CHAPTER 5–Environmental Consequences

Dave Carr

Rocky Mountain Front Conservation Area.

This chapter provides an analysis of the potential effects on the environment associated with the implementation of the management alternatives for the refuge complex. The Service assessed the environmental consequences of implementing each of the alternatives on the physical, biological, socioeconomic, and cultural resources of the refuge complex.

Management actions are prescribed in the alternatives as a means for achieving the vision and goals for the refuge complex, 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 estimated potential effects on a resource from carrying out the actions of an alternative. Table 5 (see chapter 3, section 3.6) summarizes the alternatives' actions and the associated consequences as described below.

Environmental consequences for a separate analysis—to address management specific to Benton Lake Refuge—are described in chapter 7 and are not repeated here.

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, the duration of effects is used 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

include the effect of trail construction on vegetation along the trail or the effect of hunting on wildlife.

Indirect, or secondary, effects are those induced by implementation actions but that occurs later in time or farther removed from the place of action through a series of interconnected effects. Examples of indirect effects include the effects on downstream water quality from an upstream surface disturbance or 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 due 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 help 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 three alternatives:

- Implementation of the management direction (goals, objectives, and strategies) would follow the refuge complex's best management practices.
- Management activities and programs would avoid and reduce adverse effects on federally threatened and endangered species, to the extent possible and practicable.
- The refuge complex 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 expected to be similar for each alternative.

Regulatory Effects

As described in chapter 1 of this draft CCP, the Service must follow Federal laws, administrative orders, and policies in the development and implementation of its management actions and programs. Among these mandates are the Improvement Act, the ESA, 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 (see 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.

The Service is 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 complex. 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.

5.3 Landscape Conservation Goal Effects

Climate Change

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 due to significant 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 south and southwestern part 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 very likely that extreme weather (heat waves, flooding) will become more frequent. Increases in annual precipitation may be partially offset by increases in evaporation. Moisture availability, rather than just precipitation, is a critical resource for plants and animals. One tool for trying to address this is the Hamon moisture metric (Young et al. 2010) that integrates temperature and precipitation through a ratio of actual evapotranspiration to potential evapotranspiration (AET:PET), with consideration of total daylight hours and saturated vapor pressure. This metric, when used with an ensemble of 16 major global circulation models and the "middle of the road" emissions scenario (A1B), predicts a net drying across the refuge complex, even with potential increases in precipitation (Girvetz et al. 2009).

However, this metric does not include components of habitat moisture retention such as water-holding capacity, effect of snow pack on water availability, and different vegetation types, all of which are challenging to incorporate at a national scale (Young et al. 2010). Furthermore, recent work analyzing spatial and temporal patterns in wet areas for approximately 40,000 wetland basins over nearly 20 years in the PPPLCC's Prairie Pothole Region of the Dakotas and eastern Montana found that precipitation and temperature were not sufficient to explain annual wetland water conditions (Niemuth et al. 2010). Predictive models for wetlands need to consider water regimes, spatial patterns, and other factors for more accurate prediction of water conditions and wildlife response to climate change.

Current trends in climate change are expected to affect high mountain ecotypes and lower elevation, snowmelt-dependent watersheds, such as those found in the refuge complex, more acutely than some other landscape ecotypes. Empirical data shows that during the 20th century, the Crown of the Continent region has grown warmer, and in some areas drier, especially east of the Divide and along the Rocky Mountain Front. In Montana, average spring temperatures have risen by almost 4°F over the last 55 years and winter temperatures have increased 3°F (TNC 2009).

The effects of climate change would extend beyond the boundaries of any single refuge or easement program and would therefore need large-scale, landscape-level solutions that extend throughout the refuge complex. 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 (Holling 1973, Gunderson 2000, Walker and Salt 2006).

Climate Change—Alternative A

Temperature and Precipitation Uncertainty

Translating global and continental climate change models to regional scales, such as Montana or the refuge complex are difficult. There are still major uncertainties at the regional level, especially related to precipitation (Christensen et al. 2007), although models are getting increasingly more reliable. Some robust predictions suggest that warming is likely to be most pronounced in winter and snow season length and snow depth have a greater than 90-percent probability of decreasing. Expected increases in temperature range from 4-9 °F in western North America during this century (Christensen et al. 2007).

Changes in temperature and precipitation are expected to decrease snow pack, which could affect stream flow and water quality throughout the refuge complex. Warmer temperatures would result in more winter precipitation falling as rain rather than snow throughout much of the region particularly in mid-elevation basins where average winter temperatures are near freezing. This would result in less winter snow accumulation, higher winter stream flows, earlier spring snowmelt, and earlier

peak spring stream flow and lower summer stream flows in rivers that depend on snowmelt (USFWS 2009d).

Although temperature increases over the next several decades appear inevitable, the resulting effect on precipitation, moisture and wetland hydroperiods is highly uncertain (see Climate Change section, chapter 4). Some modeling has suggested that there could be a shift to the PPPLCC's eastern Prairie Pothole Region of highly favorable water and cover conditions for waterfowl breeding and shorter hydroperiods for seasonal and semipermanent wetlands if precipitation does not increase along with temperatures (Johnson et al. 2005, Johnson et al. 2010). However, other researchers have found that precipitation and temperature alone were insufficient to explain annual wetland water conditions in the PPPLCC's Prairie Pothole Region when compared to a dataset of 40,000 basins spanning 1998–2007 and expressed concern about using climate change models that were calibrated with just a few wetlands (Niemuth et al. 2010). In addition, the natural variation in wet–dry cycles in the PPPLCC's Prairie Pothole Region may eclipse any smaller, climate-change driven shifts that occur in the near term (Niemuth et al. 2010). Continuing to manage natural wetlands by supporting wet–dry cycles, emulating historical processes such as fire, and reducing stressors such as invasive species, should maximize resiliency in natural wetlands (Walker and Salt 2006). This approach should be beneficial to natural wetlands on the refuge complex whether or not the projected magnitude of climate changes actually occur.

To analyze effects of climate change on priority wetland-dependent birds, the Service conducted a vulnerability assessment on 4 species that use deeper, more permanent wetlands and 11 species that prefer shallow, more seasonal wetlands (Young et al. 2010). Species were chosen if they are common or uncommon breeders in the refuge complex and were identified as a species of concern at the national or regional level by the Service or its partners. The Vulnerability Assessment designed by NatureServe uses up to 16 assessment factors and allows for uncertainty in any of the variables. The assessment recognized that these wetland-dependent breeding birds in the refuge complex have increased vulnerability due to their dependence on a specific hydrologic condition (wetlands) and sensitivity to phenological changes in relation to migration—wetlands thawing earlier than migration and the possible added stressor of more wind farms as a green energy solution. However, these birds are also highly mobile, have a tolerance for a wide range of temperatures and consume varied diets. All of these provide some resistance to climate changes and reduces their vulnerability relative to other species. Considering these factors in combination, the assessment ranked all of the priority bird species as "presumed stable/not vulnerable" with a slight trend toward "moderately vulnerable" for some species. Similar results, reflecting the ability of birds to respond to climate change perhaps better than other taxa, were found during vulnerability assessments in the southwestern United States, which is likely to experience stronger temperature increases and precipitation decreases than northern Montana (Girvetz et al. 2009, Christensen et al. 2007).

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Restoration in the Swan Valley Conservation Area.

In the intermountain region of the refuge complex, specialized habitat for fish and wildlife species is expected to diminish as glaciers and alpine snow fields melt and winters warm in Montana. Snow conditions that facilitate hunting success for forest carnivores, such as Canada lynx, are now changing due to winter warming (Stenseth 2004). Other birds and mammals throughout the Crown of the Continent and Greater Yellowstone Ecosystems (Kendall and Arno 1989) would also be negatively affected by winter warming.

High-elevation forest plants, such as whitebark pine, are an important food source for grizzly bears that appears to be declining. Whitebark pine is susceptible to several factors that may be exacerbated with a warming climate such as drought, wildlife and mountain pine beetle attacks. Continued decline of this important food source may result in shifts in foraging elevations and potentially increase grizzly bear conflicts with humans and livestock (Hanna et al. 2009).

As late summer flows are affected by global warming, fewer rivers would be able to supply ample cold water required by species such as bull trout. Bull trout distribution is expected to be fragmented by the heightened ambient air temperatures (America's Hottest Species 2009).

Baseline monitoring of weather information at the Benton Lake Refuge would continue to occur. Over the life of the plan (15 years), dramatic shifts are not expected; however, this baseline information may be useful for detecting trends across larger timeframes. The uncertainty of temperature and precipitation changes would continue to exist. The refuge complex would rely on outside entities such as USGS to help downscale climate change models to increase predictability of temperature and precipitation changes and apply these predictions to management accordingly.

Preservation of Water Rights

Monitoring of water usage would help preserve existing water rights. Regular usage of the cubic flows associated with the individual water right makes sure the water is available for the future. Water use is documented at the Benton Lake and Swan River Refuges and at the Kingsbury Lake, Blackfoot, Kleinschmidt Lake, Sands, Furnell, Ehli, Savik and H2–O WPAs. The retention and use of these rights is important, especially if climate conditions cause a reduction of available runoff and there is greater demand for less water.

Baseline Inventory and Monitoring of Natural Resources

The current baseline monitoring of habitat conditions, weather stations and river gauges would provide some ability to detect long-term trends related to climate change. These trends could include changes in vegetation composition, wetland water levels, some riverflows and temperature. However, this information is likely to be limited in scope, site-specific and not easily related to regional or national climate change data and trends.

Ecosystem Resilience

Resilience of ecosystems within the refuge complex would be strategically increased. Preventing the conversion of the natural habitat through wetland, grassland and conservation easements increases resilience (the capacity of an ecosystem to absorb disturbance while supporting function) by reducing fragmentation and promoting corridors for movement and adaptation of wildlife. By reducing stressors such as conversion of natural habitat and fragmentation, resilience to climate change can be enhanced.

Working with Others

At the current levels of engagement by staff in climate change related partnerships such as the GNLCC and the PPPLCC, the ability to proactively address climate change issues is limited. Research or on-the-ground conservation is less likely to directly apply to refuge complex issues without greater participation by staff. In addition, any new information about climate change, and how it relates to management in the refuge complex, or opportunities to collaborate on conservation delivery may be missed by limiting partnerships.

Carbon Sequestration and Reducing the Carbon Footprint

Carbon sequestration rates vary depending on plant species, soil type, region, climate, topography and management practices that can affect plant productivity. At a local scale, carbon sequestration is largely influenced by light conditions, water availability, soil water-holding capacity and its nutrient content. Local conditions could change the frequency and severity of natural risks such as forest fires and strong winds, increasing the probability of CO_2 emissions and hence carbon loss from these systems. In general, the protection and restoration of forest, grassland and wetlands proposed under alternative A on both fee-title lands and within the conservation

areas would support or improve carbon sequestration throughout the refuge complex. The largest gains in carbon sequestration could occur if cropland is restored to grassland or drained wetlands are restored (Bangsund et al. 2005).

Some efforts toward reducing the footprint of facilities would occur. The reduction is likely to be modest and not well quantified. Electric savings from the wind generator and photovoltaic panels at Benton Lake Refuge would continue at 73 percent annually.

Staff Time and Management Costs

No major deviations would be made with existing staff. With implementation of green innovations, some expenses such as electric, fuel (gasoline and diesel), and natural gas may decrease.

Climate Change—Alternative B

Effects would be the same as alternative A for temperature and precipitation uncertainty, preservation of water rights, ecosystem resilience, and carbon sequestration and reducing the carbon footprint.

Baseline Inventory and Monitoring of Natural Resources

The increase in baseline monitoring of habitat conditions, weather stations and river gauges would improve the ability to detect long-term trends related to climate change within the complex. These trends could include changes in vegetation composition, wetland water levels, some riverflows and temperature. However, this information may still be limited in scope, site-specific and not easily related to regional or national climate change data and trends.

Ecosystem Resilience

Resilience of ecosystems within the refuge complex would be greater in this alternative over alternative A. Preventing the conversion of the natural habitat through wetland, grassland and conservation easements is expected to happen on more acres under this alternative. This will increase resilience by reducing fragmentation and promoting corridors for movement and adaptation of wildlife. By doing more to reduce stressors, such as conversion of natural habitat and fragmentation, resilience to climate change can be enhanced.

Working with Others

An increase of engagement by staff in climate change related partnerships such as the GNLCC and the PPPLCC, would improve the ability to proactively address climate change issues. Research or on-the-ground conservation would be more likely to directly apply to refuge complex issues with greater participation by staff. In addition, any new information about climate change, and how it relates to management in the refuge complex, or opportunities to collaborate on conservation delivery may be realized by increasing partnerships.

Staff Time and Management Costs

Some reallocation of refuge resources (0.1 FTE wildlife refuge manager or biologist) would occur for taking part in more partnerships to address climate change and to take part in initiatives such as the GNLCC and the PPPLCC.

