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CHAPTER 2. ALTERNATIVE MANAGEMENT PLANS

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INTRODUCTION

In making any wildlife management decision, a range of options, or alternatives, needs to be evaluated before deciding which approach to implement. The consideration of alternatives is further reinforced by the National Environmental Policy Act, which requires that a reasonable range of alternatives be explored and evaluated for all major federal actions. The alternatives presented in this document represent different approaches that the U.S. Fish and Wildlife Service and the National Park Service could implement for managing elk and bison on the National Elk Refuge and Grand Teton National Park / John D. Rockefeller, Jr., Memorial Parkway.

Development of the alternatives was based on an extensive prescoping and scoping process that involved the public, cooperating agencies and partners in this planning process, and USFWS and NPS staff. The public scoping process identified the significant issues to be addressed by the alternatives. Following scoping, additional public and interagency workshops and meetings were held, which allowed the planning team to further develop a range of possible alternatives. Some ideas were eventually eliminated from further consideration, and those are discussed later in this chapter. Six alternatives were carried forward and are analyzed in detail in this environmental impact statement. A seventh alternative was considered but eliminated (see alternatives considered but eliminated). The six alternatives are:

- *Alternative 1* — No action
- *Alternative 2* — Minimal management of habitat and populations, with support for migrations
- *Alternative 3* — Restore habitat, support migration, and phase back supplemental feeding
- *Alternative 4* — Restore habitat, improve forage, and phase back supplemental feeding (proposed action)
- *Alternative 5* — Restore habitat, improve forage, and continue supplemental feeding
- *Alternative 6* — Restore habitat, adaptively manage populations, and phase out supplemental feeding

Each alternative is made up of a number of different measurable objectives and strategies that distinguish one alternative from another. In some cases the objectives and strategies could be quite similar between the alternatives, or they could be markedly different. Objectives are "what are you going to do" statements, and strategies are "how you are going to get there" statements.

CRITERIA FOR DETERMINING A REASONABLE RANGE OF ALTERNATIVES

The U.S. Fish and Wildlife Service and the National Park Service, as joint lead agencies, identified the criteria for determining the range of reasonable alternatives considered and analyzed in this document. Regulations of the Council on Environmental Quality require that the range of reasonable alternatives be wide enough to facilitate a "reasoned decision" by the lead agencies. For this document, alternatives were determined to be reasonable if they met all the following tests:

1. They address the project's purpose and need.
2. They contribute to the accomplishment of refuge and park goals for bison and elk management.
3. They address the significant issues.
4. They are technically and economically feasible.

An alternative's technical feasibility is based primarily on the available technical and scientific information. Economic feasibility means that sufficient funds to implement the alternative could reasonably be secured in the foreseeable future.

In some cases potential alternatives could be quickly determined to be unreasonable by their failure to meet one or more of the criteria above. In other cases a thorough analysis was required to determine consistency with the criteria. While all cooperating agencies and partners were canvassed regarding their individual determinations

of reasonability, the final results were determined by the Fish and Wildlife Service and the Park Service under their authorities as joint lead agencies.

The range of alternatives described in this document would meet legal directives, management goals, wildlife management principles, and scientific information to varying degrees. An alternative's inclusion in this planning document does not necessarily mean that it would fully meet establishing purposes, agency missions, or other legal responsibilities, or that it would be consistent with sound wildlife management principles and scientific information. The inclusion of a particular alternative should by no means imply that all agencies agree with all parts of the alternative, or agree that it could be reasonably implemented.

ACTIONS INDEPENDENT OF THE ALTERNATIVES

The following ongoing activities are independent of the alternatives and would occur under all alternatives:

- *Invasive Weed Control / Integrated Pest Management* — The control of invasive weeds and integrated pest management for both the refuge and the park would continue much as it has in the recent past using a variety of tools, including biological control, mechanical control, grazing by goats or sheep, and herbicides. This would be the same under all alternatives. The U.S. Fish and Wildlife Service and the National Park Service would continue to work in partnership with each other and with the Teton County Weed and Pest Control District, the U.S. Forest Service, the Wyoming Game and Fish Department, and private landowners.
- *Nonnative Plant Species Control* — Similar to the invasive weed control program, efforts to eradicate cheatgrass and crested wheatgrass would continue on the refuge, much as they have in the recent past. Management tools used could include mechanical control, herbicides, and biological control.
- *Jackson Hole Interagency Habitat Initiative* — The U.S. Fish and Wildlife Service and the National Park Service would continue to work cooperatively with other agencies in identifying opportunities to improve habitat for elk and bison.
- *Jackson Elk Studies Group and Greater Yellowstone Interagency Brucellosis Committee* — The U.S. Fish and Wildlife Service and the National Park Service would continue to participate in the Jackson Hole Elk Studies Group and the Greater Yellowstone Interagency Brucellosis Committee (GYIBC). As committee members, both agencies would pursue the development of risk assessment for brucellosis transmission from elk or bison to livestock.
- *Livestock Grazing* — None of the alternatives in this draft plan / environmental impact statement would change livestock grazing practices in the park, nor would any alternatives mandate that such use continue.

ELEMENTS COMMON TO ALL ALTERNATIVES

The following elements would be common to all alternatives (except where noted):

- *Chronic Wasting Disease* — Efforts would be made to coordinate with the Wyoming Game and Fish Department to increase surveillance in elk for chronic wasting disease (CWD), a fatal transmissible disease of white-tailed deer, mule deer, and elk. The objective of surveillance would be to provide a 95% confidence level of discovering infection at 1% prevalence in the Jackson elk herd. If infection was found, strategies from the WGFD feedground CWD response (2005) to reduce transmission would be implemented. These strategies include removing clinically consistent elk, removing 50 animals within 50 miles of the index case, enforcing carcass movement and disposal restrictions, decreasing duration of feeding and expanding the distribution of feeding to the extent possible, and potentially decreasing elk densities through hunting or other management strategies. Any difference from this general approach is detailed under the alternative strategies.
- *Winter Severity* — When winters are referred to as average, above-average, or severe in the text, snow accumulations would

be similar to those used in modeling for the impact analysis (Hobbs et al. 2003). These rankings were based on 50 years of measuring inches of snow-water equivalent (the amount of water stored as snowpack) at the Hunter-Talbot hayfields in Grand Teton National Park (Farnes et al. 1999). Although various factors affect winter severity, snow-water equivalent was considered the best measure for predicting how ungulates would respond to winter conditions. Based on rankings of snow severity using the data by Farnes et al., the winter of 1996 was designated as average, 1982 as above average, and 1997 as severe. For more detailed information, see Chapter 3, "Climate," and Chapter 4, "Impacts on the Jackson Elk Herd: Methodology Used to Analyze Effects."

- *Strategies for Hunting / Reduction Programs (all alternatives except Alternative 2)* — The U.S. Fish and Wildlife Service and the National Park Service would work cooperatively with the Wyoming Game and Fish Department to achieve population objectives (including herd ratios and elk herd segment sizes), to develop hunting seasons, and to evaluate hunting or elk reduction areas. The Wyoming Game and Fish Department would formally establish objectives and strategies after public review and approval by the Wyoming Game and Fish Commission.

STRUCTURE OF THE ALTERNATIVES

The objectives and strategies of each alternative were developed primarily to support the four management goals (as discussed in Chapter 1):

- habitat conservation
- sustainable populations,
- elk and bison numbers
- disease management

Four basic variables are addressed for managing ungulate populations: habitat, numbers and distribution, supplemental actions, and mitigation measures. Generally in situations where there is insufficient high-quality habitat to sustain desired numbers of ungulates, three options are available: (1) improve or expand habitat to allow populations to be maintained at the desired level, (2) redefine the desired population level, or (3) provide supplemental winter feeding.

On the following pages the key features of each alternative are summarized, along with a map that highlights the principal elements of the alternative. The objectives and strategies under each alternative are then discussed separately by goal. While this format may be different than some readers are used to reading, it allows the different objectives to be easily compared by management goals. Some alternatives may have similar or the same objectives and strategies under each goal, and this format reduces the redundancy of repeating information under each alternative. At the end of this chapter various tables summarize and highlight other differences between the alternatives.

ALTERNATIVE 1: NO ACTION

Few changes would occur in managing the elk and bison herds and their habitat on the National Elk Refuge and in Grand Teton National Park / John D. Rockefeller, Jr., Memorial Parkway. About half of the Jackson elk herd (5,600–7,500), and all of the bison herd (800–1,000+) would continue to winter on the refuge. Cultivated fields would continue to provide additional forage to existing native habitat, but a primary source of winter food would be imported feed. A limited elk hunt on the refuge and, when necessary, the elk reduction program in the park would continue. Strategies to achieve population objectives would be developed in cooperation with the Wyoming Game and Fish Department. No bison hunting would be allowed on refuge or park lands. The high prevalence of brucellosis in the elk and bison herds would continue because no new strategies would be used to reduce transmission between animals. No further measures would be taken to protect woody riparian habitat for the benefit of other species.

Habitat Conservation

- Some effort would be made to protect or acquire private lands within the approved boundary of the refuge to prevent development and provide additional elk winter range. The refuge would continue to use flood irrigation and other farming techniques to enhance forage production beyond what would be naturally produced. Some prescribed fire (less than 2,000 acres annually) would continue. In the park units, no specific objectives or strategies would be implemented to conserve elk/bison habitat. Prescribed fire would continue for controlling invasive species, but no large-scale restoration of agricultural lands would be undertaken. Attempts would be made to haze elk and bison from refuge lands during the growing season to protect winter forage.

Sustainable Populations / Numbers of Elk and Bison / Disease Management

- The 1974 Cooperative Agreement between the Wyoming Game and Fish Department and the U.S. Fish and Wildlife Service would continue to be implemented. The Wyoming Game and Fish Department's objective of 11,029 animals for the Jackson elk herd would continue to serve as the target number of elk. Bison numbers would not be controlled on either the refuge or in the park.
- Working cooperatively with the Wyoming Game and Fish Department, elk numbers and concentrations would be controlled through the elk hunt program on the refuge and the herd reduction program in the park, east of the Snake River.
- The winter feeding program would continue during average and above average years (estimated to occur 9 of 10 years) and delayed as long as possible each year. Feeding would continue to be conducted at four feeding areas that change daily, and feed would be spread along lines. Elk and bison would be separated to the extent possible.
- Elk and bison would continue to be concentrated on the refuge but kept separate from livestock on park lands during the first part of the critical period of potential brucellosis transmission (February-March). Use of vaccines or antibiotics would not occur.

Wildlife-Dependent Recreation

- Wildlife viewing opportunities would continue to be provided at concentrated locations. Elk hunting would be allowed on the refuge and, when necessary for proper management, the elk herd reduction program in the park.

Alternative 1

Map

ALTERNATIVE 2: MINIMAL MANAGEMENT OF HABITAT AND POPULATIONS, WITH SUPPORT FOR MIGRATIONS

Over time efforts to actively manage the elk and bison herds and their habitat would be greatly reduced on the refuge and in the park units. The Jackson elk and bison herds would fluctuate more naturally, with 1,200–6,000 elk and 250–500 bison estimated to winter on the refuge and 600–3,000 elk summering in the park at levels that could be supported by available habitat. Additionally, the U.S. Fish and Wildlife Service and the National Park Service would support stakeholder efforts to establish elk migration out of Jackson Hole to other wintering areas. Cultivated areas would be restored with native grasses, and irrigation practices would be phased out. The use of imported supplemental feed during winter months would be phased out over 10–15 years. Eliminating hunting on the refuge and the elk herd reduction program in the park would allow elk to increase their use of transitional winter habitats. Over time natural densities and concentrations would reduce the prevalence of brucellosis found in the elk and bison herds.

HABITAT CONSERVATION

- Cultivated fields (2,400 acres on the refuge) and agricultural lands (4,500 acres in the park) would be restored to native plant communities, and irrigation practices on the refuge would be phased out.
- Eventually, little active management of habitat would take place on the refuge with the exception of nonnative plant control. Prescribed fire would be discontinued on the refuge, but some wildland fires would be permitted to burn provided there was no threat to human safety, private property, the town of Jackson, or any cultural resources. Prescribed fire would occur in Grand Teton National Park. Irrigation would be phased out over time, and all other farming practices would be discontinued.

SUSTAINABLE POPULATIONS / NUMBERS OF ELK AND BISON / DISEASE MANAGEMENT

- The numbers of elk and bison on the refuge would fluctuate over time as the feeding program was eliminated within 15 years, but no specific numeric population targets would be set for elk or bison.
- Hunting on the refuge and herd reduction in the park units would be discontinued immediately. Initially, bison numbers would be controlled on refuge and park lands through fertility control. Over time predation and other natural mortality factors would maintain elk and bison numbers at levels that could be supported by available winter habitat in most winters.

WILDLIFE-DEPENDENT RECREATION

- Over time winter wildlife viewing opportunities would be naturally spread out and more sporadic. Hunting on refuge and the elk herd reduction program in the park would be discontinued.

Map

Alternative 2

ALTERNATIVE 3: RESTORE HABITAT, SUPPORT MIGRATION, AND PHASE BACK SUPPLEMENTAL FEEDING

The Jackson elk and bison herds and their habitat would be actively managed on the refuge, with an emphasis on restoring habitat by reducing elk numbers. An estimated 1,000–2,000 elk would winter on the refuge, and 500–1,000 would summer on park lands. Bison numbers would be maintained at current levels (800–1,000) on the refuge and in the park. Supplemental feeding would be reduced over 10 years on the refuge, in coordination with an increased elk harvest program, and eventually would only be provided during the severest winters (estimated in roughly 2 of 10 winters and depending on snow conditions). Additionally, the U.S. Fish and Wildlife Service and the National Park Service would support stakeholder efforts to establish elk migration out of Jackson Hole to other wintering areas. Elk hunting on the refuge and, when necessary, the elk herd reduction program in the park would continue, but some hunt areas would be closed after elk objectives were reached. Also, a bison hunt would be initiated on the refuge. Strategies to achieve population objectives would be developed in cooperation with the Wyoming Game and Fish Department. The prevalence of brucellosis in the elk and bison herds could decrease over time as a result of fewer concentrated animals, and vaccines with higher efficacies or other techniques would be used when developed. Woody vegetation would be sustained for the benefit of other species.

HABITAT CONSERVATION

- To allow for more use of transitional and winter habitats, the northern one-fifth of the refuge and the Blacktail Butte / Kelly hayfields area in the park would be closed to hunting, while other hunting areas would remain open.
- On refuge lands a minimum of 2,000 pounds of forage per acre on 1,100 acres would be produced using flood irrigation as necessary. Attempts would be made to haze elk and bison from refuge lands during the growing season to protect winter forage.
- About 4,500 acres of previously cultivated areas in the park would be converted to native plant communities.

SUSTAINABLE POPULATIONS / NUMBERS OF ELK AND BISON / DISEASE MANAGEMENT

- Winter feeding would continue to augment standing forage during the severest winters only, but feeding would be delayed as long as possible.
- The agencies would work in cooperation with the Wyoming Game and Fish Department to achieve an average bull-to-cow ratio of 35:100 in elk summering in the park, representative of a native, non-hunted population.
- Portions of hunt areas on the refuge and elk reduction areas in the park would be closed to hunting. To move elk into hunting areas, either an early season hunt could be provided on the southern end of the refuge or the area could be opened to wildlife-dependent public uses.
- In cooperation with the Wyoming Game and Fish Department, a public bison hunt would be started on the refuge. An estimated 70 bison per year would be harvested on the refuge and 50 in the national forest to achieve objectives. Tribal reductions of bison would also occur (estimated at 5 animals per year, or possibly more depending on the assessed need by the Wyoming Game and Fish Department).
- Minimizing the use of the same sites by elk and bison during supplemental feeding, in combination with increasing winter distribution on and off the refuge, would be used to reduce the risks of adverse effects of non-endemic diseases being introduced into the herds.

WILDLIFE-DEPENDENT RECREATION

- Wildlife viewing opportunities would be more natural and sporadic in most years. Elk and bison hunting would be allowed on the refuge and, when necessary for proper management, the elk herd reduction program in the park. The southern portion of the refuge could be open in the fall to wildlife observation, photography, and interpretation.

Map

Alternative 3

ALTERNATIVE 4: RESTORE HABITAT, IMPROVE FORAGE, AND PHASE BACK SUPPLEMENTAL FEEDING (PROPOSED ACTION)

The Jackson elk and bison herds and their habitat would be actively managed on the refuge, with an emphasis on increasing winter grazing habitat on cultivated fields to support substantial numbers of wintering elk and bison. Approximately 4,000–5,000 elk and up to 500 bison would winter on the refuge, and 1,300–1,600 elk would summer in park units. Supplemental feeding would take place only in above-average winters (estimated in roughly 5 of 10 years). The elk hunt on the refuge and, when necessary, the herd reduction program in the park would continue. Also, a bison hunt and a bison reduction by American Indian tribes would be initiated on the refuge. Strategies to achieve population objectives would be developed in cooperation with the Wyoming Game and Fish Department. The prevalence of brucellosis in the elk and bison herds as a result of high concentrations would be slightly reduced, and WGFD personnel would be permitted to use Strain 19 to vaccinate elk, although efficacy would likely be low. Woody vegetation would be restored for the benefit of other species.

