — Small mammal communities in the national forest would not be affected in the short term under Alternative 4 because elk grazing and browsing would be similar to baseline conditions and Alternative 1. However, in the long term larger numbers of elk could remain in the national forest throughout the winter, and increased grazing and browsing pressure might reduce residual vegetation and degrade habitat in localized areas, negatively affecting small mammals dependent on these habitats.

Small mammal communities in the national forest would not be affected under Alternative 5 any more than they have been in the recent past.

*Conclusion*

Alternatives 4 and 5 would have a higher level of small mammal diversity than Alternative 1 because riparian and aspen woodland habitat would be larger and in improved condition. Small mammal communities associated with wet meadow habitats and native grasslands would be reduced.

Under Alternatives 4 and 5 the park would more closely approximate a natural level of small mammal diversity due primarily to conversion of agricultural lands to native vegetation. This alternative would not result in the impairment of small mammal communities in the park.

#### Alternative 6

*Analysis*

*National Elk Refuge* — Compared to Alternative 1, Alternative 6 would have an estimated 1,090 more acres (34%) in riparian and aspen woodland habitats in the short term and an estimated 3,420 more acres (105%) in the long term. Therefore, Alternative 6 would have a more diverse small mammal community on the refuge because riparian and aspen zones support a greater diversity of small mammals than do other habitat types.

Compared to Alternative 1, Alternative 6 would likely have a slightly lower abundance of small mammals on the refuge that tend to do well in native grassland and sagebrush shrubland habitats in the short and long terms because there would be an estimated 220 fewer acres (1%) of native grassland and sagebrush shrubland habitats. The difference would likely be negligible. Fewer elk in this alternative could leave taller vegetation that would benefit small mammal species that rely on vegetation cover to avoid predators.

Cultivated fields on the refuge would produce an estimated 50% more vegetation than cultivated fields in baseline conditions and Alternative 1, and approximately 1,100 acres would be sprinkler irrigated rather than flood irrigated. This increase in vegetation production and reduction in flood irri-

gation, which can drown small mammals, would likely result in more rodents and insectivores in the cultivated fields compared to baseline conditions and Alternative 1.

Compared to Alternative 1, there would be an estimated 780 fewer acres of wet meadow habitat in the short term and an estimated 1,500 fewer acres in the long term under Alternative 6. Therefore, even fewer small mammal communities could depend on wet meadow habitats. Lower numbers of elk in this alternative would likely result in more residual grass cover on the remaining 270 acres of wet meadows, which would benefit those small mammal species that depend on tall grass cover to avoid predators.

*Grand Teton National Park* — In the park an improvement in the condition and acreage of riparian and aspen woodland habitats would benefit associated small mammal communities by a negligible to minor degree under Alternative 6. Small mammal species that tend to do well in sagebrush shrubland and native grassland habitats would benefit from the restoration of an estimated 4,500 acres of agricultural lands to native communities. Small mammal diversity would likely increase compared to baseline conditions and Alternative 1, and small mammal communities in wet meadows would not be affected under Alternative 6.

*Bridger-Teton National Forest* — Compared to Alternative 1, larger numbers of elk would graze and browse in the national forest, which could lead to reduced residual vegetation and decline of willow, cottonwood, and aspen woodland, sagebrush shrubland, native grassland, and wet meadow habitats in some locations. This would negatively affect small mammal communities in these areas. In contrast, if large numbers of elk migrated out Jackson Hole in the winters, habitats in the national forest would improve in condition and grasses would remain tall, benefiting small mammals communities.

*Other Lands* — If large numbers of elk did not migrate outside Jackson Hole, small mammal communities on riparian and aspen woodland, sagebrush shrubland, native grassland, and wet meadow habitats on BLM and private lands in Jackson Hole could experience negative impacts in localized areas. Elk that are no longer being fed in the winter would likely forage more often in habitats outside the refuge. Higher levels of browsing and grazing on BLM and private lands could result in habitat degradation and reduced residual vegetation, negatively affecting associated small mammal communities.

If large numbers of elk did migrate outside Jackson Hole, small mammal communities that tend to do well on riparian and aspen woodland, sagebrush shrubland, native grassland, and wet meadow habitats on federal, state, and private lands in other locations could be negatively affected in localized areas. This would occur as a result of higher levels of grazing and browsing degrading habitat and reducing residual vegetation.

*Conclusion*

Small mammal diversity on the refuge would likely be greater under Alternative 6 compared to Alternative 1 because the size and condition of riparian and aspen woodland habitats would be improved, and this habitat has been most impacted by large concentrations of elk. Small mammal communities associated with wet meadows and native grasslands would be reduced, and small mammal communities associated with sagebrush shrubland would expand.

Small mammal communities in the park would more closely approximate a natural level of diversity than Alternative 1 due to conversion of agricultural lands to native vegetation and a potential increase in the health of riparian and aspen woodland habitats. This alternative would not result in the impairment of small mammal communities in the park.

### Mitigation

Measures to mitigate adverse effects of the alternatives on small mammal communities would be the same as those addressed in the mitigation discussions for pertinent habitats in the "Impacts on Habitat" section of Chapter 4.

### Cumulative Effects

No cumulative effects on small mammals are expected as a result of impacts of the alternatives in

combination with the impacts of reasonably foreseeable actions.

## LARGE RODENTS

### Methodology Used to Analyze Effects

Although beaver feed on aspen trees, most aspen communities on the refuge show no signs of beaver use (Cole, pers. comm. 2002). Therefore the decline of aspen communities under Alternatives 1–5 over the long term would not greatly affect beavers.

Beavers historically occurred along Flat Creek on the refuge but have not been present for many years. Beavers prefer aspen, willow, and cottonwood habitats, and any actions in other plant communities would have negligible effects on beavers. Thus, impacts to beaver have been predicted based on the likelihood that beavers could re-colonize an area given anticipated habitat changes under each alternative.

Woody riparian habitat on the refuge currently consists of approximately 1,390 acres of willow and cottonwood communities. Beavers would primarily be affected by changes in these two communities, and impacts have been estimated based on acreage changes only within willow and cottonwood habitats.

Total woody vegetation on the refuge consists of approximately 3,240 acres of willow, cottonwood, and aspen communities. Porcupines occur in all of these habitats. Impacts have been estimated for porcupines based on acreage changes within willow, cottonwood, and aspen habitats.

### Impacts of the Alternatives

#### *Impacts Common to All Alternatives*

*Yellow-bellied Marmots* — Marmots in Jackson Hole, the Green River basin, and the Red Desert would not be affected due to any actions being considered in this planning process.

*Direct Effects of Human Disturbance* — Large rodents would not be adversely impacted or would be impacted to a negligible degree by management actions associated with the supplemental feeding program for elk and bison in Alternatives 1, 3, 4, and 5. Supplemental feeding would be phased out under Alternatives 2 and 6. During the phaseout period, management actions associated with supplemental feeding would not adversely impact large rodents or would impact them to a negligible degree. The effects would be negligible or nonexistent because large rodents do not normally occur in the cultivated fields, where supplemental feeding takes place.

Large rodents would not be adversely impacted or would be impacted to a negligible degree by activities associated with elk and bison hunting in all alternatives except 2. Hiking and horseback riding and the firing of rifles could disturb large rodents in the immediate area for a short time. However, these effects would not affect survival and reproduction.

Large rodents would not be adversely impacted or would be impacted to a negligible degree by management activities associated with a brucellosis vaccination program for elk and bison under Alternatives 3, 4, and 5. Elk and bison would be vaccinated on the feedlines in the cultivated fields, where large rodents do not normally occur.

#### *Alternative 1*

*Analysis*

*National Elk Refuge* — Under Alternative 1 beavers on the refuge would be negatively impacted because woody riparian communities along Flat Creek would decrease by an estimated 270 acres in the short and long terms compared to baseline conditions. This would be 19% of the current 1,390 acres of willow and cottonwood habitat. However, suppressed willow plants that occur on approximately 1,450 acres of wet meadow habitat would not be able to recover due to continued heavy browsing by elk. Therefore, beavers would not be able to return to the southern portion of the refuge in the future.

As the acreage of aspen stands and woody riparian areas decreased, porcupines would likely be negatively impacted to a minor degree in the short term. Due to the disappearance of aspen woodland habitat in the long term, porcupines on the refuge would likely be negatively impacted by a major amount compared to baseline conditions. Porcupines feed on conifers, as well as aspen and

willow, but conifer forest habitat would not change.

*Grand Teton National Park* — Beavers and porcupines in the park could be negatively impacted by the gradual and long-term decline of riparian and aspen woodlands compared to baseline conditions.

*Bridger-Teton National Forest* — Large rodents in the national forest would not be affected under Alternative 1 any more than they have been affected in the recent past.

*Conclusion*

Under Alternative 1 beavers would continue to experience negative impacts because of the loss of willow and cottonwood habitat on the refuge. Beaver habitat at the south end of the refuge would likely become permanently lost. This loss of habitat combined with historical loss of habitat and lethal removal from the northern part of the refuge could result in the lack of a permanent beaver population on the refuge. Porcupines would experience negative impacts to a minor degree in the short term and would likely suffer major adverse impacts in the long term due to the disappearance of aspen woodland habitat and the permanent loss of willow habitat at the south end of the refuge.

Beavers and porcupines in the park could be negatively impacted by the decline in condition of riparian and aspen woodlands compared to baseline conditions. This alternative would not result in the impairment of large rodent communities in the park.

#### Alternative 2

*Analysis*

*National Elk Refuge* — Compared to Alternative 1, beavers could benefit to a minor to negligible degree due to 150 more acres of willow habitat under Alternative 2 in the short term and 40 more acres in the long term if beavers moved into what is now unoccupied habitat in the southern portion of the refuge.

Alternative 2 would result in an estimated 150 more acres of riparian and aspen woodland habitat in the short term and 40 more acres in the long term, which would likely result in minor to negligible positive effects on porcupines.

Beavers and porcupines would potentially benefit by a moderate to major amount if large numbers of elk migrated out of Jackson Hole in the winter because impacts on 1,720 acres of riparian and aspen woodland habitats would be reduced in the long term compared to Alternative 1.

Large rodents would not be adversely impacted or would be impacted to a negligible degree by management activities associated with a fertility control program for bison under Alternative 2. If the fertility control program was conducted on refuge feedlines, large rodents would not be affected because they do not normally occur in the cultivated fields, where feeding takes place.

*Grand Teton National Park* — Beavers and porcupines in the park could benefit from a negligible to minor increase in riparian and aspen habitats compared to Alternative 1.

If the bison fertility control program was conducted in the park in the spring and summer (while most large rodents are breeding and raising young), effects would likely be minimal. Large rodents could be temporarily disturbed by humans hiking through a variety of habitats; however, relatively few people would be involved at any given time, and many areas of the park are already open to hiking.

*Bridger-Teton National Forest* — In the long term larger numbers of elk would browse in the national forest, which could negatively affect beavers and porcupines if this increased browsing pressure caused the decline of willow, cottonwood, and aspen habitats in some areas. In contrast, if large numbers of elk migrated out of Jackson Hole in the winter, riparian and aspen woodlands in the national forest would improve in condition, and porcupines and beavers could benefit from improved woody habitats as a result of less browsing pressure.

*Other Lands* — If large numbers of elk did not migrate outside the Jackson Hole area, beavers and porcupines on BLM lands and private lands in Jackson Hole could experience negative impacts in some areas. Elk that are no longer being fed in

the winter would likely forage more often in riparian and aspen woodland habitats outside of the refuge. Higher levels of browsing on BLM lands and private lands could result in further habitat degradation and loss of acreage in some areas, which would negatively affect beavers and porcupines.

If large numbers of elk did migrate outside Jackson Hole, beavers and porcupines on BLM lands and private lands in the Green River basin could experience negative, localized impacts as a result of riparian and aspen woodland habitats experiencing higher levels of browsing. This could result in habitat degradation and loss of acreage in some areas.

*Conclusion*

If large numbers of elk did not migrate outside Jackson Hole, beavers and porcupines would likely benefit by a negligible to minor degree in the short and long terms due to negligible to minor changes in woody habitat. If large numbers of elk did migrate out of the Jackson Hole area, and if beavers moved into unoccupied habitat in the southern part of the refuge, large rodents could benefit by a major amount.

Beavers and porcupines in the park could benefit from a negligible to minor increase in riparian and aspen woodland habitats and improve habitat conditions compared to Alternative 1. This alternative would not result in the impairment of large rodent communities in the park.

#### Alternative 3

*Analysis*

*National Elk Refuge* — Compared to Alternative 1, beavers that migrate into the southern portion of the refuge would benefit by a major amount in the short and long terms due to an estimated 1,000 more acres of woody riparian habitat in the short term and an estimated 1,720 more acres in the long term. Beavers that moved into the Flat Creek area before willow plants fully recovered would likely be lethally removed until willow habitat became firmly reestablished.

Compared to Alternative 1, the effects of Alternative 3 would result in an estimated 1,720 more acres of riparian and aspen woodland habitat, which would likely have major positive effects on porcupines in the short and long terms.

*Grand Teton National Park* — Beavers and porcupines in the park could benefit by a minor increase in riparian and aspen habitats compared to Alternative 1.

