Draft Comprehensive Conservation Plan and Environmental Assessment

Benton Lake National Wildlife Refuge Complex

Montana

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Prepared by

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Walling Reef at Rocky Mountain Front Conservation Area.

The United States (U.S.) Fish and Wildlife Service (Service) manages the Benton Lake National Wildlife Refuge Complex (refuge complex)—encompassing 163,304 acres in northwestern and north-central Montana. To address the long-term management of the refuge complex, the Service has developed a draft comprehensive conservation plan (CCP) and environmental assessment (EA).

The Benton Lake Refuge Complex is part of the National Wildlife Refuge System (Refuge System), and is located in northwest and north-central Montana. Spanning both sides of the Continental Divide, the refuge complex is a collection of diverse landscapes, from wetlands and mixed-grass prairie in the east to forests, intermountain grasslands, rivers, and lakes in the west. Likewise, animal species that inhabit the refuge complex lands are diverse and reflective of a variety of habitats. Large numbers of waterfowl and shorebirds inhabit wetlands in the east, while large predators such as grizzly bears make their home in the mountains and forests to the west.

The refuge complex oversees management of 27 units (2 refuges, 1 wetland management district containing 22 waterfowl production areas, and 3 conservation areas) and administers 216 easements within the Refuge System:

- Benton Lake National Wildlife Refuge (refuge) was established in 1929 and consists of 12,383 fee-title acres and 76.88 acres of right-of-way easement. It is located on the northern Great Plains, 50 miles east of the Rocky Mountains and 12 miles north of Great Falls, Montana.

- Benton Lake Wetland Management District (district) was established in 1975. It includes 10 counties (Cascade, Chouteau, Glacier, Hill, Lewis and

Clark, Liberty, Pondera, Powell, Teton, Toole), 22 waterfowl production areas, and 4 distinct easement programs. This district covers the largest geographical area of any in the United States. The protection of habitat in the district continues to grow with acquisition of more easements and waterfowl production areas.

- Blackfoot Valley Conservation Area (CA) was established in 1995 and expanded in 2011. This conservation easement program has the potential to protect up to 103,500 acres in the Blackfoot Valley by buying conservation easements on private land within the 824,024-acre project area.

- Rocky Mountain Front CA was established in 2005 and expanded in 2011. This conservation easement program has the potential to protect up to 295,000 acres in the Rocky Mountain Front (Front) by buying conservation easements on private land within the 918,000-acre project area.

- Swan River National Wildlife Refuge was established in 1973 and consists of 1,568.81 acres. It is located in the Swan Valley, 38 miles southeast of Creston, Montana.

- Swan Valley CA was established in 2011. This conservation area has the potential to protect up to 10,000 acres in the Swan Valley by buying conservation easements on private land, and up to 1,000 acres in fee-title land next to the Swan River Refuge within the 187,400-acre project area.

This document contains the draft CCP and EA for all areas that make up the refuge complex.

THE PLANNING PROCESS

Public scoping began with a Notice of Intent to prepare the draft CCP and EA which was published in the Federal Register on August 18, 2008. Information about plan development was distributed through news releases, a published planning update, presentations to local agencies and organizations, and by holding eight public scoping meetings through June 2011. In addition, the Service has coordinated with Federal, State and local agencies and Native American tribes.

KEY PLANNING ISSUES

The scoping process identified many special values of the refuge along with issues and recommendations. Based on this information as well as on guidance from the Improvement Act, National Environmental Policy Act, and planning policy, the Service identified several key issues for the refuge complex and, specifically, for the Benton Lake Refuge to address in the CCP:

Benton Lake Wetland Management District, Blackfoot Valley Conservation Area, Rocky Mountain Front Conservation Area, Swan River National Wildlife Refuge, Swan Valley Conservation Area

CLIMATE CHANGE

Climate change is anticipated, but there are many unknowns. Intact landscapes with functioning ecological processes, such as the diverse range found on the refuge complex, offer ecosystem resiliency and resistance and are better suited for adapting to the extreme impacts that some are predicting.