HABITAT CONSERVATION

- Forage production on the refuge would be enhanced by selecting plant species to optimize nutritional value and increasing sprinkler use and improving flood-irrigation methods. Attempts would be made to haze elk and bison from refuge lands during the growing season to protect winter forage.
- Efforts to restore woody vegetation on the refuge would include fencing 500 acres of willow, 1,000 acres of aspen, and 100 acres of cottonwood communities.
- About 2,400 acres of previously cultivated areas in the park would be converted to native plant communities.

SUSTAINABLE POPULATIONS / NUMBERS OF ELK AND BISON / DISEASE MANAGEMENT

- The agencies would work in cooperation with the Wyoming Game and Fish Department to achieve an average bull-to-cow ratio of 35:100 in elk summering in the park. Initially elk harvest levels on the refuge and in the park units would increase from current levels, but over time annual harvests would decrease to an estimated 300–400.
- In cooperation with the Wyoming Game and Fish Department, a public bison hunt would be started on the refuge. Initially, 90–100 bison per year would be harvested on the refuge and 50 in the national forest to reach the population objective, with a bull-to-cow ratio of 1:1. Over time harvest levels might be reduced on the refuge and adjacent national forest lands. Tribal reductions of bison would also occur (estimated at 5 animals per year, or possibly more depending on the assessed need by the Wyoming Game and Fish Department).
- Minimizing the use of the same sites by elk and bison during supplemental feeding and increased distribution of elk on and off the refuge during some winters would be used to manage the risks of adverse effects of non-endemic diseases being introduced into the herds.

WILDLIFE-DEPENDENT RECREATION

- Wildlife-viewing opportunities would be concentrated during some winters and more natural and sporadic during milder winters. Elk and bison hunting would be allowed on the refuge and, when necessary for proper management, the elk herd reduction program in the park. The southern portion of the refuge could be opened in the fall for an early season hunt or opened for wildlife observation, photography, and interpretation.

Map

Alternative 4

ALTERNATIVE 5: RESTORE HABITAT, IMPROVE FORAGE, AND CONTINUE SUPPLEMENTAL FEEDING

The Jackson elk and bison herds and their habitat would be heavily managed on the refuge with an emphasis on improving forage quality on cultivated lands through improved irrigation methods. About 5,000–7,500 elk and 400 bison would winter on the refuge. During the summer up to 2,500 elk would use habitat in the park units. Imported supplemental feed would be used in average and above-average winters (estimated to occur roughly 9 of 10 years). The elk hunt on the refuge and, when necessary, the elk reduction program in the park would continue. Also, a bison hunt would be initiated on the refuge. Strategies to achieve population objectives would be developed in cooperation with the Wyoming Game and Fish Department. Efforts to minimize disease outbreaks would include spreading out feed and moving feed locations. To reduce the prevalence of brucellosis in the elk and bison herds, WGFD personnel would be permitted to use Strain 19 to vaccinate elk and RB51 to vaccinate bison. Woody vegetation would be restored for the benefit of other species.

Habitat Conservation

- Forage production on the refuge would be enhanced by selecting plant species to optimize nutritional value and increasing sprinkler use and improving flood irrigation methods. Attempts would be made to haze elk and bison from refuge lands during the growing season to protect winter forage.
- Efforts to restore woody vegetation on the refuge would include fencing 500 acres of willow, 1,000 acres of aspen, and 100 acres cottonwood communities.
- About 2,400 acres of previously cultivated areas in the park would be converted to native plant communities.

Sustainable Populations / Numbers of Elk and Bison / Disease Management

- The agencies would work in cooperation with the Wyoming Game and Fish Department to achieve an average bull-to-cow ratio of 35:100 in elk summering in the park. Initially elk harvest levels on the refuge and in park units would increase but would decrease over time to an estimated 300–400.
- In cooperation with the Wyoming Game and Fish Department, a public bison hunt would be started on the refuge. Initially, an estimated 100 bison per year would be harvested on the refuge and 50 in the national forest to reach the objective of 400 animals, with a bull-to-cow ratio of 1:1. Over time the estimated harvest would be reduced to 60 total on refuge and forest lands.
- Minimizing the use of the same sites by elk and bison and spreading out feed during supplemental feeding would be used to manage the spread of diseases in the herd.

Wildlife-dependent Recreation

- Wildlife viewing opportunities would be concentrated during most winters. Elk and bison hunting would be allowed on the refuge and, when necessary for proper management, the elk herd reduction program in the park.

Map

Alternative 5

ALTERNATIVE 6: RESTORE HABITAT, ADAPTIVELY MANAGE POPULATIONS, AND PHASE OUT SUPPLEMENTAL FEEDING

The Jackson elk and bison herds and their habitat would be adaptively managed on the refuge to improve available winter grazing habitat and to respond to changing conditions. In the short term about 2,400–2,700 elk would winter on the refuge, but over time could increase to 2,800–3,200. An estimated 1,200–1,600 elk would summer in the park units. Native habitat and cultivated fields on the refuge would provide substantial standing winter forage, and winter feeding would be phased out within five years. Elk hunting would continue on the refuge and, when necessary, the herd reduction program in the park. Also, a bison hunt would be used on the refuge to eventually manage a herd averaging 400 animals. Strategies to achieve population objectives would be developed in cooperation with the Wyoming Game and Fish Department. The prevalence of brucellosis in the elk and bison herds as a result of concentrated animals would decrease over time, and vaccines with higher efficacies or other techniques to reduce transmission would be used when developed. Woody vegetation would be initially protected and restored for the benefit of other species.

HABITAT CONSERVATION

- Refuge cultivated fields would produce substantial forage, with improved sprinkler and flood-irrigation systems. Attempts would be made to haze elk and bison from refuge lands during the growing season to protect winter forage.
- Woody vegetation on the refuge would be protected by rotating small exclosures until habitats had recovered. Prescribed fire could be used and logging allowed on the refuge inside exclosures.
- About 2,400 acres of previously cultivated areas in the park would be converted to native plant communities.

SUSTAINABLE POPULATIONS / NUMBERS OF ELK AND BISON / DISEASE MANAGEMENT

- The agencies would work in cooperation with the Wyoming Game and Fish Department to achieve an average bull-to-cow ratio of 35:100 in elk summering in the park. Initially refuge/park elk harvest levels could be 1,000 elk, but over time would decrease to 75–350. Other options include hunting closures in the Blacktail Butte / Kelly hayfields area and the northern one-fifth of the refuge; an early season hunt on the southern portion of the refuge, or opening the southern portion of refuge to wildlife observation (in lieu of hunting); eliminating feeding sooner; or extending the deadline for feeding beyond five years.
- In cooperation with the Wyoming Game and Fish Department, a public bison hunt would be started on the refuge. Initially, an estimated 150 bison per year would be harvested on the refuge and in the national forest to reach an objective of 400 animals, with a bull-to-cow ratio of 1:1. Over time harvest levels would be reduced to about 60. Tribal reductions of bison would also occur (estimated at 5 animals per year, or possibly more depending on the assessed need by the Wyoming Game and Fish Department).
- A wider distribution of elk and bison across winter range would be used to greatly reduce the risks of adverse effects of non-endemic diseases being introduced into the herds.

WILDLIFE-DEPENDENT RECREATION

- Wildlife viewing opportunities would be more natural and more sporadic. Elk and bison hunting would be allowed on the refuge and, when necessary for proper management, the elk herd reduction program in the park. The southern portion of the refuge could be open in the fall to wildlife observation, photography, and interpretation.

Map

Alternative 6

ALTERNATIVE COMPARISON BY GOAL

GOAL 1: HABITAT CONSERVATION

National Elk Refuge. Provide secure, sustainable ungulate grazing habitat that is characterized primarily by native composition and structure within and among plant communities and that provides for the needs of other native species.

Grand Teton National Park / John D. Rockefeller, Jr., Memorial Parkway. In concert with restoring and perpetuating natural ecosystem functioning in Grand Teton National Park and John D. Rockefeller, Jr., Memorial Parkway, restore and maintain the full range of natural structural and compositional characteristics of native habitats used by bison and elk, emphasizing the plant species diversity that native habitats would support.

NATIONAL ELK REFUGE

Land Protection on the Refuge

Alternatives 1 through 6

Objective

- Within one year identify any private lands within the approved boundary of the refuge that could be protected through a habitat-protection partnership, a trade, or a willing-seller / willing-buyer transaction to prevent development of these lands and to provide additional elk winter range.

Rationale: This management plan does not constitute a commitment for funding the protection of additional lands within the approved refuge boundary. The Fish and Wildlife Service's land acquisition policy is to obtain the minimum interest necessary to satisfy refuge objectives. If lands within the approved boundary became available, the service would seek ways to either protect them or acquire them for additional elk winter range.

Strategies

- Educate stakeholders at local, regional, and national levels as to the importance of protecting private lands within the refuge to sustain the Jackson elk and bison herds, breeding habitat for birds, and habitat for other native wildlife.
- Identify future funding necessary to acquire lands.
- Work with local landowners to identify and carry out mutually acceptable options to minimize adverse impacts on wintering elk and bison.

Elk and Bison Grazing Habitat

Alternative 1 (No Action)

Objective

- Over the life of the plan provide elk and bison grazing habitat under the existing habitat management program, annually producing an average of 3,300 tons of forage on irrigated and nonirrigated cultivated fields to supplement the winter feeding program.
- For all plant communities that are grazed by elk and bison on the refuge, annually minimize the composition of invasive nonnative plant species; specifically:
  - Prevent new infestations of noxious weeds (spotted knapweed, diffuse knapweed, Russian knapweed, leafy spurge, dyer's woad, field bindweed, musk thistle, Canada thistle, sow thistle), crested wheatgrass, and cheatgrass. (*Same for all alternatives.)*
  - Within 15 years restore to native species approximately 250 acres of cheatgrass and about 650 acres of crested wheatgrass. *(Same for all alternatives.)*
  - Continue to restore native plant species in refuge areas currently dominated by spotted knapweed in the Gros Ventre drainage at the rate of 2 acres per year for the next 20 years. (*Same for all alternatives.)*

Rationale: Forage production would continue to be enhanced beyond what can naturally be produced on designated parts of the refuge so as to provide elk with additional foraging opportunities, which would reduce the need for supplemental

feeding. Invasive nonnative species are currently controlled in part because they hinder the production of preferred forage species in cultivated areas and reduce the prevalence of native forage species on native habitat.

Strategies

Native Winter Range

- ❖ Control all wildland fires. *(Same as Alternatives 3, 4, 5, and 6.)*
- ❖ Use native seed mixes of the intermountain west. *(Same for all alternatives.)*

Grazing Habitat

- ❖ Restore winter and transitional grazing habitat on the refuge that has become dominated by nonnative species. (*Same for all alternatives.)*

Irrigation and Farming

- ❖ On the refuge emphasize forage production for elk and bison to delay the onset of supplemental feeding each year.
- ❖ Use a variety of tools including prescribed fire, irrigation, harrowing, and fertilizing, as well as blading in cultivated areas to decrease crusting effects. *(Same as Alternatives 3, 4, 5, and 6.)*
- ❖ Flood-irrigate between 700 and 2,000 acres, depending on water availability and staffing. Use sprinkler irrigation on 60 acres. Fertilize cultivated areas and harrow feeding sites each spring. Reseed cultivated areas when production declines.
- ❖ Use prescribed fire on 2,400 acres in the southern portion of the refuge every five years with no more than 2,000 acres burned in any given year.

Alternative 2

Objectives

- ♦ By year 15 of the plan complete restoration of approximately 2,400 acres of historically farmed lands that are currently cultivated to native plant communities, using the ecological indicators defined by O'Brien et al. (2003) to determine success, and subsequently allow natural processes to evolve and produce winter forage.
- ♦ Over the life of the plan allow all grazing habitats on the refuge, including sagebrush, grassland, and meadow habitats, to evolve through natural disturbances and succession with little human intervention.
- ♦ Minimize the composition of invasive nonnative plant species. *(Same for all alternatives.)*

Rationale: Very little long-term, active habitat management on the National Elk Refuge would take place under this alternative. In the short term there would be an initial program to restore native plant communities in some or possibly all cultivated areas. Once these areas had been restored so that native species were dominant, all irrigation and farming would cease except for invasive nonnative plant species control. Elk and bison would use forage produced on meadows, pastures, and native range.

Strategies

Native Winter Range

- ❖ Discontinue use of prescribed fire.
- ❖ Allow for some wildland fires to burn, based on an approved fire management plan, except when they threatened the town of Jackson, other private property, cultural or historic sites, or NER facilities.
- ❖ Fund a biotech position to assist in establishing experimental plots to determine optimum species composition of acres to be restored. Use existing staff for restoration. *(Same for Alternative 3, 4, 5, and 6.)*

Grazing Habitat

- ❖ Restore winter and transitional grazing habitat on the refuge that has become dominated by nonnative species. (*Same for all alternatives.)*
- ❖ Support stakeholder efforts to establish migration of elk out of Jackson Hole to more favorable wintering areas.

  Rationale: The promotion of elk migrations to winter range in the Green River basin and possibly the Red Desert would rely on substantial interagency coordination and cooperation and would depend on the efforts of the Wyoming Game and Fish Department, the U.S. Forest Service, and the Bureau of Land Management (see further discussion at end of Chapter 4,

"Possible Conflicts with Agency, Tribal, County, or State Plans or Policies"). The success of this effort would also require the cooperation of private landowners and nongovernmental agencies. Because the U.S. Fish and Wildlife Service and the National Park Service would not have the authority or jurisdiction to implement this action, actions under Alternative 2 related to supporting elk migration out of Jackson Hole could range from letters of support to providing staff expertise or assistance in habitat improvement projects. Due to the uncertainty of implementation of this action, no projected costs have been identified.

Irrigation and Farming

❖ Phase out the use of irrigation, harrowing, fertilizing, and prescribed fire on cultivated areas.

Alternative 3

Objectives

♦ Annually produce a minimum average of 2,000 pounds of forage per acre on a minimum of 1,100 acres on the historically irrigated lands of the refuge.

♦ Minimize the composition of invasive nonnative plant species. *(Same for all alternatives.)*

Rationale: Forage production on cultivated fields would continue to be enhanced beyond what can naturally be produced so as to provide elk with additional foraging opportunities (similar to the current forage production program.) Efforts to control undesirable nonnative plant species would continue because they hinder the production of preferred forage species. Because fewer ungulates would be feeding on the refuge in the long term, supplemental feeding would be reduced to severe winters only.

Strategies

Native Winter Range

❖ Fund a biotech position. (*Same as Alternatives 2, 4, 5, and 6.)*

❖ Use native seed mixes of the intermountain west. *(Same for all alternatives.)*

❖ Control all wildland fires *(Same as Alternatives 1, 4, 5, and 6.)*

❖ Close the northern fifth of the refuge, as well as the Blacktail Butte / Kelly hayfields area in the park, to hunting so as to increase the use of transitional and winter habitat. *(Same as Alternative 6.)*

❖ Adjust other hunting areas if needed to increase utilization of habitat without affecting hunter harvest. *(Same as Alternative 6.)*

Grazing Habitat

❖ Restore winter and transitional grazing habitat on the refuge that has become dominated by nonnative species and maintain native habitat in the park, including increasing the effectiveness of some transitional and winter habitats by closing them to hunting. *(Similar to Alternatives 2, 4, 5, and 6.)*

❖ Support stakeholder efforts to establish the migration of elk out of Jackson Hole to more favorable wintering areas. *(Same as Alternative 2.)*

Irrigation and Farming

❖ Use a variety of tools. *(Same as Alternatives 1, 4, 5, 6.)*

❖ In combination with other elements of Alternative 3, consider two options for irrigation and farming:

- *Option A* — Continue the existing farming program with increased emphasis on fixing parts of the irrigation infrastructure that have fallen into disrepair. Maintain the current flood-irrigation system.

or

- *Option B* — Convert cultivated areas to native communities over 15 years. Use herbicides judiciously during the field preparation process to eliminate competing plant species and invasive plants. Phase out irrigation within 15 years. Maintain grassland habitat through the use of prescribed fire, mechanical treatment, or reseeding.

Flood-irrigated field on the National Elk Refuge.

Alternative 4 (Proposed Action)

Objectives

- On sprinkler-irrigated fields, annually produce an average of 5,000 pounds of forage per acre on about 400 acres and an average of 2,500 pounds per acre on 700 acres on the refuge, with plant communities in these areas dominated by species exhibiting a high level of palatability, preference by wintering elk and bison, nutritional value, productivity, and ability to remain upright under moderate snowpack. *(Same as Alternatives 5 and 6.)*
- On flood-irrigated fields, annually produce a minimum average of 2,500 pounds of forage per acre on up to 500 additional acres on the refuge, with the plant communities in these areas dominated by species exhibiting the characteristics listed above. *(Same as Alternatives 5 and 6.)*
- Minimize the composition of invasive nonnative plant species. *(Same for all alternatives.)*

Rationale: Producing more standing forage and better quality forage on existing cultivated fields, using plant species that have a high nutritional value, are preferred by elk and bison, and remain upright under moderate snowpack would all provide grazing habitat for a longer period so that feeding could be delayed, thus reducing concentrations of elk and bison.