*Bridger-Teton National Forest* — The effects of Alternative 3 on beavers and porcupines in the national forest and BLM lands and private lands in Jackson Hole and the Green River basin would be similar to the effects of Alternative 2.

*Conclusion*

Under Alternative 3 beavers and porcupines could benefit by a major degree due to a major increase in the amount and quality of riparian and aspen woodland habitats in the short and long terms compared to Alternative 1.

Beavers and porcupines in the park could benefit by a minor increase in the amount and quality of riparian and aspen habitats compared to Alternative 1. This alternative would not result in the impairment of large rodent communities in the park.

#### Alternatives 4 and 5

*Analysis*

*National Elk Refuge* — Compared to Alternative 1, beavers that migrated into the southern portion of the refuge would benefit to a moderate degree in the short term due to an estimated 370 more acres of riparian habitats and to a major degree in the long term due to an estimated 690 more acres. However, beavers that moved into the Flat Creek area before suppressed willow plants in the wet meadow habitat had fully recovered would likely be lethally removed until willow habitat became firmly reestablished.

Compared to Alternative 1, porcupines would benefit to a minor degree in the short term due to 340 more acres of riparian and aspen woodland habitat and by a moderate amount in the long term due to 1,590 more acres.

*Grand Teton National Park* — Beavers and porcupines in the park could benefit by a negligible to minor increase in riparian and aspen habitats compared to Alternative 1.

*Bridger-Teton National Forest* — Under Alternative 4 beavers and porcupines in the national forest would not be affected in the short term. In the long term more elk would browse in the national forest, which could adversely affect willow, cottonwood, and aspen habitats, along with porcupines and beavers that depend on woody vegetation.

Beavers and porcupines in the national forest would not be affected under Alternative 5.

*Conclusion*

Compared to Alternative 1, Alternatives 4 and 5 would negatively affect beavers in the near short term if they were lethally removed from recovering willow habitat. After large willow plants were reestablished, beavers and porcupines would benefit by a moderate increase in the amount and quality of riparian and aspen woodland habitats in the long term.

Beavers and porcupines in the park could benefit by a negligible to minor increase in the amount and quality of riparian and aspen habitats compared to Alternative 1. This alternative would not result in the impairment of large rodent communities in the park.

#### *Alternative 6*

*Analysis*

*National Elk Refuge* — Compared to Alternative 1, beavers that migrated into the southern portion of the refuge would benefit by a major amount due to an estimated 900 more acres of woody riparian habitat, especially willow habitat, in the short term, and an estimated 1,470 more acres in the long term. Beavers that moved into the Flat Creek area before willow plants had fully recovered would likely be lethally removed until willow habitat became firmly reestablished.

Porcupines would benefit by a moderate amount in the short term due to an estimated 1,090 more acres of riparian and aspen woodland habitat. In the long term porcupines would benefit by a major amount due to an estimated 3,420 more acres of riparian and aspen woodland habitat compared to Alternative 1.

*Grand Teton National Park* — Beavers and porcupines in the park could benefit by a minor increase in riparian and aspen woodland habitats compared to Alternative 1.

*Bridger-Teton National Forest* — Beavers and porcupines in the national forest would not be affected in the short term. In the long term more elk would browse in the national forest, which could adversely affect willow, cottonwood, and aspen habitats and porcupines and beavers that depend on woody vegetation.

*Conclusion*

Under Alternative 6 beavers that moved to the southern portion of the refuge would be negatively affected in the near short term as they are lethally removed from recovering willow habitat. After large willow plants were reestablished in the long term, beavers and porcupines on the refuge would benefit by a major degree, compared to Alternative1, due to increases in the amount of riparian and aspen woodland habitat and the improved condition of these habitats.

Beavers and porcupines in the park could benefit by a minor increase in riparian and aspen habitats compared to Alternative 1. This alternative would not result in the impairment of large rodent communities in the park.

### Mitigation

Measures to mitigate adverse effects of the alternatives on beavers and porcupines would be similar to those identified for riparian and aspen woodland communities in the "Impacts on Habitat" section of Chapter 4.

### Cumulative Effects

No cumulative effects on large rodents are expected as a result of impacts of the alternatives in combination with the impacts of reasonably foreseeable actions.

# BIRDS

## NEOTROPICAL MIGRATORY BIRDS

The analysis of potential effects of management alternatives on Neotropical migratory birds and other birds is of particular importance in this planning process because providing a refuge and breeding habitat for birds is a major purpose of the refuge, and the management of elk and bison has such a pervasive influence on the amount and condition of breeding bird habitat on the refuge. Analyzing the potential effects on birds is generally important given the requirement to conserve all native wildlife species on national wildlife refuges and national parks, as well as the requirement under the National Environmental Policy Act to analyze potential effects on affected resources. Executive Order 13186 requires that federal agencies pay particular attention to potential effects on migratory birds in developing resource management plans.

The role that the refuge plays in conserving breeding bird habitat in the Jackson Hole area will be assessed in the upcoming comprehensive conservation planning process for the refuge. The assessment will involve factors such as the capacity of the refuge to provide high quality and secure breeding habitat; and the importance of providing high-quality habitat for breeding birds relative to the amount and quality of breeding bird habitat throughout the study area. Because the outcome of the bison and elk management planning process will have a large influence on the options that will be considered for managing other ungulates on the refuge, a comprehensive analysis is needed in the elk and bison planning process.

### Methodology Used to Analyze Effects

Approximately 175 species of birds occur on the refuge and over 300 species of birds occur in the park. Many of these species are Neotropical migratory birds that spend the winter in South and Central America and breed and raise young in North America. Some of these species are highly dependent on particular habitat types and could require that their habitats be in a particular stage of succession or condition. Other species might use more than one habitat type and might be more tolerant of habitat degradation. Neotropical migratory species vary greatly in their seasonal distribution and in their life histories (Dobkin 1994). In addition, Neotropical migratory birds are being affected by habitat changes that are occurring in both the Northern Hemisphere and the Southern Hemisphere. Therefore, potential effects of alternatives on Neotropical migratory birds are discussed in terms of the effects that changes in the amount and condition of habitats in Jackson Hole could have on the abundance of birds while in the study area. Although there might be instances in which increased habitat might not result in an increase in the abundance of a particular species in Jackson Hole (due to factors outside the Greater Yellowstone Area), assessments made in this planning document assume that increases in suitable habitat acreage would result in increased numbers, unless otherwise noted. Estimates are not made about how populations might be affected.

### Impacts of the Alternatives

#### *Impacts Common to All Alternatives*

Neotropical migratory birds dependent on conifer forests and marshland habitats in Jackson Hole, the Green River basin, and the Red Desert are not expected to be affected by the alternatives because their habitats would not be altered to any measurable degree by any of the management actions that are being considered.

Neotropical migratory birds would not be adversely impacted by management activities associated with the supplemental feeding program for elk or bison under Alternatives 1, 3, 4, and 5. Supplemental feeding would be phased out under Alternatives 2 and 6. During the phaseout period, management activities associated with supplemental feeding would not adversely impact Neotropical migratory birds because supplemental feeding occurs during winter when Neotropical migratory birds would have migrated to their winter feeding grounds.

Neotropical migratory birds would not be adversely impacted by activities associated with elk and bison hunting (under all alternatives except 2) or a brucellosis vaccination program for elk and bison (Alternatives 3, 4, and 5) because they would have already migrated to their winter feeding grounds by the time these activities would occur.

### *Alternative 1*

*Analysis*

*National Elk Refuge* — The abundance of some species of Neotropical migratory birds that use wet meadow habitats on the refuge could increase in the short and long terms by a negligible amount due to a 50-acre (5%) increase in wet meadow habitat compared to baseline conditions. While the overall wet meadow plant community on the refuge is in good condition, some areas where grazing by elk and bison is heavy have little residual vegetation. Bird species dependent on residual vegetation for nesting could be adversely impacted by a negligible to minor amount in the short term. Increasing numbers of bison in the long term would moderately increase the negative impacts on these bird species.

The bird community associated with sagebrush shrublands and native grasslands appears to be in satisfactory condition, although few data exist to verify assessment. Neotropical migrants that require sagebrush habitat and native grassland habitat would likely increase in abundance by a negligible amount in the short term due to an estimated 310-acre (2%) increase in these habitats compared to baseline conditions. In the long term Neotropical migratory birds that depend on sagebrush shrubland and native grassland habitats would likely increase in abundance by a minor amount due to an estimated 2,070 acres (13%) of riparian and aspen woodlands converting to sagebrush shrubland and native grassland habitats. Conversely, growing bison numbers could increase grazing pressure on these habitats and result in localized negative impacts to some bird species.

Neotropical migratory birds dependent on willow habitat are already at a very low abundance on the refuge due to a historical loss of 1,450 acres that now are classified as wet meadow habitat. An additional 50 acres of willow would convert to wet meadow habitat due to heavy browsing by elk. This would have minor negative affects on the current abundance of Neotropical migratory birds that use willow communities. In addition, suppressed willow plants on 1,500 acres of wet meadow habitat would not recover in the future due to the numbers of browsing ungulates that would continue to suppress willow plants. As a result, abundances of birds that depend on willow communities would remain at a low level on the refuge.

Neotropical migratory birds on the refuge that are dependent on cottonwood habitat are in very low abundance on 20% of the existing cottonwood acreage because of their poor condition. The remaining 80% of cottonwood habitats on the refuge are in fair to good condition and continue to support an abundance of Neotropical migrants. Neotropical migratory birds that depend on healthy cottonwood habitat would probably not be affected by the conversion of 220 acres of poor condition cottonwood habitat to sagebrush shrubland and native grasslands because they no longer occur in this area. However, Neotropical cavity nesters can use poor condition cottonwood habitat, and these species would likely decline by a minor (20%) amount in the short and long terms.

Neotropical migratory birds on the refuge that depend on good condition aspen woodland habitats are already in very low abundance because 80%–90% of aspen woodland stands are in poor condition. Neotropical birds that nest in good condition aspen woodland habitat would not be affected in the short term by an estimated 90-acre (5%) decline in aspen woodland communities because they do not occur in such poor condition habitat. However, Neotropical cavity nesters would likely decline by a negligible to minor amount in the short term due to this 5% decline in aspen woodland habitat. In the long term Neotropical migratory birds that are dependent on good, fair, or poor condition aspen woodland habitat would eventually disappear as aspen woodland communities disappear on the refuge.

Alternative 1 would not affect Neotropical migratory bird species that use cultivated fields because farming activities would remain similar to baseline conditions.

*Grand Teton National Park* — Neotropical birds dependent on wet meadow habitats would not be affected by Alternative 1 any differently than they have been in the recent past unless nonnative plants began to dominate many wet meadow areas due to heavy ungulate grazing. A shift to nonnative species could adversely impact Neotropical migratory birds dependent on wet meadows.

Increased grazing pressure and reduced residual vegetation due to an unlimited number of bison grazing in the park in the summer would adversely affect Neotropical migratory birds dependent on native grassland and sagebrush shrubland habitats in the park.

Neotropical birds dependent on agricultural lands in the park could be affected by increasing numbers of bison that could accelerate the invasion of noxious weeds in an area that is already dominated by nonnative weed species. Bison wallowing would also increase the amount of bare ground, which would adversely affect Neotropical migratory birds that could still inhabit the agricultural fields.

In the park Neotropical birds dependent on willow habitat would not be affected under Alternative 1 any differently than they have been in the recent past.

Neotropical migratory birds dependent on cottonwood habitat in the park could be adversely affected to a negligible degree by a loss of this habitat type due to elk browsing and bison trampling, while birds that are dependent on aspen habitat could be affected to a minor degree by decreases in aspen habitat due to elk browsing.

*Bridger-Teton National Forest* — Neotropical birds dependent on wet meadow, native grassland, sagebrush shrubland, willow, cottonwood, and aspen habitats in the national forest would not be affected by Alternative 1 any more than they have been in the recent past. However, elk browsing in the national forest is negatively affecting some riparian and aspen woodland stands, which could adversely affect birds that breed in this habitat. This trend would likely continue in the future.

*Conclusion*

Under Alternative 1 there would be a moderate loss in the diversity of Neotropical migratory bird species on the refuge due to a major, long-term decline in the amount and condition of willow, cottonwood, and aspen habitats compared to baseline conditions (in addition to the reduction that has already occurred due to actions contained in Alternative 1). Neotropical migratory bird communities in wet meadow, sagebrush shrubland, and native grassland habitats would expand, but this would not make up for the decline in diversity associated with willow, cottonwood, and aspen habitats.

Neotropical migratory bird diversity would likely decline in small, localized areas in the park due to a minor decrease in aspen habitats in the long term. In addition, there would be a reduction of residual vegetation in native grassland and sagebrush shrubland habitats and an increase in nonnative invasive weeds on wet meadows and agricultural lands due in part to a growing bison population and continued heavy grazing by a large elk population. This alternative would not result in the impairment of Neotropical migratory bird communities in the park.

