Chapter 5—Environmental Consequences

Lori Iverson / FWS

Visitors learn about wildlife through environmental education programs on the refuge.

This chapter provides an analysis of the potential effects on the environment associated with the implementation of management alternatives for the refuge. We assessed the expected, potential environmental consequences of carrying out each of the alternatives on the physical, biological, cultural resource, and socioeconomic environment of the refuge.

Management actions are prescribed in the alternatives as the means for achieving the vision and goals for the refuge, while responding to issues raised by our managers, the public, and governmental partners. Because management would differ for each alternative, the environmental and social effects would likely differ as well. This chapter has the following sections:

5.1 Analysis Methods
5.2 Effects Common to All Alternatives
5.3 Climate Change Effects
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5.13 Resource Protection Effects
5.14 Administration Effects
5.15 Socioeconomic Impacts

Table 4 at the end of "Chapter 3—Alternatives" summarizes the alternatives' actions and the associated consequences described below.

5.1 Analysis Methods

The determination of effects is evaluated at several levels including whether the effects are adverse or beneficial and whether the effects are direct, indirect, or cumulative with other independent actions. In addition, we used the duration of effects in the evaluation of environmental consequences.

- Direct effects are those where the effect on the resource is immediate and the direct result of a specific action or activity. Examples of a direct effect are the effect of trail construction on vegetation along the trail and the effect of hunting on wildlife.

- Indirect, or secondary, effects are those induced by implementation actions but that occur later in time or farther removed from the place of action through a series of interconnected effects. Examples include the effects on downstream water quality from an upstream surface disturbance and the effect that recreational use along a trail may have on nearby plant communities.

- A cumulative effect is defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future action regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR 1508.7).

Impacts are often described in terms of their context, intensity, and duration. The duration of effects is either short term or long term. Short-term effects would persist for a period of 3–5 years and would consist primarily of temporary disturbance from habitat restoration or facility construction and subsequent revegetation efforts. Long-term effects would last more than 5 years after project initiation and may outlast the 15-year lifespan of the CCP. Many long-term effects consist of long-term benefit to wildlife habitat resulting from management actions.

5.2 Effects Common to All Alternatives

The following potential effects would be similar for each of the four alternatives:

- Carrying out the management direction (goals, objectives, and strategies) would follow the refuge's best management practices.

- Management activities and programs would avoid and reduce adverse effects on federally threatened and endangered species.

- The refuge staff, contractors, researchers, and other consultants would acquire all applicable permits, such as those for future construction activities.

The sections below describe in more detail other effects, including cumulative impacts, expected to be similar for each alternative.

Regulatory Effects

As described in chapter 1, we must follow Federal laws, administrative orders, and policies in the development and implementation of our management actions and programs. Among such mandates are the Improvement Act, the Endangered Species Act, the Clean Water Act of 1977, and compliance with Executive Order 11990—Protection of Wetlands and Executive Order 11988—Floodplain Management. The implementation of any of the alternatives described in this draft CCP and EA would not lead to a violation of these or other mandates (refer to appendix A).

Environmental Justice

Within the spirit and intent of Executive Order 12898—Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations, no actions being considered in this draft CCP and EA would disproportionately place any adverse environmental, economic, social, or health effects on minority or low-income populations when compared with the public.

We are committed to ensuring that all members of the public have equal access to the Nation's fish and wildlife resources, as well as equal access to information that would enable them to take part meaningfully in activities and policy shaping.

Geology and Soils

All alternatives would positively affect soil formation processes on the refuge. Some disturbance to

surface soils and topography would occur at locations selected for (1) administrative, maintenance, and visitor facilities, (2) removal and eradication of invasive plant species, and (3) restoration of native habitat.

Bison and Elk Plan

The Bison and Elk Management Plan was approved in April 2007 and would continue to serve as the guiding document for the management of elk and bison on the refuge. The implementation of any of the alternatives described in this draft CCP and EA would not supersede the goals and objectives in the Bison and Elk Management Plan.

Elk and bison management on the refuge has the potential to directly and indirectly affect threatened and endangered species and other species of concern. Indirect effects include (1) disturbance caused by shooting and hazing elk and bison, (2) the alteration of habitat used or potentially used by threatened or endangered plants or wildlife, (3) the introduction of disease agents into the environment through vaccination of elk and bison, and (4) changes in numbers and distribution of elk and bison, which serve as live prey or carrion for threatened or endangered animals.

By supporting the Bison and Elk Management Plan's population level objectives for elk and bison, the refuge produces greenhouse gases in excess of the benefits of the actions described above. Diesel equipment contributes to greenhouse gasses. More animals congregate on the refuge's enhanced habitat (because of deliberate management) than would naturally occur.

Migratory Birds

Operation of the K-line irrigation system entails dragging irrigation hoses using off-road vehicles. These activities have the potential to destroy ground-nesting bird nests and would likely decrease nest success for various species; the species most likely to be negatively affected are Savannah sparrow, vesper sparrow, horned lark, western meadowlark, and long-billed curlew (Dieni 2011). The refuge did surveys in 2011 to find long-billed curlew nest sites and to delay irrigation in these areas until the end of nesting. These techniques would be used to mitigate the negative effects of irrigation activities on ground-nesting birds, but there would be financial costs associated with the monitoring.

Irrigation activities would likely change the composition and structure of refuge grasslands over time (FWS and NPS 2007a). Nesting activity by species associated with shortgrasses would potentially decline, while nesting activity by species associated with taller, denser grasses might increase within the irrigation project area.

Seasonal closures would limit human disturbance of breeding birds under all alternatives, improving habitat and nesting success for migratory birds (Blumstein et al. 2005, Henson and Grant 1991, Tremblay and Ellison 1979).

Wildland Fire Management

The use of wildland fire as a tool for hazard fuel reduction and ecosystem management has been well documented by various land management organizations. Wildland fire provides many benefits that cannot be duplicated by other management techniques. Fire causes an immediate release of nutrients and warming of the soil that stimulates grass and forb growth. Fire also stimulates re-sprouting and suckering in many deciduous woody species (such as willow, aspens, and cottonwoods). Some plant species, such as lodgepole pine, are also depended on fire for seedling establishment. Fire can also be used to create a barrier to protect highly valued areas such as private property or administrative sites.

As previously mentioned, fire can stimulate suckering and re-sprouting in deciduous plant species. However, this new growth of woody vegetation is highly sought after for browsing by large ungulates. This is a concern at National Elk Refuge. Unless large ungulates can be excluded from an area after a fire, this browsing can further degrade the habitat.

Air quality is sometimes affected by wildland fire. Smoke from wildland fire contains many chemicals including particulate matter, water vapor, and carbon dioxide just to name a few. Smoke is known to cause adverse health effects in humans especially those susceptible to asthma and other respiratory illnesses. Wildland fire managers have many techniques that can be used to help minimize the impacts from smoke. Fire managers work closely with the National Weather Service and Wyoming Department of Environmental Quality to determine the best conditions for prescribed fire implementation and, to the extent possible, management of wildfires to minimize the impact of smoke emissions on the public.

As with other refuge lands, the potential invasion of a recently burned areas to be invaded by non-endemic vegetation is a concern. The best practice is to continue to work with neighboring landowners to prevent invasions in the area. An aggressive monitoring program of recently burned areas will also allow refuge staff to identify any new infestations while they are small and much easier to control.

Finally, keeping equipment clean and cleaning equipment before moving to new areas, especially if having just been in an area known to contain non-endemic vegetation, will help prevent the spread of non-native vegetation

Antler Collecting

Prohibiting the collection of antlers adheres to our agency policy of not collecting or removing items, including wildlife part, from national wildlife refuges. If antler collecting was allowed, the refuge would likely see increases in trespass into areas closed for the protection of wintering wildlife, resulting in substantial impacts to elk at critical times of the year. Prohibiting antler collection also protects wildlife habitat. However, the refuge, in a long-standing partnership with the Jackson District Boy Scouts, allows the Scouts to help us by picking up shed elk antlers that pose a hazard to refuge equipment. Most of the proceeds from an auction of antlers held by the Scouts are returned to the refuge and used primarily for habitat projects benefitting elk.

Access for Boating

Boating on the Gros Ventre River segment bounding the refuge was evaluated during development of the Snake River Headwaters Comprehensive River Management Plan. The potential wildlife and habitat effects of hand-propelled boating along this scenic river segment were reviewed and determined to be unacceptable. Disturbance from boating would affect the following:

- grizzly bears, which are known to use riparian habitat along the Gros Ventre River
- elk, moose, and bison that use riparian habitat and adjacent uplands in the summer for calving
- moose, mule deer, and small numbers of elk and bison that winter within the river corridor
- bison and elk movement between the Grand Teton National Park and the refuge during spring and fall migrations
- bald eagles and osprey that nest or hunt along the river

The Snake River Headwaters Comprehensive River Management Plan did not recommend changing the existing prohibition against nonmotorized boating because of the effects listed above, which would also occur along the segment of the Gros Ventre River located downstream from the town of Kelly.

The refuge staff evaluated nonmotorized boating for Flat Creek and ponds (impoundments). The wildlife disturbance to waterbodies and adjacent areas would be significant. There would likely be adverse effects on the following:

- trumpeter swans that nest in the lower reach of Flat Creek
- up to 200 trumpeter swans that stage on and use the refuge as a resting site during fall migration
- elk and bison during early spring when disturbance would burn their diminished energy reserves
- nesting, migrating, and wintering waterfowl

Nonmotorized boating on Flat Creek would also result in significant conflicts with the existing wildlife-dependent fishing program. Motorized boating was considered impractical due to the small size and shallow nature of refuge waterbodies. Furthermore, no boats reduces the potential introduction of aquatic invasive species.

Cumulative Impacts

Cumulative impacts are the incremental effects of the actions for an alternative when added to past, present, and reasonably foreseeable future actions. Cumulative impacts can be the result of individually minor effects, which can become significant when accumulated over time. The Council on Environmental Quality regulations that carry out the National Environmental Policy Act requires mitigation measures when the environmental analysis process detects possible significant impacts on habitat, wildlife, or the human environment.

We do not expect or intend any of the activities proposed for the CCP to produce significant levels of cumulative environmental impacts that would require mitigation. Nevertheless, the final CCP would contain the following measures to preclude significant environmental impacts from occurring:

- We would protect federally listed species from intentional or unintended impacts by banning activities where these species occur.
- We would regulate all proposed activities to lessen potential impacts to wildlife, fish, and plant species, especially during sensitive reproductive cycles.
- We would establish monitoring protocols to determine goal achievement levels and possible unforeseen impacts to resources and for application of adaptive resource management to make sure wildlife and habitat resources as well as the human environment are preserved.
- We could revise and amend the CCP after 5 years of implementation to apply adaptive resource management for correcting unforeseen impacts that occurred during the first years of the plan.

Mike Nordell / FWS

Willows

5.3 Climate Change Effects

Climate change is the preeminent issue for conservation in future decades. Over the next two decades, a warming of about 0.36 °F per decade is projected globally. Warming is expected to continue for centuries, even if greenhouse gas emissions were stabilized, because of substantial time lags in the feedback loop of climatic processes (Christensen et al. 2007).

Consequent with the projected warming, the atmospheric moisture transport and convergence is projected to increase, resulting in a widespread increase in annual precipitation over most of the continent except the southern and southwestern parts of the United States (Christensen et al. 2007). This increased precipitation is more likely to occur in winter and spring months, rather than summer (Christensen et al. 2007). It is also considered likely that extreme weather (heat waves and flooding) would become more frequent. Increases in annual precipitation might be partially offset by increases in evaporation. Moisture availability, rather than just precipitation, is a critical resource for plants and animals.

Current trends in climate change are expected to affect high-mountain ecotypes and lower elevation, snowmelt-dependent watersheds, such as those found near the refuge, more acutely than some other landscape ecotypes. The effects of climate change would extend beyond the boundaries of any single refuge and would, therefore, need large-scale, landscape-level solutions that extend beyond the refuge boundary. Such solutions include supporting intact, interconnected landscapes, restoring fragmented or degraded habitats, and preserving and restoring ecological processes. The collective goal is to protect and improve resilience in ecological systems and communities, so that, even as climate conditions change, the natural landscape would continue to support its full range of native biodiversity and ecological processes.

Resiliency in ecological system is dependent on several factors. Diversity is important for maximizing the options by which a system can respond to disturbance. Embracing ecological variability, such as droughts and floods, is also key. For example, eliminating periodic fire from forests can actually reduce resiliency and make them more vulnerable to catastrophic wildfires. Expecting the unexpected and recognizing that the understanding of systems, thresholds, and driving variables is often imperfect are also important to managing resiliency in systems and creating long-term sustainability (Gunderson 2000, Holling 1973, Walker and Salt 2006).

Alternative A

The refuge does not have the capacity or expertise to conduct climate change research, monitoring, or modeling. Fortunately, the refuge is located in the Greater Yellowstone Ecosystem where other land management agencies and scientific research organizations have a great deal of interest in monitoring and predicting the impacts of climate change on wildlife, habitat, and ecosystem functions. As ecosystem-specific climate change information becomes available, it would provide a scientific foundation for making management changes to benefit fish and wildlife and their habitats. Obtaining valuable climate change information would continue to be a tremendous help to a refuge with limited money and staff. This approach would save staff time and money and continue to allow staff to focus on refuge-specific activities.

The collection of ecosystem-wide climate change data may not show the more subtle, refuge-specific changes. By not collecting long-term climate change data on the refuge, we may not detect important changes until serious adverse impacts have occurred to wildlife or their habitats. Furthermore, we may lose the window of opportunity to address or prepare for unforeseen changes without advance notice.

As climate change information for the Greater Yellowstone Ecosystem became available, it would provide an opportunity for the refuge to respond to the our agency's strategic plan for responding to accelerating climate change. This plan, "Rising to the Urgent Challenge—Strategic Plan for Responding to Accelerating Climate Change" (FWS 2010) outlines three categories of response: adaptation, mitigation, and engagement. Climate change science would continue to advance and, in the future, provide fine-scale information that would enable the refuge to make science-based adjustments to management to help reduce the impacts of climate change on fish and wildlife and their habitats. Adaptation would be our primary focus in responding to climate change.

The refuge is implementing 14 climate change mitigations that have been identified in the "Sustainability Across Boundaries: the Greater Yellowstone Area Climate Action Plan" (Fiebig 2011), which the Greater Yellowstone Coordinating Committee sponsored. These efforts would help reduce our carbon footprint and move the refuge toward our agency goal of becoming carbon neutral by 2020. These mitigation actions fall into three categories: (1) vehicle efficiency; (2) building efficiency; and (3) reduced energy consumption.

- The refuge would accomplish vehicle efficiency through the gradual replacement of low mile-per-gallon vehicles with more efficient vehicles and the use of re-refined oil. Changing driver habits such as not letting vehicles idle and choosing to use energy-efficient vehicles when available would continue to be part of staff training. These changes would have positive effects on lowering our carbon footprint and reducing costs and have no adverse effects on completing refuge work.

- We would improve energy efficiency for refuge buildings through the gradual addition of insulation and the replacement of inefficient windows, water heaters, and furnaces. Construction of new buildings would meet high standards for energy efficiency. Over time, these building improvements would reduce maintenance and operation costs, thus making more money available for refuge activities.

- The recent irrigation system expansion quadruples the refuge irrigation capacity while reducing water consumption and fuel consumption. Previously, approximately 500 acres were sprinkler-irrigated using pressure generated by fuel-powered pumps. The new irrigation system is pressured by gravity, which eliminates pumping fuel that some years had cost up to $5,000 per week, or $20,000 per year. This system would continue to substantially increase irrigation capacity, reduce our carbon footprint through reduced fuel consumption, and eliminate maintenance time and costs.

As refuge staff continued to engage the public at the visitor center, there would be improved public understanding of climate change effects on natural resources that would encourage support for the refuge in changing management to mitigate the effects of climate change on refuge natural resources.

Alternative B

Same effects as alternative A. In addition, our involvement and cooperation with the Great Northern Landscape Conservation Cooperative might provide opportunities for the refuge to be part of ongoing climate change research. By including the refuge as a study site for data collection, the research might provide fine-scale information that directly applies to the refuge. This information would likely apply more to refuge management and planning than regional climate change information, thus providing specific information that can improve planning and management of the refuge.

Refuge staff would be involved to some degree with research conducted on the refuge if only to evaluate techniques and potential conflicts with refuge programs and policies. This would redirect limited staff time away from meeting other objectives; this would have an adverse effect on operations and existing programs. We would need more biological staff to collect or analyze data for climate change.