Strategies

Native Winter Range

- Fund a biotech position. *(Same as Alternatives 2, 3, 5, and 6.)*
- Use native seed mixes of the intermountain west. *(Same for all alternatives.)*
- Control wildland fires. *(Same as Alternatives 1, 3, 5, and 6.)*

Grazing Habitat

- Restore winter and transitional grazing habitat on the refuge that has become dominated by nonnative plant species. *(Similar to Alternatives 2, 3, 5, and 6.)*

Irrigation and Farming

- Use a variety of tools. *(Same as Alternatives 1, 3, 5, and 6.)*
- Irrigate a minimum of 1,600 acres and increase sprinkler irrigation to 1,100 acres per year of the 1,590 acres that could be sprinkler irrigated and enhance the flood-irrigation delivery system to irrigate an additional 500 acres. *(Same as Alternatives 5 and 6.)*
- Use a combination of center pivot, side-roll, and hand-line sprinklers to replace flood irrigation. Use center pivots to irrigate approximately 290 acres in the McBride area, 200 acres in the Chambers area, 160 acres in the Peterson area, and 250 acres in the Nowlin area. Use supplemental side-roll and hand-line sprinklers to irrigate approximately 450 acres in the Ben Goe area and 240 acres in the Headquarters area (see the "Irrigation Project Areas of the NER" map). *(Same as Alternatives 5 and 6.)*
- Improve delivery efficiency for flood irrigation by installing delivery pipes to the fields to replace delivery canals and ditches *(Same as Alternatives 5 and 6.)*

Alternative 5

Objectives

- Annually produce an average of 5,000 pounds of forage per acre on about 400 acres and an average of 2,500 pounds per acre on 700 acres of cultivated fields on the refuge. *(Same as Alternatives 4 and 6.)*
- Minimize the composition of invasive nonnative plant species. *(Same for all alternatives.)*

Rationale: As described for Alternative 4, producing more standing forage and better quality forage on existing cultivated fields would provide

grazing habitat for a longer period of time, delaying feeding and reducing elk and bison concentrations.

Strategies

Native Winter Range

- ❖ Fund a biotech position. *(Same as Alternatives 2, 3, 4, and 6.)*
- ❖ Use native seed mixes of the intermountain west. *(Same for all alternatives.)*
- ❖ Control wildland fires. *(Same as Alternatives 1, 3, 4, and 6.)*

Grazing Habitat

- ❖ Restore winter and transitional grazing habitat on the refuge that has become dominated by nonnative plant species. *(Same as strategies under Goal 1.)*

Irrigation and Farming

- ❖ Use a variety of tools. *(Same as Alternatives 1, 3, 4, and 6.)*
- ❖ Irrigate a minimum of 1,600 acres. *(Same as Alternatives 4 and 6.)*
- ❖ Use a combination of sprinkler systems. *(Same as Alternatives 4 and 6.)*
- ❖ Improve delivery efficiency for flood irrigation. *(Same as Alternatives 4 and 6.)*

Alternative 6

Objectives

- ♦ Annually produce an average of 5,000 pounds of forage per acre on about 400 acres and an average of 2,500 pounds per acre on 700 acres of cultivated fields on the refuge. *(Same as Alternatives 4 and 5.)*
- ♦ Minimize the composition of invasive nonnative plant species. *(Same for all alternatives.)*
- ♦ By year 15 of the plan determine the extent that sprinkler and flood irrigation are needed to provide for objective numbers of elk and bison on the refuge, and whether irrigated fields adequately attract elk away from woody vegetation at the south end of the refuge, and eliminate the system if not needed.

Rationale: Producing more standing forage and better quality forage on existing cultivated fields would provide grazing habitat for a longer period so that feeding could be delayed, reducing concentrations of elk and bison. Irrigation and farming would continue on the refuge's cultivated fields into the foreseeable future, but these activities would be reevaluated after elk and bison numbers had been at objective levels for several years to determine the extent to which they should be continued into the long term.

Strategies

Native Winter Range

- ❖ Fund a biotech position. *(Same as Alternatives 2, 3, 4, and 5.)*
- ❖ Use native seed mixes of the intermountain west. *(Same for all alternatives.)*
- ❖ Control wildland fires. *(Same as Alternatives 1, 3, 4, and 5)*
- ❖ Close the northern fifth of the refuge, as well as the Blacktail Butte / Kelly hayfields area in the park, to hunting so as to increase the use of transitional and winter habitat. *(Same as Alternative 3.)*

Grazing Habitat

- ❖ Enhance winter and transitional grazing habitat on the refuge. *(Similar to Alternatives 2, 3, 4, and 5.)*

Irrigation and Farming

- ❖ Use a variety of tools. *(Same as Alternatives 1 and 5.)*
- ❖ Irrigate a minimum of 1,600 acres. *(Same as Alternatives 4 and 5).*
- ❖ Use a combination of sprinkler systems. *(Same as Alternatives 4 and 5.)*
- ❖ Improve delivery efficiency for flood irrigation. *(Same as Alternatives 4 and 5.)*

Addressing Habitat Problems Related to Unnaturally High Elk and Bison Numbers on the Refuge

Alternative 1

Objectives

- Over the life of the plan protect sagebrush and grassland communities from degradation, maintain native structural and compositional characteristics, and allow degraded areas to recover, especially areas used by sage grouse and other sagebrush-dependent species. By year 5 of the plan define the desired characteristics of sagebrush and grassland communities for the development of the comprehensive conservation plan for the refuge. *(Same for all alternatives.)*
- Over the life of the plan limit cultivated areas on the refuge to 2,400 acres that are already under cultivation. *(Same as Alternatives 3, 4, 5, and 6.)*

Rationale. There are no objectives for balancing the needs of elk and bison with those of other wildlife. However, the National Elk Refuge has goals and objectives for perpetuating the migratory bird resource and preserving and enhancing related habitat (USFWS 1999b). Furthermore, the 1974 cooperative agreement between the U.S. Fish and Wildlife Service and the Wyoming Game and Fish Department recognizes the detrimental effects that large numbers of elk can have on habitat conditions.

Strategies

- Continue present management programs.
- Provide supplemental feed away from riparian areas. *(Same for all alternatives.)*

Alternative 2

Objectives

- Protect sagebrush and grassland communities from degradation. *(Same for all alternatives.)*

Rationale. Similar to Alternative 1, there are no objectives for balancing the needs of elk and bison with those of other wildlife. There are USFWS goals and objectives for perpetuating the migratory bird resource and preserving and enhancing related habitat (USFWS 1999b). Also, the 1974 USFWS / WGFD cooperative agreement recognizes that large numbers of elk can adversely affect habitat conditions.

Strategies

- Continue present management programs for sagebrush and grassland communities. *(Same for all alternatives.)*
- Pending the phaseout of supplemental feeding, feed away from riparian areas. *(Same for all alternatives.)*

Alternative 3

Background. Woody vegetation on the refuge is adversely affected by high concentrations of animals. If a sufficient amount of woody vegetation started to recover as the number of elk on the refuge declined, the objective number of elk could be revisited concurrent with an assessment of disease prevalence (see strategies under Goals 2 and 4). If sufficient habitat recovery did not occur after lowering elk and bison numbers on the refuge to objective levels, then numbers identified in the objectives could be further reduced.

Objectives

- Recover and sustain a minimum of 1,300 acres of willow communities, including all existing stands in the northern portion of the refuge (about 300 acres), in Class I/II conditions (as defined in Chapter 4 under "Habitat Impacts"), including an average canopy cover of about 65%–80% comprised of willows averaging 60–80 inches (1.5–2 meters) in height that receive less than 20% annual consumption by ungulates, with complete recovery occurring beyond 15 years. *(Same as Alternative 6.)*
- By year 15 of the plan allow for a sufficient level of aspen recruitment — including a minimum of 800 stems/acre that reach a height of 80 inches (2 meters) so as to be out of reach of ungulate browsers, at some point within each 100-year period — throughout each aspen stand in order to maintain the current distribution of approximately 1,850 acres of aspen in Class I/II conditions over the long term. *(Similar to Alternatives 4, 5, and 6.)*

  Rationale: Because individual aspen stems generally live about 150 years and the last major stand replacement fire on the refuge oc-

curred 120 years ago, aspen recruitment in many aspen stands will need to occur within the next 30 years. (Within-community characteristics will be specified in the upcoming comprehensive conservation plan for the refuge.)

- By year 15 of the plan allow for a sufficient level of cottonwood recruitment — including a minimum of 0.17 stem/meter that reaches a height of 80 inches (2 meters) so as to be out of reach of ungulate browsers at some point within each 100-year period — throughout each cottonwood stand in order to maintain the current distribution of approximately 1,090 acres of cottonwood in Class I/II conditions over the long term. (Within-community characteristics will be specified in the upcoming comprehensive conservation plan for the refuge.) *(Similar to Alternatives 4, 5, and 6.)*
- By year 5 of the plan maintain at a minimum the existing proportion of the wet meadow community that remains ungrazed to lightly grazed each year (an estimated 15%–20%) and collect a sufficient amount of field data on vegetation and wildlife use within the community type, as well as published literature, to formulate a quantitative objective for the upcoming comprehensive conservation plan for the refuge. *(Same as Alternatives 4 and 6.)*
- Protect sagebrush and grassland communities from degradation. *(Same for all alternatives.)*
- Limit cultivated areas on the refuge to 2,400 acres that are already under cultivation. *(Same as Alternatives 1, 4, 5, and 6.)*

Strategies

Browsing

- Reduce browsing to less than 13% of the annual growth of willow plants (Singer and Zeigenfuss 2003) by reducing elk numbers and cutting back on winter feeding.

  Rationale: Although similar estimates do not exist for aspen and cottonwood, it is expected that fewer elk would result in reduced browsing of annual growth.

Winter Supplemental Feeding

- Feed away from riparian areas. *(Same for all alternatives.)*

Water Management

- Enhance restoration of narrowleaf cottonwood communities along Flat Creek above the intake from the Gros Ventre River by limiting the amount of water that is diverted from the upper creek for irrigation on the refuge. Increase water flows in upper Flat Creek if flood irrigation was eventually phased back or eliminated under this alternative.

Woody Vegetation

- No strategies.

  Rationale: Under this alternative it is assumed that lower numbers of elk would allow woody riparian vegetation to recover. No active measures related to woody vegetation would be taken.

Alternative 4 (Proposed Action)

Objectives

- Restore 800 acres of willows to Class I/II conditions. *(Same as Alternative 5.)*
- Maintain approximately 1,000 acres of aspen in Class I/II conditions over the long term. *(Same as Alternative 5, similar to Alternatives 3 and 6.)*
- Maintain approximately 1,000 acres of cottonwood in Class I/II conditions over the long term. *(Same as Alternatives 5 and 6, similar to Alternative 3.)*
- Maintain an estimated 15%–20% of the wet meadow community type in a lightly grazed or ungrazed condition. *(Same as Alternatives 3 and 6.)*
- Protect sagebrush and grassland communities from degradation. *(Same for all alternatives.)*
- Limit cultivated areas on the refuge to 2,400 acres that are already under cultivation. *(Same as Alternatives 1, 3, 5, and 6.)*

Strategies

Winter Supplemental Feeding

- Feed away from riparian areas. *(Same for all alternatives.)*

Water Management

❖ Enhance restoration of narrowleaf cottonwood communities along Flat Creek above the intake from the Gros Ventre River by reducing the amount of water that is diverted from the upper creek for irrigation on the refuge. Use sprinkler irrigation systems more frequently to increase water-use efficiency.

Woody Vegetation

❖ Fence approximately 500 acres of former willow habitat, 100 acres of remnant cottonwood communities along upper Flat Creek, and 1,000 acres of aspen habitat to exclude elk and bison so that these communities could recover.

Rationale: Stands of woody vegetation in Jackson Hole likely received some level of browsing pressure historically, but browsing pressure was low enough at times to allow successful recruitment and maintenance of willow, aspen, and cottonwood stands on the refuge (Dobkin, Singer, and Platts 2002). Exclosures would not encompass the entire historical distribution of willows, aspen, and cottonwoods. The somewhat unnatural situation within the exclosures would compensate for heavily browsed stands and the complete loss of other stands outside the exclosures.

Alternative 5

Objectives

♦ Restore 800 acres of willows to Class I/II conditions. *(Same as Alternative 4.)*

Condition of habitat on the National Elk Refuge.

♦ Maintain approximately 1,000 acres of aspen in Class I/II conditions over the long term. *(Same as Alternative 4, similar to Alternatives 3 and 6.)*

♦ Maintain approximately 1,000 acres of cottonwood in Class I/II conditions over the long term. *(Same as Alternatives 4 and 6, similar to Alternative 3.)*

♦ Protect sagebrush and grassland communities from degradation. *(Same for all alternatives.)*

♦ Limit cultivated areas on the refuge to 2,400 acres that are already under cultivation. *(Same as Alternatives 1, 3, 4, and 6.)*

Strategies

Winter Supplemental Feeding

❖ Feed away from riparian areas. *(Same for all alternatives).*

Woody Vegetation

❖ Fence approximately 500 acres of former willow habitat, 100 acres of remnant cottonwood communities along Flat Creek, and 1,000 acres of aspen to exclude elk and bison.

Alternative 6

Objectives

♦ Restore 1,300 acres of willow communities to Class I/II conditions. *(Similar to Alternative 3.)*

♦ Maintain approximately 1,800 acres of aspen in Class I/II conditions over the long term. *(Similar to Alternatives 3, 4, and 5.)*

♦ Maintain approximately 1,000 acres of cottonwood in Class I/II conditions over the long term. *(Same as Alternatives 4 and 5, similar to Alternative 3.)*

♦ Maintain an estimated 15%–20% of the 1 wet meadow community in a lightly grazed or ungrazed condition. *(Same as Alternatives 3 and 4.)*

♦ Protect sagebrush and grassland communities from degradation. *(Same for all alternatives.)*

♦ Limit cultivated areas on the refuge to 2,400 acres that are already under cultivation. *(Same as Alternatives 1, 3, 4, and 5.)*

Strategies

Winter Supplemental Feeding

- ❖ Pending the phaseout of the supplemental feeding program, feed away from riparian areas. *(Same for all alternatives).*

Woody Vegetation

- ❖ Use smaller exclosures (up to 600 acres) around aspen stands and periodically rotate exclosures as areas recover.
- ❖ Fence 100 acres of remnant cottonwood communities along upper Flat Creek and use additional restoration activities if necessary.
- ❖ Monitor to determine success and make adjustments if necessary.

GRAND TETON NATIONAL PARK / JOHN D. ROCKEFELLER, JR., PARKWAY

Alternative 1

There are no documented objectives for managing or conserving elk and bison habitat in the park units, and no management strategies are being carried out specifically to enhance or restore habitat for the benefit of elk and bison. However, both species benefit from management actions to restore and maintain native habitats and natural ecosystem processes. The use of prescribed fire would continue, as would current procedures for controlling invasive plants. Large-scale restoration of agricultural lands would not be undertaken. Restoration work would remain experimental, only affecting limited parts of previously farmed and irrigated areas.

Parts of the Elk Ranch area would continue to be irrigated while livestock are being grazed in the area. *(Same for all alternatives.)*

Alternatives 2 through 6

Objectives

- ♦ Restore and perpetuate a natural mosaic of climax and seral vegetation within each vegetation type used by bison and elk.
  - ◊ On grassland, meadow, sagebrush, and early seral forest communities within transitional and winter ranges in Grand Teton National Park, ensure that a natural amount and quality of forage is available for bison and elk during fall migration and wintering periods.
  - ◊ Convert all formerly farmed and irrigated areas in the southern portion of the park (approximately 4,500 acres) to native plant communities within 15 years.
- ♦ Under Alternative 3 and potentially Alternative 6, withdraw the Blacktail Butte / Kelly hayfields area in the park from the elk herd reduction program, as well as the northern fifth of the refuge from hunting, in order to increase the use of transitional and winter habitat.

Rationale: Converting formerly cultivated areas to native plant communities could be the best long-term strategy to control invasive plants. Habitat restoration in park units, including invasive weed control, would continue for native wildlife communities. Elk and bison would continue to benefit from prescribed fire, invasive weed control, and research into the most effective applications of both programs to benefit elk, bison, and their native habitats.

Strategies

- ❖ Pursue a more aggressive program to convert formerly cultivated areas to native plant communities
- ❖ Seek funding for a study involving experimental plots to determine the most efficient and acceptable methods of eradicating smooth brome and other agricultural plant species (needed prior to reseeding efforts), and to determine which native species would have the highest probability of successful reestablishment.

GOAL 2. SUSTAINABLE ELK AND BISON POPULATIONS

National Elk Refuge. Contribute to elk and bison populations that are characterized by resiliency, sustainability, and minimized risks of irreversible or long-term adverse impacts to the herds and other species.