#### *Alternative 2*

*Analysis*

*National Elk Refuge* — Compared to Alternative 1, the abundance of Neotropical migratory birds dependent on wet meadow habitat would likely be less under Alternative 2 by a negligible to minor degree due to 150 fewer acres (9%) of wet meadow habitat. Any benefits to bird communities in wet meadow habit stemming from reduced numbers of elk and bison could be offset by an increased reliance of remaining animals on native winter habitat. Substantial increases in herbaceous cover might not occur.

Neotropical migratory birds that are dependent on sagebrush shrubland and native grassland communities could be more abundant under Alternative 2 by a minor amount compared to Alternative 1 due to restoring approximately 2,400 acres of cultivated fields to native grassland habitats in the short term and sagebrush shrubland in the long term. Conversely, any benefits to bird communities in sagebrush shrubland and native grassland habitats stemming from reduced numbers of elk and bison could be offset by increased reliance of remaining animals on native winter habitat. Substantial increases in herbaceous cover might not occur.

The abundance of Neotropical migratory birds that use willow habitat could be greater than the abundance of Neotropical birds under Alternative 1 but only by a negligible amount in the short and

long terms. Although there would be an estimated 150 more acres (50%) of willow habitat, this recovery would primarily occur in swales and other areas of heavy snow accumulation. These individual clumps of willow habitat might be too small to provide sufficient nesting habitat for Neotropical migratory birds dependent on willow communities. In addition, compared to the potential willow habitat (1,450 acres) that could exist with less ungulate browsing, 150 acres is a minor amount.

If most elk migrated out of Jackson Hole in the winters over the long term, Neotropical birds dependent on refuge willow communities would benefit to a major degree because potentially 1,450 acres of suppressed willow plants in wet meadows would recover to good condition habitat.

Alternative 2 and Alternative 1 would have similar abundances of Neotropical migratory birds that use cottonwood habitat in the short term. Under Alternative 2 cottonwood habitat would decrease by an estimated 110 acres (10%) in the long term, potentially resulting in fewer birds that use this habitat, but the difference would be negligible.

The effects of Alternative 2 on Neotropical migratory birds dependent on aspen habitat would be similar to the effects under Alternative 1. In the long term birds reliant on aspen woodland habitat would disappear as this habitat type disappeared from the refuge.

Restoring 2,400 acres of cultivated fields would likely result in a more diverse composition of Neotropical bird species on the refuge compared to Alternative 1.

Neotropical migratory birds would not be adversely impacted or would be impacted to a negligible degree by management activities associated with a fertility control program for bison under Alternative 2. If the fertility control program was conducted in the winter on the refuge feedlines, Neotropical birds would be absent from the area.

*Grand Teton National Park* — Neotropical migratory birds dependent on wet meadow habitats are not expected to be affected under Alternative 2 unless nonnative invasive plants began to dominate many wet meadow areas due to heavy elk grazing in some years. Neotropical migrants dependent on wet meadows could be adversely affected by nonnative plants becoming dominant in localized areas.

Neotropical migratory birds dependent on riparian and aspen woodland habitats in the park would likely benefit in the long term as willow, cottonwood, and aspen communities improved in condition and increased in acreage by a negligible to minor amount due to less browsing and trampling by elk and bison.

Restoring approximately 4,500 acres of agricultural lands to native grassland and sagebrush shrubland communities would likely increase the diversity of Neotropical migratory bird species in these formerly cultivated areas.

If the bison fertility control program was conducted in the park in the spring and summer, Neotropical migratory birds would be temporarily disturbed by the presence of a few people hiking through a variety of habitats. Even though a fertility control program in the park would be conducted while birds were breeding and raising young, effects would likely be minimal, especially since many areas of the park are already open to hiking.

*Bridger-Teton National Forest* — Neotropical migratory birds in the national forest that depend on wet meadow, sagebrush shrubland, native grassland, and riparian and aspen woodland habitats would not be affected in the short term because elk grazing in these habitats would be similar to baseline conditions and Alternative 1. In the long term, larger numbers of elk might remain in the national forest, and this increased grazing and browsing pressure could reduce residual vegetation and damage woody vegetation, negatively affecting Neotropical migratory birds that depend on tall vegetation and canopy cover for nesting.

If large numbers of elk migrated to the Green River basin, grasses in the national forest would remain tall, and woody vegetation would remain healthy, benefiting birds dependent on tall vegetation and canopy cover.

*Other Lands* — If large numbers of elk did not migrate out of Jackson Hole, Neotropical migratory birds associated with wet meadow, sagebrush shrubland, native grassland habitats on

BLM and private lands in Jackson Hole could experience negative impacts in localized areas. Elk that are no longer being fed on the refuge in the winter would likely forage more often on private lands compared to baseline conditions, and higher levels of grazing and browsing could result in further habitat degradation, reduced residual vegetation, and loss of acreage in some areas.

If large numbers of elk migrated outside Jackson Hole, Neotropical migratory birds associated with wet meadow, native grassland, sagebrush shrubland, and riparian and aspen woodland communities on BLM lands and private lands in the Green River basin and the Red Desert could be negatively affected in localized areas as a result of higher levels of grazing and browsing. This could result in habitat degradation and loss of acreage in some areas. Neotropical birds that need residual vegetation or a high percentage of canopy cover would be negatively impacted the most.

*Conclusion*

Under Alternative 2 Neotropical migratory bird diversity on the refuge could be greater than under Alternative 1 by a negligible amount because of more acres of willow habitat in healthier condition in the short and long terms. Neotropical migratory bird species dependent on aspen habitat would eventually disappear from the refuge as this habitat type disappeared under Alternative 2 (similar to Alternative 1). Neotropical migratory bird communities associated with wet meadow and cottonwood habitats would be reduced by a negligible to a minor amount, and bird communities associated with sagebrush shrublands and native grasslands would expand by a minor amount. However, if large numbers of elk migrated out of the Jackson Hole area for the winter, a major increase in willow habitat would greatly enhance Neotropical migratory bird communities dependent on this habitat type. Some aspen communities could also survive and improve in condition, which would support small communities of Neotropical migratory birds that depend on good condition aspen habitat.

In the park a minor increase in the condition and amount of riparian and aspen woodland habitat and restoring 4,500 acres of agricultural lands to native plant communities would likely increase the diversity and abundance of Neotropical migratory birds, more closely approximating natural conditions compared to Alternative 1. This alternative would not result in the impairment of Neotropical migratory bird communities in the park.

### *Alternative 3*

*Analysis*

*National Elk Refuge* — Compared to Alternative 1, wet meadow habitat under Alternative 3 would decrease by an estimated 780 acres (45%) in the short term and 1,500 fewer acres (87%) in the long term. This would affect Neotropical birds dependent on wet meadow habitats by a moderate to major degree. Fewer elk in this alternative could result in more residual grass cover on those wet meadow acres that remain, which would benefit bird species dependent on tall grass cover to avoid predators. Conversely, any benefits to bird communities in wet meadow habitats stemming from large reductions in elk numbers (bison numbers would remain unchanged) could be offset by increased reliance of remaining animals on native winter habitat. Substantial increases in herbaceous cover might not occur.

Under Option A sagebrush shrubland and native grassland habitats on the refuge would decrease by an estimated 220 fewer acres (1%) in the short and long terms. This small change in habitat would have a negligible effect on the abundance of Neotropical migratory birds dependent on these habitat types compared to Alternative 1.

Under Option B the effects on Neotropical migratory birds in sagebrush shrubland and native grassland habitats would be similar to the effects of Alternative 2.

Under Alternative 3 an estimated 780 more acres (260%) of willow habitat in the short term and an estimated 1,500 more acres (500%) in the long term could result in a major increase in Neotropical migratory birds dependent on this habitat compared to Alternative 1. This increase in willow habitat would be due to the recovery of suppressed willow plants in wet meadow habitats. As these plants grew outside the browse zone, they would provide birds with robust, multi-layered, and dense thickets that offer a variety of niches for birds that are habitat specialists.

Compared to Alternative 1, an estimated 220 more acres (20%) of cottonwood habitat under Alternative 3 could result in a minor increase in Neotropical migratory birds dependent on this habitat in the short and long terms. All cottonwood habitats would be in good or fair condition under Alternative 3, compared to 80% of cottonwood communities in good or fair condition under Alternative 1.

The effects of Alternative 3 on Neotropical migratory birds dependent on aspen habitat would be similar to the effects of Alternative 1. In the long term birds reliant on aspen woodland habitat would disappear as this habitat type disappeared from the refuge.

If large numbers of elk migrated outside Jackson Hole, some aspen stands on the refuge could survive, and Neotropical migratory birds that depend on this habitat would benefit. These aspen stands would have to be large enough to provide birds with interior forest as protection against nest predators and parasites.

Option A of Alternative 3 would not affect Neotropical migratory birds on the refuge in cultivated fields because acreage and management of these areas would be similar to baseline conditions and Alternative 1. Option B would phase out cultivated fields, which would result in effects similar to Alternative 2.

*Grand Teton National Park* — Neotropical migratory birds dependent on wet meadow habitats in the park are not expected to be affected under Alternative 3 unless large numbers of bison negated, to some extent, the lower numbers of elk and resulted in more invasions by nonnative plant species. If nonnative invasive plant communities became dominant in localized areas, Neotropical migratory birds dependent on wet meadow habitat could be adversely affected.

Neotropical migratory birds that are dependent on native grassland and sagebrush shrubland habitats could benefit from the restoration of approximately 4,500 acres of agricultural lands to native grassland and sagebrush shrubland communities.

Compared to Alternative 1, Neotropical migratory birds that are dependent on willow, cottonwood, and aspen habitats could benefit as a result of minor improvement in willow, cottonwood, aspen communities and additional acreage due to fewer ungulates browsing in the park.

*Bridger-Teton National Forest* — The effects of Alternative 3 on Neotropical migratory birds that are dependent on wet meadow, sagebrush shrubland, native grassland, and riparian and aspen woodland habitats in the national forest would be similar to the effects of Alternative 2.

*Other Lands* — The effects of Alternative 3 on Neotropical migratory birds that are dependent on wet meadow, sagebrush shrubland, native grassland and riparian and aspen woodland habitats on BLM lands and private lands in Jackson Hole, the Green River basin, and the Red Desert would be similar to the effects of Alternative 2.

*Conclusion*

Neotropical migratory bird diversity under Alternative 3 could be greater than under Alternative 1 due to a major increase in willow habitat and a minor increase in cottonwood habitat on the refuge. Neotropical migrants dependent on aspen habitat would eventually disappear from the refuge as this habitat type could disappear under Option A, similar to Alternative 1. Option B would phase out cultivated fields, which would result in effects similar to Alternative 2. Neotropical migratory bird communities associated with wet meadows would be reduced by a moderate to major amount, and those associated with sagebrush shrublands and native grasslands would be reduced by a negligible amount compared to Alternative 1.

In the park more riparian and aspen woodland habitats in healthy condition and the conversion of agricultural lands to native plant communities would likely increase Neotropical migratory bird diversity, more closely approximating natural conditions, as compared to Alternative 1. This alternative would not result in the impairment of Neotropical migratory bird communities in the park.

### *Alternatives 4 and 5*

*Analysis*

*National Elk Refuge* — Compared to Alternative 1, an estimated 270 fewer acres (16%) of wet meadow habitat in the short term would have a minor negative effect on Neotropical migratory birds that use this habitat type. An estimated 520 fewer acres (30%) in the long term would have a moderate negative effect. In the short term the construction of a 500-acre willow exclosure in wet meadow habitat on the refuge would result in a major increase in the amount of residual cover, within the exclosure benefiting those species requiring tall vegetation. However, over time the quality of wet meadow habitat would decline as willows increased within the exclosure. Outside the exclosure little residual cover would remain because elk and bison would graze heavily on the wet meadow habitat that was still accessible.

An estimated 70 fewer acres (0.4%) of sagebrush shrubland and native grassland habitat on the refuge in the short term would have a negligible effect on the abundance of Neotropical migrants dependent on these habitat types. An estimated 1,070 fewer acres (7%) in the long term would have a minor negative effect.

An estimated 270 more acres (90%) of willow habitat in the short term and an estimated 520 more acres (173%) in the long term would have beneficial effects on the abundance of Neotropical migratory birds that use this habitat type compared to Alternative 1. Compared to the potential amount of willow acreage on the refuge of 1,750 acres, this habitat increase would be minor, and the benefit to Neotropical birds would likely be minor.

Compared to Alternative 1, an increase of 70 acres (6%) of cottonwood communities would have negligible short- and long-term impacts on Neotropical migratory birds that use good and fair condition cottonwood habitat.

In the short term the recovery of approximately 500 acres of poor condition aspen woodland habitat within an exclosure would have a moderate impact on the abundance of Neotropical migratory birds that use good and fair condition aspen woodland habitat, as compared to Alternative 1. In the long term approximately 1,000 acres of aspen woodland habitat would have a major beneficial effect on Neotropical birds, as compared to Alternative 1, where all aspen woodland communities would eventually disappear.

*Grand Teton National Park* — Neotropical migratory birds dependent on wet meadow habitats in the park would not be affected under Alternative 4.

Neotropical birds dependent on wet meadow habitats would not be affected under Alternative 5 unless nonnative invasive plants begin to dominate many wet meadow areas as a result of heavy elk grazing. Neotropical migratory birds dependent on wet meadows could be adversely affected by nonnative plant species becoming dominant in localized areas.