Climate Change—Alternative C

Effects would be the same as alternatives A and B for temperature and precipitation uncertainty, and preservation of water rights.

Baseline Inventory and Monitoring of Natural Resources

Same as alternative A plus, more weather stations and river gauges would increase the refuge complex staff's ability to detect long-term trends related to climate change. The active participation of staff in data acquisition, monitoring, and analyzing management actions in respect to climate change would increase the scope of the projects and increase the likelihood that this information can be related to regional or national climate change data and trends.

Ecosystem Resilience

Resilience of ecosystems within the refuge complex would be greater in this alternative over alternatives A and B. Preventing the conversion of the natural habitat through wetland, grassland and conservation easements is expected to happen on more acres under this alternative. This will increase resilience (the capacity of an ecosystem to absorb disturbance while supporting function) by reducing fragmentation and promoting corridors for movement and adaptation of wildlife. By doing more to reduce stressors, such as conversion of natural habitat and fragmentation, resilience to climate change can be enhanced.

Working with Others

Vigorous participation of staff with landscape-level climate change initiatives would facilitate more opportunities to strategically protect areas and acquire data, check, and analyze climate change effects.

Carbon Sequestration and Reducing the Carbon Footprint

Same as alternative A, plus more efforts to reduce the refuge complex carbon footprint should decrease carbon emissions more than alternative A. For example, the expansion of the photovoltaic system at the headquarters would be expected to off-set the increase in energy demands.

Staff Time and Management Costs

Greater reallocation of refuge resources (0.2 FTE wildlife refuge manager or biologist) would occur to vigorously take part in more partnerships to address climate change, take part in initiatives such as the GNLLC and the PPPLCC and manage increased monitoring efforts.

Preserving Intact Landscapes

One of the greatest threats to wildlife today is residential development and human population growth. Much of this growth is happening in rural areas. In Montana, the rate of growth in unincorporated places during the 1990s was more than twice the rate of growth in incorporated areas (American Wildlands 2009). 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 and wildlife conflicts; (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 due to genetic inbreeding that decreases genetic diversity and produces genetic anomalies that are often detrimental to individuals and populations. Isolated populations are also less resilient to disease, overhunting, or catastrophic events like floods or 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 core 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.

Although all aspects of managing the refuge complex may be affected by the proposed action at the Benton Lake Refuge (see chapter 7), the ability to protect intact landscapes has the potential to be affected the most. In 2011, the opportunity to preserve intact landscapes within the refuge complex was greatly increased by the expansion of the Rocky Mountain Front and Blackfoot Valley CAs and the establishment of the new Swan Valley CA. Refuge complex staff, at all levels, take part in, and support, these landscape-level efforts. The more staff time and complex resources needed to manage the Benton Lake Refuge, the fewer refuge complex resources would be available to support landscape-level projects. This would affect the total number of acres that can be protected during the life of this plan.

Preserving Intact Landscapes—Alternatives A and B

Elevation Gradient

The elevation gradient, which extends from intact wetland complexes at 3,000 feet, to upland forests at 6,500 feet, is preserved in part through the Blackfoot Valley, Swan Valley, and Rocky Mountain Front Conservation Areas. Changes in elevation are especially significant along the Rocky Mountain Front Conservation Area, which encompasses 918,000 acres of topographic relief from wetland–grassland to mountains. The wide array of habitat types provides microhabitats for a plethora of plant species and associated use by a variety of wildlife species. Transitional zones of valley floors to montane forests would be preserved and help fish and wildlife resources. The preservation of the gradient habitats would enhance the resiliency of the ecosystem.

Wildlife Corridors

Fragmentation and the subsequent loss of wildlife corridors can lead to islandization of wide-roaming species. Protected areas become isolated due to the loss of corridor areas and access to prime habitat. Without the corridor bridges, genetic isolation occurs and results in serious genetic anomalies and increasing vulnerability of species to disease, catastrophic events like floods and fires, and overhunting (Yellowstone to Yukon Conservation Initiative 2009). Preservation and enhancement of wildlife corridors and linkage areas in the conservation areas, in particular, would be protected and enhanced for grizzly bear, black bear, elk, mule deer, white-tailed

deer, moose, mountain lion, Canada lynx, bobcat, gray wolf, coyote, wolverine, fisher, and a wide variety of small mammals.

Trust Resources

Within the existing efforts in the Blackfoot Valley, Rocky Mountain Front, and Swan Valley Conservation Areas, and within the district, grizzly bear, Canada lynx, gray wolf, long-billed curlews, Brewer's sparrow, bull trout, west-slope cutthroat trout, trumpeter swan, black tern, and more than 22 species of waterfowl and other migratory birds are trust species that would be helped by protecting large, intact blocks of native habitat.

Easement programs protect wildlife habitat from dispersed development that leads to degradation and loss of habitat for trust resources. For wide-ranging species, unplanned development leads to loss of habitat connectivity within the project area and, on a larger scale, between the Crown of the Continent ecosystem and other historical or potential ranges. For example, riparian zones provide excellent habitat and cover for grizzly bears moving throughout the watersheds, but they are also among the most desired locations for building (Lolo National Forest 2003). An increase in development also leads to more frequent conflicts between bears and people due in large part to the increased presence of bear attractants such as human garbage, dog food, and bird seed. The increased interaction can lead to human-caused grizzly bear mortality, which in turn results in a decrease in grizzly bear reproduction and loss of population and genetic viability.

Preserving the Rural Way of Life

Existing landscape-scale conservation partnerships such as the Blackfoot Challenge in the Blackfoot Valley Conservation Area, the Rocky Mountain Front Advisory Committee in the Rocky Mountain Front Conservation Area and the Swan Ecosystem Center in the Swan Valley Conservation Area would continue to support working landscapes in which fish and wildlife resources coexist with the ranching community, forestry, and other agricultural operations. Conservation easements would continue to be an important tool for protecting wildlife habitat while leaving the land in private ownership.

Ascertainment Needs

To meet the expansion goals of the Rocky Mountain Front CA (average tract size is 5,000 acres) 59 willing sellers would need to be contacted and successfully enrolled in the easement program. For the Blackfoot Valley CA (average tract size is 1,000 acres), at least 103 willing-seller landowners would need to be contacted and successfully enrolled in the easement program to protect 103,500 acres. The Swan Valley CA's average tract size (250 acres) would need contact and successful enrollment in the easement program with more than 45 landowners to acquire 11,000 acres.

Staff Time and Management Costs

Staff and money to manage the preservation of intact landscapes are not expected to grow significantly. A total of 2.5 FTEs (wetland district manager and 1.5 FTE wildlife refuge specialists) would be allocated toward these efforts. Budget operations and salary percentage dedicated to this activity would remain at current levels.

It is expected to be quite difficult to meet the challenges associated with any significant increases in land acquisition money from LWCF or Migratory Bird funding. Fieldwork would be necessary to carry out the program, secure willing sellers, and inspect provisions of easement contracts. A reallocation of staff and money from other refuge complex programs and reliance on other refuge regional programs (such as Realty and Partners for Fish and Wildlife programs) would be necessary to help carry the increased workload. Little flexibility exists in other complex programs and the Realty and Partners for Fish and Wildlife programs would see increased workload requirements as well with little flexibility to lend help. Without significant base money increases or help from other programs, it would be extremely difficult to adequately manage the efforts toward preserving intact landscapes.

Preserving Intact Landscapes—Alternative C

Effects would be the same as alternative A and B for ascertainment needs.

Elevation Gradient

Same as alternative A, plus better identification and protection of key transitional zones of valley floors to montane forests is likely to occur if staff are actively engaged in applying SHC with partners. The increased preservation of the gradient habitats would enhance the resiliency of the ecosystem in this alternative over other alternatives.

Wildlife Corridors

Same as alternative A, plus better identification and protection of wildlife corridors is likely to occur if staff are actively engaged in applying SHC, with partners, to the landscape. By improving connectivity through wildlife corridors, the benefit to populations of focal species would be greater under alternative C than the other alternatives.

Trust Resources

Same as alternative A, plus a greater a benefit to trust resources would be expected if staff were actively engaged in applying SHC with partners.

Preserving the Rural Way of Life

Same as alternative A, plus the potential to establish new conservation areas would provide more opportunities to support working landscapes in which fish and wildlife resources coexist with the ranching community, forestry, and other agricultural operations. Conservation easements could be used in new communities as a tool for protecting wildlife habitat while leaving the land in private ownership.

Staff Time and Management Costs

Same as alternative A, except staff and money needed to manage the preservation of intact landscapes is expected to grow significantly. One and a half more full-time wildlife refuge specialists would be needed to coordinate, carry out, and provide a local presence for the Crown of the Continent Conservation Areas and other potential conservation areas. These landscape-scale initiatives can increase the refuge complex acreage by more than 296,000 acres almost exclusively through the conservation easement program. Three FTEs (1 wildlife refuge specialist working in each of the conservation areas and more support from the Realty program) would need to be allocated toward refuge complex-wide preservation of intact landscape efforts. Budget operations and salary percentage dedicated to this activity would increase nearly two-fold. Fieldwork would be necessary to carry out the programs, secure willing sellers, and inspect provisions of easement contracts. More staff time, and potentially travel costs, would be associated with actively engaging in the application of SHC. Without significant base money increases or reallocation of complex resources from Benton Lake Refuge (see chapter 7, alternatives C1 and C2), it would be not be possible to fully carry out the landscape preservation efforts.

5.4 Habitat Goal Effects

This section discusses the effects of alternatives pertaining to grasslands, wetlands, riparian areas, forests and woodlands, and sagebrush-steppe. The following impact analysis spends little time discussing cause and effect relationships of trust species. It was assumed, by protecting landscapes expanses of native habitats through easement programs, there would be a positive effect on endemic wildlife and trust species. Also, management of fee-title lands in contiguous blocks using the environmental factors at proper levels that shaped the prairie and intermountain valley ecosystems— fire and grazing—would inherently positively affect trust species such as grassland birds, wetland-dependent birds and sage obligates such as Brewer's sparrows.

Grasslands: Native—Alternatives A and B

Protection and Management

New and expanded project areas and alternative money sources provide potential for protecting great expanses of native prairie. Preserving and managing native prairie landscapes reduces soil erosion, supports water quality, effectively sequesters carbon and make them more resilient and resistant to disturbances (Bangsund et al. 2005).

Fee-title management of native grasslands would continue to be managed extensively but imprecisely, using a coarse, generic approach because of limited resources for staff, money and scientific knowledge relative to individual management units. Grazing and prescribed fire are used to emulate historical processes, which is assumed to increase the health of native prairie. Native prairies have varying levels of invasion by noxious weeds and cool-season exotic grasses.

Monitoring

Although some baseline data and monitoring is occurring on the refuge complex, it is not comprehensive. This may result in less success in determining the effects of management actions over time. The ability to share the acquired knowledge with others is also limited without more formal monitoring.

Staff Time and Management Costs

Under current management, staff limitations are already clear and would be stretched thinner with each added conservation easement. For the Rocky Mountain Front and Blackfoot Valley CAs, easement contacts, evaluations, and preliminary acquisition work, are supported by a temporally shared fulltime position and a wildlife refuge specialist recently assigned to the Rocky Mountain Front CA. However, other easement programs that protect grasslands in the district are administered with little to no time to cultivate new interest for acquisition. In addition, easement enforcement is also a responsibility of refuge complex staff that increases with each new easement. A reduction in staff's ability to enforce easements and resolve conflicts can undermine the easement program and damage relationships with the local community. Implementing the alternatives for Benton Lake associated with alternatives A and B (Benton Lake Refuge A1, B1 or B2—see chapter 7) make it unlikely that more complex staff or money would be allocated toward easement acquisition or fee-title management of native grasslands.

Grasslands: Native —Alternative C

Protection and Management

Same as A and B plus, there is substantial potential to protect in excess of 150,000 acres of native grasslands in these expansive community supported conservation areas. With expanding opportunities for protecting native grasslands in the Blackfoot Valley CA and Rocky Mountain Front CA, increases in refuge complex, realty, and Partners for Fish and Wildlife staff functions will be necessary, either through new hires or reallocation of existing staff resources to make successful impacts.

Monitoring

The increased effort to formally watch native grasslands should improve the effectiveness of management actions over time. By tracking successes and failures, staff would be able to learn more quickly and improve results. These results may include higher productivity of native plant species, more diversity of native plant species, increased use, and increased diversity and productivity of grassland breeding birds (or other trust resource). Monitoring is also helpful in preventing the spread of new invasive species through EDRR as well as providing feedback on efforts to treat larger, established infestations. Formally documenting these efforts as part of a monitoring program may also help other refuges with their native prairie management.

Staff Time and Management Costs

Same as A and B, except implementing the Benton Lake Refuge alternatives associated with alternative C (C1 or C2—see chapter 7) will result in the greatest potential to reallocate complex resources toward easement acquisition.