Grand Teton National Park / John D. Rockefeller, Jr., Memorial Parkway. Perpetuate natural population levels, including natural fluctuation and natural

characteristics within the elk and bison populations inhabiting the park units.

Background

The most critical part of sustaining healthy populations of elk and bison that exhibit natural population characteristics would be to conserve a suitable habitat base. The following objectives and strategies are supplementary to the objectives and strategies in Goal 1, which would have to be met in order for Goal 2 to be achieved.

Alternative 1

Objective

- Over the life of the plan continue ongoing management practices aimed at sustainable and healthy elk and bison populations.

Strategies

Elk Population Control

- Continue to work cooperatively with the Wyoming Game and Fish Department to achieve population objectives (including herd ratios and elk herd segment sizes), to develop hunting seasons, and to evaluate hunting / elk reduction areas. The Wyoming Game and Fish Department would formally establish objectives and strategies after public review and approval by the Wyoming Game and Fish Commission. *(Same as Alternatives 3, 4, 5, and 6.)*
- Maintain numbers of elk wintering on the refuge below 7,500.
- Continue hazing elk off refuge lands (on a case-by-case basis) during the growing season to prevent grazing of winter forage. *(Same as Alternatives 3, 4, 5, and 6.)*
- On the refuge continue the elk hunting program; in park units continue the elk herd reduction program.
- In park units ensure an adequate harvest of elk that summer east of the Snake River and that winter on the refuge.
- Harvest an estimated 450–600 elk on the refuge and in park units each year.

Bison Population Control

- No controls used.
- Continue hazing bison off refuge lands (on a case-by-case basis) during the summer and fall to prevent grazing of winter forage. *(Same as Alternatives 3, 4, 5, and 6.)*

Winter Supplemental Feeding

- Use standing forage to delay the onset of feeding. Delay winter feeding as long as possible each year.
- In cultivated areas with high forage production that were made inaccessible to elk by crusting events, use mechanical means to increase elk access. *(Same as Alternatives 3, 4, 5, and 6.)*

Alternative 2

Objectives

- By year 15 of the plan rely on predation, winter mortality, and other natural fluctuations to maintain the bison and elk populations at levels the habitat on the refuge and park can support with minimal human intervention.
- Over the life of the plan sustain genetic viability in the elk and bison herds.

Strategies

Elk and Bison Population Control

- In the short term use fertility control (surgical sterilization, porcine zona pellucida, or gonadotropin releasing hormone) on bison on the refuge or in park units to reduce the population to what can be supported by available habitat (see Appendix B). By year 15 of the plan discontinue fertility control on bison.
- Rely on predation and other natural mortality factors to maintain elk and bison numbers on available habitat (see Chapter 4 for a detailed discussion).
- Discontinue the elk hunting and herd reduction programs immediately.
- If the bison population drops to a level that is not high enough to maintain genetic viability, especially during more severe winters, use additional measures to maintain viability, such as

periodically introducing animals from other populations.

Winter Supplemental Feeding

- ❖ Phase out the winter feeding program on the refuge and complete elk and bison transition to the use of native range within 15 years of plan implementation.
- ❖ Do not initiate winter feeding during winters with below-average snow. As more elk and bison become less accustomed to migrating to the refuge, further lessen the frequency of winter feeding in average and above-average winters. Over time, eliminate feeding in severe winters completely.
- ❖ Consider removal of portions of the refuge fence to allow for natural movements after forage was depleted or as snow depth increased, thus avoiding excessive starvation.

Alternative 3

Objectives

- ♦ By year 15 of the plan achieve a target winter population for elk on the refuge at or below 2,000 and a summer population in the park units between 500 and 1,000, and a target population for bison between 800 and 1,000. In all but the most severe winters, sustain populations on available native forage (park, refuge, national forest) and cultivated fields (refuge).
- ♦ Over the life of the plan for the park segment of the Jackson elk herd, work cooperatively with the Wyoming Game and Fish Department to sustain an average bull-to-cow ratio of 35:100, which is representative of a native, non-hunted population. *(Same as Alternatives 4, 5, and 6.)*
- ♦ For the bison population work cooperatively with the Wyoming Game and Fish Department to sustain a bull-to-cow ratio of approximately 1:1, which is representative of a native, non-hunted population. *(Same as Alternatives 4, 5, and 6.)*

Strategies

Elk Population Control

- ❖ In cooperation with the Wyoming Game and Fish Department, continue to manage the elk hunt program on the refuge and the herd reduction program in park units as described under Alternative 1 to achieve population objectives.
- ❖ Use principles of adaptive management to determine if the objective of 2,000 elk should be modified.
- ❖ Consider increasing the elk population if the potential for disease prevalence declines, woody vegetation recovers, and bison population objectives are met.
- ❖ Consider two options to reduce numbers and densities of elk on the refuge to offset reduced harvest resulting from the closure of the northern fifth of the refuge and the Blacktail Butte / Kelly hayfields in the park. (*Similar to Alternative 6.)*:
  - *Option 1* — Initiate a highly managed early season hunt on the southern end of the refuge to contribute to a higher harvest of elk.

    or
  - *Option 2* — Open the southern end of the refuge to wildlife observation to move elk into hunt zones.
- ❖ Reduce the annual harvest to an estimated 100–150 elk once elk numbers on the refuge had been reduced to 1,000–2,000 (80% reduction from Alternative 1).
- ❖ Continue hazing elk off refuge lands (on a case-by-case basis) during the growing season to prevent grazing of winter forage. *(Same as Alternatives 1, 4, 5, and 6.)*
- ❖ Consider eliminating the park's herd reduction program during years with adequate elk harvest numbers.
- ❖ Monitor the bull-to-cow ratio and, in cooperation with the Wyoming Game and Fish Department, adjust harvest if necessary. *(Same as Alternatives 4, 5, and 6.)*

Rationale: The forage accounting model developed for the Jackson Hole area (Hobbs et al. 2003) indicates that the refuge could potentially overwinter more than 2,000 elk in up to 8 out of every 10 winters (i.e., less than severe winters) if it is assumed that elk could incur forage deficits as high as 500,000 kilograms without mortality rising above about 5% (in the absence of supplemental feeding). The harvest of elk (on refuge and park lands) and of bison (on the refuge) would be man-

Elk feeding on alfalfa pellets.

aged to ensure that the park elk herd segment and the bison herd would sustain the population characteristics identified in the last two objectives.

Bison Population Control

- ❖ Working cooperatively with the Wyoming Game and Fish Department to achieve population objectives (similar to "Elk Population Control"), implement a bison hunt on the refuge to supplement the WGFD bison hunt in the adjacent Bridger-Teton National Forest. Harvest an estimated 70–85 bison per year (assuming 50+ additional bison could be harvested in the national forest). Tribal reductions of bison on the refuge would also occur (estimated at 5 animals per year or possibly more, depending on a WGFD need assessment). *(Similar to Alternatives 4, 5, and 6.)*
- ❖ Monitor the bull-to-cow ratio and, in cooperation with the Wyoming Game and Fish Department, adjust the harvest if necessary. *(Same as Alternatives 4, 5, and 6.)*
- ❖ Continue hazing bison off refuge lands (on a case-by-case basis) during the growing season to prevent grazing of winter forage. *(Same as Alternatives 1, 4, 5, and 6.)*

Winter Supplemental Feeding

- ❖ Scale back winter feeding program, but continue supplemental feeding in winters with exceptionally heavy snows or otherwise severe conditions (see strategies under Goal 3 for more detail).
- ❖ In cultivated areas with high forage production that were made inaccessible to elk by crusting events, use mechanical means to increase elk access. *(Same as Alternatives 1, 4, 5, and 6.)*

Alternative 4 (Proposed Action)

Objectives

- ♦ Within years 5–10 of the plan achieve a target winter population for elk on the refuge below 5,000 and a summer population in the park units of 1,300–1,600, and for bison a population up to 500. Rely on available native habitat (refuge / park / forest land) and cultivated forage (refuge) except during above-average winters on the refuge.
- ♦ For the park segment of the Jackson elk herd, work cooperatively with the Wyoming Game and Fish Department to sustain an average bull-to-cow ratio of 35:100. *(Same as Alternatives 3, 5, and 6.)*
- ♦ For the bison population, work cooperatively with the Wyoming Game and Fish Department to sustain a bull-to-cow ratio of approximately 1:1. *(Same as Alternatives 3, 5, and 6.)*
- ♦ For a five-year running average, ensure that the bison herd inhabiting the park and refuge does not decline below 400 animals in order to sustain long-term genetic viability.

Rationale: These numbers assume that the WGFD herd objective of 11,029 has been met and that higher numbers of elk would occupy winter range. Under Alternative 4 the numbers and concentrations of elk on the National Elk Refuge would not be as low as under Alternative 2 (although bison numbers could be about the same).

Strategies

Elk Population Control

- ❖ In cooperation with the Wyoming Game and Fish Department, continue to manage the elk hunt program on the refuge and the herd reduction program in park units to achieve population objectives, as described under Alternative 1. *(Same as Alternatives 1, 3, 5, and 6.)*
- ❖ Increase elk harvest initially to reduce herd size, then harvest an estimated 300–400 elk annually (33% reduction compared to Alternative 1).

- ❖ Consider two options on southern end of refuge, either (1) an early season hunt, or (2) public recreational use, in order to move the herd to other areas. *(Same as Alternatives 3 and 6).*
- ❖ Monitor the bull-to-cow ratio and, in cooperation with the Wyoming Game and Fish Department, adjust harvest levels if necessary. *(Same as Alternatives 3, 5, and 6.)*
- ❖ Continue hazing elk off refuge lands (on a case-by-case basis) during the growing season to prevent grazing of winter forage. *(Same as Alternatives 1, 3, 5, and 6.)*

Bison Population Control

- ❖ Working cooperatively with the Wyoming Game and Fish Department to achieve population objectives (similar to "Elk Population Control"), implement a bison hunt on the refuge to reduce the number and density of overwintering animals and to supplement the WGFD bison hunt in Bridger-Teton National Forest. Initially, harvest 90–100 bison per year to reduce the population to 500 animals within year 15 of the plan (assuming 800–1,000 bison when the planning process has been completed) and 50 bison in the national forest. *(Similar to Alternatives 3, 5, and 6.)*
- ❖ After meeting objectives, harvest an estimated 70 bison per year, including bison harvested on national forest.
- ❖ Use a public hunt to reduce numbers, similar to Alternative 3, except conduct the hunt under "fair chase" principles and allow hunters to find and harvest bison (based on license type) and to retrieve and process the carcasses. If necessary, require hunters to collect biological samples (e.g., blood samples) as a condition of the license. Establish the public hunt during the October–December period, with exact start and end dates being determined each year by the state in coordination with the Fish and Wildlife Service. Tribal reductions of bison on the refuge would also occur (estimated at 5 animals per year or possibly more, depending on a WGFD need assessment).
- ❖ Monitor the bull-to-cow ratio and, in cooperation with the Wyoming Game and Fish Department, adjust the harvest if necessary. *(Same as Alternatives 3, 5, and 6).*
- ❖ Continue hazing bison off refuge lands (on a case-by-case basis) during the growing season to prevent grazing of winter forage. *(Same as Alternatives 1, 3, 5, and 6.)*

Winter Supplemental Feeding

- ❖ Delay the onset of feeding each year, decrease the number of days of supplemental feeding, and decrease the frequency of years of providing supplemental feed.
- ❖ Reduce winter feeding to above-average winters (estimated to occur 5 out of 10 years), providing that wintering populations did not decline below objective levels and less than 5% winter mortality. Consider factors such as the amount of forage produced on the refuge, snow conditions, and numbers of overwintering elk and bison in determining whether or not to provide supplemental food.

  Rationale: Reducing the supplemental feeding program to above-average winters would help maintain lower elk numbers on the refuge as a result of behavioral changes (fewer elk would know about supplemental feeding on the refuge and more would remain on native winter range). Reducing numbers of elk on the refuge to meet the objective would depend in part on successfully reducing the park herd segment

- ❖ In cultivated areas with high forage production that were made inaccessible to elk by crusting events, use mechanical means to increase elk access. *(Same as Alternatives 1, 3, 5, and 6.)*

Alternative 5

Objectives

- ♦ Over the life of the plan manage the winter elk population on the refuge below 7,500, the summer population in the parks below 2,500, and the bison population below 400 (post hunt). Sustain populations on native habitat in the park, refuge, and national forest, supplemented by cultivated forage and supplemental food on the refuge in average and above-average winters (an estimated 9 of 10 winters).
- ♦ In cooperation with the Wyoming Game and Fish Department, sustain an average bull-to-cow ratio of 35:100 for the park segment of the

Jackson elk herd. *(Same as Alternatives 3, 4, and 6.)*

- In cooperation with the Wyoming Game and Fish Department, sustain a bull-to-cow ratio of approximately 1:1 for the bison population. *(Same as Alternatives 3, 4, and 6.)*

Strategies

Elk Population Control

- In cooperation with the Wyoming Game and Fish Department, continue to manage the elk hunt program on the refuge and the herd reduction program in the park units to achieve objectives, as described under Alternative 1. *(Same as Alternatives 1, 3, 4, and 6.)*
- Continue hazing elk off refuge lands (on a case-by-case basis) during the growing season to prevent grazing of winter forage. *(Same as Alternatives 1, 3, 4, and 6.)*

Bison Population Control

- Working cooperatively with the Wyoming Game and Fish Department to achieve population objectives (similar to "Elk Population Control"), implement a bison hunt on the refuge only to reduce the number and density of animals overwintering on the refuge and to supplement the WGFD bison hunt in Bridger-Teton National Forest. Initially, harvest 100 bison per year on the refuge and 50 in the national forest. *(Similar to Alternative 4.)*
- After meeting objectives, harvest an estimated 60 bison annually on the refuge and in the forest. *(Similar to Alternative 4.)*
- Continue hazing bison off refuge lands (on a case-by-case basis) during the growing season to prevent grazing of winter forage. *(Same as Alternatives 1, 3, 4, and 6.)*

Winter Supplemental Feeding

- In cultivated areas with high forage production that were made inaccessible to elk by crusting events, use mechanical means to increase elk access. *(Same as Alternatives 1, 3, 4, and 6.)*

Alternative 6

Objectives

- By year 5 of the plan achieve a target population for elk below 3,200 on the refuge, natural fluctuations on park units (600–1,600 estimated), and about 400 bison, based on a five-year running average. Sustain populations on available native habitat in the park, refuge, and national forest, supplemented by cultivated fields on the refuge; phase out supplemental feeding within five years on the refuge.
- In cooperation with the Wyoming Game and Fish Department, for the park segment of the Jackson elk herd sustain an average bull-to-cow ratio of 35:100. *(Same as Alternatives 3, 4, and 5.)*
- In cooperation with the Wyoming Game and Fish Department, for the bison population sustain a bull-to-cow ratio of approximately 1:1. *(Same as Alternatives 3, 4, and 5.)*
- For a five-year running average, ensure that the bison herd inhabiting the park and refuge does not decline below 400 animals in order to sustain long-term genetic viability. *(Same as Alternative 4.)*

Strategies

Strategies would be phased in over a period of 5–10 years.

Elk Population Control

- In cooperation with the Wyoming Game and Fish Department, continue to manage the elk hunt program on the refuge and the herd reduction program in park units to achieve population objectives, as described under Alternative 1. *(Same as Alternatives 1, 3, 4, and 5.)*
- Reduce wintering concentrations by increasing harvest levels initially to meet the objectives for this alternative. Harvest an estimated 1,000+ elk from the refuge and park during the first few years (similar to past harvests). Harvest an estimated 75–350 elk on the refuge and in park units. (Harvest levels would be 50%–90% less than under Alternative 1 in the long term.)
- After initial reductions, consider closing the Blacktail Butte / Kelly hayfields area in the

park and the northern fifth of the refuge or discontinue herd reduction in the park.

- ❖ Consider two options on the southern end of refuge, either (1) an early season hunt, or (2) public recreational use, in order to move the herd to other areas. *(Same as Alternatives 3 and 6).*
- ❖ Continue hazing elk off refuge lands (on a case-by-case basis) during the growing season to prevent grazing of winter forage. *(Same as Alternatives 1, 3, 4, and 5.)*
- ❖ Work cooperatively and assist the Wyoming Game and Fish Department and adjacent landowners in herding elk away from private lands and using fencing or other means to reduce property damage during the transition from supplemental feeding to a greater reliance on winter range.