Alternatives C and D

Same effects as alternative B. In addition, we would use specific management practices such as replacing cheatgrass monocultures with native plant communities to reestablish healthy, natural ecosystem functions and natural wildlife and plant communities on the refuge and surrounding lands. The resulting ecosystem resiliency would benefit wildlife and plant communities by enabling them to better respond to disturbances or changing conditions by resisting damage and recovering quickly.

Creating and maintaining resilient ecosystems would divert focus away from meeting the refuge goals—limited staff and finances would be used to achieve long-term ecosystem resiliency without the certainty of success. Our ability to meet the objectives of the Bison and Elk Management Plan and some visitor services programs would suffer if adequate money and staff were not added.

5.4 Air Quality Effects

Effects on air quality would not significantly affect the refuge or the Jackson Hole environment.

Alternative A

Effects on air quality would be negligible.

Alternatives B, C, and D

Same as alternative A. In addition, effects from prescribed burning would temporarily reduce air quality by diminishing visibility and by releasing natural compounds through combustion.

3.5 Landscape-Scale Conservation Effects

One of the greatest threats to wildlife today is residential development and human population growth. Much of this growth is happening in rural areas. Land development has three main effects on wildlife: (1) direct habitat loss; (2) increased risk of mortality by increasing the frequency and lethality of human–wildlife conflicts; and (3) displacement and avoidance of developed areas by wildlife, which decreases available habitat and serves to isolate populations. Isolated populations are less resilient to changes in environment because of genetic inbreeding that decreases genetic diversity and produces genetic abnormalities that are often detrimental to individuals and populations. Isolated populations are also less resilient to disease, overhunting, or catastrophic events like floods and fire.

As habitat fragmentation continues to create barriers to animal movement, habitat connectivity grows increasingly vital in promoting the long-term survival of species. Continued connectivity between large areas of habitat is critical to the survival of many species of concern, especially those species that travel great distances and have large home ranges such as grizzly bear, gray wolf, wolverine, and Canada lynx.

Alternatives A and B

Collaboration with land management agencies and nonprofit organizations can provide more resources and tools for habitat protection projects, which benefit refuge habitats and wildlife populations. This collaboration combines resources to complete projects that are beyond the capacity of just the refuge. For example, Flat Creek, which flows through the refuge, is a nationally known cutthroat trout fishery that attracts anglers from around the country. WGFD is interested in maintaining and improving the Flat Creek fishery. Our cooperation with WGFD to update the bank protection and stabilization on the refuge would contribute to a healthy cutthroat trout fishery throughout the Flat Creek system. A healthy cutthroat trout fishery would be a benefit to the refuge and would enable the continuation of a quality catch-and-release fishing program on the refuge.

Our involvement with the Greater Yellowstone Coordinating Committee would continue to provide resource management information and technical and management assistance, which would leverage actions for wildlife and habitat improvement on and around the refuge. It would also continue our collegial relationships that enable the effective resolution of controversial challenges that cross the administrative land management boundaries. Sharing resources and reducing land management controversies would help promote public support of land management agencies including the refuge.

Invasive plants such as spotted knapweed and cheatgrass reduce natural vegetation diversity and

are considered problems throughout Jackson Hole. Our participation and cooperation with the Jackson Hole Weed Management Association has resulted in a partnership to address this landscape problem on and off the refuge. This landscape effort would continue to help protect and enhance native plant communities and preserve plant diversity on the refuge for the benefit many wildlife species. It would also contribute to landscape resiliency, which would enable plants and wildlife to better withstand and adapt to climate change.

Alternatives C and D

Same effects as alternative A. In addition, emphasizing area-wide, off-refuge, land protection efforts that develop or preserve wildlife migration corridors would enhance genetic exchange between discrete wildlife populations, improving the long-term survival of various wildlife populations in the ecosystem. Landscape protection efforts such as "Path of the Pronghorn" (FWS, NPS, and USDA Forest Service 2008) provide positive benefits to wildlife populations across the landscape.

Migration corridors can provide a route for invasive plants and animals to enter and infest the refuge, decreasing species diversity and landscape resilience. Increased refuge monitoring would be necessary for early detection of invasive species. Once detected, a rapid response would be necessary to control and eradicate infestations to prevent establishment of problem plants and the loss of species diversity. Migration corridors might increase the long-term genetic health for wildlife but also increase the likelihood of new diseases reaching the refuge. Increased disease monitoring to account for increased risk of disease transmission would be necessary.

Land use protection through a willing-seller Federal acquisition program would contribute to landscape-scale conservation. Easements or fee acquisition in strategically selected areas could mitigate the surrounding land uses that negatively affect the refuge and wildlife populations. However, we are limited in acquiring land interest (fee or easement) to within the refuge acquisition boundary, and nearly all lands within this boundary have been protected. The expansion of the refuge acquisition boundary is a public process that requires public input.

Fee-title acquisition to protect land next to the refuge would provide more forage and reduce conflicts between wildlife and existing homes and ranch operations. However, the cost to buy land and remove existing homes and structures would be exorbitant and impractical.

Land protection using land-use easements on undeveloped acreage would be expensive but is a more realistic approach than fee purchase. These easements could be as selective as identifying the timing of cattle presence to avoid brucellosis transmission or broader to restrict future development. Easements obtained and held by private nonprofit land trusts could also be effective in complementing management efforts on the refuge.

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A view of the refuge from Snow King Resort in Jackson, Wyoming.

Emphasis on landscape-level projects would help keep the ecosystem resilient to climate change, but would divert limited refuge money and staff time away from projects that directly benefit the refuge.

5.6 Habitat Effects

This section describes the effects of alternatives pertaining to the following:

- native grasslands and sagebrush shrublands
- wetlands
- riparian woodlands and aspen woodlands
- invasive species

Native Grasslands and Sagebrush Shrublands

The effects of each alternative on grasslands and sagebrush shrublands are described below.

Alternative A

The most extensive native grassland and sagebrush shrubland plant communities exist in the Gros Ventre Hills on the northern end of the refuge, and therefore the impacts of the alternatives primarily affect this area. Lack of any management other than full fire suppression and invasive plant control would reduce motorized vehicles in native plant communities and minimize the transport of noxious weed seeds from other locations (Von Der Lippe and Kowarik 2007).

Habitat for bird species dependent on open grassland or grassland patches within sagebrush stands would decline, and habitat for bird species dependent on older, dense sagebrush stands would increase (Knick et al. 2005). Wintering and nesting habitat for greater sage-grouse would increase over time, but potential lek sites and brood-rearing habitat would decline.

Continued full fire suppression and lack of prescribed fire would result in an increase in the age and density of sagebrush stands, which would decrease elk and bison use of these areas over time (Cook 2002, Grover and Thompson 1986, Smith et al. 2004).

Alternative B

Same effects as alternative A. However, while native species composition would be maintained, the extent of older, dense sagebrush stands would be reduced compared to alternative A, and the extent of young sagebrush stands and grass-dominated sites would increase. More management could increase the transport of noxious weed seeds. The costs and staff time associated with prescribed burning and controlling invasive plants would be substantially higher than alternative A.

There would be a reduction in the extent and distribution of tall, mature sagebrush stands, which would reduce the amount of wintering habitat for greater sage-grouse.

We would still protect native grassland and sagebrush shrubland communities from degradation, but we would place greater emphasis on managing these plant communities to improve habitat quality for elk and bison. An increase in the size and distribution of grass- and young sagebrush-dominated areas would increase elk and bison use of the northern end of the refuge.

Alternatives C and D

Same effects as alternative A. In addition, increased use of prescribed fire and managed use of wildfire would be necessary to achieve desired conditions, although the frequency and extent of burning would likely be less than under alternative B. There would be an intermediate risk of invasive plant invasion. The costs and staff time for fire management, monitoring, and weed control would be substantially higher than alternative A but slightly less than alternative B.

The effects on greater sage-grouse habitat and elk and bison distribution could be greater than alternative B. However, the core area policy for greater sage-grouse is to mitigate activities in the core area; therefore, adverse effects on greater sage-grouse should be avoided.

Wetlands

The effects of each alternative on wetlands are described below.

Alternative A

The infrequent manipulation of water levels in artificial ponds would continue to promote foraging and nesting habitat for trumpeter swans.

With our current level of noxious weed control, there would be a moderate increase in the distribution and density of some weed species, particularly Canada thistle, in wet meadow habitat. Invasive plant species that are not State-listed as noxious weeds would continue to increase in distribution and density in wet meadows. Lack of prescribed fire in wetland plant communities would result in similar use by elk and bison of wet meadow habitat to that of recent years. This use would continue to be high (Cole and Ketchum 2010), but would be lower than alternative B. Costs and staff time associated with planning, carrying out, and monitoring prescribed burns would be substantially lower than alternatives B–D.

Alternatives B and D

Same effects as alternative A. In addition, there would be increased capability to improve swan habitat and potentially increase habitat quantity with new ponds (more than the other alternatives). The costs of improving water control structures and building new ponds would be much higher compared to alternatives A and C.

The costs of monitoring invasive plant and aquatic animal species would increase compared to alternative A in the short term, but the likelihood of identifying and controlling infestations before they became a major ecological problem would be much greater than under alternative A. Therefore, the long-term costs of invasive species control would likely be substantially lower than alternative A.

Prescribed burning would improve forage quality in wet meadow plant communities to a much greater extent than alternative A and modestly more than alternative C, resulting in higher elk and bison use of wet meadows on the southern end of the refuge. Costs and staff time associated with planning, implementing, and monitoring the effects of prescribed burns would be substantially greater than alternative A and modestly greater than alternative C.

Alternative C

Water regimes that mimic natural flow conditions would likely result in swan habitat similar to alternative A, with more limited swan habitat than alternative B. Costs and staff time associated with improving water control structures on existing artificial ponds would be greater than alternative A but, because no new ponds would be created, costs would be lower than alternative B.

The costs of monitoring invasive plant and aquatic animal species would increase compared to alternative A in the short term, but the likelihood of identifying and controlling infestations before they become a major ecological problem is much greater than under alternative A. Therefore, the long-term costs of invasive species control would likely be substantially lower than alternative A.

The scale and extent of prescribed burns would be lower than alternative B, resulting in a modest improvement in forage quality for elk and bison in wet meadow habitats compared to alternative A but to a lesser extent than for alternative B. Costs of planning, implementing, and monitoring the effects of prescribed burns would be greater than alternative A but less than alternative B.

As willow communities were restored (refer to "Riparian Woodlands and Aspen Woodlands—Alternative C" below), beaver presence could be reestablished and beaver ponds would increase the amount and distribution of small open water areas in wet meadow plant communities on the southern end of the refuge compared to alternative A and B. Succession at the beaver ponds would produce mudflat conditions that would support regeneration of willows from seed (Cooper et al. 2006), which over the long term would generate new willow stands intermixed with wet meadow habitat and would contribute to the increased diversity of wetland plant communities.

Riparian Woodlands and Aspen Woodlands

The effects of each alternative on riparian woodlands and aspen woodlands are described below.

Alternative A

Browsing intensity by bison, elk, and moose, the location of woody plant communities, and the relative palatability of the plant species, dictates the potential structure of woody plant communities on the refuge (Smith et al. 2004). Loss of woody plant community structure and, in some cases, a complete change from shrub and woodland communities to grass-dominated communities would continue. Without restoration of willow and cottonwood along Flat Creek, riparian communities would continue to deteriorate. Regeneration of cottonwoods would be possible in parts of the Gros Ventre River riparian area, but more palatable species such as willow, chokecherry, serviceberry, and silverberry would be heavily browsed and potentially disappear from Gros Ventre River riparian areas over time. (Keigley et al. 2009). There would be continued loss of the extent, density, and height of willow and cottonwood communities. Elk and bison density would be slightly less than current conditions, and distribution would be similar to current conditions (Cole and Ketchum 2010). Costs and staff time to carry out woody vegetation recovery strategies would be slightly lower than alternative B and much lower than alternative C.

Retention of irrigation water in the Flat Creek system through efficiency of the refuge irrigation system was discussed in "Bison and Elk Grazing Impacts" in the Bison and Elk Management Plan (FWS and NPS 2007a). These conditions would be true for each alternative.

Riparian flow regimes would be similar to current conditions. Diversion of water by private users from the Gros Ventre River to the lower Flat Creek at a level of up to 140 cubic feet per second would continue to occur from May to August in most years (Shields 1983). Stream morphology would be similar to current conditions.

Alternative B

Same effects as alternative A. In addition, because the refuge would likely use only small-scale experimental exclosures and jackstraw techniques, the structure and composition of riparian woody plant communities would be similar to alternative A. Costs and staff time for small-scale restoration of woody riparian communities would be slightly higher

than alternative A and much lower than alternative C.

The refuge would implement recommendations from the Gros Ventre River Hydrologic Assessment as appropriate, but these recommendations and their effects on riparian habitat are unknown at this time. Economic impacts to private irrigators might be possible, but given the uncertainty about the Gros Ventre River Hydrologic Assessment, those impacts are uncertain.

Comprehensive fisheries habitat improvement projects on lower Flat Creek would entail substantially higher costs and staff resources than alternatives A and C.

Alternative C

Same effects as alternative A. In addition, given the current condition of willow and cottonwood communities on the southern end of the refuge, fenced exclosures would be necessary to restore riparian willow and cottonwood communities. The Bison and Elk Management Plan prescribed the use of 500- to 1,000-acre willow exclosures and a 100-acre cottonwood exclosure to restore riparian plant communities along Flat Creek. Data from current small-scale experimental exclosures on the refuge suggest that fenced areas would have to be in place at least 10 years for willow and cottonwood to regain sufficient structure to resist browsing pressure from elk and bison. If exclosures are subsequently removed at the 500 bison and 5,000 elk population levels, these communities would only temporarily be able to withstand browsing pressure. Perpetual rotation of exclosures on a 15-year cycle would make sure that some riparian habitat would be available as elk and bison habitat, while also ensuring that willow and cottonwood plant communities would be restored on the southern end of the refuge. However, exclosure construction would be costly, requiring considerable staff resources to check fence integrity and to rotate fenced areas compared to alternatives A and B.

Nonessential exclosures and woody vegetation restoration techniques that do not support restoration to pre-European settlement conditions would be removed. For example, jackstraw structures along lower Flat Creek would be removed because there is no historical evidence that large woody debris existed in this part of the creek (Galbraith et al. 1998, Smith et al. 2004), and the shelterbelt exclosure in the Headquarters management unit would be removed, because it supports trees and shrubs that would not have existed at that site. Staff time associated with removal of these structures would be substantial, and public education efforts would be required to inform the public about the apparent contradiction in management activity (constructing exclosures in some areas and removing woody vegetation in others).

In general, mimicking natural flow regimes in the Gros Ventre River and Flat Creek drainages would result in high water levels during spring runoff (May–July) and low water levels from late fall to early spring. The existing flow regime in Flat Creek and the Gros Ventre River conforms to this pattern, but irrigation diversion by the refuge and private water users reduces flows below natural levels in upper Flat Creek and in the Gros Ventre River and increases water levels in the lower part of Flat Creek. In extreme cases, this results in the complete dewatering of parts of the Gros Ventre River during late summer and early fall. If more water stayed in the stream channels, stream morphology would more closely resemble pre-European conditions, and opportunities for cottonwood and willow regeneration would be enhanced. Implementation would be contingent on the cooperation of private water users to mimic natural flow regimes, which would entail substantially higher economic costs for these users compared to alternatives A and B.

Alternative D

Same effects as alternatives B and C.

Flat Creek

The effects of the alternative actions on Flat Creek are described below.

Alternatives A, B, and C

Based on the results of monitoring, we would use adaptive management strategies to adjust project components as needed to increase ecological benefits and better achieve objectives.

Alternative D

The Flat Creek enhancement project would reduce sediment inputs to the watershed, improve stream processes, and increase habitat for all age classes of Snake River cutthroat trout. Stable streambanks would be vegetated with native species.

Invasive Species

The effects of each alternative on invasive species are described below.

Alternative A

The refuge staff's use of integrated pest management strategies would continue to protect native plant communities and prevent new infestations. Preventing new infestations is the best and most cost effective way to fight the spread of invasive weeds, but prevention strategies can be inconvenient and incur cost to refuge users, and the demands of increased vigilance and public education require increased staff time. Operations that control invasive plants protect native plant communities by preventing the spread of existing infestations.

