5 Environmental Consequences

Mike Parker/USFWS

Subirrigated wetlands.

This chapter provides an analysis of the potential effects on environmental resources associated with the implementation of the management alternatives for the refuge. The U.S. Fish and Wildlife Service assessed the environmental consequences of implementing each of the alternatives on the biological, physical, social, economical, cultural, and historical resources of the refuge.

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. The duration of effects also is used in the evaluation of environmental consequences.

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

Indirect, or secondary, effects are those that are induced by implementation actions but occur later in time or farther removed from the place of action through a series of interconnected effects. Examples of indirect effects include the downstream water quality effects from an upstream surface disturbance, or the impact 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 nonfederal) 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 are described as either short-term or long-term. Short-term effects would persist for a period of 3 to 5 years, and would consist primarily of temporary disturbance to 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 benefits to wildlife habitat resulting from habitat management actions.

5.2 EFFECTS COMMON TO ALL ALTERNATIVES

A few potential effects would be similar under each of the alternatives:

- The implementation of any of the alternatives would follow the refuge's best management practices.

- The alternatives would avoid and minimize impacts to federally threatened and endangered species, to the extent possible and practicable.
- The refuge, contractors, researchers, and other consultants would continue to acquire all applicable permits, such as those for future construction activities.

The sections below describe other effects expected to be similar for each alternative.

Regulatory Effects

As indicated in chapter 1 of this draft CCP, the U.S. Fish and Wildlife Service must follow a number of federal laws, administrative orders, and policies in the development and implementation of its management actions and programs. Among these mandates are the *National Wildlife Refuge System Improvement Act of 1997*, the *Endangered Species Act of 1973*, the *Clean Water Act of 1977*, and compliance with Executive Orders 11990 (Protection of Wetlands) and 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.

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 compared to the general public.

The U.S. Fish and Wildlife Service is committed to ensuring that all members of the public have equal access to America's fish and wildlife resources, as well as equal access to information that would enable them to participate meaningfully in activities and policy shaping.

Cultural Resources

As a whole, cultural resources would be enhanced through protecting existing resources and extending protections to newly-discovered cultural resources.

There have been limited cultural resource surveys performed on the refuge; to fully satisfy provisions of NEPA and applicable acts and policies related to historical and archaeological resources, additional surveys would be required before any new construction or excavation.

Potentially negative effects from construction of trails or facilities would require review by the regional archaeologist (region 6) and consultation with the Montana State Historic Preservation Office.

Global Warming

The actions proposed in this draft CCP and EA would conserve or restore land and habitat, thus retaining existing carbon sequestration at the refuge. This action would contribute positively to efforts to mitigate human-induced global climate change.

The use of prescribed fire, which releases carbon dioxide, would result in no net loss of carbon because new vegetation would quickly replace the burned-up biomass. Overall, there should be little to no net change for carbon sequestered at the refuge from any of the management alternatives. As it relates to global climate change, documenting the long-term changes in vegetation, species, and hydrology is an important part of research and monitoring. Adjustments in management may be necessary over time to adapt to a changing climate.

Geology and Soils

All alternatives would positively affect soil formation processes on the refuge lands. Some disturbances to surface soils and topography would occur at those locations selected for (1) administrative, maintenance, and visitor facilities; (2) introduced and invasive species removal and eradication; and (3) restoration of native habitat.

Water Quality, Wetlands, and Floodplains

All alternatives would positively affect water quality. Positive effects are anticipated from protecting groundwater recharge, preventing runoff, retaining sediment, and minimizing nonpoint source pollution. The management alternatives are not anticipated to have any adverse effects on the area's wetlands and floodplains.

5.3 DESCRIPTION OF CONSEQUENCES BY RESOURCE

Management actions are prescribed through various alternatives as a means for achieving the refuge's vision and goals, while responding to issues raised by Service managers, the public, and governmental partners. Because management would differ for each alternative, the environmental and social effects resulting from implementation would likely differ as well. The environmental consequences discussed in this chapter are the potential effects on a resource as a result of carrying out the actions of an alternative. Chapter 3 (alternatives) presents the management scenario for each alternative, which could create the consequences described here. This chapter discusses the effects common to alternatives and provides a summary of the environmental consequences.

The following section provides an analysis of the effects estimated to result from implementing alternative A (no action), and alternatives B (the proposed action), C (wetland restoration), and D (ecological restoration). A summary of this narrative is also contained in "Chapter 3: Alternatives." The estimated potential effects of each alternative are described by the major resource topics (issues) described throughout this document.

Habitat and Wildlife

Alternative A: No Action

Lakes, Ponds, and Marshes

Maintaining the current wetland management would continue to provide a diverse submerged aquatic vegetation community for waterbirds, fishes, amphibians, and invertebrates, as well as extensive areas of sedge and other emergent vegetation for nesting birds and other wildlife.