Compared to Alternative 1, the composition of the Neotropical bird community in native grasslands and sagebrush shrublands would likely be more diverse under Alternatives 4 and 5 due to the restoration of 4,500 acres of agricultural lands to native vegetation.

Neotropical migratory birds dependent on willow, cottonwood, and aspen habitats could benefit by a negligible to minor degree due to less intense browsing compared to baseline conditions and Alternative 1.

*Bridger-Teton National Forest* — Neotropical migratory birds in the national forest that depend on wet meadow habitats would not be affected in the short term because elk grazing in wet meadows habitats would be similar to baseline conditions and Alternative 1. However, in the long term larger numbers of elk could remain on national forest lands in the winter, increasing grazing pressure and reducing residual vegetation in wet meadow communities. This could negatively affect Neotropical migratory birds that depend on tall vegetation for cover.

In the short term there would be few if any changes to the Neotropical migratory bird communities that depend on sagebrush shrubland and native grassland communities. In the long term larger numbers of elk grazing in the forest could have adverse impacts to vegetation in some areas, with negative impacts on Neotropical migratory birds that rely on tall grasses for cover.

There would be few, if any, changes to the Neotropical migratory bird community that depends on riparian and aspen woodland habitats in the short term as a result of elk browsing pressure. but more elk browsing in the long term could adversely affect willow, cottonwood, and aspen habitats and the Neotropical bird communities that depend on woody vegetation.

Neotropical migratory birds in the national forest would not be affected under Alternatives 5 compared to baseline conditions and Alternative 1. However, elk browsing in the national forest would continue to negatively affect some willow, cottonwood, and aspen stands.

*Conclusion*

Compared to Alternative 1, the diversity of Neotropical migratory birds would be higher on the refuge under Alternatives 4 and 5 by a minor to moderate amount in the long term due to a moderate increase in riparian and aspen woodland habitat in good and fair condition. Neotropical migratory bird communities associated with wet meadows would be reduced by a minor to moderate amount compared to Alternative 1, while birds dependent on sagebrush shrubland and native grasslands would be reduced by a negligible to minor amount.

In the park Neotropical bird diversity could be greater than under baseline conditions and Alternative 1 due to more riparian and aspen woodland habitat in healthier condition and the conversion of 4,500 acres of agricultural lands to native plant communities. The benefits would be less under Alternative 5 due to relatively high numbers of elk browsing on woody vegetation. This alternative would not result in the impairment of Neotropical migratory bird communities in the park.

#### *Alternative 6*

*Analysis*

*National Elk Refuge* — The effects of Alternative 6 on Neotropical migratory birds dependent on wet meadow habitats on the refuge would be similar to the effects of Alternative 3.

An estimated 310 fewer acres (2%) of sagebrush shrubland and native grassland habitats on the refuge in the short term could have a negligible adverse effect on Neotropical migrants that depend on these habitat types. An estimated 1,920 fewer acres (12%) in the long term could have a minor adverse effect. Although ungulate numbers would be lower on the refuge, any benefits to some bird species stemming from large reductions in elk and bison numbers could be offset by a greater reliance of remaining animals on native winter habitat. Substantial increases in herbaceous cover might not occur.

The effects of Alternative 6 on Neotropical migratory birds that are dependent on willow habitat on the refuge would be similar to Alternative 3.

An increase of 70 to 220 acres (6%–20%) of cottonwood communities in the short and long terms would have negligible to minor beneficial impacts on Neotropical migratory birds that use good and fair condition cottonwood habitat compared to Alternative 1.

The recovery of approximately 600 acres of poor condition aspen woodland habitat in the short term within rotating exclosures would have a moderate beneficial impact on the abundance of Neotropical migratory birds that use this habitat type. In the long term the restoration of 1,850 acres of aspen woodland habitat to good condition habitat would have a major beneficial impact on Neotropical birds compared to Alternative 1, where all aspen woodland communities would eventually disappear.

Neotropical migratory birds in the cultivated fields would likely not be affected by management activities any more than under Alternative 1.

*Grand Teton National Park* — Lower numbers of elk grazing on wet meadows would likely result in fewer invasions by nonnative weeds, and Neotropical migratory birds dependent on wet meadows could benefit from native plant communities remaining dominant.

Compared to Alternative 1, the composition of the Neotropical bird community in native grasslands and sagebrush shrublands would likely be more diverse due to the restoration of 4,500 acres of agricultural lands to native vegetation, similar to Alternatives 2 through 5.

Neotropical migratory birds dependent on riparian and aspen woodland communities in the park could benefit by a negligible to minor amount due to the reduced numbers of elk browsing on woody vegetation.

*Bridger-Teton National Forest* — The effects of Alternative 6 on Neotropical migratory birds dependent on wet meadow habitat in the national forest would be similar to the effects of Alternatives 2 and 3.

If larger numbers of elk grazed in sagebrush shrubland and native grassland habitats in the national forest, residual vegetation could be reduced, with adverse effects on migratory bird species that rely on tall grasses for cover. Conversely, if large numbers of elk migrated out of Jackson Hole in the winters, grasses in the national forest would remain tall and birds dependent on tall vegetation would not be affected.

In the long term more elk in the national forest could increase browsing pressure on riparian and aspen woodland habitats and damage woody vegetation, which could negatively affect Neotropical migratory birds that breed and nest in willow, cottonwood, and aspen habitats.

If large numbers of elk did migrate out of the Jackson area, Neotropical migratory birds dependent on riparian and aspen woodland habitat in the forest would benefit from the improved condition of these habitats.

*Other Lands* — If large numbers of elk did not leave the Jackson Hole area in the winter, Neotropical migratory bird communities associated with wet meadow, sagebrush shrubland, native grassland and riparian and aspen woodland habitats on BLM and private lands in the Jackson Hole area could experience negative impacts in localized areas. Elk would likely forage more often in these habitats outside the refuge since no supplemental feed would be provided. Higher levels of browsing and grazing on BLM lands and private lands could result in further habitat degradation and loss of acreage in some areas, which would negatively affect associated Neotropical migratory birds.

If large numbers of elk did migrate out of Jackson Hole, Neotropical migratory bird communities associated with wet meadow, sagebrush shrubland, native grasslands and riparian and aspen woodland habitats on federal, state, and private lands in other locations could experience negative impacts in localized areas. Birds that need residual vegetation or a high percentage of canopy cover would be negatively impacted the most.

*Conclusion*

Neotropical migratory bird diversity under Alternative 6 would be greater than under Alternative 1 in the short and long terms due to a major increase in good condition woody vegetation. Bird communities associated with wet meadows would be smaller than under Alternative 1 by a moderate to major amount and Neotropical migrants dependent on sagebrush shrubland and native grassland habitats would be smaller by a negligible to minor amount.

In the park Neotropical migratory bird diversity would likely be greater than under Alternative 1 due to more riparian and aspen habitats in healthier condition and the conversion of agricultural lands to native plant communities. This alternative would not result in the impairment of Neotropical migratory bird communities in the park.

## Mitigation

Measures to mitigate adverse effects of the alternatives on Neotropical migratory birds would be the same as those for riparian and aspen woodland, wet meadow, sagebrush shrubland, and native grassland habitats in the "Impacts on Habitat" section of Chapter 4.

## Cumulative Effects

### *Federal Land Management Activities*

*Grand Teton National Park Fire Management*

The park's fire management plan could have short-term adverse affects on some Neotropical migratory birds by disturbing and displacing individuals and reducing foraging and nesting habitat or habitat quality. Fire management actions are not expected to affect species at a population level. Prescribed fire can be used to maintain and restore more diverse vegetative communities in landscapes where natural fire regimes have been

disrupted. The long-term effects of prescribed fire could create vegetative diversity that would improve foraging and nesting habitat for many Neotropical migratory bird species.

The decrease in diversity of Neotropical migratory birds under Alternative 1 due to the loss of riparian and aspen woodland habitat on the refuge could be offset to some extent by the beneficial effects of Grand Teton National Park's fire management plan. Alternatives 2–6 would increase riparian and aspen woodland habitat on the refuge and convert formerly cultivated areas in the southern portion of the park to native vegetation. Improved native habitat on the refuge and in the park, combined with improved habitat as a result of fire management activities, would have long-term, cumulative, beneficial effects on Neotropical migratory birds.

*Grand Teton National Park Recreation Infrastructure Improvements*

Potential construction of a multi-use trail from Moose to the north Jenny Lake junction would result in site-specific, temporary impacts along planned trail routes during the summer. The trail construction phase would likely displace Neotropical birds within or near work areas in the short term and make habitat unavailable. If pathways were separate from existing roads, long-term impacts to birds could include loss of habitat along the new pathways. The range and specific details of the improvements are unknown at this time.

The decrease in Neotropical migratory bird diversity under Alternative 1 due to the loss of riparian and aspen woodland habitat on the refuge could have cumulative effects when combined with the effects of habitat loss in the park due to infrastructure improvements. Alternatives 2–6 would increase riparian and aspen woodland habitat on the refuge and would convert formerly cultivated areas in the southern portion of the park to native vegetation. These actions could offset the loss of habitat due to infrastructure improvement in the park over the long term.

*Bridger-Teton National Forest Fuels Management Projects*

Bridger-Teton National Forest has identified 15 fuels reduction projects in the primary analysis area, and several others in the secondary analysis area in the upper Green River watershed. These projects would alter about 9,400 acres of national forest land and could temporarily reduce Neotropical migratory bird habitat immediately after various fuel reduction treatments. However, in the long term, most of these projects would improve nesting and foraging habitats for Neotropical birds.

The negative effects on the diversity of Neotropical migratory birds due to the loss of riparian and aspen woodland habitat on the refuge and in the park under Alternative 1 could be offset to some extent by improved nesting and foraging habitat within the forest over the long term. Beneficial cumulative effects would result under Alternatives 2–6 due to increased riparian and aspen woodland habitats on the refuge and in the park, combined with improved habitats in the national forest. However, under Alternatives 2, 3, and 6, and to some extent under Alternative 4, more elk would be wintering on native winter range and might heavily browse riparian and aspen woodland habitats in the forest, decreasing the benefits to Neotropical birds.

*Bridger-Teton National Forest Recreation Planning / Moose-Gypsum Projects*

The dispersed recreation camping site plan would decrease the potential for interactions that could disturb and displace Neotropical birds from more critical habitat. In the long term these projects could result in beneficial effects to migratory birds, but the effects would likely be negligible.

*BLM Snake River Resource Management Plan*

Greater public access has the potential to increase conflicts with Neotropical migratory birds and negatively impact woody riparian habitats that support a more diverse bird community. Continued management of conservation easements for open space and wildlife habitat would help protect foraging and nesting habitat. Pursuit of a long-term protective withdrawal to prohibit the staking and development of mining claims would also

benefit birds by preventing potential adverse habitat impacts.

Cumulative effects are not expected under Alternatives 1 and 5 because the amount of browsing by elk in woody riparian habitats would not be affected. Alternatives 2, 3, and 4 in average or milder than average winters, as well as Alternative 6, would increase elk distribution in some years and increase the potential for heavy browsing that could reduce the quality of habitat for Neotropical migratory birds.

*BLM Upper Green River Special Recreation Management Area*

Proposed improvements to sensitive riparian vegetation zones would benefit a diversity of Neotropical birds. Cumulative impacts under all the alternatives would likely be negligible because of the small amount of acreage (16.5 acres) that would be directly impacted by the plan.

#### *Snake River Restoration Activities*

Restoration of the Snake River channel by the U.S. Army Corps of Engineers could impact riparian habitat for a variety of wildlife species, including Neotropical birds. This environmental restoration project will prevent further degradation of riparian habitat and facilitate habitat recovery.

The negative effects on the diversity of Neotropical migratory birds due to the loss of riparian and aspen woodland habitat on the refuge and the park under Alternative 1 could be offset to some extent by increased woody riparian habitat along the Snake River. Beneficial cumulative effects would result in the long term under Alternatives 2–6 due to increased riparian and aspen woodland habitats on the refuge and in the park, combined with increased woody riparian habitat along the Snake River. Increased browsing by elk along the Snake River under Alternatives 2, 3, and 4 in average and milder than average winters, as well as Alternative 6, could offset some of the beneficial cumulative effects.

#### *Population Growth and Private Land Development*

*Primary Analysis Area*

Projected population increases in both Teton and Sublette counties would continue to create a demand for private land development in these areas. Neotropical migratory birds would encounter increased habitat loss, conflicts with humans, and vehicle collisions. Development in riparian and aspen woodland habitats would have the most negative impacts on bird diversity. The loss of riparian and aspen woodland habitats on the refuge and in the park under Alternative 1, combined with the loss and degradation of this habitat type on private lands, would have cumulative negative impacts on Neotropical bird diversity. Increased riparian and aspen woodland habitat and improved habitat quality on the refuge and in the park under Alternatives 2–6 would offset to some extent the loss of habitat on private lands, but the effects would likely be negligible.