AGRICULTURAL CONVERSION

The refuge complex is losing native prairie due to agricultural tilling and plowing. These habitats are especially important for nesting migratory birds, including many shorebirds, waterfowl, and grassland bird species.

DEVELOPMENT

Habitat fragmentation due to housing and road developments has become a threat to the refuge complex. Many opportunities to protect habitat for wildlife may be lost when land is developed for residential, commercial, agricultural, and other purposes.

FISHERIES MANAGEMENT

Bull trout is a federally listed threatened species and is known to occur within that part of the Swan

River that flows through the Swan River Refuge. Northern pike, a nonnative fish species, migrates up Spring Creek and may be impacting bull trout and waterfowl on the refuge.

Benton Lake National Wildlife Refuge

DECLINING WETLAND ECOLOGICAL HEALTH

In recent years, refuge staff and the public have noticed significant declines in the number of waterbirds and overall productivity. An absence of historical dry periods at the refuge that sustain wetland health is a concern

There is uncertainty around how long dry periods need to be to restore and support wetland ecological health.

WATER QUALITY AND SELENIUM CONTAMINATION

Selenium concentrations in the water, sediment and biota of parts of the Benton Lake Refuge are currently at levels that can affect reproduction of species that are particularly sensitive to selenium, such as waterfowl species. In some parts of the refuge, selenium could reach levels that cause reproductive failure in waterfowl and other waterbirds in as little as 10 years.

INVASIVE PLANTS

Nonnative grasses, forbs, and woody species are of concern on the refute because they diminish the quality and suitability of habitat and reduce its potential to support many native wildlife species. Invasive species spread easily, replace native habitat, reduce diversity, and cause great expenditure of financial and human resources.

HUNTING

Hunters have expressed concern that the quality of waterfowl hunting at the refuge has declined significantly over the last several years. Excessive vegetation, limited open-water, and low-water levels have all been mentioned as contributing factors.

FUTURE OF THE REFUGE COMPLEX

VISION

A vision is a concept, including desired conditions for the future, which describes the essence of what the Service is trying to accomplish. The following vision for the refuge complex is a future-oriented statement designed to be achieved through refuge, district, and conservation area management throughout the life of this CCP and beyond.

The spirit of the American West resonates on both sides of the Continental Divide in the prairies, mountains, rivers, and wetlands of the Benton Lake National Wildlife Refuge Complex.

Here, migratory birds fill the sky, bull trout thrive, and grizzlies and wolves still roam. Visitors experience many of the same landscapes that Lewis and Clark explored on their journey through the "Crown of the Continent."

Conservation efforts in the refuge complex protect intact landscapes, manage productive habitats, and offer people opportunities to connect with wildlife in solitude under Montana's big sky.

These efforts rely on innovative public and private partnerships, are supported by the region's people, and harmonize with the historic rural economy.

GOALS

The Service developed a set of goals for the refuge complex based on the Improvement Act, the purposes of the refuge complex, and information developed during project planning. A goal is a descriptive, broad statement of desired future conditions that conveys a purpose, but does not define measurable units. The goals direct efforts toward achieving the vision and purposes of the refuge complex and outline approaches for managing refuge resources. The Service established seven goals for the entire refuge complex.

Landscape Conservation Goal

Actively pursue and continue to foster relationships within the Service, other agencies, organizations, and private partners to protect, preserve, manage, and restore the functionality of the diverse ecosystems within the working landscape of the refuge complex.

Habitat Goal

Actively conserve, restore, and manage upland and wetland habitats across the northern prairies and intermountain valleys of the refuge complex, through management strategies that perpetuate the integrity of ecological communities.

Wildlife Goal

Support diverse and sustainable continental, regional, and local populations of migratory birds, native fish, species of concern, and other indigenous wildlife of the northern prairies and intermountain valleys of northern Montana.