Natural Lakes

These lakes would continue to function naturally, with little management intervention. Natural climatic variation is the primary driver of annual habitat changes as there are no water control structures on these lakes.

Modified Wetlands

Passive management of modified wetlands would continue under this alternative. Each of the wetlands has a water control structure that permits manipulation of water levels; however, current management maintains relatively static "full pool" water levels, resulting in periodic lowering of water levels (drawdowns) occurring serendipitously during drought periods. Picnic and Elk Springs creeks would not be restored under this alternative. Alternative A would maintain winter habitat for trumpeter swans but preclude restoration of Arctic grayling spawning habitat.

Mike Parker/USFWS

Great gray owl.

Created Wetlands

North Tuck's Slough would continue to be filled each spring by diverting water from Red Rock Creek until Arctic grayling fry are observed within the creek. Filling the slough creates 103 acres of waterbird breeding habitat.

Lower Red Rock Lake / River Marsh

The Lower Red Rock Lake water control structure has been kept open since 2004 to allow, within the constraints imposed by the structure, a naturally fluctuating hydrological cycle. This will continue under alternative A, providing more than 5,700 acres of highly productive and diverse wetland habitat for waterbirds. The structure would be maintained to permit manipulation of water levels. The refuge staff would continue to conduct limited ecological experiments designed to improve the understanding and management of the system.

Shrub-dominated Wetlands

These habitats would continue to be protected from livestock grazing by maintaining and, in some areas, the construction of fences. More than 1,600 acres of shrub-dominated habitat would be maintained for breeding migratory land birds, wintering ungulates, and other native wildlife. Monitoring of browse levels by native ungulates would continue, providing information for the collaborative management of ungulate populations by MFWP and the refuge. Restoration of streams would occur as resources permitted, increasing the area of shrub-dominated wetland habitats on the refuge.

Wet Meadows

Wet meadows would continue to be managed with grazing and prescribed fire, with an emphasis on providing nesting and foraging habitat for breeding birds. This would maintain more than 7,000 acres of ungrazed to moderately grazed nesting habitat for ground-nesting migratory birds.

Shrub-steppe, Grasslands, and Centennial Sandhills

These habitats would continue to be managed with grazing and prescribed fire, with an emphasis on providing nesting and foraging habitat for breeding birds. Nearly 13,000 acres of shrub-steppe, grasslands, and Centennial Sandhills habitat would be provided for breeding birds, other native wildlife, and rare plants. Coordination with the BLM, The Nature Conservancy, and DNRC would continue to explore the need and opportunities to increase early seral habitat in the Centennial Sandhills.

Aspen Woodlands and Forests

The refuge would continue to work with The Nature Conservancy on projects investigating historical and current extent of, and browse levels on, aspen

in the Centennial Valley. Collaborative efforts with other major landholders in the valley would work toward increasing the reduced regeneration of aspen, improving existing stands of aspen and encouraging aspen expansion throughout the valley. The existing aspen enclosure would be maintained to demonstrate browse affects on reduced regeneration of aspen.

Coniferous Woodlands and Forests

The refuge would continue to coordinate with the BLM to use prescribed fire to reduce fuel loads around Lakeview, decreasing the severity of future wildland fire.

Alternative B: Proposed Action

Lakes, Ponds, and Marshes

Under alternative B, more active management of wetland habitats would provide a diverse submerged aquatic vegetation community for waterbirds, fishes, amphibians, and invertebrates, as well as extensive areas of sedge and other emergent vegetation for nesting birds and other wildlife. Increased oversight of habitat response to management actions would (1) increase understanding of montane wetland systems, (2) improve the refuge's ability to maintain these systems within the range of natural variation, and (3) provide a greater diversity of wetland conditions within and among years. Restoration activities under this alternative would result in a conversion of approximately 40 acres of lacustrine (Culver and MacDonald ponds) and about 92 acres of palustrine (West Pintail Ditch Wetlands) wetland habitats back to stream and other riparian habitats.

Natural Lakes

Upper Red Rock and Swan lakes would continue to function naturally, with little management intervention. Natural climatic variation would continue to be the primary driver of annual habitat changes because there are no water control structures on these lakes. Water-quality monitoring would be conducted to ensure management of adjacent habitats would not adversely affect the lakes. Grazing and fire are known to increase the nutrient cycling of nitrogen and phosphorous (Burke et al. 2005, Hauer and Spencer 1998, McEachern et al. 2000), therefore, management of upland habitats adjacent to Upper Red Rock or Swan lakes could result in elevated levels of these nutrients in the lakes. Elevated levels of phosphorous and nitrogen can lead to increases in algae and turbidity in shallow lakes, which may ultimately lead to significant losses of submerged aquatic vegetation communities (Egertson et al. 2004).