Grasslands: Tame

Management of fee-title tame grass was approached through supporting health and longevity of stands using a rotational system within specific management units. This scheme provides a diversity of vegetative structure within each management unit, which provides a variety of habitats for different grassland-dependent species. Offering a variety of habitats on the landscape would appeal to the widest array of species (See 4.2 Biological Resources).

Grasslands: Tame —Alternatives A and B

Management

Establishment of management rotations on tame grass units has largely been opportunistic, begun by cooperators expressing an interest in haying or grazing. Tame grass plantings consist of only three or four introduced plant species. Compared to native grasslands the diversity of soil invertebrate species and nutrient cycling processes would be vastly simplified. Tame grasslands are markedly less efficient in capturing and transferring solar energy, sequestering carbon and resisting disturbances such as invasive species (Bangsund et al. 2005). Rotations provide a diversity of structural habitats within the management unit, which appeals to a wide variety of grassland-dependent species. Tame grass favors species that like tall, dense vegetation, such as nesting mallards, but not a true prairie obligate such as Sprague's pipits.

Monitoring

Informal monitoring of tame grass would provide feedback to managers; however, less information may be collected than from formal monitoring, which

could result in less success in determining the effects of management actions over time. The ability to share the acquired knowledge with others is also limited without more formal monitoring.

Staff Time and Management Costs

Farming and reseeding degraded tame grass stands has been considered, but shortages of resources has prevented any concerted efforts (130 acres over the last 6 years). As tame grass stands continue to degrade over time into poor habitat conditions (currently approximately 850 acres), the initial resources to address these habitat needs grows substantially. Implementing the alternatives for Benton Lake Refuge associated with alternatives A and B (A1, B1 or B2—see chapter 7) make it unlikely that more complex staff or money would be allocated toward managing tame grass.

Grasslands: Tame —Alternative C

Management

Replanting tame grass to native species with subsequent treatments of prescribed fire and grazing management would mimic historical processes and gradually recover soil mycorrhizae, invertebrate diversity and symbiotic relationships. Tame grass stands replanted to native prairie species will be managed using prescribed fire and grazing prescriptions rather than haying. These types of management should replenish and improve the nutrient cycles rather than mining the soil nutrients through rotational haying systems.

Monitoring

The increased effort to formally watch the replanting of tame grass to natives should increase the effectiveness of replanting efforts over time. By tracking successes and failures, staff would be able

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United States Secretary of the Interior Ken Salazar visits the refuge complex.

to learn more quickly and improve results. These results may include better or faster establishment of native plant species, more diversity of native plant species and faster or more robust breeding bird (or other trust resource) response. Formally documenting these efforts as part of a monitoring program may also help other refuges with their native replanting efforts.

Staff Time and Management Costs

Planting 800 acres to native grass species would have higher input cost ($156 per acre) and traditionally take longer (3–4 years) and are more difficult to establish when compared to planting DNC with cost of $106 per acre and 1–2 years to establish. Seedbed preparation before seeding either native or tame grass takes at least of 2 years of farming. A conservative estimate in staff time to complete these efforts in 15 years would be one more FTE. Beside the increased staff time needed to administer and conduct farming and seeding activities, grassland monitoring and management activities would increase. Monitoring would be used to fine tune management strategies to reach vegetative objectives sooner or identify management misconceptions and begin modifications to management techniques.

Implementing the Benton Lake Refuge alternatives associated with alternative C (Benton Lake C1 or C2—see chapter 7) will result in the greatest potential to reallocate complex resources toward native grassland plantings.

Grasslands: Nonnative Tree Plantings—Alternatives A and B

Management

Currently there are no specific management activities in regard to tree plantings. Nonnative tree plantings contribute to fragmentation, depredation and parasitism, which negatively affect grassland-dependent migratory birds (Bakker 2003). Some of these bird species include species of concern, such as marbled godwits and chestnut-collared longspurs (unpublished records on file at Benton Lake Refuge). Distance to a wooded edge has been shown in many studies to increase nest predation and displace grassland species (Bakker 2003). This makes grassland habitat around tree plantings either unavailable or less desirable for grassland species. The distance varies by study area and species, but the Service estimates that between 66 and 764 acres of grassland habitat on Benton Lake Refuge would become available or more desirable to grassland species by removing these trees (Bakker 2003).

Nonnative tree plantings provide an unconventional habitat niche for a wider diversity of resident and migratory bird species. As many as 21 other bird species occur on the Benton Lake Refuge because of the nonnative tree plantings (unpublished records on file at Benton Lake Refuge). Some of these birds include species of concern, such as loggerhead shrikes and Swainson's hawk (unpublished records on file at Benton Lake Refuge).

Nonnative tree plantings consist of a handful of introduced species that are far less diverse than native grassland communities compromised by their establishment. Tree plantings can also contribute to and provide opportunities for invasive noxious weed infestations.

Staff Time and Management Costs

Currently there are no specific management activities in regard to tree plantings.

Grasslands: Nonnative Tree Plantings—Alternative C

Management

If all nonnative tree planting were removed at Benton Lake Refuge, at least seven species of migratory birds that nest primarily in trees and shrubs would no longer nest on the refuge. However, there are many tree plantings that surround the refuge and an extensive woody riparian corridor along the nearby Missouri River. Some of these species may still use the refuge for feeding and resting. The loss of nesting habitat for loggerhead shrikes and Swainson's hawks on the refuge would not be expected to have a significant negative effect on the overall populations of these species.

The use of nonnative tree plantings by migratory birds on other fee-title lands within the district has not been studied. These tree plantings only add up to 6 miles and are located on the Arod Lake WPA within tame grass. Therefore, the effects of removing any of these plantings may be similar to Benton Lake Refuge, but much smaller in scale.

Staff Time and Management Costs

Costs to remove 19 miles of planted tree would be approximately $1140 in fuel and $2,000 in main-

tenance of the equipment (replacing teeth, fluids, breakdowns). Herbicide treatment would need to follow tree removal for two growing seasons ($1,000). After the tree plantings are successfully removed, each site would be evaluated for grass seeding.

Implementing the Benton Lake Refuge alternatives associated with alternative C (Benton Lake C1 or C2—see chapter 7) will result in the greatest potential to reallocate complex resources toward shelterbelt removal.

Wetlands and Riparian Areas

This section discusses the effects of alternatives pertaining to natural wetlands, altered wetlands (creations and enhancements), restored wetlands, and wetland vegetation management for the refuge complex. Altered wetlands are where the hydrology or the topography has been actively modified from historical conditions to achieve specific management goals. For example, holding water at higher levels, longer or more frequently than occurred historically.

Wetlands and Riparian Areas: Natural—Alternatives A and B

Natural wetlands are those basins where the topography of the basin has not been altered or it has been restored as closely as practicable to historical conditions. In addition, natural basins are subject to climatic flooding and drying cycles. However, these natural wetlands may be altered by factors such as changes in hydrology and land use in the surrounding landscape.

Water Quantity, Quality, and Timing

On fee-title lands within the refuge complex, just over half of the approximately 12,000 acres of wetlands are subject to natural flooding and drying cycles. Most of these are depressional wetlands—potholes— caused by glaciation. In Montana, precipitation is cyclical, causing a series of wet and drought years, often in 10 to 20-year cycles (Hansen et al. 1995, Heitmeyer et al. 2009). Therefore, whether or not these wetlands within the refuge complex were flooded or dry in any given year would depend on natural climatic cycles, and in some cases, ground water exchange.

The extended drying periods are beneficial for removing contaminants such as salts and selenium that can build up during the wet cycles. Natural wetlands in the refuge complex are less likely to develop significant contamination problems than impounded or altered wetlands.

Within the Swan River Refuge, wetlands are part of the Swan River floodplain or meander loops of the river that have been cut off from the main channel of the Swan River. In alternatives A and B, floodwater and ground water would continue to be the dominant inputs. Evaporation, discharge to ground water and receding floodwaters would be the primary means for wetland drying. Over time, new oxbows may be created during flood events while existing oxbows may eventually be filled in by sediment.

Wetland Vegetation and Management

Vegetation within natural wetlands would vary with the long-term wet and dry cycles. During drought years, most of these wetlands on the refuge complex would be dry or mudflats. During this time, seeds from many annuals, and some perennials, would germinate and cover the exposed mudflats. When the drought ends and precipitation returns, the mudflats would be flooded and the annuals would drown, but the perennials would likely survive, expand and in 1–2 years, would dominate the sites. The drawdown during the dry cycle is necessary for emergent vegetation to establish. After a few years of stable water levels, the emergent vegetation would begin to decline and the site eventually reverts to open water. When the wet cycle ends, resulting in wetland drying and exposing the mudflats, the water level–vegetation cycle continues (Hansen et al. 1995, Heitmeyer et al. 2009).

In oxbow wetlands on the Swan River Refuge, the primary factors affecting vegetation include water chemistry, sedimentation and water fluctuations. As oxbows fill over time with sediment from flooding, the vegetation progresses from marsh through wet meadow to shrub then tree-dominated communities (Hansen et al. 1995).

Management of wetland vegetation in these basins would be strongly influenced by the natural wet–dry cycles. For example, prescribed fire, mowing, or certain herbicide applications to consume litter, rejuvenate vegetation, or control exotic species may only be possible when wetland basins are sufficiently dry. This may limit the ability to control invasive species in certain years. However, the wet–dry cycle may act as a natural control by favoring native vegetation adapted to the wet–dry cycles and by changing conditions that no longer favor certain invasive species. For example, invasive species that thrive in wet conditions may naturally be reduced or more vulnerable to treatment methods during drought.

Trust Species and Wildlife Use

For the natural wetlands on the refuge complex, the diversity and relative abundance of birds and other wildlife species would vary with the long-term flooding and drying cycles in the system. During wetter periods, many waterfowl, shorebirds, wading birds, gulls, terns and other wetland-dependent species would be present on these wetlands and productivity should be high (Murkin et al. 2000, Heitmeyer et al. 2009). Aquatic invertebrates reach high abundance, biomass and diversity during wet periods of the long-term natural cycles (Heitmeyer et al. 2009). During the dry cycles, fewer, if any, waterbirds, would use these wetlands and productivity would be reduced or absent. However, during drier periods, extensive mudflat areas would likely attract large numbers of shorebirds as well as wading birds, terrestrial birds and mammals that could feed on rich benthic and terrestrial invertebrates present during this phase.

Wetland-dependent wildlife that use these wetlands have adapted to the long-term flooding and drying cycles. For example, waterfowl that need stable, more permanent wetlands, such as canvasback, tend to return to the same breeding area used the year before (such as homing) whereas species that use less permanent and unpredictable wetlands, such as northern pintail, are much more opportunistic in where they breed. Most species of waterfowl, however, exhibit flexibility and will alter settling patterns (typically northward) in response to local drought conditions (Johnson and Grier 1988). Even species with limited mobility, such as amphibians, reptiles and small mammals, have behavioral adaptations that would enable them to survive dry periods and exploit wet cycles. For example, the northern leopard frog, a species of concern, can survive dry periods by migrating short distances or remaining in depressions (Heitmeyer et al. 2009, Grzimek 1974).

Reducing or eliminating nonnative invasive wetland vegetation would improve wetland habitat for wetland-dependent wildlife. Native wildlife has evolved to use native vegetation for feeding, nesting and hiding cover. Nonnative vegetation is often a poor substitute, potentially reducing the ability of wildlife to successfully breed and build up energy reserves for migration. However, herbicide treatments for wetland vegetation carry inherent risks for potential contamination and nontarget effects. These need to be carefully weighed against the potential benefits before proceeding.

Staff Time and Management Costs

In general, wetlands that are in a natural condition and subject to climatic variation demand significantly less management time and money than altered wetlands on the refuge complex. Natural wetland management consists primarily of controlling invasive plants or treating vegetation with prescribed fire, haying or grazing, often in conjunction with upland management.

Wetlands and Riparian Areas: Natural—Alternative C

Effects would be the same as alternative A for water quantity, quality, and timing; trust species and wildlife use; and staff time and management costs.

Wetland Vegetation

Same as alternative A, plus more focus on invasive species should improve wetland vegetation and health. This should reduce the negative effects of invasive species such as monotypic stands, reduced native plant diversity and lower overall productivity. If more herbicide treatments are used, however, careful review would be necessary to be sure that herbicides do not have unintended, negative effects that outweigh the benefits.

Wetlands and Riparian Areas: Altered—Alternatives A, B, and C

Water Quantity, Quality, and Timing

For wetlands where natural runoff is impounded or supplemental water is diverted or pumped, the natural drying cycle is reduced or ended. These wetlands have more predictable and stable flooding cycles from year-to-year and are often flooded more deeply or for more months each year than would naturally occur. Water quality impairments may be associated with these wetlands (see detailed discussions of the Benton Lake Refuge in chapter 7).