## Gallinaceous Birds

### Methodology Used to Analyze Effects

Estimates of an alternative's potential beneficial or adverse effects on populations of gallinaceous birds have been based on changes in the amount and condition of preferred habitats. Increases in the amount and/or condition of preferred habitats are viewed as benefits to populations, and decreases are viewed as detrimental effects, even though neither increases nor decreases could translate directly into increased population or production levels. For example, the effect that changes in the amount of sagebrush shrubland habitat would have on sage grouse would depend on the location of changes, existing sage grouse habitat use patterns, size and quality of adjacent sagebrush and native grassland habitats, and many other factors. Nonetheless, increases in the amount and quality of sagebrush habitat are beneficial to sage grouse populations and reductions are generally detrimental. Due to the numerous factors that may influence grouse populations, no attempt has been made to quantify (negligible, minor, moderate or major) the degree that grouse populations could benefit from or be adversely impacted by potential habitat changes.

## Impacts of the Alternatives

### *Impacts Common to All Alternatives*

Gallinaceous birds would not be adversely impacted or would be impacted to a negligible degree by management activities and other human disturbances under all alternatives. Activities associated with the supplemental feeding program (Alternatives 1, 3, 4, 5, and 6), fertility control on the refuge (Alternative 2), and brucellosis vaccination on the refuge (Alternatives 4, 5, and possibly 3) would not disturb grouse because they would occur in cultivated fields and grassland habitat where gallinaceous birds do not normally occur.

Gallinaceous birds would not be adversely impacted or would be impacted to a negligible degree by activities associated with elk and/or bison hunting in all alternatives except 2. Hiking and horseback riding and the firing of rifles could temporarily disturb gallinaceous birds in the immediate area; however, these effects would not affect survival and reproduction.

### *Alternative 1*

*Analysis*

*National Elk Refuge* — Under Alternative 1 sage grouse on the refuge would not be impacted in the short term any more than they have been in the recent past because there would be little or no change in sagebrush shrubland communities. Sage grouse could potentially benefit in the long term as sagebrush shrubland habitat on the refuge increased by an estimated 1,160 acres (15%), in large part due to the loss of aspen habitat. In addition to increased acreage of sagebrush shrubland habitat, sage grouse could also benefit from the loss of aspen habitat because it would eliminate many tall perches used by common ravens, which are key nest predators. Conversely, continued heavy grazing in some areas by elk and a growing population of bison, trampling of sagebrush in localized areas, and maintenance of higher-than-natural densities of common ravens and coyotes on the refuge (due in part to the large concentration of wintering elk and bison) could adversely affect the local sage grouse population. It is not clear whether potential beneficial and adverse effects of elk and bison management would have a net beneficial or adverse effect on the sage grouse population in the long term.

Ruffed grouse and blue grouse are rare on the refuge because suitable habitat is limited. A decrease in aspen woodlands by an estimated 90 acres (5%) in the short term would not measurably affect ruffed and blue grouse populations. However, the eventual loss of a major amount of riparian and aspen woodland habitat (an estimated 1,850 acres, or 100%, of aspen habitat, an estimated 50 acres (16%) of willow habitat, and an estimated 220 acres (20%) of cottonwood habitat under this alternative would have a negative impact on ruffed and blue grouse.

*Grand Teton National Park* — Increasing bison numbers in this alternative could result in increased use of sagebrush shrubland habitat and reduced residual vegetation, potentially adversely affecting sage grouse nesting and brooding habitat. In addition, continued encroachment of conifers into some areas formerly dominated by sagebrush could reduce the amount of suitable habitat in some areas and increase the number of widely spaced conifer trees that may provide perches for nest predators.

Ruffed grouse and blue grouse in some places in the park could be negatively impacted in localized areas by the loss of aspen and cottonwood habitat in the long term due in part to heavy browsing by elk and other ungulates.

*Bridger-Teton National Forest* — Sage grouse in the national forest would not be affected under Alternative 1 any more than they have been in the recent past, which includes localized adverse impacts due to heavy elk grazing and browsing.

Ruffed grouse and blue grouse could be negatively impacted in areas where aspen and cottonwood habitat was lost in the long term due in part to heavy browsing by elk and other ungulates.

*Conclusion*

Under Alternative 1 sage grouse populations on the refuge could potentially benefit as sagebrush shrubland communities increased by a minor amount in the long term due primarily to a loss of aspen habitat compared to baseline conditions. However, large numbers of bison could negate

any beneficial effects of more habitat by reducing residual cover and degrading habitat condition. Ruffed grouse numbers would likely decline in the short and long terms as aspen habitat eventually disappeared, and the potential for increasing blue grouse numbers would disappear.

Sage grouse in the park could be adversely affected by growing numbers of bison in sagebrush shrubland habitat compared to baseline conditions. Ruffed grouse and blue grouse could experience adverse impacts due to reductions in the amount and condition of aspen and cottonwood habitats in localized areas in the long term compared to baseline conditions. This alternative would not result in the impairment of grouse communities in the park.

#### *Alternatives 2 and 3 (Option B)*

*Analysis*

*National Elk Refuge* — Under Alternative 2 and option B of Alternative 3, an estimated 200 additional acres (2%) of sagebrush shrubland habitat would likely not affect sage grouse on the refuge in the short term, but an estimated 9,420 more acres (117%) of this habitat type in the long term compared to Alternative 1 could result in beneficial impacts. However, the immediate discontinuation of hunting and the eventual elimination of winter feeding on the refuge under Alternative 2 could result in higher levels of grazing by elk and bison in sagebrush shrubland habitats, which could offset some of the benefits of increased acreage.

Compared to Alternative 1, in the short and long terms, Alternative 2 and option B of Alternative 3 would have an estimated 150 more acres (5%) of woody vegetation, which could benefit ruffed and blue grouse on the refuge but only to a negligible degree.

Increased ungulate browsing caused by reduced feeding and the elimination of hunting under Alternative 2 could also negate any beneficial effects of increased habitat and possibly result in overall negative impacts to forest grouse.

If large numbers of elk migrated out of the Jackson Hole area, ruffed and blue grouse could benefit with the recovery of an estimated 1,600 acres of riparian and aspen woodland habitat to good and fair conditions in the long term.

Even if the fertility control program was conducted in the park in the spring and summer under Alternative 2, gallinaceous birds would not be disturbed more than a negligible degree and only for a short period of time by biologists hiking through a variety of habitats.

*Grand Teton National Park* — An estimated 2,250 additional acres of sagebrush shrubland habitat would potentially benefit sage grouse in the park in the long term compared to baseline conditions and Alternative 1. A major reduction in bison numbers, which could result in larger amounts of residual grass cover in some areas, could also benefit sage grouse.

Negligible to minor increases in the amount and condition of riparian and aspen woodland habitats as a result of less browsing and trampling by elk and bison could benefit ruffed and blue grouse in the park.

*Bridger-Teton National Forest* — Compared to Alternative 1, increased grazing and browsing pressure by elk in localized areas on sagebrush shrubland and riparian and aspen woodland habitats in the national forest could negatively affect sage grouse, ruffed grouse, and blue grouse nesting or other aspects of their ecology.

*Other Lands* — If large numbers of elk did not migrate outside the Jackson Hole area, sage grouse and ruffed grouse on private lands in Jackson Hole could be negatively affected in localized areas from elk foraging more often on private lands compared to baseline conditions and Alternative 1. Higher levels of grazing and browsing could result in further habitat degradation, reduced residual vegetation, and loss of acreage in localized areas.

If large numbers of elk did migrate outside the Jackson Hole area, sage, ruffed, and blue grouse on federal, state, and private lands in the Green River basin could be negatively affected in localized areas as a result of sagebrush shrubland and riparian and aspen woodland habitats being degraded and possibly lost from higher levels of browsing and grazing.

*Conclusion*

Sage grouse on the refuge would potentially benefit in the long term as a result of a major increase in sagebrush habitat being available compared to Alternative 1. Increased grazing by elk and bison could offset the benefits of more sagebrush shrubland habitat. Forest grouse on the refuge could be beneficially affected in the long term by a negligible increase in woody vegetation, but increased grazing and browsing by ungulates would likely negate this habitat increase and possibly result in overall negative impacts. If large numbers of elk migrated out of Jackson Hole, ruffed and blue grouse on the refuge would benefit from the recovery of an estimated 1,600 acres of riparian and aspen woodland habitats.

Sage grouse in the park would potentially benefit in the long term from 2,250 additional acres of sagebrush shrubland habitat and a major reduction in bison numbers compared to Alternative 1. Ruffed and blue grouse could benefit due to a negligible to minor increase in the condition of cottonwood and aspen habitat. This alternative would not result in the impairment of grouse communities in the park.

#### *Alternative 3 (Option A)*

*Analysis*

*National Elk Refuge* — Under Option A of Alternative 3 an estimated 90 additional acres (1%) of sagebrush shrubland habitat in the short term would likely have negligible impacts on sage grouse. An estimated 5,690 more acres (71%) of sagebrush shrubland habitat in the long term could benefit sage grouse. However, a major reduction in winter feeding and closing part of the hunt zone on the refuge could result in increased grazing pressure, which could offset some of the benefits of increased acreage.

Ruffed grouse could benefit from the estimated 1,720 more acres (53%) of riparian and aspen woodland habitat remaining on the refuge in the long term, compared to Alternative 1. However, benefits would be minimal because most of the difference in habitat would involve willow habitat, which is not used to the same extent as aspen habitat. Most or all of the aspen habitat on the refuge would be lost under both Alternatives 3 and 1. Blue grouse would become increasingly rare on the refuge.

*Grand Teton National Park* — An estimated 2,250 additional acres of sagebrush shrubland habitat, compared to baseline conditions and Alternative 1, could benefit Sage grouse in the park in the long term. A major long-term reduction in bison could also potentially benefit sage grouse.

Ruffed grouse and blue grouse in the park could potentially benefit from a minor increase in the amount and condition of riparian and aspen woodland communities because of fewer elk browsing in the park compared to baseline conditions and Alternative 1.

*Bridger-Teton National Forest* — Compared to Alternative 1, increased grazing and browsing pressure by elk in localized areas on sagebrush shrubland and riparian and aspen woodland habitats in the national forest could negatively affect sage, ruffed, and blue grouse nesting or other aspects of their ecology.

*Other Lands* — If most elk remained in the Jackson Hole area for the winters, ruffed grouse on BLM and private lands in Jackson Hole could be negatively affected in localized areas due to higher levels of browsing in willow, aspen, and cottonwood habitats.

If large numbers of elk did migrate outside the Jackson Hole area, sage and forest grouse on federal, state, and private lands in the Green River basin could be negatively impacted in localized areas due to higher levels of grazing and browsing in sagebrush shrubland and riparian and aspen woodland habitats.

*Conclusion*

Under Alternative 3 sage grouse on the refuge could benefit due to negligible habitat changes on the refuge in the short term and major habitat changes in the long term compared to Alternative 1. Increased grazing and browsing by elk and bison could offset potential benefits of more sagebrush shrubland habitat. Ruffed grouse and blue grouse could be slightly better off than under Alternative 1 because willow habitat would recover under this alternative. Blue grouse would become increasingly rare on the refuge.

Sage grouse in the park would potentially benefit in the long term from 2,250 additional acres of sagebrush shrubland habitat compared to baseline conditions and Alternative 1. Ruffed grouse and blue grouse could benefit by a minor increase in the condition of riparian and aspen woodland communities. This alternative would not result in the impairment of grouse communities in the park.

#### Alternative 4

*Analysis*

*National Elk Refuge* — An estimated 170 additional acres (2%) of sagebrush shrubland habitat in the short term and an estimated 230 more acres (3%) in the long term, compared to Alternative 1, could probably have negligible effects on sage grouse on the refuge. Major reductions in winter feeding could result in increased grazing pressure in some sagebrush shrubland habitats, which could negatively impact sage grouse populations.

Compared to Alternative 1, ruffed grouse and blue grouse on the refuge would benefit from an estimated 1,590 additional acres (49%) of woody vegetation in the long term and greatly improved habitat conditions. Improved habitat conditions could result in increased use of the refuge by forest grouse.

*Grand Teton National Park* — An estimated increase of 2,250 additional acres of sagebrush shrubland habitat in the long term and a major reduction in bison numbers could potentially benefit sage grouse populations in the park.

Ruffed and blue grouse in the park would not be affected or would be beneficially affected to a negligible degree under Alternative 4.

*Bridger-Teton National Forest* — Compared to Alternative 1, increased grazing and browsing pressure by elk in localized areas on sagebrush shrubland and riparian and aspen woodland habitats in the national forest could negatively affect sage, ruffed, and blue grouse nesting or other aspects of their ecology.

*Conclusion*

Increased browsing and grazing on sage grouse habitat due to reductions in winter feeding could negatively affect sage grouse populations compared to Alternative 1. Ruffed and blue grouse could benefit in the long term compared to Alternative 1 because good and fair condition riparian and aspen woodland habitats would increase by a moderate amount.

Sage grouse in the park would potentially benefit in the long term from 2,250 additional acres of sagebrush shrubland habitat and from a major reduction in bison numbers compared to Alternative 1. Ruffed grouse would not be affected or would be beneficially affected to a negligible degree due to fewer ungulates browsing on woody vegetation. This alternative would not result in the impairment of grouse communities in the park.