Modified Wetlands

The upper reaches of Elk Springs and Picnic creeks would be restored to provide spawning habitat for Arctic grayling. This would eliminate about 20 acres of trumpeter swan winter habitat further assisting in efforts to reestablish more southerly wintering areas for swans (USFWS 1992). Restoration of these creeks would also restore 92 acres of wet meadow habitat along West Pintail Ditch. Widgeon Pond water levels would continue to be maintained at full pool in order to provide nonbreeding season habitat for Arctic grayling that spawn in Picnic Creek. The active management of remaining modified wetlands to achieve a more dynamic water level would increase the productivity of these wetlands for the benefit of migratory birds and other wetland wildlife.

Created Wetlands

Water would be diverted from Red Rock Creek to fill North Tuck's Slough only in years when snow-water equivalent is above the 30-year average by the last day of snow-pack accumulation, as measured by the Lakeview Ridge (SNOpack TELemetry) site (USDA Natural Resources Conservation Service),. This would minimize negative hydrological effects of diverting water from Red Rock Creek, while providing 103 acres of waterbird breeding habitat as conditions allow.

Lower Red Rock Lake/River Marsh

Similar to alternative A, except ecological experiments would be greatly expanded not only to advance the understanding of the system and its management, but also to determine if the structure should be maintained or replaced.

Shrub-dominated Wetlands

In addition to activities conducted under alternative A, efforts to reduce effects of livestock grazing on upstream (off-refuge) riparian corridors would be conducted, resulting in the protection and improvement of Arctic grayling spawning habitat. Water diversion from Red Rock Creek for North Tuck's Slough would be limited (see "Created Wetlands"). This would reduce potential for loss of fry during spring, as well as an increased probability of overbank streamflows in Red Rock Creek to encourage willow germination. Irrigation ditches would be restored if they were found to affect the hydrology of adjacent areas. Existing irrigation infrastructure may be used for native grassland restoration. This infrastructure would remain until other restoration activities were completed.

Wet Meadows

Additional emphasis would be placed on improving habitat diversity through management. This would include an adaptive management plan to investigate the effects of grazing, fire, and climate on vegetation, small mammal, and bird communities. Improving habitat diversity in wet meadows would increase the number of migratory bird species using this

habitat. Currently, refuge wet meadows support relatively low bird diversity, with Savanna sparrows and western meadowlarks being predominant. Habitat could be improved for target species, such as long-billed curlews, through the use of grazing and prescribed fire. Studying state bison reintroduction intiatives would permit the refuge to thoroughly investigate the benefits and impacts of repatriating bison on the refuge and in the valley.

Shrub-steppe, Grasslands, and Centennial Sandhills

Management emphasis would be placed on improving habitat diversity. This would include an adaptive management plan to investigate the effects of grazing, fire, and climate on vegetation, small mammal, and bird communities. This would provide improved habitat conditions for target species across nearly 13,000 acres of shrub-steppe, grasslands, and Centennial Sandhills. Additionally, actions would be undertaken to restore areas currently dominated by nonnative grasses. This would likely necessitate plowing and herbicide application to remove nonnative grasses; however, the long-term benefit of native grasslands would include greater structural and species diversity, as well as creating areas more resistant to nonnative plant invasion.

Studying state bison reintroduction intiatives would permit the refuge to thoroughly investigate the benefits and impacts of repatriating bison on the refuge in the valley.

Aspen Woodlands and Forests

In addition to alternative A, the refuge would work with the BLM, The Nature Conservancy, and MFWP to manage aspen at a landscape scale. This would include efforts to increase the reduced regeneration of aspen by increasing disturbance and reducing browse levels, with the ultimate goal of creating and maintaining various-age aspen stands for the benefit of cavity-nesting birds and other migratory and resident wildlife.

Coniferous Woodlands and Forests

Same as alternative A, except a fire use plan, developed in conjunction with BLM, would allow for minimal suppression of wildland fires, thus creating a more natural fire system while saving resources on fires that do not threaten properties.

Alternative C: Wetland Restoration

Lakes, Ponds, and Marshes

Under alternative C, restoration of wetland habitats would eliminate all modified and most created wetlands on the refuge, while increasing stream corridor riparian habitat. The hydrology of refuge lakes, marshes, and streams would be restored to the extent possible, reducing the need for direct management of water resources.

Natural Lakes

Same as alternative B.

Modified Wetlands

Same as alternative B, except that all modified wetlands would be restored. This would result in the restoration of nearly 3 miles of stream corridor riparian habitat, but 355 acres of lacustrine and palustrine emergent wetland habitat would be lost, including four trumpeter swan nesting territories.

Created Wetlands

Most created wetlands would be restored, precluding diversion of water from Red Rock Creek. This would maintain instream flows, thus eliminating negative effects of this practice on riparian habitat. However, 103 acres of wetland habitat would be lost.