With our current level of noxious weed control in wetlands, there would be a moderate increase in the distribution and density of some weed species, particularly Canada thistle, in wet meadow habitat. Invasive plant species that are not State-listed as noxious weeds (such as meadow foxtail, timothy, and reed canarygrass) would continue to increase in distribution and density in wet meadows. Because there would be little management and vehicle traffic in these areas, the risk of invasive plant infestation would be minimal under alternative A compared to the other alternatives. Monitoring and control costs would also be minimal under alternative A compared to the other alternatives.

With limited monitoring for aquatic invasive species, we would be unlikely to make early detection for control of zebra mussel, quagga mussel, Asian carp, hydrilla, Asian clam, and Eurasian watermilfoil (WGFD 2010b).

Alternative B

Same effects as alternative A. In addition, more monitoring and rapid response for new infestations, including aquatic plant and animal species, would increase the likelihood of identifying and controlling infestations before they became a major ecological problem.

The large-scale eradication programs would be potentially much less expensive in the long term with less risk of an expanding infestation than if doing more limited control work. Large-scale eradication operations potentially put a greater quantity of herbicide into the environment during the short-term effort but likely put much less herbicide into the environment than long-term, never-ending control work. The goal of eradication operations is to eliminate the infestation, resulting in reduced effort in the future, which would be focused on monitoring and spot treatment as necessary.

The costs of monitoring invasive plant and aquatic animal species would increase compared to alternative A in the short term, but the long-term costs of invasive species control would likely be substantially lower than alternative A.

Alternatives C and D

Same effects as alternative B. In addition, the monitoring and control of invasive plants that are not listed as noxious weeds would help restore native plant communities, but complete success in control of "naturalized" invasive species would be difficult to achieve. There would be higher costs in labor, equipment, chemicals, and seed to carry out what would be a long-term effect.

5.7 Wildlife Effects

This section describes the effects of alternatives pertaining to the following:

- migratory birds
- aquatic species
- disease management

Migratory Birds

The effects of each alternative on migratory birds are described below.

Alternative A

The overall diversity of migratory bird species would be relatively low.

The current management in grassland and sagebrush shrubland communities would increase the size and distribution of older, dense, tall sagebrush patches. This would increase the available habitat for migratory birds that depend on these conditions and, at the same time, decrease the habitat quantity and quality for migratory birds that depend on younger sagebrush stands and open grasslands (Knick et al. 2005). Habitat quality for ground-nesting bird species that depend on shortgrasses would decline.

Wetland habitat for migratory birds would not change.

With the continued loss of willow, cottonwood, and aspen stands, the habitat quantity and quality for migratory birds that depend on understory shrubs and midcanopy woodland habitats would continue to decline (Smith et al. 2004).

Steve Koob / FWS

Yellow-headed Blackbirds

Alternatives B and D

Same effects as alternative A. In addition, the resulting diversity of migratory bird species would be slightly higher than alternative A.

Migratory birds that depend on open grasslands and young sagebrush would benefit from management that used more fire to create these conditions.

There would be less herbaceous nesting cover for migratory birds that use wet meadows. In addition, migratory birds that use riparian areas would have little change in habitat, because the willow and cottonwood restoration would occur on a very small scale.

Costs and staff time for monitoring bird populations would be substantially higher than alternative A.

Alternative C

Same effects as alternative B. In addition, habitat quality for migratory bird species would be improved, and alternative C would likely result in the highest diversity of migratory bird species.

For migratory birds that use grasslands and sagebrush shrublands, the habitat age distribution and density would be intermediate between alternatives A and B.

For migratory birds that use wet meadows, there would be an intermediate amount of herbaceous nesting cover in wet meadow areas between alternatives A and B. An increased diversity of wetland plant communities on the southern end of the refuge would increase habitat for shrub-nesting birds compared to alternatives A and B (Medin and Clary 1990).

For migratory birds that depend on riparian areas and woodlands, there would be 500–1,000 acres more of tall willow-dominated areas, 100 acres more of restored cottonwood woodlands, and 1,000 acres more of restored aspen.

Cost and staff time for bird monitoring would be higher than alternative A and comparable to alternative B.

Aquatic Species

The effects of each alternative on aquatic species are described below.

Alternative A

Current monitoring and management strategies would continue to yield a basic knowledge of native trout populations and their long-term trend in refuge waters. These strategies would allow for effective fishery and harvest management.

Working cooperatively with WGFD would continue to greatly reduce refuge costs for fisheries management and ensures good alignment with WGFD management objectives and fishing regulations. It also takes advantage of the superior fisheries management knowledge and experience of WGFD in managing resident fish populations.

Nonnative trout removal would continue to benefit native trout through the reduction of competition for food and habitat resources and release some of the predation pressure. Counting the nonnative trout removed would provide data for long-term population trends. Although removal of nonnative trout species would create positive effects for native trout, other native fish, and invertebrates, some anglers view these removals as a loss of fishing opportunity and a waste of limited resource management money. The current level of nonnative trout removal might not be enough to substantially reduce populations and might

not even be able to stop the increased brook trout population that Flat Creek has experienced in recent years. However, these activities certainly have negative effects and slow that population growth.

Given the lack of willow growth in riparian areas, beaver would continue to be absent. As a result, there would be no new beaver ponds in wetland habitats.

Alternative B

Same effects as alternative A. In addition, the construction of new artificial ponds to create wetland habitat and the rehabilitation of water control structures would increase the amount and quality of amphibian habitat compared to alternative A and would be comparable to alternative C. Increased habitat quality and quantity would increase the likelihood of stable to increasing amphibian populations (Ficetola and Bernardi 2004, Marsh and Trenham 2001).

Alternative C

Same effects as alternative A. In addition, the screens at irrigation diversions would substantially decrease the introduction of nonnative trout into Flat Creek's trophy cutthroat trout fishery. Increased removal of nonnative trout would benefit native trout, other native fish, and invertebrates by substantially reducing the abundance of nonnative trout, especially brook trout. Screen installation would have a substantial initial cost, and the screens would likely increase maintenance costs for the refuge, WGFD, and water rights holders to clear debris jams.

Information on the population trend and age structure of an unharvested species or suite of species could lead to enhanced aquatic habitat over the long term. However, a new program would increase WGFD staff costs, would do little to improve the native trout fishery, and might be viewed by anglers as being an expensive and trivial monitoring program.

Reestablishing beaver populations on the southern end of the refuge would be contingent on restoration of surrounding willow communities as a beaver food source (refer to riparian woodlands and aspen woodlands effects above). More beaver ponds would increase the amount and distribution of small open-water areas in wet meadow plant communities on the southern end of the refuge compared to alternatives A and B, and the net effect would be more amphibian habitat than alternative A (Cunningham et al. 2007) and comparable amphibian habitat to alternative B.

Alternative D

Same effects as alternative A. In addition, the screens at irrigation diversions would substantially decrease the introduction of nonnative trout into Flat Creek's trophy cutthroat trout fishery. Increased removal of nonnative trout would benefit native trout, other native fish, and invertebrates by substantially reducing the abundance of nonnative trout, especially brook trout. Screen installation would have a substantial initial cost, and the screens would likely increase maintenance costs for the refuge, WGFD, and water rights holders to clear debris jams.

Increased removal of nonnative trout would benefit native trout, other native fish, and invertebrates by substantially reducing the abundance of nonnative trout, especially brook trout. More removal activities would increase WGFD staff costs and further reduce opportunities for anglers to fish for nonnative trout.

Reestablishing beaver populations on the southern end of the refuge would be contingent on restoration of surrounding willow communities as a beaver food source (refer to riparian woodlands and aspen woodlands effects above). More beaver ponds would increase the amount and distribution of small open-water areas in wet meadow plant communities on the southern end of the refuge compared to alternatives A and B, and the net effect would be more amphibian habitat than alternative A (Cunningham et al. 2007) and comparable amphibian habitat to alternative B.

Disease Management

The effects of each alternative on wildlife disease and its management are described below.

Alternative A

By concentrating elk and bison herds in February and March, there would be less risk of brucellosis transmission from elk and bison to cattle because the current feeding regime limits commingling of elk and bison with domestic livestock. However, this alternative would have the highest densities of elk and bison on the southern end of the refuge, which would increase the herds' risk of density-dependent diseases.

Because the refuge would do only minimal disease monitoring, we would likely be unable to detect diseases in the early stages of an outbreak, particularly in populations of birds, which would reduce our ability to carry out an effective management response (Mörner et al. 2002, Stallknecht 2007).

WGFD monitoring of bighorn sheep and refuge monitoring of amphibians would help us in early

detection of diseases and to respond before there were subsequent negative population effects.

A contingency plan for chronic wasting disease would identify strategies to minimize the effects of the disease should it become established in the Jackson elk herd. These strategies potentially could reduce the prevalence of chronic wasting disease and its effects on the elk population over the long term. Monitoring would be sufficient to detect 1-percent disease prevalence with 95-percent confidence annually. The long-term incubation period of this disease suggests that chronic wasting disease has not been present in the Jackson elk herd historically. Early identification of the disease in the population might trigger a more aggressive management response, which also could reduce disease prevalence and population effects over the long term.

Alternative B

Same effects as alternative A. In addition, habitat management would result in the lowest elk and bison densities on the southern end of the refuge and the lowest risk of density-dependent disease.

Implementation of the comprehensive disease contingency plan would likely intensify disease monitoring efforts and result in management responses to disease outbreaks. There would be more early detection of diseases compared to alternative A. Management in response to disease outbreaks would have a greater potential to reduce the effects of diseases on wildlife populations compared to alternative A (Fenichel and Horan 2007, Lloyd-Smith et al. 2005). However, increased monitoring and management would require substantially more money and staff time than alternative A.

Alternatives C and D

Same effects as alternative A. In addition, the interagency disease contingency plan allowing native diseases to run their course with minimal intervention might result in population reductions in some instances, which could result in negative reactions from the public (Decker et al. 2006).

Disease monitoring efforts would be more intense than alternative A, but lack of disease management for native diseases would result in moderately higher cost and staff time than alternative A and moderately lower staff time and costs than alternative B. Therefore, our response to disease outbreaks would have less chance of reducing the effects of diseases on wildlife populations compared to alternative B.

5.8 Federally and State-Listed Species Effects

The refuge would maintain the current distribution and timing of areas closed to the public to reduce disturbance to species of concern and maximize habitat effectiveness (Frame et al. 2007, Henson and Grant 1991, Mallord et al. 2007, Redmond and Jenni 1986). In addition, staff would conduct refuge management activities in a manner to reduce disturbance to species of concern (Major 1990).

Alternative A

Monitoring would be sufficient to detect major population changes for refuge populations of grizzly bear, bald eagle, greater sage-grouse, trumpeter swan, and long-billed curlew. The ability to detect status and trends for the other Wyoming species of greatest conservation need (Keinath et al. 2010, WGFD 2010a) and for sensitive plants would be minimal.

We do not predict any significant changes in refuge populations of bald eagle, greater sage-grouse, trumpeter swan, and long-billed curlew, but we do anticipate that grizzly bear use of the refuge will increase based on the trends in current range expansion of this species. Current baseline information is insufficient to predict future population trends for all other Wyoming species of greatest conservation need that occupy the refuge.

Alternative B

Same effects as alternative A. However, alternative B would have the highest probability of meeting the nesting pair objectives of the Trumpeter Swan Management Plan (Subcommittee on Rocky Mountain Trumpeter Swans 2012). Wetland improvements would enhance trumpeter swan habitat. Rescuing eggs and installing floating nest platforms would increase nest success. These strategies would help meet the population objectives for the Snake River core area (the Snake River basin in Wyoming but outside of Yellowstone National Park) of 18 nesting pairs and 60 total adults and subadults.

This alternative is more likely than alternatives A,C, and D to result in a decline in greater sage-grouse populations. Because of the emphasis on using habitat treatments on the northern end of the refuge to promote elk and bison use of these areas, there would be a net loss of mature sagebrush habitat and a possible decline in greater sage-grouse populations.

Staff coordination with WGFD to do more monitoring would provide information about the status and trends of the Wyoming species of greatest conservation need on the refuge. Costs and staff time would be substantially higher than alternative A and comparable to alternative C.

Alternatives C and D

Same effects as alternative A. However, water management of wetlands that mimics natural flow regimes would result in slightly lower habitat quality for trumpeter swans and the potential for slightly lower swan productivity than alternative A and moderately lower swan productivity than alternative B. The likelihood of meeting swan breeding pair objectives in the Trumpeter Swan Management Plan (Subcommittee on Rocky Mountain Trumpeter Swans 2012) would be lowest under alternatives C and D.

Recent research suggests that the fire-return interval in mountain big sagebrush stands is substantially less frequent than previously indicated (Bukowski and Baker 2013) and that high-density, tall sagebrush stands may be a rare ecological type on the landscape compared to the time of pre-European settlement. Therefore, protection of dense, tall sagebrush stands from wildfire and lack of prescribed fire in these areas is an appropriate management strategy to mimic historical conditions and to preserve key wintering habitat for the greater sage-grouse (Holloran and Anderson 2004). Subsequently, effects on greater sage-grouse habitat and populations would be comparable to alternative A.

Increased monitoring would provide information about the status and trends of the Wyoming species of greatest conservation need on the refuge. Consequently, costs and staff time would be substantially higher than alternative A and comparable to alternative B.

5.9 Research and Monitoring Effects

The effects of each alternative for research and monitoring are described below.

Alternative A

The refuge would get data on only the highest biological priorities because of limited money and staff and heavy reliance on volunteers and cooperators.

Lori Iverson / FWS

Tagging wolves is part of the research and monitoring program.

Data collection to support model development and decision support tools is sufficient only to address the highest priority decisions such as feeding-initiation protocols and elk harvest strategies. Funding and staff to support these activities assures only moderate confidence in the models and decision-support tools.

Data collection to determine the effects of public use on habitat and wildlife is sufficient only to measure effects on the highest priority activities such as the effects of human disturbance on elk habitat use. Funding and staff levels assures only moderate confidence in measuring these effects.

Some monitoring projects—such as global positioning system (GPS) collar studies for elk (Cole and Ketchum 2010), forage production monitoring (Cole 2011a), irrigation effects on plant communities and birds (Dieni 2011, Dieni and Cole 2011), and disease monitoring in elk (Henningsen 2011)—provide quality data that effectively guides management decisions. However, most monitoring projects result in only marginal levels of data confidence because of insufficient money and staff. Therefore, the ability of managers to predict the outcome of management actions and emerging threats—such as public use effects, invasive species effects, disease in wildlife other than elk and bison, and fisheries effects—would be compromised.

Activities by researchers and animals marked with collars might have short-duration negative effects on visitors that observe and photograph wildlife (Bergman 2005, Mech and Barber 2002).

Alternatives B and D

Same effects as alternative A. In addition, we would find out more about the effects of public use on wildlife and habitats.

Prioritizing key information needs, developing study designs to answer questions of interest, and ensuring adequate resources to conduct research and monitoring would ensure data quality necessary to adequately inform management decisions (Legg and Nagy 2006, Lenth 2001, Osenberg et al. 1994, Stockwell 2002). This would improve local decisionmaking compared to alternative A.

Cost and staff time for biological monitoring and research would be substantially higher than alternative A.

Activities by researchers and animals marked with collars might have short-duration negative effects on visitors that observe and photograph wildlife (Bergman 2005, Mech and Barber 2002). This would increase substantially compared to alternative A, with negative effects on visitors observing wildlife.

Alternative C

Same effects as alternative B. In addition, the refuge would get more data about the role of the refuge within the Greater Yellowstone Ecosystem and the effects of natural processes on plant communities and wildlife populations. This would improve data quality and likely improve decisionmaking at regional or larger scales (Carpenter et al. 2006), but would detract from research and monitoring that would inform decisionmaking at the refuge level.

Cost and staff time for biological monitoring and research would be substantially higher than alternative A and comparable to alternative B.

5.10 Cultural Resources Effects

The effects of the alternatives on cultural resources are described below.

Alternative A

The refuge staff would make sure that known cultural resources were protected from vandalism and theft.

Because stopping construction can be expensive, preconstruction cultural resource inventories and assessments would reduce the probability of work stoppage to make sure any archaeological resources were protected.

By limiting public access and providing only supervised visits, the refuge would reduce disturbance or loss of artifacts at known archaeological sites.