Bison Population Control

- ❖ Working cooperatively with the Wyoming Game and Fish Department to achieve population objectives (similar to "Elk Population Control"), implement a public and tribal bison hunt on the refuge. Initially harvest 150 bison per year to reduce the population to 400 animals within five years. Use additional tools to reduce numbers if population objectives were not met within this period, including a quicker phaseout of winter feeding. Emphasize the harvest of young-adult female bison to lower numbers fairly quickly. *(Similar to Alternatives 3, 4, and 5.)*
- ❖ Once population objectives were met (post hunt), harvest an estimated average of 60 bison per year, including those harvested in the national forest.
- ❖ Continue hazing bison off refuge lands (on a case-by-case basis) during the growing season to prevent grazing of winter forage. *(Same as Alternatives 1, 3, 4, and 5.)*

Winter Supplemental Feeding

- ❖ Phase out the winter feeding program on the refuge within five years of plan implementation and in coordination with lowering the numbers of elk and bison. Eliminate all winter feeding in below-average winters. Reduce feeding further as more elk and bison became less accustomed to migrating to the refuge. Eventually eliminate winter feeding in all winters.
- ❖ Use other methods to reduce the herds sooner, such as eliminating feeding sooner, or extending feeding.
- ❖ After 10–15 years of plan implementation evaluate the need for the fence along the south and southwestern boundaries of the refuge and remove portions if warranted.
- ❖ In cultivated areas with high forage production that were made inaccessible to elk by crusting events, use mechanical means to increase elk access. *(Same as Alternatives 1, 3, 4, and 5.)*

GOAL 3. NUMBERS OF ELK AND BISON ON THE REFUGE AND IN THE PARK UNITS

Contribute to the WGFD herd objectives for the Jackson elk and bison herds to the extent compatible with Goals 1 and 2 and the legal directives governing the management of the National Elk Refuge and Grand Teton National Park / John D. Rockefeller, Jr., Memorial Parkway.

Contributions to WGFD Herd Objectives

Alternative 1

Background. Currently there are no formalized goals for contributing to the WGFD herd objectives. However, ongoing management practices on the refuge and in the park units have aimed at contributing to the herd objectives. As outlined in Goal 1, the primary management goal on the refuge is to provide forage for up to a maximum of 7,500 elk. The following objective and strategies would supplement the habitat management objective and strategies described under Goal 1 to ensure that sufficient forage resources (including both standing forage and supplemental feed) were available each winter to overwinter this number of elk.

No objective or maximum use levels for bison have been approved for the refuge or the park units. It is estimated that the number of bison inhabiting the refuge and park units could be 800–1,000 by summer 2005, and the population would continue to grow beyond this. It is assumed that the WGFD herd objective of a maximum of 400 would be maintained, but measures to assist the department in meeting this objective are not currently allowed on the refuge or in park units.

Objective

- Over the life of the plan supplementally feed elk on the refuge during the winter as necessary to maintain elk numbers and prevent excessive mortality.

Strategies

Winter Supplemental Feeding

- Continue the winter feeding program on the refuge by feeding elk and bison about 9 of 10 years. Continue to feed elk about 8 pounds of alfalfa pellets per day, and bison 17 pounds. Work with the Wyoming Game and Fish Department to determine the start and end dates for feeding, based on the current year's forage production, snow conditions, forage availability, elk numbers and distribution, and temperatures (USFWS and WGFD 1974).

Alternative 2

Under Alternative 2 there would be no specific objectives or strategies to help meet herd objectives (that is, no numeric population targets would be set for elk or bison). The numbers of elk and bison sustained by continued preservation of lands on the National Elk Refuge and in Grand Teton National Park and by the strategies and actions described under Goals 1 and 2 would continue to contribute to the WGFD herd objectives, albeit at reduced levels compared to existing conditions.

Alternative 3

Objectives

- By the end of the plan provide forage resources sufficient to overwinter 1,000–2,000 elk and 800–1,000* bison on the refuge (post hunt), to the extent this is consistent with previous goals and objectives and establishing purposes and agency missions.
- By the end of the plan sustain 500–1,000 elk and up to 800–1,000 bison in park units (post hunt) during summer and transitional periods, to the extent this is consistent with previous goals and objectives and does not impair park resources.

Bison on Antelope Flats in Grand Teton National Park.

Strategies

Winter Supplemental Feeding

- Augment standing forage on the refuge so that sufficient forage would be available to meet the needs of the herds, even in severe winters.
- Over time reduce the number of elk wintering on the refuge to a level that could be supported by standing forage on the refuge and by enhanced winter and transitional range to the north and east of the refuge and the park in all but the most severe winters.
- Work with the Wyoming Game and Fish Department to determine the start and end dates for feeding, except delay feeding longer to reflect a higher acceptable mortality rate (5% compared to about 1.5% under Alternative 1).

* The objective number of bison for the National Elk Refuge and Grand Teton National Park under this alternative would depend on the number of bison present when the record of decision for this planning process is signed (the population is anticipated to be between 800 and 1,000).

Rationale: During severe winters it is anticipated that elk and bison would be fed less than the existing average of 70 days because fewer animals would be foraging on standing vegetation, which would leave more standing forage longer into the winter. In severe winters supplemental feeding would be delayed as long as possible to ensure that elk and bison made use of available forage. Conducting winter feeding operations only during severe winters would depend in part on changes in elk behavior. Currently, many elk move down to feedgrounds early in the fall, even though forage is available on native range in Jackson Hole. Typically, calves are the least represented age group on the refuge. In years when supplemental feed is not provided, the one-year-old elk that visit the refuge (and that did not visit the refuge the previous year as calves) would not be rewarded with plentiful forage and might not return the following year. As frequency of winter feeding operations declined, it is anticipated that fewer elk and bison would find their way down to the refuge.

Alternative 4 (Proposed Action)

Objectives

- Provide forage resources sufficient to annually overwinter up to 5,000 elk and 400 bison on the refuge (based on post hunt numbers), to the extent this is consistent with previous goals and objectives.

Strategies

Winter Supplemental Feeding

- Augment standing forage on the refuge to meet the needs of a maximum of 5,000 elk and 500 bison, even in winters with above-average snow conditions.
- Work with the Wyoming Game and Fish Department to determine the start and end dates for feeding, except delay feeding somewhat longer to reflect a higher acceptable mortality rate (5% compared to about 1.5% under Alternative 1) and reduce the number of years when feeding occurs. (*Similar to Alternatives 1 and 3.)*

Alternative 5

Objectives

- Overwinter up to 7,500 elk on the refuge. *(Same as Goal 2.)*
- Overwinter an average of 400 bison on the refuge. *(Same as Goal 2.)*
- Sustain up to 2,500 elk and 350–400 bison in park units (post-hunt) during summer and transitional periods, to the extent this is consistent with previous goals and objectives and does not impair park resources.

Strategies

Winter Supplemental Feeding

- Work with the Wyoming Game and Fish Department to determine the start and end dates for feeding. *(Same as Alternative 1.)*

Alternative 6

Objectives

- Over the life of the plan provide forage resources sufficient to annually overwinter up to 3,200 elk and 400 bison on the National Elk Refuge (post hunt), to the extent this is consistent with previous goals and objectives. Limit elk numbers to 2,400–2,700 until willow habitat has recovered to a Class I, II condition.
- Over the life of the plan sustain an average of 400 bison in Grand Teton National Park (post hunt) during summer and transitional periods, to the extent this is consistent with previous goals and objectives and does not impair park resources.

Strategies

Winter Supplemental Feeding

- Phase out winter supplemental feeding.

GOAL 4. DISEASE MANAGEMENT

Work cooperatively with the state of Wyoming and others to reduce the prevalence of brucellosis in the elk and bison populations in order to protect the economic interest and viability of the livestock industry, and reduce the risk of adverse effects

for other non-endemic diseases not currently found in the Jackson elk and bison populations.

Alternative 1

Objectives

- For the life of the plan continue efforts to lower the risk of brucellosis transmission to livestock by concentrating elk and bison on the refuge and keeping them separated from livestock during the first part of the critical period of potential transmission (February–March).
- For the life of the plan conduct winter feeding activities in ways that reduce brucellosis transmission within the elk and bison herds.

Rationale: Current management practices on the refuge and in the park units attempt to reduce elevated disease prevalence and transmission rates and mitigate causative conditions. These include strategies for increasing grazing habitat, controlling elk populations, keeping bison off the refuge during the summer/fall, and supplemental feeding methods.

Strategies

Disease Control and Prevention

- Eliminate the use of all equipment that has been previously used in areas and facilities with known occurrences of non-endemic invasive diseases. *(Same for all alternatives.)*
- For disease control, continue winter supplemental feeding at four areas on the refuge; change feeding sites daily in each area; spread feed along long meandering lines; and separate elk and bison to the extent possible. *(Same for Alternatives 3, 4, and 5, similar to Alternatives 2 and 6.)*

Livestock Grazing Practices

- Work with livestock permittees to maintain separation between elk/bison and livestock. *(Same for all alternatives.)*

Alternative 2

Objective

- Reduce elk and bison numbers to control disease prevalence and the potential for new diseases to be introduced.

Strategies

Disease Control and Prevention

- Eliminate the use of all equipment that has been previously used in areas and facilities with known occurrences of non-endemic invasive diseases. *(Same for all alternatives.)*
- Pending the phaseout of supplemental feeding, continue feeding at four locations on the refuge. *(Same as Alternative 6, similar to Alternatives 1, 3, 4, and 5.)*

Livestock Grazing Practices

- Work with livestock permittees to maintain separation between elk/bison and livestock. *(Same for all alternatives.)*

Alternative 3

Objectives

- Over the life of the plan continue to minimize the potential transmission of diseases from elk and bison inhabiting the refuge and the park to livestock through cooperative efforts with owners to keep livestock separated from bison during critical periods (usually February–July). *(Same as Alternatives 4, 5, and 6, similar to Alternative 1.)*
- Annually work with WGFD personnel to inform hunters about the potential health risks associated with processing and eating elk and bison harvested on refuge and park land.

Rationale: In the short term diseases would be managed in much the same way they are now. Over the long term the focus would be on implementing new disease control measures and working with partners to correct the underlying causes of elevated disease prevalence and transmission rates. It is recognized that there is little that the Fish and Wildlife Service or the Park Service could do to actually prevent the introduction of new diseases. The most probable means of transmission would likely be animals, including live-

stock, contracting diseases outside the Jackson Hole area and then introducing them to animals on the refuge or in the park units. If the maximum number of elk (at or below 2,000 elk on the refuge) did not substantially reduce disease prevalence, the number of elk overwintering on the refuge would be lowered incrementally, further reducing the frequency of years in which elk and bison would be fed.

Strategies

Disease Control and Prevention

- ❖ Eliminate the use of all equipment that has been previously used in areas and facilities with known occurrences of non-endemic invasive diseases. *(Same for all alternatives.)*
- ❖ Continue supplemental feeding at four locations on the refuge. *(Same as Alternatives 1, 4, and 5, similar to Alternatives 2 and 6.)*
- ❖ Implement an intensive monitoring program to track several key diseases (either in terms of their biological importance or their ability to serve as an index to disease risk) and the major factors affecting disease prevalence.
- ❖ If chronic wasting disease is found before the completion of the 15-year implementation program, adopt a faster schedule to reduce supplemental feeding in severe winters only.
- ❖ When more effective vaccines have been developed, use them to reduce the prevalence of brucellosis in the elk and bison herds. Work cooperatively with the Wyoming Game and Fish Department and others to research vaccines and delivery systems for elk and bison that have efficacies greater than 50%, that would be safe, and that could be administered without hindering the accomplishment of other goals and objectives for elk and bison. *(Same as Alternatives 4, 5, and 6.)*

  Rationale: At present there are no known vaccines for brucellosis that approach an efficacy of 50% in elk and/or bison, and research is continuing on vaccines and delivery systems for both species. Furthermore, despite Strain 19 being available for use in elk, vaccinating elk on the refuge would not be a high priority under this alternative for several reasons. As noted by Thorne (2001), "any brucellosis control or eradication effort would have to involve all susceptible species and populations simultaneously within a geographic area sufficiently large to assure no interchange with other exposed or affected populations in order to prevent reinfection." Bison inhabiting the refuge and the park have a considerably higher prevalence of brucellosis than do elk in this area. Even if vaccination began to reduce the prevalence of brucellosis in elk, bison would be a constant source of reinfection. Therefore, without concurrently beginning to reduce the prevalence of brucellosis in bison, Strain 19 would not be expected to reduce the prevalence of brucellosis in elk to any large degree over the long term.

  When a vaccine that is at least 50% efficacious has been developed, animals would be vaccinated during winters when supplemental forage was provided on the refuge. They could be vaccinated in other years if a sufficiently effective oral vaccine was found, along with a safe and effective method of distributing it on a wider scale than on the feedgrounds. If the vaccine was only effective for one of the two species, research would continue until an efficacious vaccine was found for the other species. The GYIBC technical committee would be used to provide guidance on the use of brucellosis vaccines.

Alternative 4 (Proposed Action)

Objectives

- ♦ Minimize potential disease transmission to livestock by keeping livestock separated from bison during critical periods (usually February–July). *(Same as Alternatives 3, 5, and 6, similar to Alternative 1.)*
- ♦ Work with WGFD personnel to inform hunters about the potential health risks. *(Same as Alternatives 3, 5, and 6.)*

Rationale: Long-term disease management under this alternative would emphasize a wider distribution of elk and bison in some years to reduce the transmission of infectious diseases. Strategies would be phased in over 5–10 years. Over the short term diseases would be managed much as they are now under Alternative 1.

Strategies

Disease Control and Prevention

- ❖ Eliminate the use of all equipment that has been previously used in areas and facilities with known occurrences of non-endemic invasive diseases. *(Same for all alternatives.)*
- ❖ Continue supplemental feeding at four locations on the refuge. *(Same as Alternatives 1, 3, and 5, similar to Alternatives 2 and 6.)*
- ❖ When more effective vaccines have been developed, use them to reduce the prevalence of brucellosis in the elk and bison herds. *(Same as Alternatives 3, 5, and 6).*
- ❖ Allow WGFD personnel to use Strain 19 on elk calves and cows as necessary along feedlines during feeding operations. Administer vaccine through the use of biobullets (a lightweight pellet containing vaccine and propelled by a compressed air gun). Strive to annually vaccinate a minimum of 80% of elk calves and initially up to 50% of adult cow elk.

  Rationale: This program would be conducted until a more efficacious vaccine was found. Despite the low efficacy of Strain 19 in elk, this alternative would assume that (1) the benefits to the livestock industry stemming from even a small reduction in brucellosis prevalence would outweigh the expense of the program, and (2) activities associated with Strain 19 vaccination would not adversely impact elk or bison on the refuge. The Wyoming Game and Fish Department would provide funding, staff, and equipment for the Strain 19 vaccination program. The vaccination program would not influence the frequency and duration of feeding operations (i.e., the desire to vaccinate would not, under any circumstances, be used as a justification to begin winter feeding).
- ❖ Once supplemental feeding was phased out and bison objectives had been met, confer with other federal and state agencies and other partners to explore a variety of techniques (e.g., vaccination, selective fertility control, bison harvest) to further reduce the prevalence of brucellosis in bison.

  Rationale: Prior to winter feeding being eliminated on the refuge and bison numbers being brought down to meet the population objective, implementing other approaches would have limited cost-effectiveness during a period of fairly rapid changes.

Livestock Grazing Practices

- ❖ Work with livestock permittees to maintain separation between elk/bison and livestock. *(Same for all alternatives.)*

Alternative 5

Objectives

- ♦ Minimize the potential disease transmission to livestock by keeping livestock separated from bison during critical periods (usually February–July). *(Same as Alternatives 3, 4, and 6, similar to Alternative 1.)*
- ♦ Work with WGFD personnel to inform hunters about the potential health risks. *(Same as Alternatives 3, 4, and 6.)*

Rationale: Even though this alternative would do little to reduce or mitigate elevated disease risks, it could prevent the situation from getting worse. Two actions that would contribute slightly toward reducing the risks are (1) improved forage quality on the refuge, and (2) reduced bison numbers.

Strategies

Disease Management and Prevention

- ❖ Eliminate the use of all equipment that has been previously used in areas and facilities with known occurrences of non-endemic invasive diseases. *(Same for all alternatives.)*
- ❖ Continue supplemental feeding at four locations on the refuge. *(Same as Alternatives 1, 3, and 4, similar to Alternatives 2 and 6.)*
- ❖ Use existing vaccines and antibiotics when exotic diseases pose an immediate threat to the sustainability of the herds.
- ❖ When more effective vaccines have been developed, use them to reduce the prevalence of brucellosis in the elk and bison herds. *(Same as Alternatives 3, 4, and 6).*
- ❖ Allow WGFD personnel to use Strain 19 on elk calves and cows as necessary along feedlines during feeding operations, annually vaccinating a minimum of 80% of elk calves and initially up

to 50% of adult cow elk. *(Same as Alternative 4.)*

- ❖ Allow WGFD personnel to use RB51 to vaccinate adult female bison

  Rationale: Even though the efficacy of RB51 appears to be low and inconsistent, it would be assumed under this alternative that vaccinating bison would be better than nothing. The vaccine would be administered to adult female bison through hand-injection during trapping and handling procedures for other purposes, as well as trapping specifically for vaccination. On developing a viable technique for remote administration of RB51 (e.g., through the use of biobullets), adult female bison would be vaccinated along feed lines. Procedures would be similar to those outlined for elk vaccination with Strain 19. On finding a more efficacious vaccine that could be safely and effectively administered to bison, RB51 would be replaced. Research is currently being conducted on the use of biobullets (Olsen 2004) and an orally administered vaccine (see Elzer and Davis 1996).