Lower Red Rock Lake/River Marsh

The water control structure at the outflow of Lower Red Rock Lake would be removed as it deteriorates. The slow removal of the water control structure would permit ecological experiments to be conducted to determine its effects and anticipate the changes that would occur once it is removed. Its eventual removal may restore the hydrological system. The ability to manipulate water levels for management would be lost as well as opportunities to capture water that may be needed as water resources become depeleted by climate change.

Shrub-dominated Wetlands

Similar to alternative B, except that all water management structures on the refuge would be eliminated, as would all interior fencing. This would, to the extent possible, restore the hydrology of Red Rock Creek and several small streams on the refuge.

Wet Meadows

Under this alternative, fire would be used as the primary disturbance, complemented by native grazers. Livestock grazing would be eliminated. Interior fences would be removed, which would benefit wildlife, especially migratory ungulates like pronghorn, because fences act as a barrier and can entangle wildlife, sometimes leading to death. Additionally, with the removal of cattle from the refuge, native ungulates, such as elk, may use these habitats more, especially the recently burned areas. However, termination of the grazing program would also limit the flexibility to manage target species, including invasive plants.

Shrub-steppe, Grasslands, and Centennial Sandhills

Same as under "Wet Meadows" above, including that termination of the grazing program would limit the flexibility to manage target species, including rare plants found in the Centennial Sandhills.

Aspen Woodlands and Forests

Same as alternative B.

Coniferous Woodlands and Forests

Same as alternative B.

Alternative D: Ecological Restoration

Lakes, Ponds, and Marshes

Same as alternative B, including if bison become designated as free-ranging wildlife in Montana the refuge will work with the state and neighboring landowners to reintroduce them. Livestock grazing would be eliminated and interior fences would be removed. If free-ranging bison are introduced, they would most likely migrate out of the valley in the winter, due to typically deep snow conditions. It is uncertain where they would travel to, or what the impacts to those wintering grounds would be. However, if bison did winter in the valley this could result in increased grazing of sedge habitats which could reduce residual cover for nesting waterfowl. As generalist grazers, diets of free-ranging bison closely approximate proportions of available grasses and sedges (Meagher 1973, Reynolds et al. 1978). Beaked sedge, the predominant sedge of emergent habitats on the refuge (6,999 acres), is an especially important winter forage plant for bison (Reynolds et al. 1978). Winter grazing of sedge habitats would reduce the amount of residual cover available for early nesting waterfowl species. However, the response of beaked sedge to grazing has varied, making it difficult to predict the response to increased grazing (Allen and Marlow 1994, Clary 1995).

Natural Lakes

Same as alternative B, including if bison become designated as free-ranging wildlife in Montana the refuge will work with the state and neighboring landowners to reintroduce them. Livestock grazing would be eliminated and interior fences would be removed.

Modified Wetlands

Same as alternative C.

Created Wetlands

Same as alternative C, except there would be a complete loss of created wetland habitats, caused by removal of all diversion structures. Additional areas would be created that could be susceptible to invasion by invasive plant species. Surface water runoff patterns would be restored. A more natural appearance would be created, reflecting the wilderness character of this refuge and altered upland habitats would be reestablished.

Lower Red Rock Lake/River Marsh

Same as alternative C, except the immediate removal of the WCS would not permit ecological experiments to develop a better understanding of effects of this structure and the hydrologic system of the refuge.

Shrub-dominated Wetlands

Same as alternative C.

Wet Meadows

Livestock grazing would be phased out under this alternative. Additionally, the refuge would work with adjacent landowners and the state to reintroduce bison (if re-classified as wildlife). If bison assumed historical grazing patterns, this could return an important, historic ecological process to the refuge and, consequently, the Centennial Valley. There could be cumulative habitat impacts as a result of introducing bison into an already active cattle and native ungulate grazing community within the valley. Bison could become concentrated on the refuge causing overgrazing of grassland habitats needed by nesting migratory birds. Bison have the potential to transmit brucellosis to cattle. This would have to be addressed before reintroduction. Management would focus on increasing heterogeneity within meadows through a combination of fire and grazing by native wildlife, primarily bison (Fuelendorf and Engle 2001). Interior fences would be removed, facilitating wildlife movement within the refuge. Annual or biennial prescribed fire would be used to focus grazing by wildlife in refuge meadows. The fire return interval for focal areas would be 10–15 years, providing a mosaic of different disturbance levels across refuge meadow habitats. The increased heterogeneity would likely result in a greater diversity of breeding birds (Fuelendorf et al. 2006). Reduction of nonnative invasive grasses would continue.