#### Alternative 5

*Analysis*

*National Elk Refuge* — The potential effects of Alternative 5 on sage grouse on the refuge would be similar to the effects of Alternative 4, except that grazing pressure could be somewhat less in sagebrush shrubland habitats because supplemental feeding would make it unnecessary for elk to use native forage. More residual vegetation would benefit sage grouse.

Exclosures under Alternative 5 would result in an estimated 340 additional acres (10%) of riparian and aspen woodland habitat in the short term and 1,590 more acres (49%) in the long term and much of this habitat would be in good and fair condition. This would benefit ruffed and blue grouse, and it could result in increased use of the refuge by these grouse species compared to Alternative 1.

*Grand Teton National Park* — Sage grouse in the park would potentially benefit in the long term from an estimated 2,250 additional acres of sagebrush shrubland habitat compared to baseline conditions and Alternative 1. A major reduction in bison numbers could result in larger amounts of residual grass cover in some areas, which could benefit nesting sage grouse.

Ruffed and blue grouse would not be affected or would be beneficially affected to a negligible degree under Alternative 5.

*Bridger-Teton National Forest* — Sage, ruffed, and blue grouse in the national forest would not be affected under Alternative 5 any more than they have been in the recent past.

*Conclusion*

The effects of Alternative 5 on sage grouse on the refuge would be similar to the effects of Alternative 4 except that grazing pressure would be somewhat less on native winter range because of supplemental feeding, and sage grouse would benefit from more residual vegetation. Compared to Alternative 1, ruffed and blue grouse on the refuge could benefit because a moderate amount of good and fair condition riparian and aspen woodland habitats would be available in the long term.

Sage grouse in the park would potentially benefit in the long term by 2,250 additional acres of sagebrush shrubland habitat and a major reduction in bison numbers compared Alternative 1. Ruffed and blue grouse would not be affected or would be beneficially affected to a negligible degree under Alternative 5. These alternatives would not result in the impairment of grouse communities in the park.

### Alternative 6

*Analysis*

*National Elk Refuge* — In the short term Alternative 6 would not affect sage grouse compared to Alternative 1 due to little change in sagebrush shrubland habitat. In the long term, sage grouse could potentially benefit by an estimated 3,990 more acres (50%) in sagebrush shrubland habitat compared to Alternative 1. However, the eventual elimination of winter feeding on the refuge and possible closure of part of the hunt zone on the refuge could result in higher levels of grazing by elk in sagebrush shrubland habitats, which could offset some of the benefits of increased sagebrush shrubland.

Compared to Alternative 1, ruffed and blue grouse would likely benefit from an estimated 1,720 additional acres (53%) of riparian and aspen woodland habitat in the long term and greatly improved habitat conditions. Ruffed and blue grouse could increase their use of the refuge after habitat conditions improved.

*Grand Teton National Park* — An estimated increase of 2,250 additional acres of sagebrush shrubland habitat and a major reduction in bison numbers could potentially benefit sage grouse populations in the park.

Ruffed and blue grouse could potentially benefit by a minor increase in riparian and aspen woodland communities due to fewer elk browsing in the park compared to Alternative 1.

*Bridger-Teton National Forest* — Compared to Alternative 1, increased grazing and browsing pressure by elk in localized areas on sagebrush shrubland and riparian and aspen woodland habitats in the national forest could negatively affect sage, ruffed, and blue grouse nesting or other aspects of their ecology.

*Other Lands* — To the extent that elk increased their use of private lands in the Jackson Hole area (due to a cessation of winter feeding on the refuge), sage grouse and ruffed grouse on these lands could experience negative impacts in localized areas (similar to Alternatives 2 and 3).

If large numbers of elk migrated outside Jackson Hole, sage, ruffed, and blue grouse on federal, state, and private lands in other locations could experience negative impacts in localized areas due to sagebrush shrubland and riparian and aspen woodland habitats experiencing higher levels of grazing and browsing. This could result in habitat degradation and loss of acreage in some areas.

*Conclusion*

Sage grouse on the refuge could benefit due to major, long-term habitat changes compared to Alternative 1. Ruffed and blue grouse would benefit in the short and long terms due to moderate to major habitat changes.

Sage grouse in the park could benefit in the long term from 2,250 additional acres of sagebrush shrubland habitat and a major reduction in bison numbers compared to Alternative 1. Ruffed and

blue grouse in the park could benefit by a minor increase in the condition of riparian and aspen woodland communities. This alternative would not result in the impairment of grouse communities in the park.

### Cumulative Effects

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

## Waterfowl, Shorebirds, Rails, and Cranes

Most waterfowl, shorebirds, rails, and cranes in Jackson Hole depend on marshland and wet meadow habitats for feeding, nesting, and other activities. Both of these habitats are generally in good condition on the refuge and in the park, but the amount of grazing that occurs on the refuge can affect the amount of residual, or standing, vegetation that persists into spring when spring migrants use the refuge as a stopover point and when waterfowl, shorebirds, rails, and cranes nest on the refuge.

### Methodology Used to Analyze Effects

The nesting requirements of waterfowl and other waterbirds vary greatly; therefore, the effects of ungulate grazing in meadow and marsh communities differ. Species that prefer low stature vegetation for feeding, such as sandhill cranes, or are able to successfully nest in low stature vegetation, such as long-billed curlews, likely benefit from or would not be adversely affected by moderate to heavy grazing. Rails and other secretive birds are adversely affected by heavy grazing that reduces residual vegetation while the effects of ungulate grazing might be neutral to other species.

Some bird species using meadow habitats on the refuge need dense, rank vegetation for successful nesting, and the high level of grazing by elk in some wet meadow areas could be adversely affecting the nesting success of these species (e.g., ducks such as the cinnamon teal). Although information on the effects of elk grazing on duck nesting on the refuge is not available, the large volume of information on the effects of livestock grazing on duck production indicates there is a high probability that heavy grazing by elk adversely affects duck production on the refuge.

### Impacts of the Alternatives

#### *Impacts Common to All Alternatives*

*Impacts on Marshlands* — Most waterfowl and other waterbirds that occur in Jackson Hole, the Green River basin, and the Red Desert and that depend on marshland habitat would not be affected or would be affected to a negligible degree by actions considered in this planning process. Although localized areas of marsh habitat on the refuge have been heavily grazed, the good condition and amount of acreage under all alternatives is expected to remain the same as under baseline conditions.

*Direct Effects of Human Disturbance* — Waterfowl, shorebirds, rails, and cranes would not be adversely impacted or would be impacted to a negligible degree by management activities associated with the supplemental feeding program for elk or bison in Alternatives 1, 3, 4, and 5. The effects would be negligible or nonexistent because supplemental feeding occurs during winter after most waterfowl, shorebirds, rails, and cranes have migrated to their winter feeding grounds. Those birds that remain for the winter primarily feed in the marshland areas, which are far enough away from feeding areas to not be affected by elk and bison feeding activities.

Waterfowl, shorebirds, rails, and cranes would not be adversely impacted or would be impacted to a negligible degree by activities associated with elk and bison hunting in all alternatives except 2. Hiking and horseback riding and the firing of rifles could temporarily disturb waterfowl, shorebirds, rails, and cranes in the immediate area. However, these effects would not affect survival and reproduction.

Waterfowl, shorebirds, rails, and cranes would not be adversely impacted or would be impacted to a negligible degree by management activities associated with a brucellosis vaccination program for elk and bison in Alternatives 3, 4, and 5 for the same reasons as described above for winter feeding activities.

#### *Alternative 1*

*Analysis*

*National Elk Refuge* — Under Alternative 1 waterfowl, shorebirds, rails, and cranes that use wet meadow habitats on the refuge could benefit from a negligible increase in wet meadow acreage (50 acres or 3%) in the short and long terms, as compared to baseline conditions. However a reduction in the overall condition of wet meadow habitats from the current good condition to fair or poor condition could negatively affect foraging habitat for waterfowl, shorebirds, and cranes, as well as nesting habitat for rails. The fair to poor condition of wet meadow communities would likely more than offset any benefit from increased acreage.

The potential for adversely impacting duck production through depletion or degradation of nesting cover would continue in the short and long terms due to continued heavy grazing by elk and bison in some wet meadow communities.

Disking, plowing, and cultivation would have minimal effects on duck production because irrigated areas are usually drier sites where few ducks typically nest. Flood irrigation would continue to benefit sandhill cranes by providing water in areas that would otherwise be dry. As a result, sandhill cranes would continue to use cultivated fields and wet meadow areas maintained by flood irrigation seepage much more than they would have used native grasslands or sagebrush shrublands that existed prior to Euro-American settlement.

*Grand Teton National Park* — Three wet meadow sites in the park were studied by McClosky and Sexton (2002) and are currently dominated by nonnative plant communities (Haynes, pers. comm. 2005). High numbers of elk and growing numbers of bison grazing in wet meadows in the park could cause plant communities in some areas to shift from native to nonnative communities, negatively affecting birds dependent on wet meadows. High levels of grazing could also reduce residual vegetation and limit the amount of cover and nesting habitat for some species of birds in localized areas.

*Bridger-Teton National Forest* — Waterfowl, shorebirds, rails, and cranes in the national forest would not be affected by Alternative 1 any more than in the recent past. Although elk browsing could reduce nesting cover in some areas, effects would likely be negligible at most.

*Conclusion*

As compared to baseline conditions, Alternative 1 could result in negative impacts to waterfowl on the refuge due to heavy grazing by elk in areas used for nesting. In the long term as more bison grazed in the southern part of the refuge, adverse effects on nesting waterfowl could increase, and the condition of wet meadow habitat could decline. However, cranes would likely not be impacted to any measurable degree.

High levels of bison and elk grazing on wet meadow habitats in the park could cause plant communities in some areas to shift from native to nonnative communities. High levels of grazing could also reduce residual vegetation and limit the amount of cover and nesting habitat for some species of birds in localized areas. This alternative would not result in the impairment of waterfowl, shorebird, rail, or crane populations in the park.

#### *Alternative 2*

*Analysis*

*National Elk Refuge* — As compared to Alternative 1, an estimated 100 fewer acres (6%) of wet meadow habitat under Alternative 2 could adversely affect waterfowl, shorebirds, rails, and cranes to a negligible to minor degree in the short and long terms. However, Alternative 2 could also provide benefits to waterfowl and rails because fewer grazing elk and bison would result in denser, taller vegetation for nesting cover. However, elk and bison, even though fewer in number, could graze for longer periods of time in wet meadow areas as a result of phasing out supplemental feeding. In addition, the cessation of forage production could cause greater utilization of forage in wet meadow communities by elk and bison. Therefore, it is unclear whether waterfowl, rails, and shorebirds would experience a net benefit or adverse impact.

The phaseout of cultivated fields would have minimal direct effects on duck, rail, and most shorebird production because these birds do not use cultivated fields for nesting or feeding. The

native grasslands and sagebrush shrublands that would replace the cultivated fields also would not provide nesting or feeding habitat for these species. The cessation of flood irrigation would have adverse impacts on sandhill cranes by eliminating water in areas that would otherwise be dry. As a result, cranes might stop using much of the area that is now cultivated.

Waterfowl, shorebirds, rails, and cranes would not be adversely impacted or would be impacted to a negligible degree by activities associated with a bison fertility control program under Alternative 2. If the fertility control program was conducted on the refuge feedlines, most of these bird species would have already migrated to their winter feeding grounds, and overwintering birds spend most of their time in the marshland areas.

*Grand Teton National Park* — Waterfowl, shorebirds, rails, and cranes in the park could benefit from fewer elk grazing in wet meadow habitats. Residual vegetation could remain high and provide cover for nesting. In addition, nonnative species might not dominate plant communities as they could in heavily grazed areas.

Restoring agricultural fields to native vegetation could reduce the number of cranes that feed in those areas (Cole, pers. comm. 2005), but cranes do well with native meadow vegetation throughout the greater Yellowstone ecosystem.

If the bison fertility control program was conducted in the park during the spring and summer, waterfowl, shorebirds, rails, and cranes could be temporarily disturbed by human presence in a variety of habitats. However, few people would be engaged in this activity, and the extent of disturbance would be small, especially since many areas of the park are already open to hiking. Although a fertility control program in the park would likely be conducted while most birds are breeding and raising young, effects would likely be minimal.

*Bridger-Teton National Forest* — More elk grazing on wet meadows in native winter range could negatively affect waterfowl, shorebirds, rails, and cranes that use this habitat type in the national forest. Bird species that need residual vegetation for nesting and cover could be especially impacted.

*Other Lands* — If large numbers of elk did not migrate to the Green River basin and the Red Desert, waterfowl, shorebirds, rails, and cranes on wet meadow habitat on private lands in the Jackson Hole area could experience negative impacts in localized areas. Elk that were no longer being supplementally fed on the refuge would likely forage more often on private lands, and higher levels of grazing could result in further habitat degradation and reduced residual vegetation in some areas. BLM lands in Jackson Hole contain a limited amount of wet meadow habitat; therefore, effects on waterfowl, shorebirds, rails and cranes would be minimal.