Flooding and holding water in a basin above the natural level creates a wetland where the water is deeper, and likely holds water longer, than would normally occur. It would also likely expand the extent of the wetland basin, essentially creating a bigger wetland.

H2–O WPA

On average, 1,535–1,829 acre-feet of water is diverted from the Blackfoot River to the H2–O WPA each season. Water diverted from the Blackfoot River fills wetlands, but also recharges ground water and elevates ground water levels. It also extends the length of time there are return flows to Nevada Creek and the Blackfoot River. This diversion ditch provides senior water rights to neighboring landowners which often leads to season-long flows. However, in dry years diversions may be stopped during July–August and wetlands on the H2–O may dry out in fall.

Wetland Vegetation and Management

In wetlands where water is impounded or supplemented annually, wetland vegetation management is often focused on creating a 50:50 mix of open water and emergent vegetation, or a hemi-marsh phase. To do this, some type of treatment (e.g. herbicide, fire, mowing or discing) must be applied either overwater or in combination with periodic drying because otherwise these wetlands will likely become dominated by emergent vegetation or be primarily open water with emergent vegetation only on the edges. Focusing wetland vegetation management on the hemi-marsh phase reduces the diversity of wetland habitat types on the refuge complex and reduces the diversity of wetland-dependent wildlife that can successfully breed in these wetlands.

Flooding during periods outside of the normal cycle (for example fall) may further disrupt the vegetative cycle because necessary seed deposition and germination conditions are not met (Heitmeyer et al. 2009; personal communication, L. Frederickson).

Holding water above the natural basin level would likely shift the wetland vegetation communities from plants adapted to more shallow conditions to those adapted to deeper water conditions. In general, the typical progression of wetland vegetation communities from deeper to shallow are open water to robust emergents (for example, cattails) to rushes and sedges to wet grasslands and meadows (Hansen et al. 1995, Heitmeyer et al. 2009). In intermountain valley wetlands, vegetation transitions from open water, to sedges, to reed grasses to shrubs to trees (Hansen et al. 1995).

As with natural wetlands, in altered wetlands reducing or eliminating nonnative invasive wetland vegetation would improve wetland habitat for wetland-dependent wildlife. Native wildlife has evolved to use native vegetation for feeding, nesting and hiding cover. Nonnative vegetation is often a poor substitute, potentially reducing the ability of wildlife to successfully breed and build up energy reserves for migration. However, herbicide treatments for wetland vegetation carry inherent risks for potential contamination and nontarget effects. These need to be carefully weighed against the potential benefits before proceeding.

Trust Species and Wildlife Use

Wetlands on the refuge complex that are impounded or receive supplemental water provide a breeding opportunity for waterbirds and other wetland-dependent wildlife almost every year. The specific birds that would breed in a given wetland in a given year depend on the depth and duration of that flooding. While the presence of water would likely attract waterbirds to these wetlands, the quality and likelihood of breeding success is uncertain. Sustained flooding, with shortened or absent drying cycles, may negatively affect productivity by disrupting plant and invertebrate cycles, which may reduce the quality of food and cover on the wetlands (Heitmeyer et al. 2009; personal communication, L. Frederickson).

In conjunction with the vegetative shifts described above, the wildlife that use altered wetlands has likely changed. Deeper wetlands are typically attractive to certain waterbirds including diving ducks (for example, canvasback, redheads), swans and grebes, although some dabbling ducks may still use these wetlands (Heitmeyer et al. 2009). Deeper wetlands would be more likely to hold water longer, and thus provide brood rearing and fall migration habitat, than a basin at its naturally lower level.

H2–O WPA

Wetlands flooded with diverted water provides pair, brood, and migratory habitat for waterfowl as well as potential nesting habitat for other waterbirds such as black terns (State species of concern).

Diverted flows from the Blackfoot River reduce flows for the threatened bull trout by less than 1 percent during below average water years (Roberts and Levens 2005). A fish screen has recently been installed at the point of diversion from the Blackfoot River to prevent fish from being trapped in the irrigation ditch.

Staff Time and Management Costs

Wetland management for altered wetlands often requires higher inputs of staff time and money than naturally functioning wetlands. Altered wetlands need monitoring, artificial drawdowns, potentially more intensive mechanical and chemical manipulation, infrastructure (for example, ditch and pump) maintenance, and potential contamination remediation. These costs are extremely variable and would increase with the number of acres of wetlands

treated. Wetlands need to be monitored to find when they have begun to lose productivity and need management as well as to identify nonnative invasive plant concerns. As with natural wetlands, fire, grazing, and haying all need preplanning and, in the case of grazing and haying, also need coordination with an outside cooperator. Herbicide treatment also adds expense to management.

H2–O WPA

Managing water diversions from the Blackfoot River onto the H2–O requires approximately 1–2 days per week for 2–3 hours per day April–October, or 0.2 FTE. In addition, less than $500 for cleaning and repair per year is needed annually for upkeep and maintenance.

Wetlands and Riparian Areas: Creation, Enhancement, and Restoration—Alternatives A, B, and C

Water Quantity, Vegetation, and Wildlife Use

Wetland restorations would have similar effects for water quantity, vegetation and wildlife use as described under "Natural Wetlands." The full benefit of a wetland restoration requires several years to fully realize as vegetation and wildlife use respond to the restored hydrology.

Wetland creations are primarily used as a tool to provide a water resource to improve grazing management, which, in turn, can be used to improve native prairie. In addition, the created wetland provides more habitat for wetland-dependent wildlife. Impounding water can, however, change the water dynamics within the drainage such that water flowing downstream or ground water flows are reduced or altered. There can also be unintended negative effects to water quality and wetland vegetation.

Staff Time and Management Costs

A general estimate of wetland restoration cost is $1,000 per acre plus staff time. Wetland creations are more expensive due to the added dirt work, spillways and water control structures. The cost of creations on a per acre basis would vary considerably with the size of the wetland. Wetland creation can be an important tool for building relationships with private landowners that lead to further cooperative relationships, such as easements, that further protect native habitats. Created wetlands are roughly 10 times cheaper than other water sources such as wells. However, created wetlands provide a less predictable and reliable water source for cattle.

Wetlands and Riparian Areas: Protection—Alternatives A and B

Placing a high priority on easement acquisition, compliance and enforcement helps protect wetlands from being drained or altered. In addition, it makes sure that any wetlands that have been negatively altered are restored.

Under current management and money levels, most wetland protection in the next 15 years is likely to occur within the Rocky Mountain Front, Blackfoot Valley and Swan Valley Conservation Areas. More wetlands may occasionally be protected and expansions to waterfowl production areas and refuges or new waterfowl production areas may occur. Protection in other areas of the district may increase if ongoing landscape-level research shows that these wetlands have a high density of breeding waterfowl. Approximately one-quarter of the wetlands in Montana have been lost. In the prairie parts of the refuge complex, many wetlands have no clear surface water connection to any river system, and in the absence of State legislation, may lack any substantial legal protection. At the same time, these wetlands are under pressure from resource extraction and agricultural conversion. In parts of the refuge complex where wetland easement acquisition is not active, more wetlands would likely be lost.

Protecting wetland basins and the associated grassland uplands would help support resiliency in these systems. Wetlands protected with easements provide habitat for a wide diversity of wetland-dependent wildlife. The benefits of protecting wetlands for these species is similar to effects described under "Natural Wetlands" in alternative A. A vulnerability assessment of priority wetland-dependent birds in the district highlighted their potential susceptibility to human-related impacts related to climate change, such as the development of wind farms in the district. Protecting high-priority wetlands with easements can mitigate impacts from infrastructure development associated with wind farms to some degree.

Riparian areas support the greatest concentration of plants and animals in Montana, serving as a unique transition zone between aquatic and terrestrial environments. Buying easements and forming

partnerships with private landowners to protect riparian areas from modification or degradation, due to land conversion or housing development, would help protect water quality by reducing siltation and preventing vegetation changes that can lead to higher stream temperatures. This would help the aquatic life in the streams including imperiled fish species such as westslope cutthroat and bull trout. Intact, protected riparian zones are also important linkages for terrestrial species of concern such as grizzly bears and migratory birds.

Staff Time and Management Costs

In general, protecting wetlands with conservation easements is significantly more cost-effective than buying wetlands in fee title. Easements provide a means to protect many more acres of wetlands than would be possible with fee-title purchase alone. See grasslands and preserving intact landscapes sections for staff time and costs associated with conservation and grassland easements. Wetland easements currently require 2 days of inspections via air. The time required for follow-up on any violations is highly variable.

Implementing the alternatives for Benton Lake Refuge associated with alternatives A and B (Benton Lake A1, B1 or B2—see chapter 7) make it unlikely that more complex staff or money would be allocated toward protecting wetlands with easements.

Wetlands and Riparian Areas: Protection—Alternative C

Same as A and B, except implementing the Benton Lake Refuge alternatives associated with alternative C (Benton Lake C1 or C2—see chapter 7) will result in the greatest potential to reallocate complex resources toward easement acquisition.

Forests and Woodlands

Sustainable forestry practices can increase the ability of forests to sequester atmospheric carbon while enhancing other ecosystem services, such as improved soil and water quality. Improving forest health through thinning and prescribed fires would increase forest carbon sequestration over the long term.

Forests and Woodlands—Alternative A

Physical and Biological Conditions

A policy of suppressing wildfires for decades has resulted in areas where trees are densely stocked and subject to extreme drought stress. They often have poor vigor and are susceptible to stand-replacing wildfire as well as insect and disease attacks. Stand replacement fires in areas that have evolved under more frequent, less intense fire regimes can have devastating effects on soils, watershed functions, and biodiversity. Fire, or the lack of fire, has also affected nutrients, turbidity, buffering capacity, water temperature, and other water characteristics. Because forests on refuge complex lands are relatively small and are surrounded by vast acres of managed forests, the probability of stand replacing fires and

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Swan Valley Conservation Area.

insect and disease outbreaks may be lessened by adjacent land use practices.

Protection of forest lands would make sure that there is continued watershed function and health. Forests capture, store, and slowly release water back into the watershed. On the other hand, deforestation and development along the stream banks can contribute to surface runoff and subsequent soil erosion, which can cause excessive sedimentation. Sedimentation can seriously degrade water quality, instream and riparian habitats and affect the health of fish, aquatic invertebrates, and aquatic plants.

Cultural Resources

The inner bark or sap layer in various pine species was an important food source for Native Americans in western Montana including the Salish, Kootenai and Blackfoot tribes. The bark was usually collected when the sugary sap was running in the spring. Bark sheets were cut from trees using wooden sticks or rib bones from elk. The inner and outer bark was separated and could either be eaten fresh or rolled into balls that could be stored for later use. Harvesting methods did not kill the tree (Ostlund et al. 2005). Surviving trees exhibit distinctive peeling scars. These trees are found throughout northwestern Montana and can now be used to interpret native peoples' land use and movements. This alternative could increase the chance of catastrophic wildfire and insect and disease outbreaks, which could potentially destroy culturally significant trees.

Staff Time and Management Costs

No other FTEs or refuge resources would be needed to carry out this alternative. There is a greater chance for ignition of a wildfire in this alternative and, should a wildfire occur, it could be larger and more destructive than under the other alternatives.

Forests and Woodlands—Alternatives B and C

Physical and Biological Conditions

This alternative would use silvicultural practices and introduce fire to forests, following approved fire management plans for each unit, on refuge complex lands to emulate historical fire regimes, which would help natural ecosystem processes and reduce the chance of catastrophic fire. A reduction in stand density and competition and a release of nutrients to the soil would increase forest health reducing the vulnerability to insects and disease and increasing carbon sequestration. Short-term increases in carbon released into the atmosphere by controlled fire would be offset by increased carbon sequestration in healthy, vigorous forest environment.

Properly carried out on suitable sites, prescribed fire can be a very effective and cost efficient treatment method to help restore the desired composition of plant species in an ecological site, rejuvenate sprouting browse species and stagnant grass plants, release nutrients into the soil, improve palatability and nutrient content of forage, reduce fuel load, and prepare an ash seedbed for seeding.

There would be an expected increase in benefits due to an expanded effort to acquire easements and fee-title land of forest lands.

Cultural Resources

This alternative may initially result in the loss of some trees with historical bark peeling scars. Pretreatment surveys could be done to limit these losses. This alternative would reduce the chance of catastrophic wildfire and insect and disease outbreaks, which could potentially destroy culturally significant trees.

Staff Time and Management Costs

This alternative would reduce the chance of catastrophic wildfire and wildfire suppression costs. Although the chance of catastrophic wildfire would be less, there would be a chance that a controlled burn could spread onto neighboring lands. If this were to happen, the Service would be liable for all losses associated with this burn. Timber losses from disease and insect outbreaks on Service lands as well as neighboring forest lands would be reduced.