Shrub-steppe, Grasslands, and Centennial Sandhills

Livestock grazing would be phased out under this alternative. Additionally, the refuge would work with adjacent landowners and the state to reintroduce bison. If bison assumed historical grazing patterns, this could return an important, historic ecological process to the refuge and, consequently, the Centennial Valley. There could be cumulative habitat impacts as a result of introducing bison into an already active cattle and native ungulate grazing community within the valley. Bison could become concentrated on the refuge causing overgrazing of grassland habitats needed by nesting migratory birds. Bison have the potential

to transmit brucellosis to cattle. This would have to be addressed before reintroduction. Management would focus on increasing heterogeneity within grasslands through a combination of fire and grazing by native wildlife, primarily bison (Fuelendorf and Engle 2001). Interior fences would be removed, facilitating wildlife movement in the refuge. Annual or biennial prescribed fire would be used to focus grazing by wildlife within refuge grasslands. The fire return interval for focal areas would be 10–15 years, providing a mosaic of different disturbance levels across refuge grassland habitats. The increased heterogeneity would likely result in a greater diversity of breeding birds (Fuelendorf et al. 2006).

Shrub-steppe habitats would similarly be managed by a combination of fire and grazing, but with a greater emphasis on maintaining canopy cover levels of sage sufficient for sage-obligate species such as Brewer's sparrow, greater sage-grouse, and pygmy rabbits. Reduction of nonnative invasive grasses would continue.

Aspen Woodlands and Forests

Same as alternative B.

Coniferous Woodlands and Forests

Same as alternative B.

Visitor Services and Cultural Resources

Alternative A: No Action

Management strategies under alternative A would not change, so visitor services would continue at the present level. The refuge would continue to provide quality recreational opportunities to visitors. As funding allows, the refuge would continue to replace outdated interpretive panels, directional and boundary signs, and update brochures to better orient and inform visitors. The refuge would continue to support partnerships with the BLM and MFWP that provide the refuge with limited law enforcement coverage; however, due to the large areas the officers are responsible for, violations would continue to occur.

Hunting

The refuge would continue to provide quality hunting opportunities to visitors.

Fishing

The fishing program on the refuge would continue to be valued as one of the compatible wildlife-dependent recreational activities. Currently, fishing is allowed in limited areas to protect breeding birds. Birds or mammals feeding or resting may be disturbed by anglers when fishing, but the current visitor use is often low enough that disturbance by anglers has minimal impact on most wildlife species.

Wildlife Observation and Photography

Wildlife observation and photography would continue to play an important part in visitors' recreational experience at the refuge. No new infrastructure would be added to provide a higher quality, interactive experience, resulting in missed opportunities to educate refuge visitors.

Environmental Education, Interpretation, and Outreach

Tours and talks would continue to be provided by refuge staff on an opportunistic basis. As funding allows, the refuge would continue to replace outdated interpretive panels, directional and boundary signs, and update brochures to better orient and inform visitors. The refuge would continue to miss opportunities to inform visitors about refuge issues and resources without dedicated staff developing environmental education, interpretation, and outreach programs.

Campgrounds

Two campgrounds would continue to provide visitors with an opportunity to experience quality wildlife-dependent recreational activities for more than half a day without having to drive excessive distances across rough roads. Minor improvements would occur as funding allows. Some short-term impacts, such as littering, vegetation trampling, and wildlife disturbance, can be expected, but these would be minimal and manageable impacts to current refuge programs or wildlife use of the area. The campgrounds would continue to be important to provide visitors a place to reconnect with wildlife and the natural environment.

Cultural Resources

Under this alternative, the refuge would continue to maintain historic properties that are in use and update the interpretive panel at the Shambow Way Station. These actions would preserve the buildings built by the Works Progress Administration for the public to enjoy and to educate visitors about the history of the Way Station.

Alternative B: Proposed Action

Alternative B would increase opportunities for visitors to participate in wildlife-dependent recreation. Visitor numbers are expected to increase. Hiring a temporary seasonal visitor services specialist would allow the refuge to expand the on-refuge interpretive program, enhancing the visitors" experience. In addition, having one staff member acquire and maintain law enforcement credentials would provide added protection for these additional visitors while protecting the refuge and its resources.

Hunting

Hunting area boundary changes would simplify hunting area boundaries and reduce road hunting, while providing additional huntable acres. This change should result in a reduction of violations and a reduction in illegal road hunting while providing continued and expanded opportunities for quality, fair-chase hunts.There would be a reduction in browsing impacts on habitat because ungulates would become more dispersed throughout the refuge. A refuge hunting brochure would assist hunters in identifying areas open to hunting and understanding refuge regulations. To maintain other wildlife-dependent recreational opportunities, use by the public in areas closed to hunting would be allowed, thereby providing year-round nonconsumptive compatible uses to occur.

R. Madsen/USFWS

Waterfowl hunter.

Fishing

The focus of management would be on fish species of management concern, primarily Arctic grayling and Westslope cutthroat trout. While Arctic grayling populations are being restored, MacDonald, Widgeon, and Culver ponds would be open under state regulations to bank fishing, but closed if necessary to protect nesting swans and Artic grayling. All refuge streams would be open to fishing in compliance with state and refuge regulations. Educating anglers about restoration projects could lead to involvement in the process to protect native species.