Keeping the Miller Ranch open to the public during summer months would give the public an opportunity to visit a historic site and learn about refuge history and homesteading in Jackson Hole. However, if an adequate number of volunteers to staff and run the Miller House were not maintained, the Service would have to substantially reduce the hours of operation or close the house to public viewing, resulting in the loss of a valuable community historic and cultural resource. The Grand Teton Association and refuge would lose money from the sale of the turn-of-the-century items sold in the Miller House bookstore if it were closed. In addition, allowing the continued deterioration of the Miller Barn could result in the loss of a valuable community and State cultural resource.

Alternatives B, C, and D

Same effects as alternative A. In addition, with a new interpretive trail near the Miller Ranch buildings, visitors could take leisurely walks while learning about the historic value of the ranch. If the trail was made accessible to persons of all physical abilities, a more substantial trail would be needed and would disturb more soil and vegetation. In addition, there would be some disturbance from installing signs that directed visitors to the various buildings. Visitors allowed to walk unescorted around the Miller Ranch buildings might not respect the adjacent closed areas. A substantial number of visitors currently leave Elk Refuge Road and walk down to a series of nearby ponds that are in a marked closed area. Putting visitors closer to these closed areas might increase the amount of trespass, resulting in disturbance to waterfowl and other animals.

Rehabilitation of the Miller Barn would expand the interpretive opportunities by having another restored building on site that the public could view and could be an alternate site for holding programs indoors when needed. The barn is in fair condition overall, but several aspects require attention to ensure its preservation including foundation stabilization, improved drainage, repair of split or loose battens in the walls, and possible roof repairs. The refuge budget would not likely be able to accommodate a rehabilitation project of this scale. Working with partners to rehabilitate the barn would give us more chance of success by stretching funding and sharing resources.

A USDA Forest Service cabin is the third building on the Miller Ranch property that is not open to the public now and would need substantial rehabilitation before it could be opened to the public.

If money were available for permanent or seasonal interpreters to maintain and enhance programs at the Miller House, Miller Barn, and USDA Forest Service cabin, the refuge could provide consistent opportunities for the public to experience cultural resources on the refuge.

5.11 Visitor Services Effects

This section discusses the effects of alternatives pertaining to the following:

- hunting
- fishing
- wildlife observation and photography
- environmental education and interpretation
- Jackson Hole and Greater Yellowstone Visitor Center
- other uses
- access
- public outreach

Hunting

The effects of each alternative on hunting are described below.

Alternative A

Both historically and presently, harvest has been insufficient to meet the herd objectives in the Bison and Elk Management Plan. Contributing factors include season structure, hunting effort, available licenses and permits, timing of elk migration, and access on the refuge and on surrounding land jurisdictions. The decline in elk and bison use of grasslands and sagebrush shrublands on the northern end of the refuge would also contribute to the decreased likelihood of meeting population objectives for elk and bison and decreased hunter opportunity.

Current monitoring and analysis of elk GPS collar data will provide information and inform management recommendations to adaptively modify elk hunting seasons to better achieve elk population objectives. The adaptive management process to reduce reliance on supplemental feeding is an interagency effort that is currently underway. This process might also result in modifications to the elk and bison hunting seasons that would allow us to meet elk and bison population objectives over the life of the CCP.

Elk harvest on adjacent Hunt Area 80 on national forest land is an important component of meeting herd objectives, and allowing retrieval of harvested elk through the refuge makes hunting in Hunt Area 80 much easier than it otherwise would be, which encourages more hunters to hunt there.

The program for voluntary use of lead-free ammunition, promoted by the refuge and area land management agencies and conservation partners, has resulted in up to a 47-percent reduction in blood-lead levels in ravens. Hunter education and information efforts would continue to promote participation in this program and increase these positive results.

Hunting opportunities for hunters with disabilities and for young people are popular; however, changing elk migration patterns would continue to negatively affect young hunters, often resulting in no available elk on the refuge during their special hunt held early in the season.

Accommodating the annual American Indian ceremonial bison hunt would continue to support tribal cultural tradition and provide access to culturally important historic lands.

Alternatives B and D

Effects would be the same as alternative A. In addition, more opportunities for hunting could create hunter interest, attract more refuge hunters, and increase the pool of nonlocal hunters over time. Opening closed areas on the southern end of the refuge to archery hunting could provide for greater harvest opportunity by denying elk access to safe zones while, at the same time, protecting crucial winter forage. More hunter access points for bison hunters could increase harvest and help achieve herd size objectives, but the extra traffic might not be well received by residents of the Teton Valley Highlands subdivision.

Increased quality of wet meadows, and subsequent higher elk and bison use, would increase hunter opportunity, harvest rates, and the likelihood of meeting the population objectives for elk and bison compared to alternative A. In addition, more grass- and sagebrush-dominated areas would increase elk and bison use of the northern end of the refuge and increase hunter opportunity for a greater likelihood of achieving population objectives for elk and bison compared to alternative A.

Expanded youth-mentoring programs could attract and keep more young hunters and would support programs such as the Department of the Interior's "Connecting Youth with Nature" initiative. Adjusting the hunt season for young people would give young hunters better opportunities for viewing and harvesting elk. However, scheduling this season for the middle of the existing hunting season would

decrease the hunting opportunity for adult hunters and potentially reduce the elk harvest for the season.

We may alienate some nonhunters with the more visible archery harvest in currently closed areas, a bull harvest that includes a trophy value, or the harvest of predatory species such as mountain lion or wolf. In addition, opening the closed areas could negatively affect wildlife-viewing opportunities along Highway 89 and Elk Refuge Road during the hunting season. Disturbance of elk by hunters next to roads and to Jackson would move elk to other areas and limit viewing opportunities.

Regulations on proper storage of bear attractants and bear-deterrent practices could provide a safer environment for refuge hunters, neighboring communities, and bears but could also cause inconvenience and higher costs for hunters.

Gaining information from hunters would help the staff improve management of the hunt program, but collecting data might inconvenience and alienate hunters.

Outreach on the Service's position of allowing hunting on refuges would educate the public on the need and purpose for this recreational activity.

There would be higher equipment costs and more labor and personnel needed to develop and manage the added programs.

Alternative C

Effects would be the same as alternative A. In addition, more opportunities for hunting could create hunter interest, attract more refuge hunters, and increase the pool of nonlocal hunters over time. Opening closed areas on the southern end of the refuge for archery hunting could provide for greater harvest opportunity by denying elk access to safe zones while, at the same time, protecting crucial winter forage. More hunter access points for bison hunters could increase harvest and help achieve herd size objectives, but the extra traffic might not be well received by residents of the Teton Valley Highlands subdivision.

We might alienate some nonhunters with the more visible archery harvest in currently closed areas, a bull harvest that includes a trophy value, or the harvest of predatory species such as mountain lion or wolf. In addition, opening the closed areas could negatively affect wildlife-viewing opportunities along Highway 89 and Elk Refuge Road during the hunting season. Disturbance of elk by hunters next to roads and to Jackson would move elk to other areas and limit viewing opportunities.

Elk and bison use of wetland plant communities and effects on hunter opportunity, harvest level, and populations would be intermediate between alternatives A and B. As the bison herd grew and distribution changed because of hunting practices, bison might be more frequently seen in the southern sections of the refuge.

Lead-free ammunition requirements would protect scavenging birds from being poisoned by lead contained in the elk and bison gut piles and would help to further reduce blood-lead levels in these birds. Hunters would incur higher costs from the more expensive lead-free ammunition, and this requirement might alienate some hunters.

Bear-deterrent regulations and practices could provide a safer environment for refuge hunters, neighboring communities, and bears but could also cause inconvenience and higher costs for hunters.

Gaining information from hunters would help the staff improve management of the hunt program, but collecting data might inconvenience and alienate hunters.

Outreach on the Service's position of allowing hunting on refuges would educate the public on the need and purpose for this recreational activity.

There would be higher equipment costs and more labor and personnel needed to develop and manage the added programs.

Fishing

The effects of each alternative on fishing are described below.

Alternative A

Stream morphology, fisheries habitat, access, and angler opportunity would be similar to current conditions. The fishing program would continue to offer anglers access to quality trout waters while protecting waterfowl nesting areas from human disturbance.

Alternative B

Same effects as alternative A. In addition, fisheries habitat improvement and angler opportunity in Flat Creek would be greater than alternative A in Flat Creek but similar to alternative A in the Gros Ventre River. Failure to devote adequate resources to the refuge fisheries might result in a serious decline in the native Snake River cutthroat trout population.

Offering more fishing opportunities for young people would perpetuate this traditional use of the refuge but would also need more time from staff and partners.

The change to morning access, not the night before, to lower Flat Creek on opening day would be consistent with a refuge regulation allowing access during daylight hours only. However, this would deny a few anglers the opportunity for an early start to fish during predawn hours on opening day.

More people would be able to access Flat Creek to fish by using an accessible platform.

With limits set in the permits for fishing outfitters, the refuge would restrict group size and reduce crowding. Adding use limits to guiding permits and allowing guided trips to access the Gros Ventre River could reduce streamside crowding on lower Flat Creek. The refuge would keep fee revenue from fishing outfitter permits and use it for access maintenance, signing, regulation brochures, and other aspects of the fishing program. Use limits and fees might have a financial impact on permitted fishing outfitters.

The design and installation of fish screens or barriers would require time, effort and money by the Service, WGFD and partners. Continued suppression of the rainbow trout population in the Gros Ventre River would support the native cutthroat trout.

Alternative C

Same effects as alternative B. In addition, because of riparian area improvement, the fisheries habitat quantity and quality and angler opportunity would be the highest among the alternatives in the Gros Ventre River. In Flat Creek, these effects would be similar to alternative A.

Alternative D

Same effects as alternative B. In addition, because of riparian area improvement, the fisheries habitat quality and quantity and angler opportunity would be higher in Flat Creek than alternatives A and C. In the Gros Ventre River, these effects would be similar to alternative A and lower than alternative C.

Wildlife Observation and Photography

The effects of each alternative wildlife observation and photography are described below.

Alternative A

Wildlife viewing is an important activity by both local and nonlocal refuge visitors that would continue to support the mission of the Refuge System. Visitors would continue to have opportunities for wildlife observation and photography at existing trails, observation sites, and the visitor center. Visitors might stay longer at the visitor center and enhance their refuge experience with the easily accessible wildlife-viewing opportunities offered. However, use of the remote-viewing platform is low because visitors are reluctant to cross the lawn or are not aware of the platform. By encouraging visitors to use areas that are already disturbed, such as turnouts, wildlife would be affected less.

Allowing commercial operations, with required safety and wildlife-viewing practices, would provide a service to the public that allows visitors to safely enjoy the refuge and provide a financial benefit to local companies. All traffic on Elk Refuge Road is currently unlimited in regard to the number of vehicles allowed, including the number of commercial tour companies that are allowed to operate on the refuge through a special use permit. Because special use permits have contact information, the refuge staff would be able to contact permittees if they were not following permit stipulations.

Sleigh rides would increase refuge visitation and continue to provide a unique winter wildlife-viewing opportunity that raised awareness of the refuge and received national as well as international attention. Because the refuge does not have the resources to offer sleigh rides, this opportunity would continue to be contracted to local companies, which would help the local economy. Contracted sleigh rides would reduce stress to wintering wildlife, particularly elk, by including stipulations in special use permits that require contractors to follow acceptable viewing practices. The increased visitation would contribute to the local sales tax revenue.

The refuge would continue to receive a percentage of the revenue generated by the sleigh ride operation, which provides money for winter naturalists. This seasonal staff would continue to be the only means to respond to a large number of program requests from schools and other groups. The winter naturalists would also help the refuge in offering a range of programs and events at the visitor center that could not be provided with the refuge's current budget and permanent, visitor services staff.

The public—individuals, organizations, and the media—would have access to refuge photos posted by visitors, photographers, and refuge staff on the Web-based photo-sharing site, reducing staff time to address individual requests. A Web-based photo gallery would be a contemporary way to share images, allowing users to view and download photos. A photo gallery would also help media looking to promote the Jackson area, resulting in benefits to the local economy.

Lori Iverson / FWS

There are opportunities for wildlife observation on the refuge for all age groups.

Alternative B

Same effects as alternative A. In addition, the narrow North Highway 89 Pathway would have pull-offs that would allow visitors to conveniently and safely stop and view wildlife and scenery. Conflicts among visitors, cyclists, runners, or other users would be reduced.

More visitors would be able to observe birds and other animals by using a designated route through the visitor center lawn to the existing remote-viewing platform behind the visitor center. Construction of the path would temporarily affect wetlands and soil in the immediate area and might disturb nesting geese using the lawn in spring and early summer.

Developing a boardwalk through already-disturbed wetlands near the visitor center would increase wildlife-viewing opportunities. The visitor experience would be greatly enhanced by having a longer route that allows people to walk through wetland habitat rather than just viewing it from the platform. In addition to a variety of bird species, deer and moose use the wetlands in the winter. Construction of the boardwalk might temporarily disturb wildlife, and there would be seasonal disturbance of wildlife when people used the boardwalk. There would be a substantial cost for the boardwalk, but this type of project might be appealing to local interest groups and the cost might be offset by partners. The photo blind would increase wildlife photography opportunities; there would be fewer construction effects if the blind were installed during initial construction of the boardwalk. Additional maintenance time would be needed in the winter for snow removal if the boardwalk was open year-round.

Webcams at key sites would reach a wider audience because they would allow viewing experiences for people that are unable to visit the refuge. The installation and maintenance of webcams could have minor soil effects. No information technology support would be available at the refuge for repairs to the equipment or system.

Alternative C

Same effects as alternative A. In addition, increased visitation and the number of people requesting wildlife tours, especially during the winter season when abundant wildlife is visible, could lead to increased traffic and congestion on Elk Refuge Road. This could reduce the quality of the wildlife-viewing experience and cause possible economic impacts to tour operators. Limiting the number of commercial operators could mitigate these issues and reduce wildlife disturbance. Limiting the number of available permits could have negative economic impacts on tour companies not selected to receive special use permits. The demand for commercial tours on the refuge could exceed the capacity of the limited number of permittees. There would be higher law enforcement costs to ensure compliance.

Webcams would reach a wider audience because they allow viewing experiences for people that are unable to visit the refuge. The installation and maintenance of webcams could have minor soil effects. No information technology support would be available at the refuge for repairs to the equipment or system.

A photo gallery on the refuge's Web site would provide a contemporary way to share images, allowing users to view and download photos. Easily accessible photos would reduce staff time to address individual requests. A photo gallery would also help media looking to promote the Jackson area, resulting in benefits to the local economy.

Alternative D

Same effects as alternative B. In addition, increased visitation and the number of people requesting wildlife tours, especially during the winter season when abundant wildlife is visible, could lead to increased traffic and congestion on Elk Refuge Road. This could reduce the quality of the wildlife-viewing experience and cause possible economic impacts to tour operators. Limiting the number of commercial operators could mitigate these issues and reduce wildlife disturbance. Limiting the number of available permits could have negative economic impacts on tour companies not selected to receive special use permits. The demand for commercial tours onto the refuge could exceed the capacity of what the limited number of permittees could provide. There would be higher law enforcement costs to ensure compliance.

Environmental Education and Interpretation

The effects of each alternative on environmental education and interpretation are described below.

Alternative A

By allowing nonmotorized use of the North Highway 89 Pathway, we would increase opportunities for environmental education and interpretation during the season the pathway is open.

By using nongovernmental money to hire seasonal naturalists, the refuge could hire needed staff to provide environmental education for schools and other groups and conduct a wide range of programs and events at the visitor center that we could not provide with our current funding and staff. The nongovernmental hiring process would also help the refuge to quickly fill vacancies, rather than increasing the workload of staff during an extended vacancy that is common with the Government hiring process. However, nongovernmental money would continue to be based on bookstore sales and sleigh ride proceeds, which are unpredictable from year to year. Many factors can negatively affect the amount of revenue generated annually such as the national economy, a Government shutdown, a natural disaster, and equipment failure. Therefore, the refuge staff could not do any long-term planning for environmental education or interpretive programs because there would not be a reliable estimate for nongovernmental money that might be available. Seasonal positions through a nongovernment funding source are less desirable than Government seasonal positions because the employees do not get benefits or contribute toward years of service if the employee is seeking eventual permanent status with the Federal Government.