Livestock Grazing Practices

- ❖ Work with livestock permittees to maintain separation between elk/bison and livestock. *(Same for all alternatives.)*

Alternative 6

Objectives

- ♦ Minimize the potential transmission of diseases from elk and bison to livestock through cooperative efforts with owners to keep livestock separated from bison during critical periods (usually February–July). *(Same as Alternatives 3, 4, and 5, similar to Alternative 1.)*
- ♦ Work with WGFD personnel to inform hunters about the potential health risks. *(Same as Alternatives 3, 4, and 5.)*

Strategies

Disease Control and Prevention

- ❖ Eliminate the use of all equipment that has been used in areas and facilities with known occurrences of non-endemic invasive diseases. *(Same for all alternatives.)*
- ❖ When more effective vaccines have been developed, use them to reduce the prevalence of brucellosis in the elk and bison herds. *(Same as Alternatives 3, 4, and 5).*
- ❖ Increase surveillance for chronic wasting disease to a 99% confidence level of detecting prevalence at 1% in the Jackson elk herd.
- ❖ Pending the phaseout of supplemental feeding, continue feeding at four locations on the refuge when feeding was necessary. *(Same as Alternative 2, similar to Alternatives 1, 3, 4, and 5.)*
- ❖ Emphasize the harvest of young-adult female bison (e.g., 2–4 years old), which are more likely to abort due to brucellosis infection.

  Rationale: By focusing on this age group, the number and rate of abortions would decline, with the largest effect on reducing the population (which would have secondary benefits to reducing the prevalence of brucellosis in bison).

Livestock Grazing Practices

- ❖ Work with livestock permittees to maintain separation between elk/bison and livestock. *(Same for all alternatives.)*

OTHER ALTERNATIVES CONSIDERED, BUT NOT STUDIED IN DETAIL

The U.S. Fish and Wildlife Service and the National Park Service considered several additional alternative approaches to conserving and managing elk on the National Elk Refuge and in Grand Teton National Park and John D. Rockefeller, Jr., Memorial Parkway. These approaches were found to not be appropriate or realistic, as described below, and they were not evaluated in detail.

ELIMINATE BISON FROM THE REFUGE AND THE PARK

Some stakeholders advocated the complete removal of bison from the refuge and the park, which would mean their removal from Jackson Hole. This was dropped from further consideration because bison are native to Jackson Hole (Fryxell 1928; Ferris 1940; Skinner and Kaisen 1947; Haines 1955; Hall and Kelson 1959; Long 1965; Love 1972; Wright et al. 1976; McDonald 1981). Their removal would be contrary to the missions and policies of the Fish and Wildlife Service and the Park Service, the missions of the National Wildlife Refuge System and the National Park System, and the establishing purposes of the refuge and the park units.

ELIMINATE LIVESTOCK FROM THE PARK

Many stakeholders advocated the removal of livestock grazing within Grand Teton National Park / John D. Rockefeller, Jr., Memorial Parkway and other federal lands in the Jackson elk herd unit to make additional forage available for elk and bison (thus reducing the need for artificial winter feeding) and to eliminate the risk of transmitting brucellosis from elk and bison to livestock. This was dropped from consideration because it is contrary to the establishing authority of the park (PL 81-787 and PL 105-81), and because changes in management practices outside the refuge and the park are beyond the scope of this planning process. Because some amount of cattle grazing in the park may be eliminated through other actions, the analysis of each alternative considers the presence or absence of such grazing.

FENCE AND HAZE BISON OFF THE REFUGE

Fencing bison from the refuge in order to force them to use native winter range in other areas was considered. However, keeping bison out of the refuge would require a minimum of 8.5 miles of fence along the refuge portion of the Gros Ventre River. Any fence to keep bison out of the refuge would also prohibit the movement of elk and other species, resulting in unacceptable impacts. There are no known fence designs that would selectively exclude bison, but not elk, moose, deer, pronghorn, and other large wildlife. Jackson bison also readily cross cattle guards.

Bison-proof fences to steer bison away from the refuge would probably prove ineffective. Along Yellowstone National Park's northern boundary, drift fences were constructed but failed to deter bison from leaving the park (Meagher 1989a). Likewise, hazing has proven futile in restricting movements of bison on more than a temporary basis. Bison either become conditioned to hazing, bypass locations, or avoid the times when it occurs (Meagher 1989a, 1989b). Efforts to haze bison away from supplemental feed on the refuge have met with little success, and only persistent and repeated hazing kept bison away from roadways and residential inholdings.

Fencing bison within a 330-acre enclosure in the Hunter-Talbot area was considered in the *Jackson Bison Herd Long-term Management Plan and Environmental Assessment* (NPS and USFWS 1996). This alternative was not considered in detail in this planning process because, since the *Management Plan and Environmental Assessment* was printed and distributed, further analysis has revealed that snow conditions in the Hunter-Talbot area would be too extreme to sustain bison through most winters (NPS and USFWS 1997). Also, restricting a native wildlife population to a limited portion of its available range is contrary to NPS policy.

PROVIDE TEMPORARY AND LONG-TERM WINTER FEEDING OF BISON IN THE HUNTER-TALBOT AREA

One way to increase the winter distribution of bison and to reduce intermingling with elk would be to alter the behavior of some bison through an interim supplemental feeding program in the Hunter-Talbot area, getting them to winter north of the refuge.

This alternative was rejected for further consideration because it was determined to be unrealistic in the "Finding of No Significant Impact" (NPS and USFWS 1997) after it was analyzed in the *Jackson Bison Herd Long-term Management Plan and Environmental Assessment* (NPS and USFWS 1996). After the *Environmental Assessment* was completed, additional information indicated that snow in most winters would be too deep to allow for the successful establishment of the Hunter-Talbot area as a new wintering area for bison.

Another option would be to feed bison a maintenance ration of long or pelleted hay beginning before they normally depart for the refuge and to continue feeding operations through the entire winter. To keep bison from moving onto the refuge, this would need to be done annually. This alternative was dropped from further consideration because

1. Some or all bison might still move south to the refuge, especially during severe winters.
2. Feed intended for bison might stop elk from moving onto the refuge.
3. Artificial feeding and the changes in bison and elk ecology are contrary to NPS policy.

DEPOPULATE AND REESTABLISH THE BISON HERD FROM BRUCELLOSIS-FREE STOCK

Under this alternative the entire Jackson bison herd would be destroyed through one or more reduction methods, and certified brucellosis-free bison would then be introduced into the valley to reestablish the population. This would be the most rapid method of establishing a brucellosis-free herd. This alternative was rejected for the following reasons:

1. While some Jackson bison have been exposed to brucellosis, not all are infected. Uninfected bison pose no risk of infecting cattle or spreading brucellosis.
2. The removal of hundreds of bison that have merely been exposed to brucellosis would be unacceptable to many people.
3. A portion of Jackson bison may have desirable genetic materials, such as immunity to brucellosis, that could contribute to future genetic research and development, as well as to the diversity of the species and the biodiversity of the planet.
4. In time, bison would be reinfected by the Jackson elk herd. As previously discussed, bison were destroyed in 1963 when brucellosis was discovered in the herd in Grand Teton National Park, and brucellosis-free stock were introduced. Nevertheless, the herd was reinfected.

INCREASE ELK NUMBERS WINTERING ON THE REFUGE THROUGH EXPANDED FEEDING

An alternative based on the assumption that expanding the refuge feeding program would increase wintering elk numbers was eliminated from detailed study because the assumption that this could be achieved based on WGFD herd objective levels (11,000) was incorrect. Although the refuge feeding program could be expanded, elk numbers on the refuge would probably not increase notably.

Unless the herd objective was increased to numbers above the most recent herd estimate of 13,500 elk (February 2004), elk on the refuge would not increase based on current distribution. Under this alternative up to 8,500 elk could winter on the refuge, plus an estimated 2,500 elk on the Gros Ventre feedgrounds outside the refuge, and 2,900 or more elk on native range, resulting in at least 13,900 elk in the Jackson herd. The Wyoming Game and Fish Department does not plan to increase the herd objective to this level.

FERTILITY CONTROL FOR ELK

A number of stakeholders indicated an interest in options for reducing elk and bison populations by non-lethal means. This option is being considered for bison populations under Alternative 2, but has been eliminated from further consideration for elk as it is not a reasonable or a feasible option at this time. Many research projects have shown that several drugs and vaccines are capable of preventing pregnancy in elk. However, major technical and social implications continue to exist when applying fertility control techniques to long-lived, free-ranging, huntable populations of wildlife. (Fagerstone et al. 2002). Wildlife fertility control is usually practiced on animal populations that are not hunted either because they reside in a park or urban area where hunting is not allowed or because it is unsafe due to human presence.

Two types of fertility control for elk were considered: (1) surgical sterilization, which would render animals permanently incapable of producing offspring; and (2) biochemical contraception, which usually lasts for one breeding season. Surgical sterilization would require anesthetizing each animal in order to perform an operation that would remove or crush the ovaries. Biochemical contraception in this document refers to hormonal or immunocontraception drugs that have been tested on elk and include porcine zona pellucida (PZP), leuprolide, and gonadotropin releasing hormone (GnRH). Using PZP and GnRH would require anesthetizing each animal in order to mark it with "Do Not Consume" tags (PZP and GnRH) or to hand inject the drug (GnRH). Leuprolide could be delivered remotely by means of darts because it has been approved by the Food Drug Administration as safe for human consumption (Baker 2004). However, leuprolide causes pregnant females to abort; therefore, it would not be used on refuge feedlines because of the risk of brucellosis transmission.

Modeling indicates that approximately 85% of adult female elk in the Jackson herd would have to be incapable of giving birth every year in order to effectively reduce population growth in the absence of hunting (Lubow, pers. comm. 2003). After the signing of the record of decision (anticipated in 2006), an estimated 5,000–7,500 elk would winter on the refuge and approximately 3,500–5,250 animals would be adult females. An estimated 2,500–3,500 elk would summer in the park, and of these, approximately 1,750–2,450 animals would be adult females. Therefore, an estimated 2,975–4,465 adult female elk on the refuge or an estimated 1,490–2,085 adult female elk in the park would have to be treated in order for 85% of the adult females in the Grand Teton herd segment to be affected. In subsequent years, as elk numbers in the Grand Teton segment declined, fewer elk would have to be treated.

If fertility control was conducted initially on the National Elk Refuge in the winter while the elk were on the feedlines, elk from all herd segments would be present. Therefore, a greater number of elk would need to be treated to ensure that a large enough number of Grand Teton elk would be affected. However, recruitment would also decline in non-target elk herd segments.

As mentioned above, surgical sterilization and PZP and GnRH contraception would require that each animal be handled. Researchers that have anesthetized and radio-collared elk in the past have only been successful at treating two to three elk per day on the feedlines before the animals became intolerant of their presence (Smith, pers. comm. 2003). If elk were treated in the summer in Grand Teton National Park, biologists would have to approach within 35–75 yards of each animal to fire an anesthetizing dart or a leuprolide dart (Roffe, pers. comm. 2003). Therefore, each team could likely locate and anesthetize a maximum of two elk per day in the park.

FERTILITY CONTROL ON THE NATIONAL ELK REFUGE

To meet the needs in the initial years of a fertility control program on the refuge, it is estimated that 27–40 teams of one veterinarian and two to three biological technicians would be needed to surgically sterilize 85% of the adult female elk (2,975–4,465) during a 55-day season. Likewise, an estimated 27–54 teams of one veterinarian or biologist and one biological technician would be needed to administer PZP or GnRH to 85% of the adult female elk on the refuge. If GnRH was used, contraception for elk could not begin until late March. If PZP was used, each elk would have to receive two shots the first year of the program, although the second shot could be delivered remotely. Annual costs would range from $994,000 to $1,861,000 not including one-time capital costs for equipment,

such as guns and oversnow vehicles, plus travel expenses for team members. Surgically sterilizing 2,975–4,465 adult female elk or contracepting this number of elk with PZP or GnRH would be cost prohibitive, and elk would not tolerate this many people working on the feedgrounds at one time. One team per feedground is likely to be the maximum number of teams that could work at one time without causing the elk to abandon the feedgrounds. If one team on each of four feedgrounds worked throughout a 55-day season to surgically sterilize 440 elk per year or a total of 2,975–4,465 animals, it would take 7–10 years to complete the program. Treating only 440 elk per year with PZP or GnRH would be ineffective in reducing the elk population.

Fertility Control in Grand Teton National Park / John D. Rockefeller, Jr., Memorial Parkway

In park units a minimum of 9–11 teams would be needed to surgically sterilize or biochemically contracept (with PZP, GnRH, or leuprolide) 85% (or an estimated 1,490–2,085) of the adult female elk during an 85-day season. Leuprolide could be delivered remotely without the need to anesthetize each animal, but approaching elk close enough to deliver a dart would still be very difficult and likely not many more than two elk per day could be treated per team. PZP would have to be administered twice the first year and then once per year thereafter. The number of teams necessary to administer two shots of PZP in the first year at 30-day intervals would be 18–22.

Labor and drug costs for surgical sterilization or biochemical contraception of elk would range from an estimated $630,000 to $1,826,000 for the first year, depending on the number of team members, drugs used, and the number of elk in the park herd segment. After the first year costs would be somewhat lower. In addition, there would be travel expenses for some team members and one-time capital costs for guns, animal handling equipment and other equipment and materials. Because of the high cost and the uncertainty in estimating the number of elk that could be successfully treated each year, fertility control for elk in the park units was deemed infeasible.

ALTERNATIVES REQUIRED TO BE IDENTIFIED BY POLICY

PROPOSED ACTION

The U.S. Fish and Wildlife Service planning policy (USFWS 2000c) requires that a proposed action be identified in a draft NEPA document. Alternative 4, which would restore habitat, improve quality of forage, and phase back feeding, was selected as the proposed action for the *Draft Bison and Elk Management Plan and Environmental Impact Statement*. This alternative strives to balance the significant issues, as well as other agencies' and stakeholder perspectives identified during prescoping and public scoping, with the purposes, missions, and management policies of the U.S. Fish and Wildlife Service and the National Park Service.

COSTS OF THE ALTERNATIVES

Estimated costs for the alternatives are summarized in the tables below. Costs are presented in 2004 dollars. The tables look at both one-time costs and annual costs over 15 years.

TABLE 2-1: ONE-TIME COSTS OF ALTERNATIVES
(2004 dollars)

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
National Elk Refuge						
Woody Vegetation Protection on the Refuge	0	0	0	299,824	299,824	188,238
Refuge Forage Production	320,000	0	320,000	2,847,113[1]	2,847,113[1]	2,847,113[1]
Refuge Winter Feeding Program	433,000	0	324,750	433,000	433,000	0
Refuge Hunting Program	0	0	5,000	5,000	5,000	5,000
USFWS Subtotal	753,000	0	649,750	3,584,937	3,584,937	3,040,351
Grand Teton National Park / John D. Rockefeller, Jr., Memorial Parkway						
Elk/Bison Monitoring	0	2,000	0	0	0	2,000
Habitat Restoration in the Park	0	87,000	87,000	87,000	87,000	87,000
NPS Subtotal	0	89,000	87,000	87,000	87,000	89,000
Total	**753,000**	**89,000**	**736,750**	**3,671,937**	**3,671,937**	**3,129,351**

1. One-time costs for forage production on the refuge under Alternatives 4, 5, and 6 are for a five-year set up period.

TABLE 2-2: ANNUAL COSTS OF ALTERNATIVES
(2004 dollars)

	Alt. 1	Alt. 2	Alt. 3		Alt. 4	Alt. 5	Alt. 6
			Option A	Option B			
National Elk Refuge							
Elk/Bison Monitoring	55,177	53,377	53,977	53,977	53,377	53,377	53,377
Refuge Habitat Restoration							
• 2,400 Acres Restored to Native Species	0	110,458	0	110,458	0	0	0
• Woody Vegetation Protection	0	0	0	0	1,392	1,392	12,065
Refuge Forage Production	64,709	0	64,709	0	218,275[1]	218,275[1]	218,275[1]
Invasive Plant Species Control	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Hunting Program on the Refuge	36,073	0	54,296	54,296	51,690	57,752	48,548
Refuge Winter Feeding Program	503,517	0	175,606	0	297,340	394,070	0
• Additional costs during initial implementation	0	167,838	167,838	167,838	0	0	100,703
Bison Fertility Control[2]	0	55,250	0	0	0	0	0
Elk/Bison Conflict Resolution on Adjacent Lands[3]							33,333
USFWS Subtotal	669,476	396,923	526,426	396,569	632,074	725,866	476,301
Less Local Contributions							
• Boy Scout Sales Contributions[4]	62,339	34,344	14,310	14,310	42,930	59,625	26,800
• Sleigh Ride Program Contributions	13,998	0	0	0	0	13,998	0
Contribution Subtotal	76,337	34,344	14,310	14,310	42,930	73,623	26,800
USFWS Subtotal	**593,139**	**363,079**	**512,116**	**382,259**	**589,744**	**652,843**	**449,501**
Grand Teton National Park / John D. Rockefeller, Jr., Memorial Parkway							
Elk Monitoring	107,563	80,781	110,672	110,672	111,872	107,563	119,391
Bison Monitoring	144,927	128,672	127,672	127,672	130,677	124,427	128,672
Bison Fertility Control[2]	0	55,250	0	0	0	0	0
Elk Reduction Program	100,086	23,333	87,820	87,820	87,903	99,823	88,816
Park Habitat Restoration (4,500 acres)	0	312,891	312,891	312,891	312,891	312,891	312,891
NPS Subtotal	**352,576**	**600,927**	**639,055**	**639,055**	**643,343**	**644,704**	**649,770**
Total Annual Costs[5]	**945,715**	**964,006**	**1,151,171**	**1,021,314**	**1,233,087**	**1,297,547**	**1,099,271[5]**

1. Annual costs for forage production on the refuge under Alternatives 4, 5, and 6 are for years 6 through 15 (a 10-year period).
2. Bison fertility control costs are midrange costs for the annual biochemical sterilization of 360 adult females. Because shared costs by the park and the refuge are assumed, USFWS and NPS costs in the above table are one-half of the total midrange costs.
3. A total of approximately $500,000 ($100,000 per year for approximately five years) would be spent to reduce management conflicts during transition from supplemental feeding to use of native range.
4. The contribution for Alternative 1 is an average of actual contributions from 2000–2004; Contributions for the other alternatives are midpoints based on the expected number of elk that would winter on the refuge.
5. WGFD currently pays for an interim elk brucellosis vaccination program on the refuge. Based on 2,123 elk vaccinated with Strain 19 in 2004, estimated program costs entail a one-time initial expense of $13,787 and $14,703 annually. The total costs for Alternatives 1 and 2 in these tables would remain unchanged because vaccination would not occur. Other alternatives may have added costs if vaccination occurs.