The refuge would promote the taking of nonnative fish species, according to state regulations, to reduce competition with Arctic grayling. Opening new streams to fishing may lead to some vegetation trampling, invasive species spread, and wildlife disturbance. A fishing brochure would be developed. There is a potential for increased disturbance to nesting swans on Shambow Pond that may lead to nest abandonment, but the closed area surrounding this nesting area should provide adequate protection.

Wildlife Observation and Photography

Additional opportunities for wildlife observation and photography would provide visitors with a higher quality visitor experience while maintaining wilderness qualities. The refuge would accomplish this through improving signing, updating brochures, new information kiosks, clarifying regulations, constructing pullouts for wildlife viewing, and developing an auto tour route. With improved facilities to view wildlife, visitor numbers may increase, and visitors may stay longer or go to more sites on the refuge. This may lead to increased disturbance to wildlife. A positive effect of public involvement in these priority visitor services would be a better appreciation and more complete understanding of refuge wildlife and habitats. That can translate into more widespread, stronger support for the refuge, Refuge System, and the protection of the Centennial Valley.

Environmental Education, Interpretation, and Outreach

The actions in this alternative would result in an improved understanding by the refuge visitors of this area's natural history, wildlife resources, cultural resources, and qualities of the refuge, and the mission of the Refuge System. A temporary seasonal visitor services specialist would allow the refuge to develop a limited interpretive program by replacing outdated interpretive panels, directional and boundary signs, and update brochures to better orient and inform visitors. An interpreted auto tour route would allow visitors of all abilities to view and learn about the refuge resources. With no environmental education programs and little outreach, there could be a loss of opportunities to reach surrounding communities, local governments and youth and young adults that could garner support for refuge programs and conservation efforts in the Centennial Valley.

Campgrounds

Campgrounds would continue to be open for visitors participating in wildlife-dependent recreation. They would be improved through the installation of universally accessible toilets at both campgrounds, along with making one campsite at the River Marsh campground accessible. Other improvements, such as food storage containers, picnic tables, fire rings and road repair, would increase visitor safety and the opportunities to use the refuge over multiple days. A recreational fee would be charged to help offset the maintenance of the campgrounds.

Wildlife disturbance would occur in the immediate vicinity of the campgrounds, but impacts would be minimal. Camping supports other priority uses (fishing, hunting, wildlife observation, and photography). Camping on the refuge would have limited negative impacts on natural resources when conducted under refuge regulations.

By providing environmental educational and interpretive programs at the campgrounds to a "captive" audience, the refuge staff can influence citizens of all ages to protect wildlife and habitat,

while developing their own environmental ethics, developing support for the refuge, and decreasing wildlife violations.

Cultural Resources

The actions in this alternative would improve refuge staff's knowledge of the locations and types of cultural resources on refuge lands. This improved knowledge would give the Service the ability to preserve and restore various cultural resources. Better interpretation of cultural resources would provide visitors opportunities to better understand the history of this area.

Alternative C: Wetland Restoration

Alternative C would greatly increase opportunities for visitors to participate in wildlife-dependent recreation. By hiring a full-time visitor services specialist, on- and off-site programs could be developed to reach a much larger number of people, building a constituency who would have a greater understanding of refuge resources and programs and the Refuge System.

Hunting

Same as B, but additional quality hunting opportunities would be providing by creating a unique primitive hunt (such as archery or black powder) area in the central portion of the refuge (see figure 9, page 35). New hunting opportunities would increase harvest and disperse unnaturally concentrated ungulates (as a result of this large closed area) thereby reducing browsing impacts on habitats.

Fishing

This alternative is similar to alternative B, with the exception that fishing opportunities would decrease on creeks currently open to fishing according to state regulations, by opening them later in the summer (June 15) to protect spawning Arctic grayling. Educating anglers about restoration projects and new regulations can lead to their involvement in the process to protect these native species.

Wildlife Observation and Photography

Same as alternative B, but the eastern ponds area would be opened later (June 15), decreasing visitor access to the auto tour route. The refuge would miss opportunities to inform visitors about refuge issues and resources because of the later opening date; however this should be offset by increased opportunities elsewhere on the refuge.

Environmental Education, Interpretation, and Outreach

This alternative would greatly increase opportunities for on- and off-site programs by hiring a full-time visitor services specialist. These actions could reach a much larger number of people, potentially building a constituency who would have a greater understanding of refuge resources and programs, the Refuge System, and the importance of protecting these lands and the surrounding resources in the Centennial Valley. This could result in expanded interest in the refuge's Conservation Easement Program; thereby protecting the valley from impacts from residential development.

Campgrounds

River Marsh campground would be closed, decreasing opportunities for visitors to enjoy extended stays on the refuge during periods of high use (such as holidays, weekends, and hunt openings). These visitors may be displaced from the refuge due to the limited capacity and popularity of Upper Lake campground. They may not be able to participate in other priority uses (fishing, hunting, wildlife observation, and photography), forcing them to leave the valley and limiting their opportunity to learn about the refuge.