Using a volunteer workforce to meet the demand for environmental education and interpretive programs during the school year would not be a reliable and stable staff source. Jackson has a relatively small population and is located in an isolated area, so it would be difficult to recruit volunteers from local communities. Many of the refuge volunteers provide their own housing in the form of recreational vehicles, motor homes, or other mobile residences. Because of the snow and cold temperatures common during Jackson's long winters, this type of living situation would not be practical. The refuge has limited housing to offer to residential volunteers, and the high cost of living and rental market shortages in the Jackson area preclude most from finding or paying for offsite housing. Furthermore, trends at the refuge show that volunteers working in unpaid positions are more likely to leave their positions because of unplanned situations, family matters, heath issues, unexpected weather, or other changes. Requests for educational field trips in the spring may not be accommodated because volunteers are not available until later in the season.

The refuge relies solely on a volunteer staff to staff the information desk at the interagency visitor center. When volunteers were available beyond the minimum needed to staff the desk, volunteers would also provide formal and interpretive programs. However, because of the turnover in volunteers, the number of volunteers needed to cover basic operations, and the variety of work shifts and days off, the refuge would not be able to provide training to develop the skills of these volunteers.

Service money to cover costs for a volunteer program has been reduced and, in 2011–2014, eliminated. The refuge's base funding has had to cover the expenses for items and services such as uniforms, utilities, phone and Internet service, laundry facilities, and recognition items to run the volunteer program. Because of the large number of volunteers needed to provide basic services, the current volunteer program may not be sustainable if money becomes even more limited, meaning a reduction or elimination of services and programming.

Contracted sleigh rides would provide unique learning opportunities while reducing stress to wintering wildlife, particularly elk.

Alternatives B and D

Using the North Highway 89 Pathway for interpretation would increase opportunities to interpret wetland values in an already disturbed area.

A self-guided interpretive tour route would provide more interpretive opportunities to increase public knowledge and awareness of the refuge purposes and the Refuge System mission. This would also provide another free opportunity for visitors to the refuge. Commercial sleigh rides require a fee. Refuge staff would need time to develop and maintain the route as well as needing money for interpretive materials such as signs or brochures or both. An interpretive route might increase traffic on Elk Refuge Road and create conflicts with hunters or other users.

The winter opportunities already attract a substantial number of visitors to Elk Refuge Road, which has created the need to enhance road and traffic safety and education and interpretation programs. Brochures associated with numbered turnouts or interpretive panels (some equipped with spotting scopes) would attract visitors to the turnouts, minimizing the number of vehicles parked in the roadway. This scenario would create an opportunity to educate the public about wintering wildlife, the National Elk Refuge, and our agency.

Replacing a longer length video with shorter video segments on various topics would respond to visitors' needs and preferences as well as allow the refuge staff to update segments with substantially less cost and staff time. Shorter segments stored on the refuge's Web site would let viewers to watch them at a more convenient time, thus increasing viewership. Replacing the video would help us to emphasize the role of refuges versus national parks and national forests and differentiate our agency missions. The refuge would continue to offer visitors to the Jackson Hole and Greater Yellowstone Visitor Center a wide range of information and services, but many visitors do not sit in the theater to watch an entire film. While a well-produced video could be an effective and popular outreach tool, it would be an expensive and labor-intensive project. An updated video could enhance the information in the visitor center. However, the visitor center only has a small theater in which to show a longer length film, and seating and acoustics are inadequate. Because traditional-length videos take a substantial amount of time to produce, they are not easily updated to reflect changes in management practices, wildlife species or numbers, or new issues or developments. Furthermore, longer videos are not the prevalent method for people to get information, as this is a somewhat outdated approach. Studies clearly indicate that people now prefer shorter video, film, smart phone, and tablet applications that they can view at their convenience or docking stations to download needed information such as for self-guided tours.

Environmental education and interpretive programs could include the following:

- Promoting understanding of invasive species control and prescribed fire as a management tool.
- Increasing public education about migratory bird use of the refuge and reasons for closing areas during bird breeding.
- Offering improved programs at the visitor center, Miller House, and offsite areas with more permanent or seasonal interpreters.
- Emphasizing the role of national wildlife refuges versus national parks and national forests and differentiating our agency missions.
- Discussing the complexities of management on the refuge, including describing the supplemental feeding program and the goals of the Bison and Elk Management Plan.

A reliable source of money to hire permanent and seasonal interpreters could attract people trained and experienced in the fields of environmental education and interpretation to improve the quality of the programs. People looking for or developing permanent careers with the Federal Government are more apt to apply for Government positions than nongovernmental positions that do not offer grade increases, benefits, and insurance. This would increase the applicant pool and help us mentor and develop future career employees in our agency.

Alternative C

Same effects as alternative B. In addition, disturbance would be limited to areas that include nonnative vegetation.

Jackson Hole and Greater Yellowstone Visitor Center

The effects of each alternative on the visitor center are described below.

Alternative A

The refuge would be unable to provide educational and interpretive programs along with the tasks of keeping the visitor center open. The daily demands on the visitor center would continue to grow as (1) new visitation records were set during both winter and summer, (2) the visitation season was

extended through local aggressive marketing efforts by the tourism industry, and (3) the building ages. Peak visitation would reach 3.6 visitors per minute during the summer season, intensifying the operational workload of the visitor center manager and leaving no time for planning and scheduling environmental education programs, guest speakers, special events, or interpretive programs.

If no money was received from visitor center partners for operational expenses and routine supplies, the refuge might need to reduce hours or look at alternative ways to offset costs, such as a single-agency facility. Reducing the hours would decrease services for the visiting public. This could have financial impacts on the local economy. A 2010 survey noted that out of 100 people who stopped at four Wyoming visitor centers, one-quarter, or 26 people, stayed longer and stayed at least 1 additional day in Wyoming. Although the visitor center was not one of the centers in the survey, the statistics show the effect a visitor center operation can have on the local economy. Reduced visitor center hours might also decrease revenue from sales at the Grand Teton Association's retail outlet. Because the refuge would receive a portion of the sales revenue, decreased visitor center hours would also decrease the amount of money we could receive, which is an important source of money for seasonal staff and other support for educational, interpretive, and research programs.

Alternatives B, C, and D

Sharing the financial burden among the agencies for operating the center and purchasing supplies would make it more equitable than having the refuge cover all or most of the annual costs. Partners would continue to gain substantial financial benefit from helping staff the interagency center and using it as their primary visitor services contact location, rather than providing and staffing their own centers.

A new or renovated visitor center would address the current building's safety and maintenance issues and accessibility deficiencies and lack of space adequate for requested programs. Furthermore, a new visitor center would enhance the flow of visitors as they came into the center, distinguishing between the types of services and agency-specific information available at the facility and increasing staff efficiency. It could be designed to meet accessibility standards that are deficient in the current facility.

North Highway 89 Pathway

The effects of each alternative for the North Highway 89 Pathway are described below.

Alternative A

By allowing nonmotorized and pedestrian use and connecting to other pathways, the public would have more opportunity for wildlife observation, photography, environmental education, and interpretation. The pathway would also encourage a safe transportation option for workers and visitors to and from the town of Jackson to Grand Teton National Park and provide a connection to other pathways and cycling routes for most of the biking season.

The seasonal closure (November 1–April 30) would continue to protect elk migration corridors and prevent disturbance to wintering elk and other wildlife. Prohibiting pets would limit disturbance to wildlife, particularly nesting waterfowl and other wildlife that use the area between the fence and Highway 89. The pet prohibition would also reduce the accumulation of fecal matter from pet owners that do not clean up after their animals.

The refuge would need substantial staff time to coordinate regulation enforcement by Teton County and to conduct public outreach on our mission and how it differs from the mission of the surrounding National Park Service and USDA Forest Service.

Alternatives B, C, and D

Same effects as alternative A. In addition, people would have more opportunity for interpretive experiences, and the refuge would be better able to promote our agency mission. Refuge staff would get data about wildlife movement across the pathway that would help us to adjust public use, if needed, to protect wildlife and keep people safe. There would be more staff time needed and higher costs for associated facilities and signage. Increased use of the pathway could adversely affect the success of trumpeter swan nests.

To effectively manage the pathway, we would address the following situations:

- Because the pathway is narrow, it might be difficult for cyclists, runners, or other users to safely pass visitors that are focused on wildlife- and habitat-viewing. This is common on other parts of the Jackson Hole Community Pathways when users are distracted by talking, using cell phones, or engaging in other activities that detract them from being conscious of their position on the pathway or limits their reaction time to oncoming users. It might cost us more to add needed signage and facilities for safety and interpretation.

- The refuge, in coordination with Teton County, could adjust the dates for the seasonal closure (increase the number of weeks the pathway is open) if data collected by either the refuge or the county provided solid justification for a change. Use must remain compatible with the purposes of the refuge and the "wildlife first" mission of the Refuge System.

North Park

The effects of each alternative for North Park are described below.

Alternative A

The current fee collection and reservation system used by the Teton County Parks and Recreation Department for reserving the site is not in compliance with Service policy. Weddings, family reunions, and other non-wildlife-dependent events would continue to be common at North Park. Depending on the size of the party, a wedding at North Park or the visitor center could reduce or eliminate parking spaces for visitors using the center to learn about the area and get visitor service information. The wedding prohibition would be a largely unenforceable situation.

Alternative B

Revising the memorandum of understanding with the town of Jackson for North Park to exclude activities such as weddings and reserving picnicking sites through a fee-based system would comply with our agency's policies. There potentially could be negative public relations about the new restrictions. Jackson might be affected by having one less picnic shelter within the town limits that can be rented and reserved. However, Jackson has many designated picnic sites and public parks available through a fee-based reservation system, including some close to North Park, for these activities.

Weddings, family reunions, and other non-wildlife-dependent events would continue to be common at North Park. Depending on the size of the party, a wedding at North Park or the visitor center could reduce or eliminate parking spaces for visitors using the center to learn about the area and get visitor service information. The wedding prohibition would be a largely unenforceable situation.

Alternatives C and D

Same effects as alternative B. In addition, by converting North Park to native habitat, the refuge could add to the visitor experience by providing a more natural setting, rather than a manicured lawn, along with interpretation. The refuge would incur costs to restore the park and maintain the area. Most breeding birds, except Canada geese, would benefit from the increased habitat value.

Special Uses

The effects of each alternative on special uses are described below.

FWS

The visitor center hosts exhibits and allows staff to offer interpretation.

Alternative A

Additional activities that the refuge could not provide because of lack of funding and staff follow: guided hunting and fishing, hunting retrieval services, wildlife-viewing tours, commercial photography and videography, and research. However, commercial services could provide some of these activities. These activities promote wildlife-dependent recreation and increase outreach about the refuge. Guides offer services that might bring visitors, who would not otherwise engage in the activity without assistance, to the refuge. The refuge would continue to accommodate commercial photographers and film companies, depending on the potential effects and staff available at the time of filming.

We might approve certain special requests, such as accompanying staff during management operations on a very limited basis that takes into account equal treatment of requestors, setting precedents, safety, and the availability and priorities of our staff.

Special permit conditions would reduce effects on resources and other activities. In many cases, we would require permittees to report their use at the end of the permit period, documenting the number of clients and trips onto the refuge. Staff would spend a substantial amount of time on contacting the permittee, writing the special conditions, completing the permit, recording the information in a register, monitoring the permitted use, filing the use reports, and compiling annual use results. In the case of commercial filming, staff would spend more time making logistical arrangements and accompanying the film crew.

The refuge would deny requests for holding weddings at Miller House.

Commercial, non-wildlife-dependent horseback trail rides along a 1-mile segment of the Gros Ventre River would continue as long as staff was available manage the use. This effort would divert limited staff resources away from critical refuge programs. More commercial horseback trail riding would be prohibited, which would prevent the diversion of additional staff time to this activity.

Alternative B

Same effects as alternative A. In addition, the fees charged for special use permits for commercial activities would help cover some of the associated administration and enforcement. Companies who violate refuge regulations or permit conditions could have their permits revoked by refuge management or be assessed fees.

The use of wildlife-viewing tours to provide interpretation to visitors could increase public understanding of refuge resources and management.

By restricting weddings on all refuge land, we would help reduce disturbance to visitors using the refuge for wildlife-dependent activities, as well as comply with our agency policy. There might be some negative public relations related to restricting weddings.

Phasing out commercial horseback trail riding would reduce the risk of new invasive plant infestations and allow staff time devoted to managing this activity to be used on higher priority programs.

Alternatives C and D

Same effects as alternative B. In addition, limiting the number of commercial operators could help mitigate traffic congestion and reduce wildlife disturbance on Elk Refuge Road. On the other hand, fewer tours could reduce the quality of the wildlife-viewing experience and might not meet public demand. There might be negative economic impacts to the tour companies not selected to receive a special use permit.

General Access and Elk Refuge Road

The effects of each alternative on general access to refuge lands are described below.

Alternative A

By keeping open Elk Refuge Road, Flat Creek Road, and Curtis Canyon Road, visitors would be able to see more of the refuge. For winter wildlife viewing, visitors would have opportunities along the 3.5 miles of Elk Refuge Road that we would keep open.

Alternatives B, C, and D

Same as alternative A. In addition, the refuge would consider adding more access and designated parking lots for hunters. This could include access on the northern end of the refuge for bison hunters and access on the western boundary of the refuge for archery hunters.

Access to the National Forest

The effects of each alternative access to the Bridger-Teton National Forest are described below.

Alternative A

By providing access to national forest lands at designated locations, the refuge would exhibit good cooperation between the two Federal agencies and extend a convenience to national forest users. Closure of the "jump cliff" access to the national forest would decrease use in this area. Limiting access to designated locations would reduce disturbance to wildlife and habitat, reduce trespass onto the refuge, and provide an opportunity for public outreach on our agency's mission and how it differs from that of the USDA Forest Service, where more recreational opportunities exist. There would be some disturbance to wildlife, mainly elk, from people passing through the refuge.

The refuge has allowed people to park overnight on Elk Refuge Road one night each year; these are people interested in accessing national forest lands as soon as the winter closure is lifted on May 1 to look for antlers and has involved hundreds of cars. The resulting congestion would continue to reduce access by other road users, interfere with egress and ingress for residents of the Twin Creek subdivision, and impair access by emergency vehicles responding to private property owners. There would also continue to be some impacts to the areas next to the roadway from foot traffic and horses. The refuge would continue to have substantial costs (up to $30,000 annually) to provide more law enforcement.

Because the travel distance across the refuge for winter users of the Goodwin Lake Ski Cabin (on national forest land) is several hundred yards and the designated route is next to a fence, only minor wildlife disturbance would occur. Refuge staff would administer the permits for access to the cabin, which is off refuge land. Staff duties and costs would increase in late April to manage the May 1 event.

Alternatives B, C, and D

Same effects as alternative A. In addition, signing for an egress route would decrease trespass on private land in the Twin Creek subdivision. Since skiers would predominantly recreate on national forest lands, moving special use permit administration to the national forest would shift the workload to the agency that is most involved.

Prohibiting overnight parking and staging on April 30 would reduce congestion and effects on other road users, local residents, and emergency and service vehicles. Effects on the areas next to the roadway would be reduced because of less use by pedestrians and stock, mainly horses. There would be substantial savings for expenses previously related to the event (up to $30,000 annually) that could be used for priority refuge management. The prohibition of overnight camping and staging on Elk Refuge Road could create other law enforcement issues, such as increased poaching and illegal access. The local economy might see increased revenue from lodging and dining if people were not allowed to spend the night on the refuge camped in vehicles and trailers. However, these "campers" instead might choose to stage their vehicles in the streets and parking lots of Jackson, resulting in complaints from the local police department and residents. In addition, with a later refuge gate opening time than at other access points to the national forest, refuge staff might be able to reduce or eliminate people interested in staging on Elk Refuge Road. Users that learned other accesses onto the national forest would be opening before the refuge access might be discouraged from using Elk Refuge Road, knowing other antler collectors would be reaching the same destinations sooner.

Public Outreach

The effects of each alternative for public outreach are described below.

Alternative A

Sending out news releases and refuge articles, maintaining the refuge Web site, and using social media would keep a wide variety of audiences current on visitor opportunities and management activities and would serve both internal and external audiences. Maintaining an email contact list to distribute refuge information would help the refuge to reach a wide and diverse audience.

Working with the media would increase the presence of the refuge and its attraction as a destination site, but is an activity that requires a large amount of staff time because the refuge receives so much regional and national coverage.

More hunt program outreach would help refuge users and critics understand both the wildlife management and the priority recreational use aspects of hunting on a national wildlife refuge.