This alternative would require the allocation of 0.2 fire specialist FTE and 0.2 biological technician FTE to carry out. Burn costs could be up to $35 per acre. A 0.2 FTE wildlife refuge specialist would be needed to plan and administer silvicultural work.

5.5 Wildlife Goal Effects

This section discusses the effects of alternatives pertaining to threatened and endangered species, species of concern, migratory birds, and wildlife disease.

Species of Concern—Alternative A

Monitoring and considering species of concern in management decisions would help the individual species and also help make sure that there is ecosystem health and biodiversity. This alternative would make sure that there is compliance with the ESA and allow staff to evaluate management decisions to protect species of concern.

Considering species of concern in management decisions may have negative effects on public use because area or seasonal closures may be necessary. Disturbance caused by recreational pursuits may elicit behavioral and physiological responses in wildlife. Behavioral responses may be of short duration (temporary displacement) or long term, such as abandonment of preferred foraging or secure nesting areas. Physiological responses may increase an individual's metabolic rate increasing energy expenditure. Under stress conditions such as winter this could reduce productivity or even result in death to an animal (Joslin 1999).

Effects to public use may include the following:

- Creation of designated trails to localize disturbance
- Establishment of viewing sites that provide viewing opportunities while minimizing disturbance
- Location of travel routes to avoid sensitive habitats features (sensitive wetland communities, bogs, amphibian breeding areas, big game winter habitat)
- Buffer zones around nest sites
- Seasonal use restrictions or closures where needed to reduce or prevent disturbance or displacement to sensitive wildlife
- Seasonal closures to recreational activity to reduce disturbance or displacement (nesting season, winter big game habitat)

Staff Time and Management Costs

An added 0.25 FTE would be needed to inventory and check species of concern, and evaluate the effects of management decisions.

Species of Concern—Alternatives B and C

Same as alternative A, plus considering and monitoring more species of concern in management decisions would help more species and also help make sure that there is ecosystem health and biodiversity to a greater degree than alternative A.

Staff Time and Management Costs

An added 0.5 FTE would be needed to accomplish more monitoring, evaluate effects of management actions to species of concern, to develop partnerships and support databases.

Migratory Birds—Alternative A

All of the migratory birds that use the fee-title lands within the refuge complex are part of a larger population and spend at least a part of their life somewhere else. Population and landscape-level studies help inform management on Service lands by providing a broader context for evaluating success. Evaluating migratory bird population responses to management only within refuge complex fee-title lands can be misleading and result in ineffective management actions.

Annual increases in breeding bird populations are figured out by using several components of reproduction, including the number of breeding pairs, hatching success and survival of the young. Human disturbance can reduce any or all of these components and, in time, result in declining bird populations (Korschgen and Dahlgren 1992). By establishing seasonal closures on fee-title lands subject to frequent disturbance, this alternative should reduce or stop the negative effects of human-caused disturbance and protect reproductive success of migratory birds using these areas.

In general, predator removal in the greater region has been shown to be effective for increasing nest success for breeding waterfowl (Duebbert and Lokemoen 1980). The effect on waterfowl nesting success of recent trapping efforts at the Benton Lake Refuge is unknown because systematic nest success studies have not been conducted over this same period. Please see chapter 7 for more details.

Historically, goose structures were placed across complex lands to restore declining goose populations. Canada goose populations for the Rocky Mountains and prairies of Montana have rebounded significantly and are no longer a significant management concern (USFWS 2009e). No complex re-

sources are currently obligated toward waterfowl nesting structures. Other nesting structures across the refuge complex currently target other species with stable or increasing populations and have limited use.

Staff Time and Management Costs

All participation in population and landscape-level studies requires more investment of staff time and money; however, this varies greatly between studies. The most intensive studies currently are the prairie pothole breeding waterfowl survey (four-square mile survey) and waterfowl banding. These two studies both need 3–4 people for at least 1 month each to complete. Banding costs up to $3,500 per year, but these costs are offset by the regional office. In general, population and landscape-level studies provide a good return on investment because they do not need station-level staff to analyze data and interpret results, but the Service receives substantial management information from the resulting large datasets. However, broader studies may not provide site specific information for managing a refuge or waterfowl production area.

Informing the public of closures via signs and brochures requires a small amount of staff time.

Current trapping efforts require 60 staff hours over 4 months. Added costs for bait, traps, and fuel are a few hundred dollars per year.

Staff time is not currently spent on supporting the nesting structures on waterfowl production areas. The nest boxes for bluebirds and kestrels on Benton Lake require approximately 2 days per year to support.

Migratory Birds—Alternative B

Same as A plus, selecting migratory bird species as indicators to inform future management decisions. It is possible that habitat objectives may be met, but bird use does not respond as expected. This information may show that management actions are the cause or it may show that there is another influence at a population or landscape level. Evaluating all of these possibilities would help staff make proper adjustments to management and engage others at a landscape level. This could result in greater benefits to migratory birds such as higher nest success, greater survival or greater fecundity.

None of the current nesting structures provide habitat for bird species whose populations are in decline or cannot find other habitat options in the area. Therefore a reduction in these structures would not be expected to negatively affect target species. If in the future nesting structures could help a species of concern, they may be used and may sustain or increase populations.

Staff Time and Management Costs

If nesting structures were necessary in the future to replace otherwise unavailable habitat, the costs would be highly variable. Cost savings may be realized if participation in a landscape-level migratory bird study is no longer a priority and is discontinued. There would be increased staff time required to watch the response of migratory birds used as indicators.

Migratory Birds—Alternative C

Same as B, plus increased efforts to check conservation areas would provide more information to target land protection that benefits high-priority migratory birds. Protecting key parcels that help these species should result in greater benefits such as higher nest success, greater survival, and greater fecundity.

None of the current nesting structures provide habitat for bird species whose populations are in decline or cannot find other habitat options in the area. Therefore elimination of these structures would not be expected to negatively affect target species.

Staff Time and Management Costs

Same as alternative B except, costs to support artificial structures would decline to zero as structures fail and are not replaced. There would be more staff

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Waterfowl workshops for youth are held at Benton Lake National Wildlife Refuge.

time required to take part in, or lead, migratory bird monitoring within the conservation areas.

5.6 Visitor Services Goal Effects

This section discusses the effects of alternatives pertaining to hunting, fishing, wildlife observation and photography, environmental education and interpretation, and other uses.

Hunting

Hunting, as one of the six priority uses of the Refuge System, provides traditional recreation activities with no adverse effects on biological resources. The refuge complex would provide approximately 1,850 hunt visits per year mostly occurring in the district. See chapter 7 for effects across alternatives for hunting at Benton Lake Refuge.

Hunting—Alternative A

Benton Lake Wetland Management District

Annually, approximately 1,350 visits for hunting would be expected; however, factors beyond the scope of this plan would affect hunter numbers on waterfowl production areas. For example, economic conditions, weather, and State permit availability would influence hunter numbers from one year to the next. Hunter numbers are not expected to fluctuate dramatically throughout the life of the plan under any alternative.

Blackfoot Valley, Rocky Mountain Front, and Swan Valley Conservation Areas

These areas would only be open to hunting if the landowner chooses to allow this use. Under all alternatives the Service relies on the other entities (nongovernmental organizations and State) that offer payment for hunting access with their easements such as MFWP block management program.

Swan River National Wildlife Refuge

Annually, approximately 100 visitor use-days are expected to occur on the refuge for waterfowl hunting for each alternative. Waterfowl-hunting opportunity and availability would remain stable throughout the life of the plan for all alternatives. Use would be focused north of Bog Road. There would not be any conflicts with other hunting groups (big game or upland game) for they are not authorized. There would be equal opportunity for all user groups with a first-come-first-serve basis and no reserved areas or guided operations would be occurring on the refuge.

Hunting—Alternatives B and C

Same as A plus, hunting could increase under this alternative with increased opportunities. Unintentional hunting violations should be reduced by increasing signage and informational materials.

Wildlife Observation and Photography

Wildlife Observation and photography are one of the six priority uses of the Refuge System, and provides traditional recreation activities with no adverse effects on biological resources. The refuge complex hosts 8,230 wildlife observation visits per year and 490 photography visits per year, which accounts for 62 percent and 4 percent, respectively, of the total visits to the refuge complex. These are the most popular recreational uses occurring within the refuge complex. On all units, wildlife observation and photography is regulated by seasonal closures and a variety of access methods to protect their primary purposes: migratory birds or waterfowl production. Commercial photography is authorized under special use permit and generates photography used by refuge staff to expand outreach and educational efforts. For wildlife observation and photography at Benton Lake Refuge, see chapter 7 for effects across alternatives.

Wildlife Observation and Photography—Alternatives A and B

Wildlife observation and photography would continue to provide recreational opportunities throughout the refuge complex with no definable adverse effects on the biological integrity or habitat sustainability of the refuge complex resources as defined in the Improvement Act. Annual visitation to the refuge complex for wildlife observation and photog-

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Cattle on the Sweet Hills in the refuge complex.

raphy would remain similar to existing visitation rates: 8,230 and 490 visits per year, respectively.

Benton Lake Wetland Management District

Wildlife observation and photography would account for 580 and 50 annual visits, respectively. The uses would remain popular recreational activities with stable growth; however, no effects on nesting migratory birds would be expected.

Blackfoot Valley, Rocky Mountain Front, and Swan Valley Conservation Areas

Public access to conservation easement lands would remain under the control of the landowner.

Swan River National Wildlife Refuge

Bog Road would provide wildlife-viewing and photography opportunities and access to the interior of the refuge. The existing observation platform, kiosk, and interpretive panel and associated parking area would provide opportunity for wildlife observation and photography and would remain a popular destination point while traveling through the Swan Valley.

Wildlife Observation and Photography—Alternative C

Same as alternative A, plus the wildlife observation and photography opportunities would be expanded. Expanding public opportunities for wildlife observation and photography may lead to increased disturbance due to wildlife and trampling of vegetation, particularly if visitors travel off roads and trails. More staff and resources would be required to manage the increased public use to reduce disturbance to wildlife and habitat and to educate photographers and wildlife observers about the local resources. The facilitation of the expanded opportunity (new photography/wildlife observation blind) and improved or supported infrastructure would only be possible by the addition of the 0.5 FTE for park ranger. This would be increase in staff costs for the refuge complex; however, significant increase in usage by the public is possible by tapping into the 60,000 individuals of Great Falls leaving 12 miles south of the refuge complex headquarters and expanding outreach to other communities such as Missoula, Kalispell, Lincoln, and Helena. The amount of increase in visitation is unknown, but could be quite significant.

Benton Lake Wetland Management District

Same as alternative A, plus interpretive guided tours could lead to increases in participation.

Blackfoot Valley, Rocky Mountain Front, and Swan Valley Conservation Areas

Same as alternative A.

Swan River National Wildlife Refuge

Same as alternative A.

Environmental Education and Interpretation

Environmental Education and interpretation are one of the six priority uses of the Refuge System, and provide traditional recreation activities with

no adverse effects on biological resources. In FY 2011, approximately 1,765 visits for environmental education programs on and offsite occurred. Approximately 120 recreational visits for on and offsite interpretation occurs annually. These uses account for 13 percent and 1 percent, respectively, of the total visits to the refuge complex. Popular events include the Annual Envirothon that attracts more than 250 students and teachers throughout Montana, Great Falls Public School third grader visits to Benton Lake each year, and several University of Montana field trips to the Blackfoot Valley for onsite classrooms. For impacts specific to environmental education and interpretation at Benton Lake Refuge, see chapter 7.

In virtual geocaching, participants follow GPS coordinates to locations such as a visitor center, informational kiosk, or even a scenic view. Virtual "caches" would lead people into refuges without damaging habitat and would promote the National Wildlife Refuge System and the complex.

Environmental Education and Interpretation—Alternatives A and B

Benton Lake Wetland Management District

Environmental and educational activities would continue at current rate of approximately 100 participants annually. No effects on resources would be expected at this rate.

Swan River National Wildlife Refuge

Minimal environmental education and interpretation exists at the refuge for approximately 10 visits per year. This is expected to continue due to lack of staff for environmental and interpretive programming in the refuge complex.

Blackfoot Valley, Rocky Mountain Front, and Swan Valley Conservation Areas

No participation in environmental education or interpretation is expected. Landowners have the sole discretion to allow such uses on conservation easement land.

Environmental Education and Interpretation—Alternative C

Same as alternative A, plus programming would be increased and expanded to enhance public knowledge, understanding of restoration efforts throughout the refuge complex and emphasis on landscape-scale conservation efforts through easement programs in the refuge complex. These efforts would help foster support and success of the easement program and the numbers of acres protected of grasslands and wetlands. In addition, the efforts would generate support by the public for restoration efforts conducted by staff throughout the refuge complex. Community engagement would increase throughout the refuge complex especially in Great Falls from educational efforts such as field exploration kits, workshops for teachers, special events, job shadows, and the Web site and other social networking tools. The numbers of individuals reached through educational and interpretive efforts would be significantly greater than under any other alternative due to the programming implementation conducted by the addition of a park ranger (0.5 FTE) and wildlife refuge specialist (0.25 FTE) stationed at Upsata WPA, which is proposed for acquisition. These efforts would also tap into the resources of Great Falls not being addressed in alternatives A or B (see chapter 7).