Upper Lake campground would continue to be open for visitors participating in wildlife-dependent recreation. Restrooms would be replaced and made universally accessible. Other improvements, such as food storage containers, picnic tables, fire rings, and road repair, would increase safety for visitors and opportunities to use the refuge over multiple days. The new recreational fee would help offset the maintenance costs of the campgrounds.

Cultural Resources

This alternative is similar to B, except that it has the potential to improve certain aspects of the refuge's habitat management and visitor services because areas of cultural concern would be identified. Additionally, this alternative would increase the likelihood of protecting cultural resources while accomplishing habitat management. This alternative would require an increase in funding to complete the inventory and cultural resources management plan.

Alternative D: Ecological Restoration

Under this alternative wildlife-dependent recreational opportunities would decrease because campgrounds would be closed; interpretation and information would be focused at the visitor contact station in the office; and moose hunting would be eliminated. No new facilities would be built to improve opportunities for wildlife observation and photography. These actions would reduce facility maintenance costs and promote a wilderness/backcountry experience. Lack of facilities and programs may lead to missed opportunities to educate visitors and garner support and understanding for refuge programs.

Hunting

Same as alternative C, except that moose hunting would be eliminated. Moose would be less dispersed during the hunting season and willow habitat would be negatively impacted due to increased moose population size. There would be impacts to a variety of species that use willow habitats, including migratory birds and wintering moose. This impact may increase as moose become concentrated on the newly-created closed area during the hunting season.

Fishing

Same as alternative C.

Wildlife Observation and Photography

This alternative would decrease costs of maintaining infrastructure but would also lead to missed opportunities to educate refuge visitors. No new facilities would be built to improve wildlife observation and photography experiences by visitors. The refuge would promote walking off the trails and roads to observe and photograph wildlife. Dispersed use may increase disturbance to wildlife across a wider area instead of focusing use at developed sites.

Environmental Education, Interpretation, and Outreach

This alternative would be similar to alternative A, but it would focus outreach and interpretation at the visitor contact station only. This would lead to missed opportunities to educate refuge visitors about issues. Minimal signage would preserve a more wilderness setting but only a minimum number of visitors would independently understand and be oriented to the refuge and its resources.

Campgrounds

This alternative would eliminate campgrounds, thus eliminating extended visits at the refuge and promoting one-time day use. Visitors would now have to drive long distances, over rough roads, to other camp sites (≥15 miles) and communities (≥45 miles), These visitors would be displaced due to the limited capacity and popularity of the nearest campsites at Elk Lake. They may not be able to participate in other priority uses (fishing, hunting, wildlife observation, and photography), forcing them to leave the valley and limiting their learning about the refuge. This could lead to increased road traffic from visitors driving from town or other distant campsites to view wildlife, fish, or hunt on the refuge. An increase in road traffic may increase wildlife disturbance and impact the wilderness setting. The combination of more vehicles and poor road conditions could affect the safety of visitors.

Cultural Resources

Same as alternative B.

Refuge Operations

Alternative A: No Action

Under this alternative the refuge would not add any infrastructure or staff to support the biological or visitor services programs. This would severely limit the ability of the refuge to develop a greater understanding of the refuge's habitats and dependent wildlife and conduct effective and necessary management actions. The visitor services program would continue to receive minimal attention due to current staff, time, and facility limitations. This lack of interaction with visitors would result in a continued loss of opportunities to educate the many visitors about the refuge and resources and provide almost no opportunities to conduct off-refuge programs.

Alternative B: Proposed Action

Increased biological staffing, including an increase in annual discretionary funding for biological technicians, would greatly increase the ability of the refuge to gain a greater understanding of the refuge's wildlife and habitats. This would allow the refuge to make scientifically-based management decisions and monitor results. Facilities would be built to support basic refuge programs and to provide universal accessibility for visitors of all abilities to enhance their appreciation for and understanding of the resources of the refuge while maintaining wilderness values. There would be added maintenance costs for these facilities. Visitors would also be better oriented on the refuge through better signage. These improvements and the recruiting of a temporary seasonal visitor services specialist would lead to opportunities to educate visitors and garner support and understanding of refuge programs, issues, and the conservation of the resources of the refuge and the Centennial Valley. Closing refuge roads that receive minimal use will save maintenance costs.

Alternative C: Wetland Restoration

This alternative is the same as alternative B except that up to five residences would be constructed. This additional residence would allow the refuge to recruit additional staff, but there will be added costs for contructing and maintaining this additional residence. The addition of a full-time permanent visitor services specialist would allow the refuge to reach a much larger number of people, building a constituency who have a greater understanding of refuge resources and programs, the Refuge System, and the values of conserving the resources of the Centennial Valley.