The staff's educational outreach to anglers would increase harvest of nonnative species and supplement our efforts to suppress populations of the nonnative rainbow trout, brown trout, and brook trout.

The amount of indepth outreach information would be limited because of limited staff and the reliance on seasonal naturalists and volunteers. With high turnover in the seasonals and volunteers, staff would be constantly training new people who would lack the institutional knowledge that comes with long-term employees.

FWS

Public meetings are a good form of outreach.

Alternatives B and D

Same effects as alternative A. In addition, by using more electronic media, the refuge would reach a greater number and diversity of people. Unlike Web sites, new media sites are an outreach tool that requires a designated person that can regularly post updates, add to previous information, check the sites and public responses, and respond to questions and comments on a regular basis. The size of the visitor services staff in relation to the workload would dictate the level of electronic media used.

The staff outreach about migratory birds would increase public understanding of our habitat management to help these birds. Likewise, outreach about the comprehensive wildlife disease plan would increase public understanding of our habitat management as it relates to dispersion of elk and bison herds to reduce the risk of disease.

Alternative C

Same effects as alternative B. In addition, the public would have more understanding of the role of the refuge in the Greater Yellowstone Ecosystem.

Cost and staff time associated with outreach related to migratory birds would be higher than alternative A but less than alternative B.

5.12 Safety Effects

The effects of each alternative for visitor and employee safety are described below.

Alternative A

Visitors would have safe conditions when using the refuge, and employees would have safe working conditions. By reducing workplace hazards and focusing on safe work practices, the refuge would have a secure workforce and substantial financial savings.

Alternatives B, C, and D

Same effects as alternative A. In addition, to keep pace with the hunting program, more law enforcement presence during hunting season would increase enforcement of refuge regulations emphasizing safe practices. Continued efforts by WGFD and the refuge would keep a good safety record in the refuge hunt program. Hunters observed by law enforcement committing safety violations could have their refuge hunting permits revoked. This could improve hunt area safety by removing unsafe hunters from the refuge. Failure to check and improve safe hunting practices might result in more hunting-related accidents. More staff would increase costs

5.13 Resource Protection Effects

The effects of each alternative for resource protection are described below.

Alternative A

The current suboptimal law enforcement presence would prevent most major wildlife resource violations. Limited patrol activities would continue to miss significant violations such as those that occurred in backcountry areas during hunting season, fishing violations, trespass, theft of shed antlers, and illegal road and parking use that occurred during night hours and was associated with public use activities on the adjoining Bridger-Teton National Forest. Failure to supply an increased law enforcement presence might result in the degradation or loss of refuge resources.

Since hunter densities and animal harvest are concentrated near roads and parking areas, covering these activities would consume the law enforcement staff to the exclusion of having a presence on the refuge boundary or in backcountry hunt areas. Consequently, few hunters would be checked away from roadways, and several hunting violations would remain unresolved each season.

Alternative B

As visitor services were expanded, the ability to protect refuge resources would decline. However, more law enforcement staff and equipment would help us deter refuge trespass and theft of shed elk antlers and other wildlife parts. Increased patrol activity involving staff and equipment would have a higher cost. More staff could increase data gathered about hunter and angler use, which could be used to guide future management.

Alternatives C and D

Same effects as alternative B. In addition, land exchanges between the refuge and adjacent Federal agencies could be used to simplify (straighten) the refuge boundaries. Hunters would benefit from a simplified refuge boundary because they are required to comply with refuge-specific regulations within the refuge boundary. Land exchanges would be an expensive and time-consuming process for our agency realty divisions and would not result in a net increase in protected acres. There would be a change in mandate for those acres, from multiple use or wilderness on national forest lands, to a wildlife-first mandate as U.S. Fish and Wildlife Service lands. A simplified boundary might increase compliance with regulations and have a corresponding decreased need for law enforcement.

5.14 Administration Effects

This section discusses the effects of alternatives pertaining to funding, staff, and facilities and real property assets.

Funding and Staff

The effects of each alternative for funding and staff are described below.

Alternative A

Low base funding and lack of staff has limited management on some units and reduced emphasis for some programs. Current funding and staff levels (10.5 FTEs) would continue to be insufficient to conduct programs and achieve the refuge goals. A staff of 10.5 FTEs is 42-percent lower than the 18 FTEs recommended for the refuge during a nationwide (adjusted by region) minimum staffing exercise completed for the Refuge System in 2008 (FWS 2008). The workload and complexity of refuge programs has continued to increase since that time.

Today, the refuge can only achieve its critical work through the additional money from private organizations and the efforts of one of the region's largest volunteer programs. A reduction in private money would prevent the refuge from successfully conducting its programs and substantially reduce the service and benefits the refuge provides to the public and wildlife populations.

Private money could enable the refuge to hire approximately 4.8 FTE positions, and volunteers would continue to contribute approximately 9.3 FTEs of assistance each year. There would continue to be high turnover in these positions, resulting in staff with limited experience, which would require more training and oversight of workers and volunteers. This would make a higher supervisory workload for the permanent staff and would reduce their ability to address other refuge priorities. Volunteers are limited in the type of work they can do because of Service policies for use of Government computers. Volunteers are often not hired far enough in advance to get the credentials needed for Government computer use during their scheduled season. Because of the high turnover in volunteers, staff would need to continually get credentials for volunteers that may not assist the refuge for an extended period of time.

Reliance on partnerships that provide nongovernmental money would continue to be an excellent way of involving private citizens in supporting the management of the refuge. The refuge relies on money received from the Grand Teton Association and the Jackson District Boy Scouts to accomplish programs:

- Financial support from the Grand Teton Association would continue to enable the hiring of three temporary winter naturalists from November through March (1.5 FTEs). These naturalists would provide winter interpretive programs during a key period when herds of elk and bison are on the refuge. Without this money, the refuge would eliminate popular and requested environmental education and interpretive programs, substantially reducing the positive effect these programs have on public understanding of the refuge mission.

- A minimum of 2.6 FTE temporary employees would continue to be hired to operate the irrigation system using money from the Boy Scouts of American Elk Antler Auction. Use of irrigation to increase winter forage and reduce the need for supplemental feed-

ing is a primary strategy in the management of elk and bison. If this money were not available, the acres irrigated would be severely limited, substantially reducing the amount of natural winter forage available for elk and bison. Reduction in forage would increase the seasonal length of the supplemental feeding program, increase the cost for alfalfa pellets, and put elk and bison at greater risk of disease transmission because of longer periods of concentration.

Seasonal law enforcement officers would continue to be critical to safely and successfully conducting the refuge hunting programs. These officers would continue to be funded each year from the annual sales of "America the Beautiful—National Parks and Federal Recreational Lands Passes," also called Interagency Passes. This is an unreliable source of money for a critical refuge program. If money for seasonal law enforcement officers was unavailable, the hunting program might need to be scaled back for public safety reasons. This would likely reduce the harvest of elk and bison and have an adverse effect on refuge efforts to achieve a balance between habitat and herd sizes and meet the objectives in the Bison and Elk Management Plan.

The integrity of long-term, biological monitoring programs would require annual consistency. If money for staff was unavailable or volunteers were unable to collect specific biological data, the value of the long-term monitoring efforts could be severely reduced. This could negatively affect our ability to make reliable management decisions based on sound science.

Alternative B

Increased base funding would enable the refuge to add 14 FTE positions, which would have the following benefits:

- The combination of adding a permanent biological technician to collect field survey information and the addition of a permanent rangeland specialist would substantially enhance the refuge's ability to manage refuge lands for the greatest benefit to the elk and bison herds. These positions would also lead to improved management of native plant communities for the highest diversity, which would benefit other wildlife species. Establishing native plant plots would provide a long-term source of desirable seed for management purposes.

- The addition of permanent seasonal irrigators would reduce training, orientation time, and the need for annual utility vehicle certification. By using primarily trained and experienced irrigators, the efficiency of the program would improve and ultimately increase the amount of forage produced. This would have a positive effect on reducing the need for supplemental feeding and the potential for disease transmission, which would make a positive contribution toward the refuge goal of managing for healthy herds.

- The addition of a permanent law enforcement officer would help enforce regulations across the refuge, respond to public safety incidents promptly, and improve wildlife protection during the hunting season.

- An environmental education specialist would dramatically improve the amount of educational programming offered to the public. Currently, the visitor center manager works primarily on the interagency coordination of the facility, visitor center supplies and expenses, license sales, facilities maintenance, scheduling, and extensive volunteer recruitment coordination. This leaves little time for educational programming including interpretation, environmental education, special events, and family activities. An environmental education specialist would increase the number of public activities; promote high priority, wildlife-dependent activities such as wildlife observation, photography, environmental education, and interpretation; and help coordinate volunteers. Permanent seasonal staff for the visitor center desk would provide consistent and reliable service to nearly 300,000 visitors annually and reduce the staff workload of training short-term volunteers and temporary employees. The addition of this staff would reduce the current workload demand on the visitor center manager.

- The reestablishment of three permanent seasonal winter naturalists would enable the refuge to regularly provide interpretative presentations on a variety of topics specific to the Service mission. In addition to elk biology and management, these presentations could emphasize the mission of the National Wildlife Refuge System, the refuge, and other refuge wildlife.

Private funding would be subject to the annual success of fundraising efforts primarily by the Grand Teton Association and the Jackson District Boy Scouts. The refuge would use this money to enhance refuge management and conduct volunteer programs. However, there would be no guarantee on the availability of this money.

Alternatives C and D

Same effects as alternative B. In addition, an environmental education specialist would elevate the quality and quantity of environmental education and interpretive programs. Through this specialist's focused efforts, the public, especially students, would better understand ecosystem functions in the Greater Yellowstone Ecosystem and the changes that threaten the integrity of this area.

The addition of three seasonal naturalists would enable the refuge to increase the number of programs provided to the public when demand for programs is high. These programs could broaden the public's understanding of the mission of the Refuge System and the refuge by focusing programs on wildlife species other than elk and bison.

With the work of added visitor services staff, the refuge staff could improve basic programming outreach, and the public would gain a better appreciation and understanding of wildlife and the natural resources that support them. This would build public support for the agencies that protect and manage natural resources such as our agency, the National Park Service, and the USDA Forest Service.

Facilities

The effects of each alternative for facilities and infrastructure are described below.

Alternative A

The refuge has two primary visitor services facilities, the Jackson Hole and Greater Yellowstone Visitor Center and the Miller House. The continued maintenance and use of these facilities would be vital in achieving the environmental education and interpretation aspects of the visitor services goal.

The refuge was established in 1912 and is one of the oldest national wildlife refuges in the Refuge System. The continued maintenance and use of refuge buildings that are more than 50 years old (and qualify for protection under the National Historic Preservation Act) would preserve their historic value and would help us achieve the spirit of the act while providing the public with a connection to refuge history.

The option for refuge staff to rent Government (refuge) housing would have several benefits:

- The high cost of both permanent and temporary housing is a significant impediment to recruiting and retaining staff to work at the refuge. Renting a refuge house would provide a reasonably affordable alternative to purchasing a home in the Jackson area, though Jackson has experienced severe rental shortages. This housing would also be slightly more affordable than area rentals and would locate the employee near the refuge, thus eliminating the need for a long and difficult commute from other communities. Providing the option of renting a refuge house has been vitally important in recruiting highly qualified staff, especially at times when there is a strong housing market. Even with this option, it is common for candidates who are considering filling a staff vacancy to decline the position because of the high cost of housing (Government housing, private rental, and home purchase).

- Wildlife observations by staff after normal work hours could provide valuable information about wildlife use of habitat, movements, and wildlife interactions. Refuge houses located at various places on the refuge could provide these after-hour wildlife observations, and this information could be especially helpful in conducting the supplemental feeding program.

- Key refuge staff such as equipment operators would continue to be located in houses that are near the refuge's heavy equipment. Operators could quickly access their heavy equipment to keep hunter parking lots accessible and conduct the supplemental feeding program, even during winter storms.

- Security for resources would be enhanced by providing staff housing at various refuge locations. Refuge facilities and equipment would less likely be vandalized or burglarized if located near an occupied refuge house. Public actions that violate refuge regulations such as trespass or wildlife harassment could be observed by refuge employees from their houses and reported to the county sheriff or the refuge law enforcement officer.

- Staff that live in refuge housing would provide an economic benefit to the town of Jackson. These employees would buy many of their daily living items such as groceries, vehicle fuel, and entertainment in Jackson, thus supporting the local economy.

Attracting bears to refuge houses could result in damage to personal or refuge property. Lack of regulations to prevent bear habituation and food conditioning, in which bears learn to associate humans with easily available food sources, could result in the destruction of bears, which would be inconsistent with the purpose of the Refuge System.

Alternatives B, C, and D

Same effects as alternative A. In addition, more refuge housing for permanent and seasonal refuge staff would help us to effectively recruit highly qualified candidates for staff vacancies, especially for lower graded positions. Three to four (up to five) new family houses would reduce the amount of open space on the refuge headquarters campus and could be perceived as negative by some surrounding residents. Dog owners from the local community who have illegally allowed their pets to roam on the refuge campus might also complain.

Refuge regulations for refuge houses and volunteers' recreational vehicle sites could prevent bears from becoming habituated and seeking out humans to obtain food rewards, resulting in safe living conditions and limited need to relocate bears.

The relocation of the Calkins House would allow the refuge to expand the zone where hunters could use high-powered rifles for hunting elk and bison. This might lead to a minor improvement in harvest, which would help the refuge to achieve herd size objectives. Removing the house would create a minor visual improvement in the viewshed for some hunters and the public when they travel through the refuge to access the Bridger-Teton National Forest. Another acre (plus driveway) of habitat would be available to produce winter forage, which would have a negligible positive effect on wintering elk and bison. Relocation of the Calkins House would eliminate (1) the benefit of obtaining after-hours wildlife observations from the refuge employee living there, and (2) that employee's opportunity to observe and report violations.

Elk Refuge Road

The effects of each alternative for Elk Refuge Road are described below.

Alternative A

Elk Refuge Road provides safe, reasonable, uninterrupted access (ingress and egress) for our agency staff, the public, and private landowners year-round.

Increases in visitation and traffic during either the summer or winter seasons could increase the potential for more traffic-related incidents. Refuge staff has noted increased congestion during both seasons, which impacts refuge vehicles and equipment, general traffic on the road, pedestrians, private adjacent landowners, and service and utility vehicles such as delivery trucks, propane trucks, gas and electrical service vehicles, and phone service vehicles. There could be increased traffic and congestion on the road from increasing numbers of permitted commercial tours, especially during the winter when abundant wildlife is visible. This could reduce the quality of the wildlife-viewing experience and cause possible economic impacts to tour operators. In addition, an increase in the use of Elk Refuge Road could cause moderate impacts by increasing the spread of invasive species such as perennial pepper plant and spotted knapweed from vehicles, especially during the summer season.

Refuge managers anticipate a time when the summer and fall months might include an increased use of the refuge by grizzly bears, which might draw more visitors and photographers to use Elk Refuge Road. Leaving only the first 3.5 miles of Elk Refuge Road open from December 1 through April 30 and restricting all traffic beyond that point would offer critical protection to wintering animals during a time of year when minimizing encounters with humans is key to their survival. However, despite this closure, there would still be outstanding, wildlife-viewing opportunities for the public on the open stretch of road during the winter months. Enforcing a no-stopping regulation to prevent the obstruction to other vehicular traffic along the road would improve safety along the road. The regulation prohibiting stopping or parking on the roadway would prevent the creation of unwanted parking areas and associated disturbance to vegetation. The refuge is located within the Greater Yellowstone Ecosystem, which includes two nearby heavily visited national parks where frequent stopping in the road to take photographs or view wildlife is common. Many of those same visitors come to Elk Refuge Road, bringing with them the same habits and viewing practices they exhibited in those areas during their same vacation stay. The current capacity in the turnouts might not be adequate to accommodate all the visitors. The county road easement would continue to be treated for dust abatement during summer months using magnesium chloride

(salt)-treated water, which is an attractant to bighorn sheep.

Plowed turnouts in the winter would give wildlife viewers an alternative to stopping in the road to photograph or view wildlife. Depending on the location of the bighorn sheep, the turnouts might not be in the best viewing locations and thus not used by wildlife viewers. While this would let the public closely view bighorn sheep, it could lead to increased vehicle–wildlife collisions. The bighorn sheep would become acclimated to vehicles using the road, but there would be potential for human–wildlife conflicts if wildlife viewers approached too closely on foot. Bighorn sheep close to the road could increase the potential for disease transmission to livestock or vice versa or lead to the spread of disease among the bighorn sheep herd itself.