If large numbers of elk did migrate outside Jackson Hole, waterfowl, shorebirds, rails, and cranes on BLM lands in the Green River basin could be negatively affected in localized areas. Wet meadow communities in the Green River basin are already heavily grazed by livestock, and the addition of grazing by elk from the Jackson herd could adversely affect ecological condition in some areas, with negative impacts on waterfowl, shorebirds, rails, and cranes in those areas.

*Conclusion*

As compared to baseline conditions and Alternative 1, waterfowl and rails could benefit under Alternative 2 from a possible increase in nesting cover; shorebirds would likely not be affected to any measurable extent. Sandhill cranes could decrease on the refuge due to cessation of irrigation.

Waterfowl, shorebirds, rails, and cranes in the park could benefit in some areas from fewer elk and bison grazing in wet meadow habitats. Residual vegetation might remain high enough to provide cover for nesting birds. In addition, the condition of wet meadow habitats might not decline to the same degree that they would under Alternative 1. This alternative would not result in the impairment of waterfowl, shorebird, rail, or crane populations in the park.

### Alternative 3

*Analysis*

*National Elk Refuge* — The conversion of an estimated 780 acres (45%) of wet meadow habitat to willow habitat in the short term and an estimated

1,500 acres (87%) in the long term, compared to Alternative 1, would limit the amount of foraging and nesting habitat available to waterfowl, shorebirds, rails, and cranes. This could reduce the number of birds that feed and nest on the refuge. However, because the affected area naturally produced willow habitat in the past, the resulting bird community would more closely approximate a native diversity of birds.

In the wet meadow habitat that remains under Alternative 3, the potential for adverse impacts to duck and rail production through reduction or degradation of nesting cover could decrease in the short and long terms as compared to baseline conditions because fewer elk would browse on the refuge, but bison numbers would remain relatively high (800–1,000). Elk and bison could also graze for longer periods of time in wet meadow areas as a result of elk and bison only being fed in the most severe winters. In addition, stopping forage production under Option B could cause greater utilization of forage in wet meadow communities. If bison grazed heavily in wet meadow communities in the future, impacts to duck and rail production due to the removal of residual cover in wet meadows and hoof damage would be increasingly negative.

Disking, plowing, and other cultivation practices and the continuation of flood irrigation under Option A would have similar effects on duck and rail production and sandhill cranes as Alternative 1. However, a major loss of wet meadow habitat would likely result in overall adverse impacts to waterfowl, shorebirds, rails, and cranes in the short and long terms as compared to baseline conditions and Alternative 1.

*Grand Teton National Park* — Waterfowl, shorebirds, and rails in the park could benefit from the reduction in elk numbers grazing in wet meadow habitats. Residual vegetation could remain high enough to provide cover for nesting. In addition, nonnative species might not dominate plant communities as they could in heavily grazed areas.

Restoring agricultural fields to native vegetation could reduce the number of sandhill cranes that feed in those areas (Cole, pers. comm. 2005), but cranes do well with native meadow vegetation throughout the greater Yellowstone ecosystem.

*Bridger-Teton National Forest* — More elk grazing on wet meadows in native winter range could negatively affect waterfowl, shorebirds, rails, and cranes that use this habitat type in the national forest. Bird species that need residual vegetation for nesting and cover could be especially impacted.

*Other Lands* — The effects of Alternative 3 on waterfowl, shorebirds, rails, and cranes on BLM lands in the Jackson area and in the Green River basin and private lands in the Jackson Hole area would be similar to the effects of Alternative 2.

*Conclusion*

Under Alternative 3 the conversion of wet meadow habitat to willow habitat on the refuge would likely result in overall adverse impacts to waterfowl, shorebirds, rails, and cranes in the short and long terms as compared to Alternative 1. However, because the area naturally produced willow habitat in the past, the resulting bird community would more closely approximate a native diversity of birds.

Waterfowl, shorebirds, rails, and cranes in the park could benefit in some areas from fewer elk grazing in wet meadow habitats. Residual vegetation might remain higher and provide better cover for nesting in these areas, as compared to Alternative 1. This alternative would not result in the impairment of waterfowl, shorebird, rail, or crane populations in the park.

### Alternative 4

*Analysis*

*National Elk Refuge* —The reduced acreage of wet meadow habitats on the refuge under Alternative 4 would reduce the amount of nesting and foraging habitat available for waterfowl, shorebirds, rails, and cranes, possibly leading to reduced numbers of birds feeding or nesting in these habitats on the refuge. As compared to Alternative 1, Alternative 4 would result in an estimated 270 fewer acres (25%) of wet meadow habitat in the short term and an estimated 520 fewer acres (48%) in the long term. The conversion of wet meadow communities to willow habitat would reduce foraging opportunities for shorebirds,

rails, and cranes, and it would reduce nesting opportunities for waterfowl, shorebirds, and rails.

A 500-acre willow exclosure would initially protect 500 acres of wet meadow from grazing by elk and bison. In the short term residual cover in the 500-acre willow exclosure would be higher than under Alternative 1. But in the long term, the recovery of willow habitat would eliminate much of the potential nesting habitat for waterfowl, shorebirds, rails, and cranes. The exclosure could also increase grazing pressure on wet meadow communities outside the exclosure, resulting in a decline in tall, dense vegetation that serves as cover for grass nesting birds, such as rails, snipe, willet, and curlew. However, much of this area naturally produced willow habitat in the past, so the resulting bird community would more closely approximate a native bird diversity.

The continuation of farming practices under Alternative 4 would have similar effects as under Alternative 1 in terms of disking, plowing, and sowing seeds. Converting an estimated 1,100 acres from flood irrigation to sprinkler irrigation would adversely affect waterfowl, shorebirds, rails, and cranes because standing water would be eliminated.

Under Alternative 4 the loss of wet meadow habitat, combined with the conversion from flood irrigation to sprinkler irrigation, would likely result in overall adverse impacts to waterfowl, shorebirds, rails, and cranes in the short and long terms as compared to baseline conditions and Alternative 1.

*Grand Teton National Park* — Waterfowl, shorebirds, rails, and cranes in the park could benefit from fewer elk grazing on park wet meadow habitats although not as much as under Alternatives 2 and 3. Residual vegetation could remain high enough to provide cover for nesting. In addition, nonnative species might not dominate plant communities as they could in heavily grazed areas.

Restoring agricultural fields to native vegetation could reduce the number of sandhill cranes that feed in those areas (Cole, pers. comm. 2005), but cranes do well with native meadow vegetation throughout the greater Yellowstone ecosystem.

*Bridger-Teton National Forest* — More elk grazing on wet meadows in native winter range could negatively affect waterfowl, shorebirds, rails, and cranes that use wet meadow habitat in the national forest. Bird species that need residual vegetation for nesting and cover could be affected the most.

*Conclusion*

The conversion of a moderate amount of wet meadow habitat to willow habitat on the refuge, combined with a change from flood irrigation to sprinkler irrigation, would likely result in overall adverse impacts to waterfowl, shorebirds, rails, and cranes in the short and long terms as compared to baseline conditions and Alternative 1. However, because the area naturally produced willow habitat in the past, the resulting bird community would more closely approximate a native diversity of birds.

Waterfowl, shorebirds, rails, and cranes in the park could benefit from fewer elk and bison grazing on wet meadow habitats in some areas of the park, although not to the same extent as under Alternatives 2 and 3. Residual vegetation could remain higher and provide better cover for nesting birds in these areas, as compared to Alternative 1. This alternative would not result in the impairment of waterfowl, shorebird, rail, and crane communities in the park.

### Alternative 5

*Analysis*

*National Elk Refuge* — The conversion of wet meadow habitat to willow habitat on the refuge under Alternative 5 would decrease the amount of foraging and nesting habitat available for waterfowl, shorebirds, rails, and cranes, possibly reducing the number of birds that feed or nest on the refuge. As compared to Alternative 1, Alternative 5 would result in an estimated 270 fewer acres (25%) of wet meadow habitat in the short term and an estimated 520 fewer acres (48%) in the long term. However, because the area naturally produced willow habitat in the past, the resulting bird community would more closely approximate a native diversity of birds.

The potential for adverse impacts to duck and rail production due to the reduction or degradation of nesting cover would continue in the short and long terms because of continued heavy grazing by elk in some wet meadow communities outside the 500-acre willow exclosure. This would result in a decline in tall, dense vegetation that serves as cover for grass-nesting birds, such as rails, snipes, willet, and curlews. In the short term residual cover within the exclosure would be higher than under Alternative 1, and this would potentially benefit shorebirds and rails. In the long term the recovery of willow habitat would eliminate much of the potential nesting habitat for grass-nesting birds.

Converting an estimated 1,100 acres from flood irrigation to sprinkler irrigation would adversely affect waterfowl, shorebirds, rails, and cranes due to the elimination of standing water.

The combination of reduced wet meadow habitat and changing from flood to sprinkler irrigation would likely result in overall adverse impacts to waterfowl, shorebirds, rails, and cranes in the short and long terms as compared to baseline conditions and Alternative 1.

*Grand Teton National Park* — Waterfowl, shorebirds, rails, and cranes in the park would not be affected by actions under Alternative 5. High levels of elk and bison grazing on wet meadows in the park could cause plant communities in some areas to shift from native to nonnative communities.

Restoring agricultural lands to native vegetation could reduce the number of sandhill cranes that feed in those areas (Cole, pers. comm. 2005), but cranes do well with native meadow vegetation throughout the greater Yellowstone ecosystem.

*Bridger-Teton National Forest* — Waterfowl, shorebirds, rails, and cranes in the national forest would not be affected under Alternatives 5 anymore than in the recent past.

*Conclusion*

The conversion of a moderate amount of wet meadow habitat to willow habitat on the refuge, combined with a change from flood irrigation to sprinkler irrigation, would likely result in overall adverse impacts to waterfowl, shorebirds, rails, and cranes in the short and long terms as compared to baseline conditions and Alternative 1. However, because the area naturally produced willow habitat in the past, the resulting bird community would more closely approximate a native diversity of birds.

Waterfowl, shorebirds, rails, and cranes in the park would not be affected under Alternative 5 any more than under Alternative 1. High levels of elk and bison grazing on wet meadows in the park could cause plant communities in some areas to shift from native to nonnative communities. This alternative would not result in the impairment of waterfowl, shorebird, rail, or crane communities in the park.

#### *Alternative 6*

*Analysis*

*National Elk Refuge* — The effects of Alternative 6 on waterfowl, shorebirds, rails, and cranes on the refuge would be similar to the effects of Alternative 3. The reduced acreage of wet meadow habitats on the refuge would limit the amount of foraging and nesting habitat available for waterfowl, shorebirds, rails, and cranes, possibly reducing the number of birds that feed and nest on the refuge.

*Grand Teton National Park* — Waterfowl, shorebirds, rails, and cranes in the park could benefit from the reduction in elk numbers grazing on park wet meadow habitats. Residual vegetation could remain high enough to provide cover for nesting. In addition, nonnative species might not dominate plant communities, as they could in heavily grazed areas.

Restoring agricultural fields to native vegetation could reduce the number of sandhill cranes that feed in those areas (Cole, pers. comm. 2005), but cranes do well with native meadow vegetation throughout the greater Yellowstone ecosystem.

*Bridger-Teton National Forest* — More elk grazing on wet meadows in native winter range could negatively affect waterfowl, shorebirds, rails, and cranes that use wet meadow habitat in the national forest. Bird species that need residual vegetation for nesting and cover could be negatively impacted the most.

*Other Lands* — If large numbers of elk did not migrate outside Jackson Hole, waterfowl, shorebirds, rails and cranes on wet meadow habitats on private lands in Jackson Hole could experience negative impacts in localized areas. Elk that are no longer being fed on the refuge in the winter would likely forage more often on private lands compared to Alternative 1, and higher levels of grazing could result in further habitat degradation and reduced residual vegetation in some areas. BLM lands in Jackson Hole contain a limited amount of wet meadow habitat; therefore, effects on birds would be minimal.

If large numbers of elk did migrate outside the Jackson Hole area, waterfowl, shorebirds, rails and cranes on federal, state, and private lands in other locations could experience negative impacts in localized areas. Waterfowl, shorebirds, rails and cranes in these areas could be negatively impacted as a result of wet meadow communities experiencing higher levels of grazing from a combination of livestock and elk, which could result in reduced ecological condition.

*Conclusion*

The conversion of a major amount of wet meadow habitat to willow habitat on the refuge, combined with the change from flood irrigation to sprinkler irrigation, would likely result in overall adverse impacts to waterfowl, shorebirds, rails, and cranes in the short and long terms, as compared to baseline conditions and Alternative 1. However, because the area naturally produced willow habitat, the resulting bird community would more closely approximate a native diversity of birds.

Waterfowl, shorebirds, rails, and cranes in the park could benefit from the reduction in elk and bison numbers grazing on park wet meadow habitats as compared to Alternative 1. Residual vegetation could remain high enough to provide cover for nesting. This alternative would not result in the impairment of waterfowl, shorebird, rail, and crane communities in the park.

### Mitigation

Measures to mitigate adverse effects of the alternatives on waterfowl, shorebirds, rails, and cranes would parallel those addressed in mitigation discussions for wet meadow habitats in the "Impacts on Habitat" section of Chapter 4.