Alternative D: Ecological Restoration

Same as alternative B, except interpretation and outreach would be concentrated at the visitor contact

station only, minimizing facilities in the field. No new facilities would be built to improve opportunities for wildlife observation and photography. Campgrounds would be eliminated. No new trails or roads would be developed or improved. These actions would reduce facility maintenance costs and promote a wilderness/backcountry experience. The lack of facilities in the field would lead to missed opportunities to educate visitors and garner support and understanding of refuge programs. Eliminating the campgrounds would result in a loss of multi-day visits due to the refuge's remoteness and minimal lodging facilities nearby. The greatest impact would be on hunters who typically spend multiple days at the refuge in pursuit of this wildlife-dependent activity. Wildlife observers and photographers would also not be accommodated should they wish to explore the refuge and the surrounding valley for extended periods. Overall, visitor numbers would decline. Closing refuge roads that receive minimal use will save maintenance costs.

Socioeconomics

Alternative A: No Action

Alternative A, the no-action alternative, would not see any significant change in the net economic contribution of the refuge to the local economy through visitor spending and employee earnings. Current visitation levels are expected to remain the same, contributing $260,000 to the local economy. Employment would remain at five full-time employees.

Alternative B: Proposed Action

Under alternative B, increases in employment and visitation to the refuge and Centennial Valley would result in an increase in the economic activity the refuge generates in the local area. Visitation would increase due to enhanced outreach efforts and offerings at the refuge. Visitation under this alternative is expected to increase to 15,000 visitor days, 12,750 of which are from nonlocal visitors. Assuming nonlocal visitors spend an average of $25 per day, visitation to the refuge would generate roughly $320,000 in annual local spending. Additional employees under this alternative would increase employment at the refuge from five to seven full-time employees and add at least five seasonal staff. There would be added costs associated with constructing and maintaining housing for staff. Designating refuge trails and an auto tour route may add to maintenance costs and would require the replacement of one refuge bridge.

Alternative C: Wetland Restoration

Under alternative C, increases in employment and visitation would cause a more significant increase in economic activity generated by the refuge. Visitation would increase due to enhanced outreach efforts, programming, and other offerings at the refuge. Visitation is expected to increase to 16,000 visitor days per year under this alternative, of which 13,600 are from nonlocal visitors. Assuming nonlocal visitors spend an average of $25 per day, visitation to the refuge would generate about $340,000 in annual local spending. The addition of an additional full-time employee under this alternative would increase employment at the refuge from five to six full-time equivalents.

Alternative D: Ecological Restoration

Alternative D is expected to result in a decrease in the economic activity generated by the refuge due to a large decrease in visitation. Visitation is expected to fall due to the closing of campgrounds and the banning of moose hunting. However, if free-ranging bison were reintroduced to the refuge, expected visitation loss under this alternative may be offset by attracting new wildlife viewers. Combining these effects, it is estimated that visitation would decline to 7,500 visitor days per year under alternative D, of which 6,375 of those visitors would be nonlocal. Assuming nonlocal visitors spend an average of $25 per day, visitation to the refuge would generate about $160,000 in annual local spending. The elimination of grazing would have an uncertain effect on the local economy. The effect may be negative if the ranchers currently using the refuge for grazing do not have adequate private land for cattle grazing and have to move their cattle out of the study area, thereby incurring transportation costs. If there is an adequate local substitute for refuge grazing land, then impacts would be minor. There would be substantial financial costs associated with the removal of all water impoundment or management structures. Additional employees under this alternative would increase employment at the refuge from five to seven full-time employees and add several temporary seasonal staff. There would be added cost for constructing and maintaining additional refuge housing while maintenance costs would be reduced for signage, roads, and trails.

Cumulative Impacts

Cumulative impacts include the incremental effects of the actions for an alternative, when these are added to past, present, and reasonably foreseeable future actions. Cumulative impacts can be the result of individually minor impacts, which can become significant when added over time.

The Council on Environmental Quality regulations that carrys out NEPA requires mitigation measures when the environmental analysis process detects possible significant impacts on habitat, wildlife, or the human environment.

None of the activities proposed are expected nor intended to produce significant levels of cumulative environmental impacts that would require mitigation measures. Nevertheless, the final CCP would contain the following measures to preclude significant environmental impacts from occurring:

- Federally listed species would be protected from intentional or unintended impacts by having activities banned where these species occur.
- All proposed activities would be regulated to lessen potential impacts to wildlife, fish, and plant species, especially during sensitive reproductive cycles.
- Monitoring protocols would be established to determine goal achievement levels and possible unforeseen impacts to resources. This would allow for application of adaptive resource management to ensure wildlife and habitat resources, as well as the human environment, are preserved.
- The CCP could be revised and amended after 5 years of implementation, for application of adaptive resources management to correct unforeseen impacts that occur during the first five years of the plan.

Mike Parker/USFWS

Garter snakes are the only reptile known to inhabit the refuge.