Opening parts of Elk Refuge Road would allow the public seasonal access to national forest lands on foot or by vehicle and shows good cooperation between the two Federal agencies. Because the number of foot trails to the national forest boundary is limited, disturbance to soils and vegetation would be minimal. Trailhead parking could spill over onto Elk Refuge Road during times of peak use, especially during hunting season. This would occur infrequently enough that it would have only a minor effect. However, allowing spillover parking onto Elk Refuge Road by hunters might conflict with future management decisions to be stricter on enforcing a regulation of no parking on the road. It could also lead to the public perception that hunters have special privileges on the Elk Refuge Road over other user groups, which could lead to conflicts between wildlife observers and hunters.

Ann Hough / FWS

Roads on the refuge are used by staff and visitors alike..

Alternatives B and D

Same effects as alternative A. In addition, the regulation prohibiting stopping or parking on the roadway would prevent the random creation of unwanted parking areas and associated disturbance to vegetation. Increased signing could lead to better compliance with these regulations and improve safety for a variety of road users; however, increased signage does not always result in better compliance. More signs would detract from the aesthetics of the scenic, rural setting and would have installation and maintenance costs. Depending on the location of the signs, the signs could interfere with snowplowing operations. A roadside parking ban that would prohibit hunter retrieval of harvested game would not be desired by the refuge or by refuge hunters because it would greatly increase the amount of time to haul the animal out and could lead to spoilage of meat.

Visitors would learn about refuge wildlife and management issues by traveling the interpretive auto tour route. It would take substantial staff time initially to develop the auto tour route along with money for signs and printed material. We would update and reprint the brochure to include current information. Adding this interpretive experience could increase the amount of traffic on Elk Refuge Road, resulting in the effects discussed in alternative A. There would be higher costs and more staff time to develop and maintain the route.

Increased visitation for wildlife viewing would elevate the potential for accidents between vehicles, pedestrians, and wildlife. Widening strategically located segments of Elk Refuge Road would improve the line-of-sight for vehicles and reduce the possibility of accidents involving vehicles. Minor habitat loss at these sites would cause temporary disturbance of vegetation but would not adversely affect long-term wildlife populations.

Improving and increasing the number of turnouts on Elk Refuge Road and strategically placing them in areas commonly used by wildlife might encourage more visitors to use the turnouts than to stop in the road and create traffic hazards. This would enhance the public's visit by providing a safer experience on the road as well as improving wildlife-viewing opportunities. Directing wildlife watchers into maintained parking areas would reduce the number of instances

when their vehicles became stuck in the roadside ditch during winter months. However, increasing the number of turnouts or widening the road would create habitat loss. It would also add to the risk of new infestations from invasive species because of soil disturbance and the importation of fill material.

Observation scopes at turnouts would provide better opportunities for viewing wildlife close up and could encourage wildlife viewers to safely park and exit their vehicle to use the equipment. Scopes could make turnouts attractive destinations for refuge visitors, reducing the number of vehicles stopped or parked in the roadway. Scope could provide accessible wildlife-viewing opportunities. Physical and biological effects to the area where the scopes were placed would be minimal. The refuge would incur costs to maintain and replace the scopes, which could also be susceptible to vandalism or theft. The scopes could impede snowplowing operations to clear out the turnouts, and they could result in vehicle or equipment damage if struck by cars during times of limited visibility or icy road conditions. Reducing dust abatement on Elk Refuge Road would decrease the attractiveness of the road to bighorn sheep, which would reduce potential conflicts with humans and reduce the likelihood of disease transmission in the herd and with domestic livestock. The dust during the summer months could negatively affect pedestrian and bicycle users on the road. Reduced dust abatement treatments would continue to attract bighorn sheep to the road during fall and winter months because road water runoff promotes tall, dense, green grasses even during the fall and winter.

Increased maintenance in the winter would improve safety on the road and decrease the potential for incidents such as slide offs, multivehicle collisions, vehicle–wildlife collisions, vehicle–pedestrian collisions, or getting stuck in snowbanks or ditches. Increased road maintenance would take more staff time and increase long-term costs. With only one law enforcement officer on staff to enforce current regulations and make contacts with traffic offenders, the refuge would need money for more law enforcement support or to increase the amount of time the current officer could spend on enforcement of refuge road regulations.

Alternative C

Same effects as alternative A. In addition, reducing the number of turnouts would decrease disturbance to soil and native habitats and reduce the risk of spreading invasive species. However, fewer turnouts would not address safety concerns on Elk Refuge Road. Visitors likely would still use the road but would not have a safe alternative to parking on the road to look at animals or take photographs. Fewer turnouts would mean less snowplowing, thus reducing cost and staff time.

Ending dust abatement would likely decrease the attractiveness of the road to bighorn sheep, dispersing the sheep away from the road and reducing their numbers around Miller Butte. This would reduce the potential for human–wildlife conflicts if bighorn sheep stay away from the roadway, and wildlife viewers would not have the opportunity to come close to the sheep on foot. Without the attraction of salt on the road, bighorn sheep might remain more dispersed and reduce the transmission of diseases. Without dust abatement, more dust on foliage might predispose bighorn sheep to the risk of pneumonia. Wind along the road can be significant, and the dispersal of dust could occur throughout the east slope of Miller Butte to the national forest on the east. Less visitor use of the road for viewing bighorn sheep would require fewer parking areas and less vegetation disturbed. There would be less potential for vehicle collisions, and the refuge would have lower installation and maintenance costs if winter visitation on Elk Refuge Road decreased. Fewer bighorn sheep on or near the road would reduce the wildlife-viewing opportunity for some refuge visitors. However, visitors would be able to watch the bighorn sheep in a natural, dispersed population. Dispersing the bighorn sheep away from the road might decrease business opportunities for wildlife-viewing companies that have a special use permit to operate on the refuge.

Partnerships

The effects of each alternative for partnerships are described below.

Alternative A

Working with partners would help us in meeting the refuge goals and objectives. Furthermore, partnerships would be an excellent way of involving private citizens in supporting the management of the refuge.

The refuge would maintain effective and professional relationships with Federal and State partners as well as community members, leaders, nongovernmental organizations, and business representatives to foster an understanding of a variety of concerns, impacts, perspectives, and needs of each of the organizations and partners. Refuge staff would be more efficient and effective by working with partners and combining resources. Building and maintaining a leadership role in the community and maintaining partnerships would require staff commitment and time.

The refuge would continue to rely on partner support in many aspects of refuge management, as described below.

Physical Environment Support

Water conservation in the Greater Yellowstone Ecosystem could affect water resources on the refuge. Efforts to prevent new water diversions for irrigation and fish ponds, projects to remove unnecessary low-head dams, and programs to protect streambanks from excessive livestock use would have positive effects on the streams and rivers that flow onto the refuge. Although specific programs to address these water conservation issues do not exist in the Yellowstone Ecosystem, the Greater Yellowstone Coordinating Committee is the likely organization to address these needs in the future.

Biological Environment Support

Intense scrutiny and often contradictory public opinions about management of some wildlife species would continue to require coordinated efforts among Federal land managers and WGFD. Each agency could contribute expertise and resources toward management of high-profile species, and combined efforts could ultimately provide better results than the disconnected efforts of the individual agencies. Sharing inventory and monitoring data, coordinating the timing and scope of habitat improvement projects, and synchronizing seasonal public access restrictions are examples of ways Federal land management agencies and WGFD work together. These efforts would improve wildlife management that benefits wildlife species and their habitats and would enhance the public's understanding and confidence in management efforts by wildlife and land management agencies.

Involvement with land management agencies and nongovernmental wildlife research organizations is essential for answering wildlife management questions because it combines expertise and resources that the refuge might not have. The Jackson Hole Cooperative Elk Studies Group and the local greater sage-grouse working group are collaborative efforts that would continue to combine agency resources to improve management of high-priority species (elk and greater sage-grouse). This sharing of expertise and resources would enhance the refuge's ability to find sound solutions to management questions in a way that should increase public confidence. It would also provide an opportunity for the refuge to contribute to wildlife and land management efforts off the refuge, which could benefit the ecosystem wildlife populations and the populations that might use the refuge seasonally.

Nongovernmental organizations can play an essential role in projects targeted for specific wildlife issues. The discovery of elevated blood-lead levels in scavenging birds on the refuge and Grand Teton National Park is a good example of positive involvement by a nongovernmental organization. Craighead-Beringia South, a private, nonprofit, wildlife research organization, not only conducted research that identified the blood-lead level problem, but they also obtained private money to help correct the problem. As a result of their involvement, a program for voluntary use of lead-free ammunition was established for these Federal lands and is showing positive results in reducing lead exposure to specific wildlife populations.

Fire is a natural ecosystem process but unplanned wildfires can be destructive to agency facilities and sometimes impede wildlife management efforts. For example, a wildfire in September that would remove most of the refuge forage intended for use by wintering elk and bison would be counterproductive to the refuge management strategy. Also, the refuge could be held responsible for wildfire damage to adjacent private lands if the fire originated on the refuge. Cooperative agreements between the refuge, the Bridger-Teton National Forest, and the Grand Teton National Park would continue to provide important wildfire suppression capability that the refuge does not have. This partnership could prevent damage to wildlife habitat, refuge structures, and adjacent private lands.

Invasive plants such as spotted knapweed and cheatgrass reduce natural vegetation diversity and are considered problems throughout Jackson Hole. Our participation with the Jackson Hole Weed Management Association has resulted in a partnership to address this landscape problem on and off the refuge. Control efforts in Jackson Hole, especially next to the refuge, would help prevent new infestations from becoming reestablished on the refuge. This landscape effort would continue to help protect and enhance native plant communities and preserve plant diversity on the refuge for the benefit of many wildlife species. It would also contribute to landscape resiliency, which would enable plants and wildlife to better withstand and adapt to climate change.

Social Interaction Support

The refuge and its management can be affected by challenges or issues that are ecosystem-wide. Infestations of mountain pine beetle and white pine blister rust might not directly affect refuge habitat, but the resulting changes to adjacent habitats can have a profound effect on refuge wildlife management. The Greater Yellowstone Coordinating Committee is well positioned to address problems across the ecosystem, and the information they distribute to the public can help Jackson Hole residents understand how ecosystem-wide issues affect refuge

resources. Refuge staff involvement with this committee provides an opportunity for refuge staff to help influence news releases that are effective for the Jackson area.

Partnerships would be essential for the continued operation of the Jackson Hole and Greater Yellowstone Visitor Center that serves more than 300,000 visitors each year. Information about wildlife and the use of Jackson Hole's Federal lands would continue to enhance public understanding about the purpose and importance of the refuge. The visitor center would continue to provide an important service to the visiting public by not only answering questions about wildlife and natural resources, but also providing information about area accommodations and available recreational activities.

Our coordination of the North Highway 89 Pathway project with Teton County has expanded public opportunities for wildlife observation, photography, and interpretation on the refuge. Collaborating with Teton County and other private, nonprofit organizations—to inform the public of use restrictions necessary for compatibility—has helped reduce conflicts with wildlife and reduce violations of the use restrictions. Public compliance with these restrictions would help ensure that use of the pathway remains a compatible use and that the pathway would remain open to the public in the future.

Interpretation as part of the winter sleigh ride program would continue to inform more than 20,000 visitors annually about the Refuge System and the refuge. The refuge does not have the resources to provide this program to the public, and it is only made possible through our partnership with the Grand Teton Association and the private sleigh ride contractor.

Economic Support

Sustainable operations is a priority goal for the Greater Yellowstone Coordinating Committee. They have helped inventory, analyze, and develop plans to improve energy efficiency and reduce the carbon footprint for all land management units in the Greater Yellowstone Ecosystem. This assistance would continue to help the refuge focus on reducing the cost and environmental impact of refuge operations.

Cost sharing with partner organizations for projects of mutual interest and benefit is a common approach to leveraging limited refuge money. An example is the cooperation between the refuge and the WGFD to monitor chronic wasting disease on the refuge and throughout Jackson Hole. The refuge has

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The barn at Miller Ranch.

contributed money to help defray the cost of seasonal technicians who collected and analyzed samples from hunter-harvested deer and elk. This cost-sharing partnership would continue to enable a disease detection program on the refuge that is vital to both agencies and likely could not be conducted at a high level of confidence without this collaboration.

The refuge has worked in partnership with the Jackson District Boy Scouts for more than 50 years. The Scouts periodically use the refuge to accomplish various Scouting programs as well as helping us by picking up shed elk antlers that pose a hazard to refuge equipment. Most of the proceeds from an auction of antlers held by the Scouts are returned to the refuge and used primarily for habitat projects benefitting elk.

The Grand Teton Association has shown exceptional leadership and remarkable assistance in providing support for the Jackson Hole and Greater Yellowstone Visitor Center, which is a tremendous asset to Jackson's tourist-based economy. Financial support from the association would continue to be invaluable in providing temporary staff to run the visitor center when the Government position is vacant. Proceeds from the visitor center sales outlet that is run by the Grand Teton Association, would be used to support environmental education, interpretation, and wildlife research programs on the refuge.

Historical Program Support

With help from the Grand Teton Association and other partner organizations, the historic Miller House was restored by removing or replacing contemporary fixtures and decorating with early 1900s period décor. The money leveraged by the Grand Teton Association was instrumental in completing this project. The association would continue to run a seasonal sales outlet in the Miller House that provided merchandise with a historical theme.

Alternatives B and D

Same effects as alternative A, except as noted below.

Biological Environment Support

Same effects as alternative A. In addition, the potential exists for a Friends group to provide volunteer assistance and or money to enhance the refuge's biological and visitor services programs. Increased focus in Jackson Hole by our Partners for Fish and Wildlife program could result in off-refuge projects with private landowners that have the potential of providing important benefits for refuge habitat and wildlife populations. The restoration and enhancement of private land wetlands near the refuge would help support nesting waterfowl on the refuge: (1) shallow wetlands can help provide early season invertebrates, which are an important source of protein for nesting hens; and (2) deeper wetlands can help to provide summer brood-rearing habitat.

Social Interaction Support

Same effects as alternative A. In addition, the establishment of a Friends group would expand public awareness and participation in wildlife conservation on and around the refuge. The focus of a local Friends group usually develops in response to refuge needs and membership interests.

Alternative C

Same effects as alternative B, except as noted below.

Physical and Biological Environment Support

Same effects as alternative B. In addition, the refuge would emphasize partnerships that support research focused on the natural resources and unique conditions found in the Greater Yellowstone Ecosystem. The results of this research would help land managers better understand and manage the natural resources found within their administrative boundary of responsibility.

Social Interaction Support

Same effects as alternative B. In addition, emphasizing partnerships that result in ecosystem-wide and landscape-level activities would reduce the time spent on and benefits received from partnerships that focus primarily on refuge projects and programs.

5.15 Socioeconomic Effects

Economic impact analyses are commonly used to determine how changes in spending resulting from changes in policy or management activities affect business sales, jobs and income in local economies. This analysis quantifies how Refuge Revenue Sharing Act (RRS) payments to states and counties, Refuge personnel salary expenditures, Refuge purchases of goods and services, and spending by refuge visitors affect the local two-county region.

The economic impacts of the alternatives were estimated using the IMPLAN software and data system supplied by IMPLAN Group LLC. (Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.) IMPLAN is a widely used input-output modeling system. The underlying data drawn upon by the IMPLAN system are collected by the

IMPLAN Group LLC from multiple Federal and State sources including the Bureau of Economic Analysis, Bureau of Labor Statistics, and the U.S. Census Bureau. IMPLAN data profiles from 2012 for Teton County, Idaho, and Teton County, Wyoming, were used in this study.

Large management changes often take several years to achieve. The estimates reported for alternatives B, C and D represent final economic effects after all changes in management have been made.

Impacts from Refuge Revenue Sharing

We make revenue sharing payments to counties for land that is under our administration. Under provisions of RRS, local counties receive an annual payment for lands that have been purchased by full fee-title acquisition by the Service. Payments are based on the greater of 75 cents per acre or 0.75 percent of the fair market value. The exact amount of the annual payment depends on Congressional appropriations, which in recent years have tended to be substantially less than the amount required to fully fund the authorized level of payments. Only Teton County, Wyoming, received an RRS payment of $323,217 in 2013, which was much lower than in previous years. Table 15 shows the impacts of local RRS payments. They generate an estimated annual total impact of 2 jobs, $103,000 in labor income and $137,000 in value added to the local two-county area.