TABLE 2-3: TOTAL COSTS OF ALTERNATIVES
(2004 dollars)

	Alt. 1	Alt. 2	Alt. 3		Alt. 4	Alt. 5	Alt. 6
			Option A	Option B			
One-time Costs	753,000	89,000	736,750	736,750	3,671,937	3,671,937	3,129,351
Total Plan Costs (annual cost × 15 years)	14,185,725	14,460,090	17,267,565	15,319,710	17,395,930	18,497,830	15,397,690
Total	**14,938,725**	**14,549,090**	**18,004,315**	**16,056,460**	**21,067,867**	**22,169,767**	**18,527,041**

SUMMARY COMPARISONS OF ALTERNATIVES

TABLE 2-4: SUMMARY OF BISON AND ELK MANAGEMENT ALTERNATIVES

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Goal 1. Habitat Conservation						
Winter Grazing Habitat on National Elk Refuge	Continue 800–2,000 ac / yr flood irrigated; 60 ac. sprinkler irrigated. Little management of native habitat. Other management practices: Fertilizing, harrowing, and prescribed fire. Restore native vegetation on 900 acres of non-cultivated fields *(same for all alternatives).*	No active management; reliance on forage produced on meadows, pastures, and native range without management, except an initial program to restore native vegetation.	Same as Alternative 1 plus: Produce 2,000 lbs forage per acre on 1,100 acres. Two options for irrigation: a. continue farming b. convert cultivated fields to native vegetation.	Same as Alternative 1 plus: Increase forage to 5,000 lbs on 400 acres and 2,500 lbs. on 1,200 acres. Irrigate up to 1,600 ac., including 1,100 ac. sprinkler irrigated.	Same as Alternative 1 plus: Increase forage *(same as Alt. 4, 6).* Irrigate up to 1,600 ac. *(same as Alt. 4).*	Same as Alternative 1 plus: Increase forage *(same as Alt. 4, 6*). Irrigate up to 1,600 ac. except could be reduced over time *(similar to Alt. 4, 5).*
Support Efforts to Establish Elk Migration to Other Areas[1]	None.	Support others in their efforts to establish elk migrations to winter range outside Jackson Hole.	Same as Alt. 2.	None.	None.	None.
Other Habitat on the National Elk Refuge (e.g., woody plant communities)	Experimental work: two small exclosures, limited logging, prescribed fire in grassland / agricultural habitats.	No active management; restoration would rely on reduced densities (including periodic major reductions).	Lowered numbers of elk and bison would allow restoration of woody vegetation.	Use exclosures to allow recovery of woody vegetation (500 ac. for willow, 1,000 ac. for aspen, 100 ac. for cottonwood); also, somewhat lower numbers of elk and bison.	Same as Alt. 4.	Lowered elk and bison numbers, supplemented with rotating 600 ac. of aspen exclosures until recovery occurs (then only as needed).
Agricultural Fields in Grand Teton National Park	No restoration.	Restore 4,500 ac. to native species.	Same as Alt. 2.	Same as Alt. 2.	Same as Alt. 2.	Same as Alt. 2.
Goal 2. Sustainable Populations / Goal 3. Elk and Bison Numbers						
Elk on the National Elk Refuge	7,500 (max.) est. avg. 5,600.[2]	No population target and no maximum (est. 1,200–6,000).	1,000–2,000 (phased in).	4,000–5,000	7,500 (max.) est. avg. of 5,600.[2]	2,400–2,700 (max. for 7 years). 2,800–3,200 (max. after 7 years).
Elk in Grand Teton National Park	No approved objective (one third of the refuge numbers).	No population target and no maximum (est. 600–3,000)	500–1,000	1,300–1,600	<2,500	No population target and no maximum (est. 1,200–1,600).
Bison on National Elk Refuge and in Grand Teton National Park	No population target and no maximum (may be >2,000 in future).	No population target and no maximum (est. 250–500 or more).	Number of bison at time record of decision is signed (est. 800–1,000).	450–500	350–400	400 (avg.)
Elk Hunt on the Refuge / Herd Reduction in the Park	Continue the existing elk hunt program on the refuge and the elk reduction program east of the Snake River in the	Eliminate elk hunt immediately on refuge and park	Stop elk hunt on northern fifth of the refuge and elk herd reduction on Blacktail Butte / Kelly hayfields in	Same as Alt. 1, except an initial increase in harvest plus consider Alt.3 options.	Same as Alt. 1.	Same as Alt. 1 initially except consider Alt. 3 options to improve herd management.

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
	park. Work with Wyoming Game and Fish Department to determine annual harvests.		park; plus either of the following options: a. initiate an early season hunt on southern part of the refuge b. open southern refuge to wildlife observation			
Bison	No population control on the refuge or in the park.	Fertility control of bison.	No bison hunt in the park. On the refuge a public bison hunt and a tribal reduction.	Same as Alt. 3.	Public bison hunt on the same refuge lands where elk are hunted; no bison hunting in the park.	Same as Alt. 3.
Winter Supplemental Feeding	Supplementally feed 9 of 10 years (avg. 70 days/year).	Phase out within 15 years of plan implementation.	Feed only in an emergency (e.g., 2 out of 10 years); phase out within 10–15 years.	Feed in above-average winters (e.g., 4–5 out of 10 years); phase back within 10–15 years of plan implementation..	Same as Alt. 1.	Phase out within 5 years.
Goal 4. Disease Management						
Health of Elk and Bison Populations	Continue supplemental feeding at four sites; spread feed along lines; change location of sites.	Same as Alt. 1 plus reduce density; wider distribution.	Same as Alt. 1 and 2.	Same as Alt. 1 and 2.	Same as Alt. 1.	Same as Alt. 1 and 2.
Minimize Risk of Brucellosis Transmission to Livestock	Maintain separation between elk/bison and livestock, but manage feeding as described above.	Same as Alt. 1, but reduce risks by end of 15 years.	Same as Alt. 1, but manage for fewer risks over 10–15 years, plus vaccinate when vaccine developed with greater than 50% efficacy.	Same as Alt 1. Allow WGFD personnel to use Strain 19 vaccine in elk until a more effective vaccine developed; for bison wait until the development of a vaccine with greater than 50% efficacy.	Same Alt 1, plus use Strain 19 for elk and RB51 for bison until more effective vaccines developed.	Same as Alt. 1, but reduce risks greatly in 5 years, plus harvest 2–4 year-old female bison; delay vaccination until a vaccine with greater than 50% efficacy developed.

1. An option under Alternatives 2 and 3 would be to support stakeholder efforts to establish elk migration out of Jackson Hole to other wintering areas. It is recognized that the U.S. Fish and Wildlife Service the National Park Service do not have jurisdiction to implement this option. This effort could only happen if the agencies responsible for the management of ungulates and their habitat outside the National Elk Refuge and Grand Teton National Park pursued such measures.
2. Under Alternative 1 the average number of elk on the refuge would be about 5,600 when the Jackson elk herd is at objective levels. Under Alternative 5 elk numbers on the refuge could be higher if the Jackson elk herd objective was raised.

TABLE 2-5: HOW WELL MANAGEMENT ALTERNATIVES FULFILL THE NATIONAL WILDLIFE REFUGE SYSTEM MISSION, U.S. FISH AND WILDLIFE SERVICE MISSION-RELATED RESPONSIBILITIES, AND NATIONAL ELK REFUGE ESTABLISHING PURPOSES

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Conserve and restore fish, wildlife, and plant resources and their habitats (overall assessment).	6	2	2	3	4	1
Sustain healthy fish and wildlife populations over long term.	6	1	2	3	4	1
Conserve and restore habitat for fish and wildlife and maintain biological diversity.	6	4–5	4	2	3	1
Maintain biotic integrity and environmental health.	6	1	3	4	4–5	2
Contribute to natural population levels in the Jackson Hole area:						
• Elk	1	3	6	2	1	4
• Bison	6	1	5	1	1	2
Densities cannot be so high that they cause habitat and disease problems (a requirement).	6	2–3	2–3	4	5	1
Provide a winter reserve for elk:						
• Winter grazing habitat (natural conditions)	3	1	2	4–5	4–5	2–4
• Winter grazing habitat (total production)	2	4	2 or 4	3	1	1–3
• Refuge (minimal disturbance/sanctuary)	4	1	2	5	4	3–5
• Overall — Would suitable grazing habitat be provided?	Yes	Yes	Yes	Yes	Yes	Yes
Provide a refuge and breeding ground for birds	6	4–5	4	2	3	1
Provide grazing habitat and refuge for elk and other ungulates (deer, moose, bighorn sheep)	4	3–4	2	6	5	1

Note: Ranked from highest (1) to the lowest (6). The sum of numbers for each alternative does not represent its overall ranking because some of the directives are higher in importance than others (e.g., refuge purposes are of higher priority than maintaining biotic integrity, and some of the listed responsibilities are not absolute requirements while others are).

TABLE 2-6: HOW WELL ALTERNATIVES WOULD FULFILL NPS MISSION-RELATED DIRECTIVES AND PARK ESTABLISHING PURPOSES

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Mission Related Directives						
Conserve park resources and values.[1]	5	1	3	3	3	2
Leave park resources in unimpaired condition for future generations; consider:						
• minimizing disease threats in elk and bison	6	1	2	4	5	1
• habitat conditions	Yes	Yes	Yes	Yes	Yes	Yes
Restore and sustain natural population levels:						
• elk	3	1	5	4	3	2–3
• bison	6	1	5	3	3	2
• other wildlife (e.g., moose, predators, birds)	6	1	3–4	3	3–4	2
Restore and sustain natural population fluctuations.	4	1	3	3	4	2
Maintain natural diversity within populations:						
• age and sex ratios	4	1	3	3	3	2
• genetic diversity in elk (based on numbers)	1	4	5	2	1	3
• genetic diversity in bison (based on numbers)	1	4–6	2	3	5	4
Provide natural habitat conditions.	6	1	4–5	3–4	4–5	2
Work with others to fulfill the mission and to address external threats.	6	1	3	4	5	2
Purposes of Grand Teton National Park						
Protect the area's native plant and animal life.	5	1	3	3	3	2
Protect the area's geologic features.	n/a	n/a	n/a	n/a	n/a	n/a
Provisions of 1950 Legislation (PL 81-787)						
Permanent conservation of elk in the park	5	1	3	3	3	1
Use of elk reduction program when necessary for proper management:						
• Elk originating within Grand Teton National Park	Yes	No/Yes[2]	No[3]	Yes	Yes	Yes
• Elk originating from the Bridger-Teton National Forest	Yes	Unclear[4]	Partially[3]	Yes	Yes	Yes/Unclear[4]
• Elk originating from Yellowstone National Park	6	1	4	5	6	2
Conserve resources and values (e.g., natural size, fluctuations, structure).	6	1	3	4	5	2
Provide for the enjoyment of park resources.	6	1	3	4	5	2

NOTE: Rankings are highest (1) to lowest (6).

1. This is a compilation/synthesis of the factors that follow.
2. Alternative 2 would be inconsistent with PL 81-787 in the short term, but would be consistent with the law in the long term.
3. Alternative 3 would in part be consistent with PL 81-787 so long as fertility control was only used to supplement the elk reduction program in the park. "Proper management" of elk in the park likely does not include maintaining the population at the low end of the natural range of variability, thereby conflicting with the provision of the law addressing the herd reduction program.
4. In the short term, Alternative 2 might conflict with PL 81-787 since it could hinder the Wyoming Game and Fish Department's ability to regulate the Teton Wilderness segment, but eliminating winter feeding on the refuge would negate the need for hunting elk from the Teton Wilderness segment in the park. The same would be true of Alternative 6 in the long term if the herd reduction program was discontinued.

TABLE 2-7: HOW WELL THE ALTERNATIVES MEET MANAGEMENT GOALS

Goals	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
1. Habitat Conservation						
• Forage Production on NER[1]	4	5	3	6	6	2
• Woody Riparian Vegetation on the National Elk refuge[2]	5	4	2	3	3	1
• Native Habitats in Grand Teton National Park	3	1	1	1	1	1
2. Sustainable Populations	5	1	2	3	4	1
3. Numbers of Elk[3]	1	5	4	2	1	3
Numbers of Bison	6	4	5	3	1	2
4. Disease Management	6	2	3	4	5	1

Note: Ranked from highest (1) to lowest (6). Alternatives with the same number are equal with regard to that particular goal.
1. Rankings do not take into consideration the number of animals that would be feeding on forage.
2. Exclosures on the refuge to protect woody vegetation would reduce the amount of available forage under Alternatives 4, 5, and 6.
3. Rankings do not take into consideration the risk that high concentrations of animals could contribute to high prevalence of disease, which could cause numbers to decrease.

TABLE 2-8: SUMMARY OF POTENTIAL LONG-TERM IMPACTS OF THE ALTERNATIVE BISON AND ELK MANAGEMENT PLANS RELATIVE TO LEGAL DIRECTIVES, WILDLIFE MANAGEMENT PRINCIPLES, WGFD HERD OBJECTIVE, AND SOCIOECONOMIC CONSIDERATIONS

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Legal Directives						
• Mission-related (National Elk Refuge)	6	2	2	3	4	1
• Purposes (National Elk Refuge)	6	2–5	2–5	2–5	2–5	1
• Mission-related (Grand Teton National Park)	5	1	3	3	3	2
Pertinent Management Principles	6	2	3	4	5	1
Jackson Elk Herd Objective	2	5	6	3	2	4
Recreational Opportunities	3	6	5	1	2	4
Contribution to Local Economies	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

Note: Alternatives are ranked relative to each other, according to (1) the ability of the U.S. Fish and Wildlife Service and National Park Service to fulfill legal directives, (2) the consistency of alternatives with pertinent wildlife management principles, (3) the ability of the state to meet its herd objective, and (4) the contributions of the alternatives to providing recreational opportunities and contributing to the local economy. A rating of 1 is highest (highest consistency, highest contributions) and 6 the lowest. The sum of numbers for each alternative does not represent its overall ranking because some factors are of higher importance than others.