Cultural Resources Goal

Find and evaluate the cultural resources of the refuge complex and protect those that are found to be significant.

Visitor Services Goal

Provide opportunities to enjoy wildlife-dependent recreation on Service-owned lands and increase knowledge and appreciation for the refuge complex's ecological communities and the mission of the National Wildlife Refuge System.

Administration Goal

Provide facilities, strategically allocate staff, and effectively use and develop sources of money, partnerships, and volunteer opportunities to support the long-term integrity of habitats and wildlife resources of the refuge complex.

USFWS

Wetland gathering on the refuge complex.

Visitor and Employee Safety and Resource Protection Goal

Provide for the safety, security, and protection of visitors, employees, natural and cultural resources, and facilities throughout the refuge complex.

ALTERNATIVES

The Service developed and analyzed three alternatives as options for managing habitats and public use across the entire refuge complex:

- alternative A–no action
- alternative B
- alternative C–proposed action

These alternatives examine different ways for providing permanent protection and restoration of fish, wildlife, plants, habitats, and other resources and for providing opportunities for the public to engage in compatible wildlife-dependent recreation. Each alternative incorporated specific actions intended to achieve the goals. The no-action alternative, however, represents the current, unchanged refuge management and may not meet every aspect of every goal. The no-action alternative provides a basis for comparison of the action alternatives B and C.

Alternative A (no action)

Management activity being conducted by the Service would remain the same. The Service would not develop any new management, restoration, or education programs at the refuge complex. Current habitat and wildlife practices helping migratory species and other wildlife would not be expanded or changed. Habitat management within the refuge complex would continue to focus, primarily, on helping migratory birds, especially during breeding. Other species would be considered through land protection programs and partnerships (for example, grizzly bear and bull trout). Staff would continue monitoring, inventory, and research activities at their current levels. Money and staff levels would remain the same with little change in overall trends. Programs would follow the same direction, emphasis, and intensity as they do now.

Alternative B

Management efforts would focus on supporting the resiliency and sustainability of native grasslands, forests, shrublands, and unaltered wetlands throughout the refuge complex by emulating natural processes. Prescribed fire, grazing, and other management techniques would be used to replicate historical disturbance factors. Where feasible, restoration of native uplands would occur.

For altered wetlands where water management capability exists, management efforts would focus on minimizing the effects of drought periods of the northern Great Plains and Rocky Mountains. Management would be active and intensive to keep these wetland conditions in a consistent state for wildlife using artificial flooding and drawdowns. Management would be active and intensive to support consistency for wildlife using tools such as artificial flooding, drawdowns, fire, rest, and grazing.

Changes in the refuge complex's research and monitoring, staff, operations, and infrastructure would likely be required.

Alternative C (proposed action)

Emphasis would be placed on achieving self-sustaining systems with long-term productivity. Management efforts would focus on supporting and restoring ecological processes, including natural communities and the dynamics of the ecosystems of the northern Great Plains and northern Rocky Mountains in relationship to their geomorphic landscape positioning. Conservation of native landscapes would be a high priority accomplished by protecting habitats from conversion using a combination of partnerships, easements and fee-title lands, and through active management and proactive enforcement of easements. Management actions, such as prescribed fire, grazing, and invasive species control, would be used to support the resiliency and sustainability of Service-owned lands throughout the refuge complex.

Whenever possible, habitat conditions would be allowed to fluctuate with climatically driven wet and dry cycles, which are essential for long-term productivity.