Table 15. Annual impacts of Refuge Revenue Sharing payments for all alternatives.

	Employment (number of full- and part-time jobs)	*Labor income (2013)*	*Value added (2013)*
Direct effects	2	$86,600	$109,100
Secondary effects	less than 1	$16,400	$27,900
Total effect	2	$103,000	$137,000

Effects of Refuge Personnel Salary Spending within the Local Economy

Refuge employees reside and spend their salaries on daily living expenses in the local area, thereby generating impacts within the local economy. Household consumption expenditures consist of payments by individuals or households to industries for goods and services used for personal consumption. The IMPLAN modeling system contains household income consumption spending profiles that account for average household spending patterns by income level. These profiles also capture average annual savings and allow for leakage of household spending to outside the region. The IMPLAN household spending pattern for households earning $50,000-75,000 per year was used to reflect the average salary of full-time permanent employees at the refuge.

The current approved refuge staff consists of 11 permanent employees. This will remain the same under alternative A. Refuge staff is anticipated to increase by an additional 24 employees under alternative B, and 27 employees under alternatives C and D (including full time, part time and seasonal positions). See table 21 in section 6.10 for a full list of positions.

Refuge personnel estimate that current annual salaries total approximately $1,021,000 under alternative A. Staff needs are expected to increase to approximately $1,586,000 under alternative B, and $1,680,400 under alternatives C and D. The economic impacts associated with the spending of salaries in the local two-county area by refuge employees are summarized in Table 16. These impacts only include the secondary effects of non-refuge jobs created as refuge employees spend their salaries in the local two-county area. For alternative A, it is estimated that salary spending by refuge personnel would generate annual secondary effects of 3 jobs, $120,300 in labor income, and $225,200 in value added annually, in the local economy. Under alternative B, the annual impact of salary spending would increase to 4 jobs, $186,800 in labor income and $349,600 in value added. Under alternatives C and D, refuge salary spending would generate secondary effects of 4 jobs, $198,000 in labor income, and $370,500 in value added annually.

Table 16. Annual impacts of salary spending.

	Employment (number of full- and part-time jobs)	*Labor income (2013)*	*Value added (2013)*
Alternative A			
Direct effects	0	$0	$0
Secondary effects	3	$120,300	$225,200
Total effect	3	$120,300	$225,200
Alternative B			
Direct effects	0	$0	$0

Table 16. Annual impacts of salary spending.

	Employment (number of full- and part-time jobs)	*Labor income (2013)*	*Value added (2013)*
Secondary effects	4	$186,800	$349,600
Total effect	4	$186,800	$349,600
Alternatives C, D			
Direct effects	0	$0	$0
Secondary effects	4	$198,000	$370,500
Total effect	4	$198,000	$370,500

Effects of Refuge Purchases of Goods and Service within the Local Economy

A wide variety of supplies and services are purchased for refuge operations and maintenance activities. Refuge purchases made in the local two-county area contribute to the local economic impacts associated with the refuge. The refuge currently spends an average of $229,000 per year on nonsalary expenditures. Major local expenditures include office supplies, utilities, and equipment maintenance and repair. Table 17 provides a breakdown of current nonsalary expenditures by expenditure category. To determine the local economic impacts of nonsalary expenditures, only expenditures made within the local two-county area are included. This analysis assumes the percent of local spending will not differ across the alternatives.

Table 17. Breakdown of current purchases of goods and services.

Expense category	*Average annual percent of nonsalary expenditures*	*Percent spent in local two-county area*
Heavy equipment purchasing or leasing	4	0
Equipment Maintenance and Repair	26	83
Vehicle Purchase	9	0
Vehicle Maintenance and Repair	5	6

Table 17. Breakdown of current purchases of goods and services.

Expense category	*Average annual percent of nonsalary expenditures*	*Percent spent in local two-county area*
Habitat and grounds improvements and treatments	6	100
Travel	4	0
Construction of New Structures	8	83
Maintenance and Repair of Structures	7	57
All other expenses (for example: overhead, office supplies, utilities)	31	86

Average annual nonsalary expenditures are anticipated to be $229,000 for alternative A, $348,000 for alternative B, and $369,000 for alternatives C and D. Table 18 shows the economic impacts associated with nonsalary related expenditures in the local communities near the refuge. For alternative A, the purchase of good and services would generate an estimated total economic impact of 2 jobs, $68,600 in labor income, and $92,400 in value added, annually. Under alternative B, 2 jobs, $104,200 in labor income and $140,500 in value added would be generated annually by the purchase of goods and services by the refuge. Alternatives C and D are estimated to have a slightly higher economic impact than alternative B, annually generating 2 jobs, $110,500 in labor income and $148,800 in value added.

Table 18. Annual impacts of purchases of goods and services.

	Employment (number of full- and part-time jobs)	*Labor income (2013)*	*Value added (2013)*
Alternative A			
Direct effects	1	$54,800	$70,000
Secondary effects	less than 1	$13,800	$22,400
Total effect	2	$68,600	$92,400
Alternative B			
Direct effects	2	$83,300	$106,400
Secondary effects	less than 1	$20,900	$34,100
Total effect	2	$104,200	$140,500

Table 18. Annual impacts of purchases of goods and services.

	Employment (number of full- and part-time jobs)	*Labor income (2013)*	*Value added (2013)*
Alternative C			
Direct effects	2	$88,300	$112,700
Secondary effects	less than 1	$22,200	$36,100
Total effect	2	$110,500	$148,800
Alternative D			
Direct effects	2	$88,300	$112,700
Secondary effects	less than 1	$22,200	$36,100
Total effect	2	$110,500	$148,800

Effects of Visitor Expenditures

Spending associated with recreational visits to national wildlife refuges generates significant economic activity. The Service report, Banking on Nature: The Economic Benefits of National Wildlife Refuge Visitation to Local Communities, estimated the impact of national wildlife refuges on their local economies (Carver and Caudill, 2013). According to the report, more than 46.5 million people visited the national wildlife refuges in fiscal year 2011, which generated $2.4 billion of sales in regional economies. Accounting for both the direct and secondary effects, spending by national wildlife refuge visitors generated over 35,000 jobs and $792.7 million in employment income (Carver and Caudill, 2013). Additionally, spending on refuge recreation generated approximately $342.9 million in tax revenue at the local, county, state and federal levels (Carver and Caudill, 2013).

This section focuses on the local economic impacts associated with National Elk Refuge visitation. The refuge offers a wide variety of recreation opportunities including wildlife observation and photography, interpretation, environmental education, fishing and big game hunting. Currently, the refuge does not allow waterfowl or upland game hunting. In the winter, the refuge offers its guests horse-drawn sleigh rides to view the wildlife living on the refuge. Additionally, visitors can participate in the refuge's winter wildlife excursions; a refuge staff naturalist will take participants on a guided tour to view elk, bighorn sheep and waterfowl.

Annual visitation estimates for the refuge are based on several refuge statistic sources including visitors entering the refuge and general observation by refuge personnel. Annual visitation estimates are on a per-visit basis. Table 19 summarizes estimated visitation by type of visitor activity for alternatives A, B, C, and D.

Table 19. Estimated annual refuge visitation activity by alternative.

	Total number of visits	*Number of non-local visits*	*Average hours spent on refuge*	*Number of non-local visitor days**
Alternative A				
Fishing	3,800	1,140	4	570
Big game hunting	2,500	1,875	8	1,875
Waterfowl and migratory bird hunting	0	0	0	0
Upland game hunting	0	0	0	0
Nonconsumptive uses	111,300	55,650	2	13,913
Total visitation	117,600	58,665	—	16,358
Alternative B				
Fishing	3,990	1,197	4	599
Big game hunting	2,750	2,063	8	2,063
Waterfowl and migratory bird hunting	0	0	0	0
Upland game hunting	0	0	0	0
Nonconsumptive uses	122,430	61,215	2	15,304
Total visitation	129,170	64,475	—	17,965
Alternative C				
Fishing	3,990	1,197	4	599
Big game hunting	2,625	1,969	8	1,969

Table 19. Estimated annual refuge visitation activity by alternative.

	Total number of visits	*Number of non-local visits*	*Average hours spent on refuge*	*Number of non-local visitor days**
Waterfowl and migratory bird hunting	0	0	0	0
Upland game hunting	0	0	0	0
Nonconsumptive uses	127,995	63,998	2	15,999
Total visitation	134,610	67,163	—	18,567
Alternative D				
Fishing	3,990	1,197	4	599
Big game hunting	2,750	2,063	8	2,063
Waterfowl and migratory bird hunting	0	0	0	0
Upland game hunting	0	0	0	0
Nonconsumptive uses	133,560	66,780	2	16,695
Total visitation	140,300	70,040	—	19,356

* One visitor day equals eight hours.

The information in Table 19 does not capture the estimated annual number of visitors using the visitor center. The interagency visitor center is a complex issue for which socioeconomic effects are difficult to quantify.

To estimate visitor expenditures, we use average daily visitor spending profiles from the Banking on Nature report (Carver and Caudill, 2007) that were derived from the 2006 National Survey of Fishing, Hunting, and Wildlife Associated Recreation (FWS, 2008). The National Survey reports trip-related spending of State residents and nonresidents for wildlife-associated recreational activities. For each recreation activity, spending is reported in the categories of lodging, food and drink, transportation, and other expenses. Carver and Caudill (2007) calculated the average per-person, per-visitor day expenditures by recreation activity for each Service region. The

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Conducting a forage survey on the refuge.

spending profiles for nonresidents for Region 6 were used here, and the 2006 spending profiles were updated to 2013 dollars using the Consumer Price Index Inflation Calculator. Average daily spending profiles for nonresident visitors to Region 6 for fishing ($129.94 per-day) and big game hunting ($220.84 per-day) were used to estimate nonlocal visitor spending for refuge fishing- and hunting-related activities. The average daily nonresident spending profile for nonconsumptive wildlife recreation (observing, feeding, or photographing fish and wildlife) was used for nonconsumptive wildlife viewing activities ($162.93 per-day).

Visitor spending profiles are estimated on an average per day (eight hours) basis. Because some visitors only spend short amounts of time visiting a refuge, counting each refuge visit as a full visitor day would overestimate the economic impact of refuge visitation. In order to properly account for the amount of spending, the annual number of nonlocal refuge visits were converted to visitor days. Refuge personnel estimate that nonlocal anglers spend approximately four hours (half a visitor day) on the refuge, while nonlocal big game hunters typically spend a full day, or eight hours. Nonlocal visitors who view wildlife on nature trails or participate in other wildlife observation activities typically spend two hours (one quarter of a visitor day). Table 16 shows the number of nonlocal visitor days by recreation activity for each alternative. Total spending by nonlocal refuge visitors was determined by multiplying

the average nonlocal visitor daily spending by the number of nonlocal visitor days at the refuge.

Table 20 summarizes the total economic impacts associated with current nonlocal visitation by alternative. Under alternative A, nonlocal refuge visitors would spend nearly $2,755,000 in the local economy annually. This spending would directly account for an estimated 19 jobs, $801,600 in labor income, and $1,148,800 in value added in the local economy. The secondary, or multiplier, effects would generate an additional 5 jobs, $262,600 in labor income, and $429,100 in value added. Accounting for both the direct and secondary effects, spending by nonlocal visitors for alternative A would generate total economic impacts of 24 jobs, $1,064,200 in labor income, and $1,577,900 in value added.

Table 20. Annual impacts of nonlocal visitor spending by alternative.

	Employment (number of full- and part-time jobs)	*Labor income (2013)*	*Value added (2013)*
	Alternative A		
Direct effects	19	$801,600	$1,148,800
Secondary effects	5	$262,600	$429,100
Total effect	24	$1,064,200	$1,577,900
	Alternative B		
Direct effects	21	$880,700	$1,262,200
Secondary effects	6	$288,600	$471,400
Total effect	27	$1,169,300	$1,733,600
	Alternative C		
Direct effects	22	$909,100	$1,302,600
Secondary effects	6	$298,400	$487,400
Total effect	28	$1,207,500	$1,790,000
	Alternative D		
Direct effects	23	$948,200	$1,358,500
Secondary effects	6	$311,300	$508,400
Total effect	29	$1,259,500	$1,866,900

As shown in table 19, refuge nonlocal visitation for all activities is anticipated to increase by 1,607 visitor days under alternative B as compared to alternative A. Under alternative B, nonlocal visitors would spend approximately $3,026,800 in the local area annually. Accounting for both the direct and secondary effects, spending by nonlocal visitors for alternative B would generate an estimated total annual economic impact of 27 jobs, $1,169,300 in labor income, and $1,733,600 in value added (table 20).

Refuge, nonlocal visitation across all activities is anticipated to increase by 2,209 visitor days under alternative C as compared to alternative A (Table 19). Under alternative C, nonlocal refuge visitors would spend approximately $3,119,400 in the local area annually. Accounting for both the direct and secondary effects, spending by nonlocal visitors for alternative C would generate an estimated total economic impact of 28 jobs, $1,207,500 in labor income, and $1,790,000 in value added (Table 20).

Finally, under alternative D, refuge visitation is expected to increase by 2,998 visitor days as compared to alternative A. It is estimated that this would result in the annual spending of approximately $3,253,400 in the local area. This spending by nonlocal visitors would result in a total annual economic impact of 29 jobs, $1,259,500 in labor income and $1,866,900 in value added (Table 20).

Jackson Hole and Greater Yellowstone Visitor Center

In addition to the National Elk Refuge, the refuge also staffs and maintains the visitor center, located just outside the town of Jackson, Wyoming, within Teton County, Wyoming. It serves as a contact for six governmental, non-profit and private agencies, including Grand Teton National Park, Bridger-Teton National Forest, the Jackson Hole Chamber of Commerce, the Wyoming Game and Fish Department, the National Elk Refuge, and the Grand Teton Natural History Association. In 2012, an estimated 306,048 visitors came through the visitor center. Visitors can access information or make purchases related to trip planning, hunting and fishing licenses, annual park passes, off-road vehicle and snowmobile permits, firewood and Christmas tree permits, trail maps, bear canister rental and fires as well as view wildlife exhibits and tour the wildlife observation deck.

Economic impacts are generated through the spending of money within a local community, and while the information provided to visitors by the refuge staff at the visitor center has an associated economic value, specific economic impacts directly related to visitor center visitation is difficult, in part due to the interagency nature of the facility. Economic impacts may be generated by the visitor center if individuals are inspired by their visitor center experience to spend additional time and money in the area, thus generating additional nonlocal spending. A 2010 statewide survey of Wyoming visitor centers

conducted by Randall Travel Marketing indicated that after stopping at a visitor center and receiving information, a portion of visitors stayed in Wyoming at least one more day (Randal Travel Marketing 2010). This additional day spent within Wyoming by visitor center guests demonstrates that not only do visitor centers have an important educational component, but these centers can also help generate economic activity through increased visitor spending. Given that it is unknown where visitors may spend an additional day and in what activities they may participate, the economic impacts of visitation to the visitor center cannot be quantified. While directly quantifying the economic impacts of the visitor center is difficult, the importance of the center itself, as well as the value of the service and information provided to visitors by refuge staff, should not be overlooked or discounted.

Spending in the visitor center through the nonprofit cooperating association (Grand Teton Association) was not included in the study. In 2013, the Grand Teton Association generated over $700,000 in sales at the visitor center.

Summary of Economic Effects

Under alternative A, refuge management and visitation activities annually generate an estimated 31 jobs, $1,356,100 in labor income, and $2,032,500 in value added in the local economy. Given slight increases in refuge administration and an increase of over 1,600 in visitor days, alternative B would generate 4 additional jobs, $207,200 more in labor income, and $328,200 more in value added, as compared to alternative A. Under alternative C, refuge public use and administration activities would also increase. Alternative C would generate 5 additional jobs, $262,900 more in labor income, and $413,800 more in value added as compared to alternative A. Under alternative D, the refuge anticipates the greatest increase in visitation, an increase of nearly 3,000 visitor days. Alternative D would generate an additional 6 jobs, $314,900 in labor income, and $490,700 in value added compared to alternative A. These impacts do not include the additional economic activity generated by the visitor center, though its management and maintenance by the refuge is essential. Total economic impacts associated with refuge operations across all alternatives represent slightly more than one tenth of one percent of total income and total employment in the overall two-county local economy. Total economic effects of refuge operations play a much larger role in nearby communities where most of the refuge-related expenditures and public use-related economic activity occurs.

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Snow Goose