### Cumulative Effects

Several reasonably foreseeable actions, including the reconstruction of U.S. 26/287, The Bureau of Land Management's *Snake River Resource Management Plan* and the *Upper Green River Special Recreation Management Area Project Plan*, and private land development would all likely result in short- and long-term impacts to waterbird habitat. Additionally, some of the actions associated with the upper Green River project plan and the Snake River restoration project could benefit waterbird habitat. Overall, the cumulative effects of the alternatives on waterbird habitat would be negligible. The extent of these effects is unclear due to the varied and conflicting negative and positive impacts that would simultaneously occur on the refuge and in the park.

## AMPHIBIANS

### IMPACTS OF THE ALTERNATIVES

#### *Impacts Common to All Alternatives*

Amphibians would not be adversely impacted or would be impacted to a negligible degree by management activities associated with the supplemental feeding program for elk or bison under Alternatives 1, 3, 4, and 5 because supplemental feeding occurs during winter in cultivated fields where amphibians do not generally occur. Furthermore, amphibians would be hibernating in the winter. Supplemental feeding would be phased out under Alternatives 2 and 6; impacts on amphibians during the phaseout period would be negligible or nonexistent.

Amphibians would not be adversely impacted or would be impacted to a negligible degree by activities associated with elk and bison hunting under all alternatives except 2. Hiking and horseback riding and the firing of rifles could temporarily disturb amphibians in the immediate area. However, these effects would not affect survival and reproduction. In addition, amphibians would be hibernating during most of the hunting season.

Amphibians would not be adversely impacted or would be impacted to a negligible degree by man-

agement activities associated with a brucellosis vaccination program for elk and bison in Alternatives 3, 4, and 5. Elk and bison would be vaccinated in the winter on the refuge feedlines, where amphibians do not generally occur and when they are hibernating.

#### Alternative 1

*Analysis*

*National Elk Refuge* — Under Alternative 1, the irrigation system on the refuge would remain essentially the same as current conditions, and standing water would remain available for amphibian habitat. The diversion of water from refuge streams could adversely affect some amphibians, but the diversions would continue to provide a net benefit by providing wet areas associated with flood irrigation. In general, amphibians are not greatly affected by elk and bison (D. Patla, pers. comm. 2003). However, if growing numbers of bison congregated along the banks of Nowlin and Flat Creeks in the winter and trample the underbank cavities that are important shelters for toads, boreal toads could be adversely affected.

Willows provide important shelter areas that protect amphibians from predation and that provide thermal cover. Historical loss of willow and especially the accompanying loss of beaver are probably a limiting factor for amphibians on the refuge (D. Patla, pers. comm. 2003). Willow habitat would decline by an estimated 50 acres, and 1,450 acres of suppressed willow plants that currently occur in wet meadow habitat would not be able to recover. Under Alternative 1 amphibians reliant on willow habitat would be adversely affected to a negligible degree as compared to baseline conditions.

*Grand Teton National Park* — Amphibians in the park could be affected to a minor degree by the loss of woody riparian habitats due to high levels of browsing or trampling by elk and bison.

*Bridger-Teton National Forest* — Amphibians in the national forest would not be affected under Alternative 1 any more than in the recent past.

*Conclusion*

Compared to baseline conditions, Alternative 1 could negatively impact amphibians on the refuge in the short and long terms due to the continued loss of riparian and aspen woodland habitat (including lost opportunities to recover healthy willow habitat) and possible trampling of stream banks by elk and bison (i.e., loss of undercut banks). Although the diversion of water from refuge streams could adversely affect some amphibians, the diversions would continue to provide a net benefit by providing wet areas associated with flood irrigation.

Amphibians in the park could experience adverse impacts due to a loss of woody riparian habitat in localized areas from heavy browsing and trampling by elk. This alternative would not result in the impairment of amphibian populations in the park.

#### Alternative 2

*Analysis*

*National Elk Refuge* — Alternative 2 would eliminate irrigation on the refuge, and this could negatively affect amphibians because there would be less standing water in some areas, and potentially fewer amphibians would survive due to elimination of this excess water. The Nowlin area has soil conditions that allow water to pool when flood irrigation is used, and amphibians in this area could be negatively impacted as compared to baseline conditions and the Alternative 1 due to elimination of flood irrigation (D. Patla, pers. comm. 2003).

Bison numbers under Alternative 2 are not likely to grow large enough that they would impact the banks of Nowlin and Flat Creek by trampling the underbank cavities that are important to boreal toads. Compared to Alternative 1, Alternative 2 would result in an additional 150 acres of willow habitat, which could benefit amphibians in the short and long terms.

Amphibians would not be adversely impacted or would be impacted to a negligible degree by management activities associated with a fertility control program for bison under Alternative 2. If the fertility control program was conducted in the

winter on refuge feedlines, amphibians would be hibernating.

*Grand Teton National Park* — Amphibians in the park could benefit from additional woody riparian habitats due to fewer elk and bison browsing and trampling woody vegetation.

If a bison fertility control program was conducted in the park in spring and summer, amphibians could be temporarily disturbed by humans hiking through a variety of habitats. However, few people would be engaged in this activity, and many areas of the park are already open to hiking; therefore, the extent of disturbance would be small. Although a fertility control program in the park would likely be conducted while most amphibians are breeding and raising young, effects would likely be minimal.

*Bridger-Teton National Forest* — Amphibians could be adversely affected by larger numbers of elk browsing in cottonwood and willow habitats on native winter range in the national forest, potentially causing a decline in these riparian communities and reducing cover for amphibians.

*Other Lands* — If large numbers of elk did not migrate outside the Jackson Hole area, amphibians on BLM lands and private lands in Jackson Hole could experience negative impacts in localized areas. Elk that are no longer being fed in the winter would likely forage more often in riparian woodland habitats outside the refuge. Higher levels of browsing on BLM and private lands could result in further habitat degradation and loss of acreage in some areas, negatively affecting amphibians.

If large numbers of elk did migrate outside Jackson Hole, amphibians on BLM lands and private lands in the Green River basin and the Red Desert could experience negative impacts in localized areas as a result of higher levels of browsing in riparian woodland habitats, which could result in habitat degradation and loss of habitat in some areas. In addition, on BLM wet meadows, grazing by both livestock and elk could result in reduced ecological condition, which could negatively affect amphibians.

*Conclusion*

Amphibians on the refuge would likely be negatively impacted as compared to Alternative 1 due to elimination of the flood irrigation system, although more acres of good and poor condition willow habitat (as compared to Alternative 1) could mitigate this impact to some degree. The loss of habitats produced by flood irrigation would limit the refuge's ability to mitigate habitat losses in surrounding areas.

Amphibians in the park could benefit from larger amount of woody riparian habitat (as compared to Alternative 1) due to fewer elk browsing and trampling woody vegetation, although effects would be negligible. This alternative would not result in the impairment of amphibian populations in the park.

#### Alternative 3

*Analysis*

*National Elk Refuge* — Flood irrigation would continue under Option A of Alternative 3, and the beneficial effects on amphibians would be similar to baseline conditions and Alternative 1. Under Option B irrigation would be eliminated on the refuge, and the effects on amphibians would be similar to the effects of Alternative 2. Compared to Alternative 1, amphibians would benefit due to an additional estimated 1,500 acres of willow habitat.

There would be a large number of bison under this alternative, some of which could congregate along the banks of Nowlin and Flat Creeks in the winter and trample the underbank cavities that are important shelters for boreal toads. Compared to Alternative 1, the negative impacts of Alternative 3 on toad survival would likely be less because there would be fewer bison under Alternative 3 than Alternative 1.

*Grand Teton National Park* — Amphibians in the park could benefit by additional woody riparian habitats due to fewer elk browsing in the park as compared to baseline conditions and Alternative 1.

*Bridger-Teton National Forest* — Amphibians could be adversely affected by larger numbers of elk browsing in cottonwood and willow habitats on

native winter range in the national forest, potentially causing a decline in these riparian communities and reducing cover for amphibians.

*Other Lands* — The effects of Alternative 3 on amphibians on BLM lands and private lands in Jackson Hole, the Green River basin, and the Red Desert would be similar to the effects of Alternative 2.

*Conclusion*

Under Option A of Alternative 3 amphibians would likely benefit from a larger amount of willow habitat than under Alternative 1 and from the continuation of flood irrigation. Under Option B amphibians would likely benefit from a greater amount of good and fair condition willow habitat, but they would be adversely affected by the elimination of flood irrigation. The potential would exist for large numbers of bison to trample stream banks along Nowlin and Flat Creek (i.e., loss of undercut banks) which could adversely affect boreal toads.

Amphibians in the park could benefit from more woody riparian habitat (compared to Alternative 1) as a result of fewer elk browsing in the park. This alternative would not result in the impairment of amphibian populations in the park.

#### Alternatives 4 and 5

*Analysis*

*National Elk Refuge* — Approximately 1,100 acres of flood irrigation on the refuge would be converted to sprinkler irrigation under Alternatives 4 and 5. Sprinkler irrigation uses less water and spreads it evenly over the cultivated fields. As a result, there would be much less standing water or no standing water in areas where the soil is normally conducive to pooling (such as in the Nowlin area), so potentially fewer amphibians would survive (D. Patla, pers. comm. 2003).

Under Alternatives 4 and 5 there would be an estimated 270 more acres of willow habitat in the short term and an estimated 520 more acres in the long term. As a result of increased willow habitat, amphibians would benefit compared to baseline conditions and Alternative 1.

*Grand Teton National Park* — Amphibians in the park would not be affected or would be beneficially affected to a negligible degree by actions being considered under Alternatives 4 and 5 as compared to baseline conditions and Alternative 1.

*Bridger-Teton National Forest* — Under Alternative 4 amphibians could be adversely affected by larger numbers of elk browsing in cottonwood and willow habitats in the national forest, potentially causing a decline in these riparian communities and reducing cover for amphibians. Amphibians in the national forest would not be affected by actions being considered in Alternative 5 anymore than in the recent past.

*Conclusion*

Amphibians on the refuge would likely be positively impacted under Alternatives 4 and 5 compared to Alternative 1 due to the moderate to major increase in good and fair condition willow habitat. However, the elimination of flood irrigation on most fields would offset this benefit to some extent. Converting to sprinkler irrigation in most fields would result in a closer approximation of a natural diversity of amphibians on the refuge, but the loss of amphibian habitat produced by flood irrigation would limit the refuge's ability to offset habitat losses in surrounding areas.

Amphibians in the park would not be affected or would be beneficially affected to a negligible degree under Alternatives 4 and 5 as compared Alternative 1. Neither alternative would result in the impairment of amphibian populations in the park.

#### Alternative 6

*Analysis*

*National Elk Refuge* — Approximately 1,100 acres of flood irrigated fields on the refuge would be converted to sprinkler irrigation under Alternative 6, and the effects would be similar to the effects described for irrigation practices under Alternatives 4 and 5.

Under Alternative 6 an estimated 1,500 additional acres of willow habitat would be provided in the long term, a larger expansion than under Alterna-

tives 4 and 5. Amphibians would benefit as a result.

*Grand Teton National Park* — Amphibians in the park could benefit from a larger amount of woody riparian habitat (compared to Alternative 1) due to fewer elk browsing in the park.

*Bridger-Teton National Forest* — Amphibians could be adversely affected by larger numbers of elk browsing in cottonwood and willow habitats on native winter range in the national forest, potentially causing a decline in these riparian communities and reducing cover for amphibians.

*Other Lands* — If large numbers of elk did not migrate outside the Jackson Hole area, amphibians on BLM lands and private lands in Jackson Hole could be adversely affected in localized areas. Elk that are no longer being fed in the winter would likely forage more often in riparian woodland habitats outside the refuge on BLM and private lands. This could result in further habitat degradation and the loss of acreage in some areas, which would negatively affect amphibians.

If large numbers of elk did migrate outside the Jackson Hole area, amphibians on federal, state, and private lands in other locations could be negatively affected in localized areas as a result of more intense browsing in riparian woodland habitats, which could result in habitat degradation and loss in some areas. In addition, grazing by both livestock and elk on wet meadows could result in reduced ecological condition, negatively affecting amphibians.

*Conclusion*

Amphibians on the refuge are likely to be positively impacted under Alternative 6 as compared to Alternative 1 due to an increase in the amount and condition of willow habitat. However, the elimination of flood irrigation would offset some of these benefits.

Amphibians in the park could benefit from a larger amount of woody riparian habitat (compared to Alternative 1) due to fewer elk browsing in the park. This alternative would not result in the impairment of amphibian communities in the park.

### Mitigation

Many of the potential measures to mitigate adverse effects of the alternatives on amphibians would parallel those described in the mitigation discussion for riparian and aspen woodland and wet meadow communities in the "Impacts on Habitat" section of Chapter 4 and for water quantity and water quality in the "Impacts on the Physical Environment" section of Chapter 4.

For alternatives that would convert flood irrigation to sprinkler irrigation (Alternatives 4, 5, and 6), one option would be to install spigots along pipelines, which could be used to disperse water in designated areas in order to re-create wet areas for amphibians.

### Cumulative Effects

No cumulative effects on amphibians are expected as a result of impacts of the alternatives in combination with impacts of reasonably foreseeable actions.