5.7 Administration Goal Effects

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

Staff and Funding

In FY 2009, the Refuge System received an increase of $250 million (National Wildlife Refuge Association 2009 Annual Report). Projections show that due to the current state of the economy and the increasing debt and recession, operations money would remain stable to decreasing. With annual inflation, base allocations would erode with the inability to keep up with expenses beyond salary, such as health insurance and retirement benefits. The Service conservatively estimates a need for annual increases between $18 million and $35.5 million to meet conservation expectations of partners and the U.S. Congress

(National Wildlife Refuge Association 2009 Annual Report). Increased operation money is not expected. However, nearly $6 million in Land Water Conservation Fund (LWCF) for the Rocky Mountain Front CA was received in FY 2011. LWCF directly affects the refuge complex's ability to preserve intact landscapes. To accomplish the administration goal, complex staff would need to maximize opportunities for in-kind help, both fiscal and human resources, in addition to experiencing increases in base allocations. The refuge complex has a rich tradition of maximizing partnerships to meet established goals and objectives. The Service would need to continue these efforts and look for more opportunities to leverage dollars and human capital through partnerships.

Needed staff has been identified throughout the CCP, with special emphasis on implementation and monitoring of the wetland, grassland, and forest management; preservation of intact landscapes; protection of visitors and natural resources; and growth of the visitor services program. Visitors expect information and help to be available during high visitation periods (weekends during the summer months). This is currently not possible due to lack of visitor services staff to run visitor contact facilities during the peak visitation time—summer weekends. Particular needs of the visitor services program identified during scoping include the following inreach and outreach activities:

- kiosks, interpretive panels, flier distribution, and brochure updates
- congressional and directorate briefing packages
- keeping the Web site current and updated
- establishing a Friends group for the refuge complex
- coordinating multi-agency youth and volunteer activities
- providing interpretive and educational outreach programs
- refining and increasing participation in the refuge complex's volunteer program

Volunteer use on the refuge complex has been low, partly due to not having a staff position to nurture the program and the opportunistic manner in which the program has been implemented. Volunteers represent an untapped resource that can further contribute to meeting the goals and objectives of the CCP.

Staff and Funding—Alternative A

Staff Time and Management Costs

The refuge complex currently has 9.5 full-time employees and 3 seasonal employees. Special emphasis throughout the refuge complex is the management and some monitoring of the wetland and grassland habitats as well as preserving intact landscapes. Money and staff is allocated accordingly with the greatest concentration of operations and maintenance money (more than $130,000) going toward water level management at Benton Lake Refuge (pumping electrical expense, managing water delivery, pump house and structures and ditch maintenance).

Under this alternative, staff and money to manage the preservation of intact landscapes is not expected to grow significantly. A total of 2.5 FTEs (1.0 wetland district manager and 1.5 FTE wildlife refuge specialists) would be allocated toward these efforts. Budget operations and salary percentage dedicated to this activity would remain at current levels.

It is expected to be quite difficult to meet the challenges associated with any significant increases in land acquisition money from LWCF or Migratory Bird funding. Fieldwork would be necessary to carry out the programs, secure willing sellers, and inspect provisions of easement contracts. A reallocation of staff and money from other refuge complex programs and reliance on other refuge regional programs (such as Realty and Partners for Fish and Wildlife programs) would be necessary to help carry the increased workload. Little flexibility exists in other programs and the realty and partners for wildlife programs would see increase workload requirements as well with little flexibility to lend help. Without significant base money increases or help from other programs, it would be extremely difficult to adequately manage the efforts toward preserving intact landscapes.

Visitor Services, Partnerships, Volunteers, Resource Protection, and FTE and Base Money Allocation

Competing staff and money needs for the biological program and efforts to preserve intact landscapes would stifle the efforts of growth in the visitor services program. In FY 2009 and 2010, visitor and volunteer service allocations of money and staff include approximately $600 a year for the refuge complex's

volunteer program administration and regional allocation of deferred maintenance money were used toward interpretive panels and kiosks updates (FY 2009 $30,000). In FY 2011, no money was provided.

Visitor and resource protection needs, however, could be enhanced throughout the refuge complex by replacing a full-time law enforcement officer position that was part of the refuge complex in FY 2009.

The establishment of Friends group to advocate the needs of the refuge complex internally and externally would not be possible. Formation of other partnerships to leverage staff and money and growth of the volunteer program would also not be possible due to the lack of staff and money.

Staff and Funding—Alternative B

Staff Time and Management Costs

Other complex priorities may see shifts of operations money and personnel to accomplish management objectives at the Benton Lake Refuge. During intense water level management years, money and staff would predominately go toward habitat restoration efforts at the Benton Lake Refuge (see alternatives B1 and B2, chapter 7).

Staff and money to manage the preservation of intact landscapes is expected to be reduced as well. Although preserving intact landscapes would be of special importance especially with the challenges of climate change and the implementation of SHC through the GNLCC, no added staff would be available. Fieldwork would be necessary to carry out the programs, secure willing sellers, and inspect provisions of easement contracts. Staff would continue to rely on other programs for help. Without significant base money increases, it would be not be possible to carry out the landscape preservation efforts.

A total of 2.5 added FTE would be required to fully carry out this alternative for the complex (0.5 generalist, 1.0 supervisory wildlife biologist, 1.0 law enforcement officer).

Visitor Services, Partnerships, Volunteers, Resource Protection, and FTE and Base Funds Allocation

Same as alternative A, plus efforts to secure money to replace a full time law enforcement officer would occur to improve visitor and resource protection and enhance easement compliance.

Staff and Funding—Alternative C

Staff Time and Management Costs

Other complex priorities may see increases in the availability of operations money made available for work elsewhere in the complex from implementing alternatives C1 or C2 at Benton Lake Refuge. Following the initial restoration or decommissioning of the system, some of the savings from reduced annual operations and maintenance for water management could be distributed to other priorities within the refuge complex such as preserving intact landscapes, grassland restoration, and visitor services.

Staffing increases would be the same as for alternative B, plus there would be an increase of 2.5 FTE (1.5 wildlife refuge specialist, 1.0 maintenance, and 1.0 park ranger) would be needed to accomplish objectives in the wetland management district and throughout the complex. Particular emphasis would be placed on managing and preserving intact landscapes and increasing visitor services throughout the complex. A total of 6.0 FTEs (0.5 generalist, 1.0 supervisory wildlife biologist, 1.0 law enforcement officer, 1.0 wildlife refuge specialist, 0.5 wildlife refuge specialist, 1.0 maintenance worker, and 1.0 park ranger) would be required to fully carry out this alternative.

Visitor Services, Partnerships, Volunteers, Resource Protection, and FTE and Base Money Allocation

Growth in the visitor services program is most likely to occur with the addition of a park ranger to manage the volunteer program, establish a Friends group, and manage visitor services operations. This position would tap into the resources of Great Falls and other population centers within the refuge complex. Focus would be on restoration efforts throughout the refuge complex.

Replacing a full-time law enforcement officer position that was part of the refuge complex in FY 2009 would have high priority. The growth in conservation areas (Swan Valley and the potential for other areas) would require more inspection and enforcement responsibilities.

5.8 Visitor and Employee Safety and Resource Protection Goal Effects

Visitor and Employee Safety—Alternative A

The refuge complex has historically had an issue with dead zones for radio and cell phone coverage in remote parts of the refuge complex. Radios and repeaters that exist are ineffectual for certain locations, as are cell phones. Although no major incident has yet resulted from this lack of communication, the potential exists for someone to be stranded, injured or in need of aid with no way of contacting immediate help.

Visitor and Employee Safety—Alternatives B and C

Efforts would be made to increase the ability to communicate throughout the refuge complex. This is critical to respond to emergencies by staff and visitors. Currently, blackout zones exist and many units of the refuge complex are greater than 5-hour vehicle response time. Improvements in radio communication and portable phones are necessary.

Resource Protection—Alternative A

Staff would continue to provide visitor, employee, and resource protection at current levels. The presence of law enforcement officers on the refuge complex results in greater compliance with regulations that are designed to protect the natural (wildlife and habitat) resources, cultural resources, facilities, visitors, and employees of the refuge complex.

Resource Protection—Alternative B

Same as alternative A, plus an increased effort to engage in proactive communications and contacts with the public to educate them on rules and regulations would reduce citations and to build support for refuges and public lands. These preventative law enforcement efforts would ideally lead to increased compliance with regulations, thus resulting in less damage to the refuge complex's resources.

Officers would engage in proactive communications and contacts with the public to educate them on rules and regulations in an effort to reduce citations and to build support for refuges and public lands.

Resource Protection—Alternative C

Same as alternative B, plus focusing more law enforcement efforts on the inspection and enforcement of easements would result in the continued protection of wetland and grassland habitat.

5.9 Socioeconomic Effects

Economic Impacts of Current and Proposed Management Activities

During the CCP planning process it became evident that the issues surrounding the management of Benton Lake Refuge, and the wetland basin in particular, were of significant concern within the refuge complex. The U.S. Fish and Wildlife Service and the public have identified selenium contamination, and its effect on all aspects of management at Benton Lake Refuge and the declining wetland productivity, as some of the most critical situations needing to be addressed in this CCP planning process. Because of the complexity of these issues, the economic impact analysis for the Benton Lake Refuge will be presented separate from the rest of the refuge complex. The issues described in Benton Lake Refuge analysis fit within the umbrella of the refuge complex, but explore some aspects in greater detail. When completed, the management direction for the refuge complex and the management direction for Benton Lake Refuge will be used in conjunction to serve as a working guide for management programs and activities throughout the refuge complex over the next 15 years.

Methods for a Regional Economic Impact Analysis

Economic input-output models are commonly used to decide how economic sectors will and will not be affected by demographic, economic, and policy changes. The economic impacts of the management alternatives for the refuge complex were estimated using Impact Analysis for Planning (IMPLAN), a regional input-output modeling system developed by the USDA Forest Service. IMPLAN is a computerized database and modeling system that provides a regional input-output analysis of economic activity in terms of 10 industrial groups involving more than four hundred economic sectors (Olson and Lindall, 1999). The IMPLAN model draws upon data collected by the Minnesota IMPLAN Group from multiple federal and state sources including the Bureau of Economic Analysis, Bureau of Labor Statistics, and the U.S. Census Bureau (Olson and Lindall, 1999). For the refuge complex analysis, the year 2009 IMPLAN 3.0 data profiles for Cascade, Chouteau, Glacier, Hill, Lake, Lewis and Clark, Liberty, Missoula, Pondera, Powell, Teton, and Toole Counties were used for the local area analysis. For the Benton Lake Refuge analysis, the year 2009 IMPLAN 3.0 data profiles for Cascade, Chouteau, and Teton Counties were used for the local area analysis. The IMPLAN county level employment data estimates were found to be comparable to the U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Information System data for the year 2009.

Because of the way industries interact in an economy, activity in one industry affects activity levels in several other industries. For example, if more visitors come to an area, local businesses will buy extra labor and supplies to meet the increase in demand for more services. The income and employment resulting from visitor purchases from local businesses represent the *direct* effects of visitor spending within the economy. Direct effects measure the net amount of spending that stays in the local economy after the first round of spending; the amount that doesn't stay in the local economy is termed a leakage (Carver and Caudill, 2007). To increase supplies to local businesses to meet increased demand, input suppliers must also increase their purchases of inputs from other industries. The income and employment resulting from these secondary purchases by

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Trumpeter swans are released in the Blackfoot Valley Conservation Area.

input suppliers are the *indirect* effects of visitor spending within the economy. Employees of the directly affected businesses and input suppliers use their incomes to buy goods and services. The resulting increased economic activity from new employee income is the *induced* effect of visitor spending. The indirect and induced effects are known as the secondary effects of visitor spending. "Multipliers" (or "Response Coefficients") capture the size of the secondary effects, usually as a ratio of total effects to direct effects (Stynes, 1998). The sums of the direct and secondary effects describe the total economic impact of visitor spending in the local economy.

For each alternative, regional economic effects from the IMPLAN model are reported for the following categories:

- Employment represents the change in the number of jobs generated in the region from a change in regional output. IMPLAN estimates for employment include both full time and part time workers, which are measured in total jobs.

- Labor Income includes employee wages and salaries, including income of sole proprietors and payroll benefits.

- Value Added measures contribution to Gross Domestic Product. Value added is equal to the difference between the amount an industry sells a product for and the production cost of the product, and is thus net of intermediate sales.