TABLE 2-9: SUMMARY OF POTENTIAL LONG-TERM IMPACTS OF THE ALTERNATIVES

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Physical Environment						
Soils	Overall negligible to minor adverse impacts; localized adverse impacts	Lower level of impacts	Lower level of impacts	Lower or higher by a negligible to minor amount, depending on area	Similar to Alt. 4	Similar to Alt. 4
Water Quality	Somewhat lower than potential	Higher by a major amount	Higher by a moderate amount	Similar to Alt. 3	Higher by a negligible to minor amount	Similar to Alt. 3
Visual Resources						
• National Elk Refuge	Semi-natural to rural character	Shift toward natural views	Similar to Alt. 1, except fewer elk	Shift toward more rural character	Shift toward more rural character	Shift toward more rural character
• Grand Teton National Park	Semi-natural views	Somewhat more natural	Somewhat more natural	Somewhat more natural	Somewhat more natural	Somewhat more natural
Habitat						
Agricultural Lands						
• National Elk Refuge – Total acres – Sprinkler irrigated – Flood irrigated	 2,400 60 930	 0 0 0	 2,400 0 990	 2,400 1,100 500	 2,400 1,100 500	 2,400 1,100 500
• Grand Teton National Park (ac.) (Current = 5,600 ac.)	5,600	1,100	1,100	1,100	1,100	1,100
Native Grasslands						
• National Elk Refuge (ac.)[1] (Current = 8,090 ac.)	8,400 → 9,000	10,600 → 3,250	8,090 → 3,090	8,160	8,160	8,090 → 3,090
• Grand Teton National Park (ac.) (Current = 8,093 ac.)	Similar to current conditions	Moderately higher	Moderately higher	Moderately higher	Moderately higher	Moderately higher
• Bridger-Teton National Forest (Effects of elk on habitat condition)	Localized adverse impacts	Possible increased impacts in some areas	Similar to Alt. 2	Similar to Alt. 2	Similar to Alt. 1	Similar to Alt. 2
• Green River Basin (Effects of elk on habitat condition)	Negligible adverse impacts	Possible increased adverse impacts in localized areas	Similar to Alt. 2	Similar to Alt. 1	Similar to Alt. 1	Similar to Alt. 2
Sagebrush Shrubland						
• National Elk Refuge (ac.)[1] (Current = 8,010 ac.)	8,010 → 9,170	8,210 → 17,430	8,100 → 14,860	8,180 → 8,940	8,180 → 8,940	8,010 → 13,160
• Grand Teton National Park (ac.) (Current = 56,843 ac.)	More acres than now	More acres than Alt. 1	More acres than Alt. 1	More acres than Alt. 1	More acres than Alt. 1	More acres than Alt. 1
• Bridger-Teton National Forest (Effects of elk on habitat)	Localized adverse impacts	Possible increased impacts in some areas	Similar to Alt. 2	Similar to Alt. 2	Similar to Alt. 1	Similar to Alt. 2
• Green River Basin (Effects of elk on habitat)	Negligible adverse impacts	Possible increased adverse impacts in localized areas	Similar to Alt. 2	Similar to Alt. 1	Similar to Alt. 1	Similar to Alt. 2
Riparian/Aspen Woodlands[2]						
• National Elk Refuge (ac.)[1] (Current = 3,240 ac.)	2,880 → 1,120	3,030 → 1,270	3,880 → 2,840	3,220 → 2,710	3,220 → 2,710	3,970 → 4,540

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
• Grand Teton National Park (ac.) (Current = 22,324 ac.)	Fewer acres than current	More acres than Alt. 1	More acres than Alt. 1	More acres than Alt. 1	More acres than Alt. 1	More acres than Alt. 1
• Bridger-Teton National Forest	Variable, some stands in declining condition and acreage	Improved condition and higher acreage	Similar to Alt. 2	Similar to Alt. 2	Similar to Alt. 1	Similar to Alt. 2
• Green River Basin	Variable, some stands declining in condition and acreage	Escalated decline in some areas	Similar to Alt. 2	Similar to Alt. 1	Similar to Alt. 1	Possible increased impacts in some areas
Wet Meadow Habitat						
• National Elk Refuge (acres)[1] (Current = 1,720 acres)	1,770	1,620	990 → 270	1,500 → 1,250	1,500 → 1,250	990 → 270
Elk and Bison (estimated numbers)						
• No. of Elk on the National Elk Refuge (5-year avg. 6,500[3])	5,000–7,500 (est. avg. 5,600)	1,200–6,000	1,000–2,000	4,000–5,000	5,000–7,500 (est. avg. 5,600)	2,400–3,200
• No. of Elk on Native Winter Range (low end)	2,900	4,400+	4,400+	4,400	2,900	4,400+
• No. of Elk on Gros Ventre Feedgrounds	2,500	2,500	2,500	2,500	2,500	2,500
• No. of Elk in the Jackson Herd	11,000	8,100–11,000	7,900–11,000	10,900–11,000	11,000	9,300–11,000
• No. of Elk in the Grand Teton National Park Herd Segment	~2,500	600–3,000	500–1,000	1,300–1,600	<2,500	1,200–1,600
• No. of Bison in Herd (Baseline = 800–1,000)	2,000+	250–500	800–1,000	450–500	400	avg. 400
• Winter Distribution – Elk (Current: about half of Jackson elk herd winters on refuge; remainder in national forest and park)	Similar to current	Major increase	Moderate to major increase	Minor increase	Similar to Alt. 1	Moderate to major increase
– Bison (Current: most bison winter on refuge; small numbers in park and national forest)	Negligibly greater than current	Major increase	Moderate increase	Minor increase	Similar to Alt. 1	Similar to Alt. 2
• Winter Mortality of Elk and Bison	1%–2%	1%–20%	1%–5%	1%–5%	1%–2%	1%–10% (<20%)
• Brucellosis Prevalence in Wintering Elk on the National Elk Refuge (Current = 20%–40%)	Potentially higher than current	Lower by a major amount	Similar to Alt. 2	Lower by a moderate to major amount	Lower by a minor to moderate amount	Similar to Alt. 2
• Brucellosis Prevalence in the Bison Herd (Current = 60%–90%)	Similar to current; may be higher in long term	Lower by a moderate amount	Similar to Alt. 2	Similar to Alt. 2	Lower by a minor amount	Similar to Alt. 2
• Potential Prevalence of CWD (if elk became infected) (Potential under current = 5%–90%)	Closer to 90%	Lower by a moderate to major amount (closer to 5%)	Lower by a minor to moderate amount	Lower by a minor amount (closer to 90%)	Similar to Alt. 1	Similar to Alt. 2
• Potential Prevalence of Other Diseases (e.g., TB, paraTB) in Elk on Refuge If Herd Became Infected	Highest potential prevalence	Lower potential by a major amount	Lower potential by a moderate to major amount	Lower potential by a moderate amount	Similar to Alt.1	Similar to Alt. 2

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
• Potential Prevalence of Other Diseases (e.g., TB, paraTB) in Bison If Herd Became Infected	Highest potential prevalence	Lower potential prevalence by a major amount	Lower potential prevalence by a moderate amount	Lower potential prevalence by a minor amount	Lower potential prevalence by a negligible to minor amount	Similar to Alt. 2
Other Wildlife						
Threatened, Endangered, or Special Concern Species						
• Wolves As affected by distribution and abundance of prey (Baseline: average of 11,000 elk in herd unit, about 75% on winter feedgrounds)	Wolves benefit from large number of elk in herd unit and large density of elk on winter feedgrounds	Lower benefits from large elk numbers, but more benefits due to wider winter distribution	Similar to Alt. 2	Similar to Alt. 1, but more benefits due to wider winter distribution of elk	Similar to Alt. 1	Similar to Alt. 2
• Grizzly Bears As affected by abundance and distribution of elk (Baseline: average of 11,000 elk in herd unit, about 75% on winter feedgrounds)	Diminished benefits due to large proportion of winter-killed elk dying on feedgrounds (not available to bears in spring)	Higher level of benefits due to larger numbers of elk dying in areas accessible to bears	Similar to Alt. 2	Similar to Alt. 2	Similar to Alt. 1	Similar to Alt. 2
As affected by availability of elk calves, based on elk numbers (Baseline: average of 11,000 in herd)	Beneficial impacts from large numbers of elk calves in the park and national forest	Fewer benefits due to lower elk numbers, especially in the park	Similar to Alt. 2	Similar to Alt. 2	Similar to Alt. 1	Similar to Alt. 2
Other Ungulates						
• Mule Deer (Current: major depletion of browse quality on National Elk Refuge)	Continued degradation and loss of browse quality	Similar to Alt. 1 to somewhat better conditions	Somewhat slower decline, but continued loss of browse quality	Accelerated loss of browse due to exclosures	Similar to Alt. 4	Enhanced condition and major acreage increase in browse
• Moose (Current: major depletion of amount and quality of willow habitat on National Elk Refuge)	Continued degradation and loss of willow habitat	Similar to Alt. 1 to somewhat better of willow habitat conditions	Somewhat slower decline in willow habitat, and larger acreage than Alt. 1	Accelerated loss of willow habitat due to exclosures	Similar to Alt. 4	Enhanced condition and major acreage increase in willow habitat
• Bighorn Sheep (Current: high level of competition on the National Elk Refuge)	Continued high level of competition	Possibly higher levels of competition	Similar to Alt. 2	Similar to Alt. 2	Similar to Alt. 1	Similar to Alt. 2
Non-endemic Diseases — Severity of Potential Impacts on Mule Deer, Moose, Bighorn Sheep	High potential for impacts	Lower potential for impacts by a moderate to major amount	Lower potential for impacts by a minor to major amount	Similar to Alt. 3	Similar to Alt. 1	Similar to Alt. 2
Small Mammals – National Elk Refuge (Current: lower than natural)	Diminished diversity and continued decline	Negligible change in trend, except on previously farmed fields (increase)	Small shift toward a more natural level of diversity	Shift toward a more natural level of diversity	Similar to Alt. 4	Similar to Alt. 4
– Grand Teton National Park (Current: somewhat less than natural)	Similar to current level of diversity	More closely approximate natural diversity	Similar to Alt. 2	Similar to Alt. 2	Similar to Alt. 2	Similar to Alt. 2

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Beavers National Elk Refuge (Current: little suitable habitat)	Less habitat	More habitat	More habitat by a major amount	Similar to Alt. 3	Similar to Alt. 3	Similar to Alt. 3
Neotropical Migratory Birds – National Elk Refuge (Current: less than natural conditions in riparian and aspen woodlands)	Moderate decrease in diversity in riparian and aspen woodlands	Negligible increase in diversity in riparian and aspen woodlands	Negligible to minor increase in diversity in riparian and aspen woodlands	Similar to Alt. 3	Similar to Alt. 3.	Moderate to major increase in diversity in riparian and aspen woodlands
– Grand Teton National Park (Current: less than natural)	Less diversity than current conditions	Higher diversity	Similar to Alt. 2	Similar to Alt. 2	Negligible higher diversity	Similar to Alt. 2
Sage Grouse – National Elk Refuge (Current: less suitable habitat than natural)	Minor increase in habitat from current	Major increase in habitat	Similar to Alt. 2	Negligible change in habitat	Similar to Alt. 4	Similar to Alt. 2
– Grand Teton National Park (Current: less suitable habitat than natural)	Similar to current conditions	More habitat	Similar to Alt. 2	Similar to Alt. 2	Similar to Alt. 2	Similar to Alt. 2
Waterfowl National Elk Refuge (Current: less than optimal conditions)	Low level of residual plant cover; negligible acreage increase in nesting habitat	Potentially higher level of residual plant cover; fewer acres of nesting habitat	Continued low level of residual cover; fewer acres of nesting habitat	Similar to Alt. 3	Similar to Alt. 3	Similar to Alt. 2
Archeological and Ethnographic Resources						
• Archeological Sites	Negligible adverse impacts due to more bison (possible adverse effect)	Fewer effects (no adverse effect)	Similar to Alt. 2	Fewer adverse effects (fewer bison); possible adverse effect from irrigation pipeline construction	Similar to Alt. 4	Similar to Alt. 4
• Ethnographic Resources	Negligible impact	Negligible impact	Potential beneficial impact from bison hunting	Similar to Alt. 3	Similar to Alt. 3	Similar to Alt. 3
Social and Economic Impacts						
Viewing Opportunities — Relative Number of Opportunities						
• Elk Viewing Opportunities – National Elk Refuge (winter)	Abundant opportunities	Major decrease (variable)	Major decrease (variable)	Moderate decrease (variable)	Similar to Alt. 1	Major decrease (variable)
– Grand Teton National Park (spring, summer, fall)	Limited opportunities	Possibly higher or lower	Moderate decrease	Negligible to minor decrease	Similar to Alt. 1	Moderate decrease
– Bridger-Teton National Forest (spring, summer, fall)	Limited opportunities	Similar to Alt. 1 but minor decrease	Similar to Alt. 1 but minor decrease	Similar to Alt. 1	Similar to Alt. 1	Similar to Alt. 1 but minor decrease
– Green River Basin	Very limited	Moderate to major increase	Moderate to major increase	Similar to Alt. 1	Similar to Alt. 1	Possible increased opportunities
• Bison Viewing Opportunities – National Elk Refuge (winter)	Very limited	Major increase	Major increase	Very limited to major increase	Similar to Alt. 1	Major increase
– Grand Teton National Park (spring, summer, fall)	Seasonal opportunities	Moderate to major decrease	Minor decrease	Moderate decrease	Moderate decrease	Moderate decrease

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
• NER Sleigh Ride Annual Numbers	24,367	0–15,152	0–15,152	0–17,879	Similar to Alt. 1	0–15,152
• Park Visitation (May–October) (Baseline = 2,350,000)	No change	No change	No change	No change	No change	No change
Hunting Opportunities (average number of hunters)						
• Elk hunters – National Elk Refuge (Current average = 975)	660–806	0	100–525	420–487	<670	120–403
– Grand Teton National Park (Current average = 2,484)	1,440–1,760	0	215–895	773–957	<1,494	260–897
– Bridger-Teton National Forest (Current average = 6,178)	3,900–4,767	3,275–5,540	3,120–6,247	5,600–5,870	>4,593	2,870–5,767
• Bison hunters – Jackson Hole (avg.)	50	50	150	90	75	75
– Green River basin	Baseline	More opportunities	Similar to Alt. 2	Similar to Alt. 1	Similar to Alt. 1	Possibly more opportunities
Local Economic Impacts Associated with Recreation						
• NER Sleigh Rides – Annual personal income generated in Jackson Hole	$1.01 million	$0–$560,000	Similar to Alt. 2	$0–$671,000	Similar to Alt. 1	Similar to Alt. 2
– Jobs generated in Jackson Hole	49	0–27	Similar to Alt. 2	0–33	Similar to Alt. 1	Similar to Alt. 2
• Grand Teton National Park Visitation – Annual personal income generated in Jackson Hole	$306.5 million	$286.4–$306.5 million	Similar to Alt. 2	$297.3–$306.5 million	Similar to Alt. 1	Similar to Alt. 2
– Jobs generated in Jackson Hole	14,265	13,329–14,265	Similar to Alt. 2	13,839–14,265	Similar to Alt. 1	Similar to Alt. 2
Other Economic Impacts						
• Boy Scout Antler Auction	$66,600	$43,000	$17,900	$53,700	Similar to Alt. 1	$33,400
• **Damage to Landscaping** – Damage in the Jackson Hole area (from elk and bison)	Negligible to minor damage	Possible major increase in some winters	Similar to Alt. 2	Possible moderate increase in some winters	Similar to Alt. 1	Similar to Alt. 2
– Damage in the Green River basin (from elk)	Negligible damage	Possible moderate to major increase in some winters	Similar to Alt. 2	Similar to Alt. 1	Similar to Alt. 1	Possible negligible to minor increase in some winters
Impacts on Livestock Operations						
• Risk of Brucellosis Transmission – Risk of Transmission from Elk to Cattle in the Jackson Hole area	Low risk	Higher risk in the short term; minor decrease in the long term	Minor to moderate decrease	Negligible to moderate increase in the winter; minor decrease in the spring	Negligible decrease	Similar to Alt. 2
– Risk of Transmission from Bison to Cattle in the Jackson Hole area	Low	Major decrease	Higher in the short term; minor to moderate decrease in the long term	Minor to moderate decrease	Low to moderate decrease	Higher in the short term; minor decrease in the long term
– Risk of Transmission from Elk to Cattle in the Green River basin	Low	Higher in the short term; unclear in the long term	Similar to Alt. 2.	Similar to Alt. 1	Similar to Alt. 1	Possibly somewhat higher

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
• Competition for Forage – Competition in Grand Teton National Park	Considerable in some areas	Lower by a major amount	Lower by a minor amount	Similar to Alt. 2	Similar to Alt. 2	Similar to Alt. 2
– Competition in Bridger-Teton National Forest	Negligible to minor amount	Higher by a negligible amount	Similar to Alt. 2	Similar to Alt. 2	Similar to Alt. 1	Similar to Alt. 2
– Competition in the Green River Basin	Negligible	Higher by a major amount in places	Similar to Alt. 2	Similar to Alt. 1	Similar to Alt. 1	Possibly higher
• Depredation of Stored Hay and Damage to Crops – Depredation/Damage in the Jackson Hole area	Negligible to minor	Higher	Higher	Possibly higher	Similar to Alt. 1	Higher
– Depredation/Damage in the Green River Basin	Negligible	Higher	Higher	Similar to Alt. 1	Similar to Alt. 1	Possibly higher

NOTE: For numeric assessments, estimated effects of all alternatives are provided. For qualitative assessments, all action alternatives (Alternatives 2–6) are compared to Alternative 1 (the No Action Alternative), and in some places, Alternative 1 is compared to current conditions. Potential short-term impacts are presented for some resources where there may be particular concerns.

1. The arrow between numbers of acres indicates short-term to long-term changes in acreages. Short-term changes would occur within 15 years. Long-term changes would occur beyond 15 years.
2. The "Riparian / Aspen Woodland" category in this table includes wet meadow and other non-woody riparian habitats, which differs from the riparian and aspen woodland classification throughout this document, which only includes woody vegetation.
3. 6,500 is the average number of elk wintering on the refuge during five of the last six years (1999–2004). An incomplete winter classification count in 2000 was excluded from the calculation.