The CCP provides long range guidance and management direction to achieve the refuge complex purposes over a 15-year timeframe. The economic impacts reported in this report are on an annual basis in 2011 dollars. Large management changes often take several years to achieve. The estimates reported for all the alternatives represent the final average annual economic effects after all changes in management have been implemented.

Economic Impacts of Benton Lake National Wildlife Refuge Complex (Excluding Benton Lake National Wildlife Refuge)

This section provides an analysis of the potential economic effects associated with the implementation of the management alternatives for the refuge complex. Economic impacts for a separate analysis—to address the management at Benton Lake Refuge—are described in the next section and are not repeated here.

The planning team developed and analyzed two alternatives beyond current management; the evaluation included an analysis of the environmental and socioeconomic consequences and the cumulative impacts of implementing each of the following alternatives:

- Alternative A (no action): represents the current management of the refuge complex. This alternative provides the baseline against which to compare the other alternatives.;

- Alternative B: management efforts would be focused on supporting the resiliency and sustainability of native grasslands, forests, shrublands and unaltered wetlands throughout the complex by mimicking natural processes.;

- Alternative C: emphasis would be placed on self-sustaining systems with ecological processes functioning for long-term productivity. Management efforts are focused on supporting and restoring ecological processes including natural communities and dynamics of the ecosystems of the Northern Great Plains and Northern Rocky Mountains in relationship to their geomorphic landscape positioning.

Impacts from Payments to Communities and Landowners

Impacts from Refuge Revenue Sharing

Under provisions of the Refuge Revenue Sharing Act (RRS), local counties receive an annual payment for lands that have been purchased by full fee simple acquisition by the Service. Payments are based on the greater of 75 cents per acre or 0.75 percent of the fair market value of lands acquired by the Service. The exact amount of the annual payment depends on congressional appropriations, which in recent years have tended to be less than the amount to fully fund the authorized level of payments. In FY 2010, actual RRS payments were 21 percent of authorized levels. FY10 refuge complex RRS payments (made in 2011) were: $887 to communities in Cascade County; $1,112 to communities in Chouteau County; $42 to communities in Glacier County; $517 to communities in Hill County; $13,173 to communities in Lake County; $1,541 to communities in Pondera County; $11,463 to communities in Powell County; $1,496 to communities in Teton County; and $2,327 to communities in Toole County for a total payment of $32,558. Table 14 shows the resulting economic impacts of RRS payments under

Table 14. Annual impacts from refuge revenue sharing payments for all alternatives for Benton Lake National Wildlife Refuge Complex, Montana.

	Employment (# full and part time jobs)	*Labor income (Thousands, $2011)*	*Value Added (Thousands, $2011)*
Alternatives A, B, and C			
Direct effects	< 1	$8.8	$11.7
Secondary effects	< 1	$2.5	$4.7
Total economic impact	< 1	$11.3	$16.4

all alternatives. Accounting for both the direct and secondary effects, RRS payments for alternatives A, B, and C would generate total annual economic impacts of $11.3 thousand in labor income and $16.4 thousand in value added in the local twelve-county impact area.

Impacts from Conservation Easement Payments

Over the life of the plan the Service's conservation easement acquisition objectives are 5,000 acres in the Swan Valley CA, 120,000 acres in the Rocky Mountain Front CA and 45,000 acres in the Blackfoot Valley CA. Acquisition is dependent upon money; primarily from the Land Water Conservation Fund which varies annually. Although there is not enough information to estimate the economic impact of the easements on these private properties, it is generally expected that conservation easement purchases inject new money into the local economy. The sale of conservation easements provides landowners with more revenue. Some percentage of this money may be spent in the local economy, including purchasing more real estate interests, consumer goods, or services in the local area. Other transactions may include paying of loans, corporate ventures, or family and financial planning initiatives. In many cases, the sale of easements allows farm owners to continue farming practices on their land. The farmer's costs for equipment, supplies and materials likely to be spent in the local economy, thus stimulating local businesses and supporting local employment. Farm workers will also generally spend their salaries in the local economy, thus supporting further local employment. From a social perspective, conservation easements generate benefits for local residents, communities, and governments by protecting values associated with biodiversity and wildlife abundance, aesthetic beauty, local agriculture, and social and culturally significant features of landscapes and livelihoods.

Impacts from Public Use and Access Management

Refuge Complex

Visitor Expenditures in Local Economy

Spending associated with recreational visits to national wildlife refuges generates significant economic activity. The FWS report Banking on Nature: The Economic Benefits of National Wildlife Refuges Visitation to Local Communities, estimated the impact of national wildlife refuges on their local economies (Carver and Caudill, 2007). According to the report, more than 34.8 million visits were made to national wildlife refuges in FY 2006 which generated $1.7 billion of sales in regional economies. Accounting for both the direct and secondary effects, spending by national wildlife visitors generated nearly 27,000 jobs, and more than $542.8 million in employment income (Carver and Caudill, 2007). Approximately 82 percent of total expenditures were from nonconsumptive activities, 12 percent from fishing, and 6 percent from hunting (Carver and Caudill, 2007).

The overarching goal of the refuge complex public use program is to enhance wildlife-dependent recreation opportunities and access to quality visitor experiences while managing units to conserve fish, wildlife, plants, and their habitats. A variety of recreational opportunities are associated with the "Big-Six" wildlife-dependent uses: hunting, fishing, wildlife observation and photography, interpretation, and environmental education. In FY11, there were 3,027 visits to the refuge complex, including: 375 anglers, 455 big game hunters, 267 waterfowl and other migratory bird hunters, 750 upland game hunters, 1,180 nonconsumptive users (wildlife observation, photography, environmental education, and interpretation).

This section focuses on the regional economic impacts associated with refuge complex visitation. Annual visitation estimates for the refuge complex are based on several refuge complex statistic sources including: visitors entering the visitor center/office and general observation by refuge complex person-

nel. Annual visitation estimates are on a per visit basis. Visitor spending profiles are estimated on an average per day (8 hours) basis. Because some visitors only spend short amounts of time visiting the refuge complex, counting each visit as a full visitor day would overestimate the economic impact of refuge complex visitation. To properly account for the amount of spending, the annual number of visits were converted to visitor days. Refuge complex personnel estimate that big game hunters spend approximately 8 hours (1 visitor day), anglers and upland game hunters spend approximately 4 hours (1/2 a visitor day) on the refuge complex, while waterfowl hunters spend approximately 6 hours (3/4 a visitor day). Visitors that view wildlife or take part in other wildlife observation activities typically spend 4 hours (1/2 a visitor day).

To figure out the local economic impacts of visitor spending, only spending by persons living outside of the local twelve-county area are included in the analysis. The rationale for excluding local visitor spending is twofold. First, money flowing into the local twelve-county area from visitors living outside the local area (hereafter referred to as nonlocal visitors) is considered new money injected into the local economy. Second, if residents of the local twelve-county area visit the refuge complex more or less due to the management changes, they will correspondingly change the spending of their money elsewhere in that local area, resulting in no net change to the local economy. These are standard assumptions made in most regional economic analyses at the local level. Refuge complex personnel figured out the percentage of nonlocal refuge complex visitors. Table 15 shows the estimated percent of current visits and visitor days by visitor activity for the district and Swan River Refuge.

The annual average number of refuge complex visits are shown in table 16. The refuge complex staff anticipates that the number of big game, waterfowl, and other migratory bird hunting visits will remain constant for all the alternatives. For alternatives B and C, fishing visits are anticipated to increase by 10 percent compared to alternative A. Upland game visits are anticipated to increase by 5 percent for alternative B and 10 percent for alternative C compared to alternative A. Nonconsumptive use visitation will remain the same as current estimates for alternatives A and B but is anticipated to increase by 25 percent under alternative C.

A visitor usually buys a wide range of goods and services while visiting an area. Major expenditure categories include lodging, restaurants, supplies, groceries, and recreational equipment rental. In this analysis 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 (USFWS 2008a). The National Survey reports trip related spending of state residents and nonresidents for several different 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-day expenditures by recreation activity for each FWS region. We used the spending profiles for nonresidents for FWS Region 6 (for the purposes of the analysis in the Banking on Nature report, Region 6 includes Montana), and updated the 2006 spending profiles to 2011 dollars using the Consumer Price Index Inflation Calculator. Average daily spending profiles for nonresident visitors to Region 6 for fishing ($125.71), big game hunting ($213.64), upland game hunting

Table 15. Estimated current annual visitation for Benton Lake Wetland Management District and Swan River National Wildlife Refuge, Montana.

Visitor Activity	*Total annual number of visits*	*Number of hours spent*	*Total annual number of visitor days**	*Percentage of nonlocal visits (%)*	*Number of nonlocal visitor days**
Fishing	375	4	188	2%	4
Big game hunting	455	8	455	25%	114
Waterfowl and migratory bird hunting	267	6	200	25%	50
Upland game hunting	750	4	375	10%	38
Non consumptive visitors: wildlife observation, photography, education, and interpretation	1,180	4	590	42%	248
Total Visitation	*3,027*		*1,934*		*504*

*One visitor day = 8 hours.

Table 16. Annual average number of visits and visitor days by activity and alternative for Benton Lake National Wildlife Refuge Complex, Montana.

	Alternative A	*Alternative B*	*Alternative C*
Total Visits			
Fishing	375	413	413
Big game hunting	455	455	455
Waterfowl and migratory bird hunting	267	267	267
Upland game hunting	750	788	825
Non consumptive visitors: wildlife observation, photography, education, and interpretation	1,180	1,180	1,475
Total Annual Visits	3,027	3,102	3,435
Total Visitor Days			
Fishing	188	206	206
Big game hunting	455	455	455
Waterfowl and migratory bird hunting	200	200	200
Upland game hunting	375	394	413
Non consumptive visitors: wildlife observation, photography, education, and interpretation	590	590	738
Total Visitor Days	1,808	1,845	2,012
Nonlocal Visitor Days			
Fishing	4	4	4
Big game hunting	114	114	114
Waterfowl and migratory bird hunting	48	48	48
Upland game hunting	38	39	41
Non consumptive visitors: wildlife observation, photography, education, and interpretation	248	248	310
Total Nonlocal Visitor Days	451	453	517

($176.03 per-day), and waterfowl hunting ($75.88 per-day) were used to estimate nonlocal visitor spending for refuge complex 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 ($157.62 per-day).

Total spending by nonlocal refuge complex visitors was figured out by multiplying the average nonlocal visitor daily spending by the number of nonlocal visitor days at the refuge complex. The economic impacts of each alternative were estimated using IMPLAN. Table 17 summarizes the total economic impacts associated with current nonlocal refuge complex visitation by activity and alternative. Under alternative A, nonlocal refuge complex visitors would spend approximately $74 thousand in the local economy annually ($39 thousand in spending by nonconsumptive visitors, $24.3 thousand by big game hunters, $6.6 thousand by upland game hunters, $3.6 thousand by waterfowl hunters, and $500 by anglers). This spending would directly account for $17.9 thousand in labor income, and $29.4 thousand in value added in the local economy. The secondary or multiplier effects would generate $7.9 thousand more in labor income, and $14.5 thousand in value added. Accounting for both the direct and secondary effects, spending by nonlocal visitors for alternative A would generate total economic impacts of 1 job, $25.8 thousand in labor income, and $43.9 thousand in value added.

As shown in table 17, the total annual average economic impacts for alternative B would be similar to alternative A. The economic impacts are slightly higher for alternative C compared to alternative A which corresponds to the slight (66 visitor days) increase in visitation between the alternatives.

Table 17. Average annual impacts of nonlocal visitor spending by activity and alternative for Benton Lake National Wildlife Refuge Complex, Montana.

	Employment *(# full and part time jobs)*	*Labor income* *(Thousands, $2011)*	*Value Added* *(Thousands, $2011)*
Alternative A			
Direct effects	< 1	$17.9	$29.4
Secondary effects	< 1	$7.9	$14.5
Total economic impact	*1*	*$25.8*	*$43.9*
Alternative B			
Direct effects	< 1	$18.2	$29.8
Secondary effects	< 1	$7.9	$14.5
Total economic impact	*1*	*$26.1*	*$44.3*
Alternative C			
Direct effects	< 1	$20.6	$33.8
Secondary effects	< 1	$9.1	$16.6
Total economic impact	*1*	*$29.7*	*$50.4*

Impacts from Refuge Complex Administration

Staff – Personal Purchases

Refuge complex 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/households to industries for goods and services used for personal consumption. The IMPLAN modeling system contains household consumption spending profiles that account for average household spending patterns by income level. These profiles allow for leakage of household spending to outside the region. Several members of the refuge complex staff work at Benton Lake Refuge as well as other areas on the refuge complex. For the purposes of the economic analysis, the USFWS provided the percentage split of staff time spent working on the refuge complex for each position. Table 18 illustrates refuge complex staffing and time spent working at the refuge complex (as well as working on refuge complex-related issues) for each alternative. Under alternative A, salary would total $580.3 thousand for the part of time the refuge complex staff members spent working on the refuge complex. Table 18 shows the changes in positions, time spent working, and total salary amounts for refuge complex staffing by alternative.

Refuge complex personnel estimate that annual salaries total around $580.3 thousand for alternative A and would increase under alternatives B and C. Table 19 shows the economic impacts associated with spending of salaries in the local twelve-county area by refuge complex employees under all alternatives. For alternative A, salary spending by refuge

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Blackfoot Valley Conservation Area.

Table 18. Staffing and percent of time allocated for working by alternative on the Benton Lake National Wildlife Refuge Complex, Montana.

		Percent of Time Spent Working at the Refuge Complex		
Positions by Alternative	Full Time Equivalent	Alternative A	Alternative B	Alternative C
Administrative Officer	1.0	60%	60%	60%
Assistant Fire Management Officer	1.0	40%	50%	40%
Bio-Science Technician	0.8	10%	10%	10%
Bio-Science Technician	0.5	25%	10%	25%
Bio-Science Technician	0.5	100%	100%	100%
Budget Analyst	1.0	80%	80%	80%
Complex Manager	1.0	50%	40%	40%
Deputy Refuge Manager	1.0	50%	40%	40%
Generalist	0.5	60%	50%	50%
Generalist	0.5	80%	60%	60%
Law Enforcement Officer	1.0	0%	75%	75%
Maintenance Worker	1.0	25%	10%	25%
Maintenance Worker	1.0	0%	0%	100%
Park Ranger	1.0	0%	0%	50%
Supervisory Wildlife Biologist	1.0	0%	20%	30%
Wetland District Manager	1.0	75%	75%	85%
Wildlife Biologist	1.0	25%	10%	10%
Wildlife Refuge Specialist	1.0	90%	80%	100%
Wildlife Refuge Specialist	0.5	100%	80%	100%
Wildlife Refuge Specialist	0.5	0%	0%	100%
Wildlife Refuge Specialist	1.0	0%	0%	100%
Wildlife Refuge Specialist	1.0	0%	0%	100%
Total Salary		*$ 580,300*	*$605,100*	*$894,100*

Table 19. Annual local impacts of salary spending by personnel by alternative for the Benton Lake National Wildlife Refuge Complex, Montana.

	Employment (# full and part time jobs)	*Labor income (Thousands, $2011)*	*Value Added (Thousands, $2011)*
Alternative A			
Direct effects	0	$0	$0
Secondary effects	4	$124.3	$237.0
Total economic impact	4	$124.3	$237.0
Alternative B			
Direct effects	0	$0	$0
Secondary effects	4	$129.6	$247.2
Total economic impact	4	$129.6	$247.2
Alternative C			
Direct effects	0	$0	$0
Secondary effects	6	$191.5	$365.2
Total economic impact	6	$191.5	$365.2

complex personnel would generate the secondary effects of 4 jobs, $124.3 thousand in labor income, and $237 thousand in value added in the local economy. Alternative C would have the largest increase in impacts, generating secondary effects of 6 jobs, $191.5 thousand in labor income, and $365.2 thousand in value added in the local economy. As shown in table 19, impacts for alternative B are less than alternative C but higher than alternative A.

Work-related Purchases

A wide variety of supplies and services are purchased for refuge complex operations and maintenance activities. Refuge complex purchases made in the local twelve-county area contribute to the local economic impacts associated with the refuge complex. Major local expenditures include: supplies and services related to annual maintenance costs; small equipment; auto repairs, parts, and fuel; and utilities. Average annual refuge complex nonsalary expenditures are anticipated to be $414.3 thousand for alternative A, $420.5 thousand for alternative B, and $492.8 thousand for alternative C. According to refuge complex records, approximately 70 percent of the annual nonsalary budget expenditures are spent on goods and services purchased in the local twelve-county area. Table 20 shows the economic impacts associated with work related expenditures in local communities near the refuge complex. For alternative A, work related purchases would generate a total economic impact of 2 jobs, $45.5 thousand in labor income, and $72.1 thousand in value added. Work related purchases under alternative C would generate the largest total economic impact of 2 jobs, $62.5 thousand in labor income, and $98.9 thousand in value added. As shown in table 20, impacts for alternative B are less than alternative C but higher than alternative A.

Summary of Economic Impacts for Alternative A

Table 21 summarizes the direct and total economic impacts in the twelve-county area of refuge complex management activities for alternative A. Under alternative A, refuge complex management activities directly related to refuge operations generate an estimated 2 jobs, $58.1 thousand in labor income, and $87.1 thousand in value added in the local economy. Including direct, indirect, and induced effects, all refuge complex activities generate a total economic impact of 7 jobs, $206.9 thousand in labor income, and $369.4 thousand in value added. In 2009, total labor income was estimated at $8.7 billion and total employment was estimated at 231 thousand jobs for the local twelve-county area, according to IMPLAN 2009 data. Thus, total economic impacts associated with refuge complex operations under alternative A represent less than .01 percent of total income and total employment in the overall twelve-county area economy. Total economic effects of refuge complex operations play a larger role in the communities near the refuge complex where most of the refuge complex-related expenditures and public use related economic activity occurs.

Table 20. Local economic impacts by alternative of purchases related to Benton Lake National Wildlife Refuge Complex, Montana.

	Employment (# full and part time jobs)	*Labor income (Thousands, $2011)*	*Value Added (Thousands, $2011)*
Alternative A			
Direct effects	1	$31.4	$46.0
Secondary effects	< 1	$14.1	$26.1
Total economic impact	2	$45.5	$72.1
Alternative B			
Direct effects	1	$32.3	$47.4
Secondary effects	< 1	$14.5	$26.9
Total economic impact	2	$46.9	$74.2
Alternative C			
Direct effects	2	$43.1	$63.2
Secondary effects	< 1	$19.4	$35.8
Total economic impact	2	$62.5	$98.9

Table 21. Summary of all management activities for alternative A for the Benton Lake National Wildlife Refuge Complex, Montana.

	Employment (# full and part time jobs)	*Labor income (Thousands, $2011)*	*Value Added (Thousands, $2011)*
Revenue Sharing and Refuge Complex Administration*			
Direct effects	2	$40.2	$57.7
Total Effects	6	$181.1	$325.5
Nonlocal Public Use Activities			
Direct effects	< 1	$17.9	$29.4
Total Effects	1	$25.8	$43.9
Aggregate Impacts			
Direct effects	2	$58.1	$87.1
Total effects	7	$206.9	$369.4

**Staff salary spending and work related purchases*

Summary of Economic Impacts for Alternative B

Table 22 summarizes the direct and total economic impacts in the twelve-county area of refuge complex management activities for alternative B. Under alternative B, refuge complex management activities directly related to refuge operations would generate an estimated 2 jobs, $59.3 thousand in labor income, and $88.9 thousand in value added in the local economy. Including direct, indirect, and induced effects, all refuge complex activities would generate a total economic impact of 7 jobs, $213.9 thousand in labor income, and $382.1 thousand in value added. In 2009, total labor income was estimated at $8.7 billion and total employment was estimated at 231 thousand jobs for the local twelve-county area, according to IMPLAN 2009 data. Thus, total economic impacts associated with refuge complex operations under alternative B represent less than .01 percent of total income and total employment in the overall twelve-county area economy. Total economic effects of refuge complex operations play a larger role in the communities near the refuge complex where most of the refuge complex-related expenditures and public use related economic activity occurs.

Table 23 summarizes the change in economic effects associated with refuge complex operations under alternative B as compared to alternative A. Due to slight increases in refuge complex visitation and administration, alternative B would generate $7 thousand more in labor income, and $12.7 thousand more in value added as compared to alternative A.

Table 22. Summary of all management activities for alternative B for Benton Lake National Wildlife Refuge Complex, Montana.

	Employment (# full and part time jobs)	*Labor income (Thousands, $2011)*	*Value Added (Thousands, $2011)*
Revenue Sharing and Refuge Complex Administration*			
Direct effects	2	$41.1	$59.1
Total Effects	6	$187.8	$337.8
Nonlocal Public Use Activities			
Direct effects	< 1	$18.2	$29.8
Total Effects	1	$26.1	$44.3
Aggregate Impacts			
Direct effects	2	$59.3	$88.9
Total effects	7	$213.9	$382.1

** Staff salary spending and work related purchases*

Summary of Economic Impacts for Alternative C

Table 24 summarizes the direct and total economic impacts in the twelve-county area of refuge complex management activities for alternative C. Under alternative C, refuge complex management activities directly related to refuge operations would generate an estimated 3 jobs, $72.5 thousand in labor income, and $108.7 thousand in value added in the local economy. Including direct, indirect, and induced effects, all refuge complex activities would generate a total economic impact of 10 jobs, $294.9 thousand in labor income, and $531 thousand in value added. In 2009, total labor income was estimated at $8.7 billion and total employment was estimated at 231 thousand jobs for the local twelve-county area, according to IMPLAN 2009 data. Thus, total economic impacts associated with refuge complex operations under alternative C represent less than .01 percent of total income and total employment in the overall twelve-county area economy. Total economic effects of refuge complex operations play a larger role in the communities near the refuge complex where most of the refuge complex-related expenditures and public use related economic activity occurs.

Table 25 summarizes the change in economic effects associated with refuge complex operations under alternative C as compared to alternative A. Due to increases in refuge complex visitation and administration, alternative C would generate 3 more jobs, $88.0 thousand more in labor income, and $161.6 thousand more in value added as compared to alternative A.

Table 23. Change in economic impacts under alternative B compared to alternative A for Benton Lake National Wildlife Refuge Complex, Montana.

	Employment (# full and part time jobs)	*Labor income (Thousands, $2011)*	*Value Added (Thousands, $2011)*
Revenue Sharing and Refuge Complex Administration*			
Direct effects	(+) < 1	(+) $0.9	(+) $1.4
Total Effects	(+) < 1	(+) $6.7	(+) $12.3
Nonlocal Public Use Activities			
Direct effects	(+) < 1	(+) $0.3	(+) $0.4
Total Effects	(+) < 1	(+) $0.3	(+) $0.5
Aggregate Impacts			
Direct effects	(+) < 1	(+) $1.2	(+) $1.8
Total effects	(+) < 1	(+) $7.0	(+) $12.7

* *Staff salary spending and work related purchases*

Table 24. Summary of all management activities for alternative C for Benton Lake National Wildlife Refuge Complex, Montana.

	Employment (# full and part time jobs)	*Labor income (Thousands, $2011)*	*Value Added (Thousands, $2011)*
Revenue Sharing and Refuge Complex Administration*			
Direct effects	2	$51.9	$74.9
Total Effects	9	$265.2	$480.5
Nonlocal Public Use Activities			
Direct effects	< 1	$20.6	$33.8
Total Effects	1	$29.7	$50.4
Aggregate Impacts			
Direct effects	3	$72.5	$108.7
Total effects	10	$294.9	$531.0

* *Staff salary spending and work related purchases*

Table 25. Change in economic impacts under alternative C compared to alternative A for Benton Lake National Wildlife Refuge Complex, Montana.

	Employment (# full and part time jobs)	*Labor income (Thousands, $2011)*	*Value Added (Thousands, $2011)*
Revenue Sharing and Refuge Complex Administration*			
Direct effects	(+) < 1	(+) $11.7	(+) $17.1
Total Effects	(+) 3	(+) $84.1	(+) $155.0
Nonlocal Public Use Activities			
Direct effects	(+) < 1	(+) $2.7	(+) $4.4
Total Effects	(+) < 1	(+) $3.9	(+) $6.6
Aggregate Impacts			
Direct effects	(+) < 1	(+) $14.4	(+) $21.5
Total effects	(+) 3	(+) $88.0	(+) $161.6

** Staff salary spending and work related purchases*

5.10 Cumulative Impacts

Cumulative impacts include 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 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 for the CCP would be expected or 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 decide goal achievement levels and possible unforeseen impacts to resources and for application of ARM to make sure wildlife and habitat resources as well as the human environment are preserved.
- The Service could revise and amend the CCP after 5 years of implementation, for application of adaptive resources management to correct unforeseen impacts that occur during the first years of the plan.

The refuge complex is located in an area that is designated as a high priority for conservation and linkage protection by many partners including MFWP, National Fish and Wildlife Foundation, TNC, Conservation Fund, American Wildlands, Blackfoot Challenge, Swan Ecosystem Center, Northwest Connections, Trout Unlimited, Ducks Unlimited and Yellowstone to Yukon Initiative. Many of these organizations are involved in transboundary conservation, protecting and connecting habitat in the United States and Canada. Given the level of public and private partnerships focused on land protection within the Crown of the Continent, this landscape is arguably one of the most promising large-scale opportunities remaining in North America for species resiliency and adaptation in the face of climate change.