Benton Lake National Wildlife Refuge alternatives

In addition, it was found that a separate analysis would be conducted, and that a broader range of alternatives would be developed, for just Benton Lake Refuge because the issues that applied to this refuge were more complex. The following alternatives are specific to Benton Lake Refuge and do not apply to the rest of the refuge complex. However, they are extensions of alternatives A, B, and C that would apply to the entire refuge complex:

- alternative A1–no action
- alternative B1
- alternative B2
- alternative C1–proposed action
- alternative C2

ALTERNATIVE A1 (NO ACTION)

Current management on the refuge would continue and would focus, primarily, on the individual wetland units. Most of staff time and efforts would be directed toward providing migration and breeding habitat every year for wetland-dependent wildlife, primarily waterfowl. Annual flooding would be supported by pumping water from Muddy Creek to supplement natural run-off. Water management within the 8 wetland units on the refuge would be similar each year so that units are flooded at approximately the same time and depths consistently. This alternative would provide an opportunity for waterfowl hunting every fall. Managing grasslands and other wildlife-dependent public uses (wildlife observation and photography, environmental education and interpretation, and upland game-bird hunting) on the refuge would be a secondary focus.

ALTERNATIVE B1

Refuge wetland impoundments would be intensely managed to improve health over current conditions, yet provide for wetland-dependent wildlife habitat and recreation (waterfowl hunting) every year at consistent levels. Efforts would be made to improve wetland health and sustainability for individual wetland units through short-term drying rotations, prescriptive management treatments and working in the Lake Creek and Muddy Creek watersheds. Drying rotations may be extended if necessary to achieve wetland health objectives. Managing grasslands and other wildlife-dependent public uses (wildlife observation and photography, environmental education and interpretation, and upland game-bird hunting) would be a secondary focus.

ALTERNATIVE B2

Refuge wetland units would be intensely managed to improve health over current conditions, yet provide for wetland-dependent wildlife habitat and recreation more often than would occur naturally. Efforts would be made to improve wetland health and sustainability through an initial, basin-wide dry period to "reset" the system, prescriptive management treatments and work in the Lake Creek and Muddy Creek watersheds. When wetland health has improved sufficiently, pumping may be incrementally reintroduced and reevaluated annually. Managing grasslands and other wildlife-dependent public uses (wildlife observation and photography, environmental education and interpretation, and upland game-bird hunting) on the refuge would occur as resources allow, primarily during the initial, basin-wide dry period.

ALTERNATIVE C1 (PROPOSED ACTION)

Refuge management would focus on the refuge as a whole, with emphasis on restoring the health and long-term sustainability of the wetland basin, to support a wide diversity of migratory birds and a variety of wildlife-dependent recreation. This would be accomplished by reintroducing the full extent and variability of the natural wet-dry cycles, prescriptive management treatments and working in the Lake Creek watershed. The wetland basin would receive only natural run-off and wetland basin infrastructure (for example, ditches, dikes, and water control structures) could be modified or removed only if necessary to achieve wetland health objectives. The pumphouse and all water rights would be supported. As the wetland basin is restored and becomes self-sustaining, more resources would be directed toward managing and restoring upland grasslands, providing other wildlife-dependent public uses (wildlife observation and photography, environmental education and interpretation, and upland game-bird hunting), and providing support for conservation easement acquisition in the complex.

Refuge management would focus on the refuge as a whole, with particular emphasis on restoring the long-term sustainability of the wetland basin, to support a wide diversity of migratory birds and wildlife-dependent recreation. This would be accomplished by reintroducing the full extent and variability of the natural wet-dry cycle, removal of the water management infrastructure (for example, ditches, dikes, and water control structures), prescriptive management treatments, working in the Lake Creek watershed and decommissioning of the pump house. As the wetland basin is restored and becomes self-sustaining, more resources would be directed toward managing and restoring upland grasslands, providing other wildlife-dependent public uses (wildlife observation and photography, environmental education and interpretation, and upland game-bird hunting), and providing support for conservation easement acquisition in the complex.

Abbreviations

A.D.	Anno Domini or "in the year of the Lord"
Administration Act	National Wildlife Administration Act of 1966
amsl	above mean sea level
ARM	adaptive resource management
AUM	animal unit month
B.C.	before Christ
BLM	Bureau of Land Management
CA	conservation area
CCP	comprehensive conservation plan
CFR	Code of Federal Regulations
cfs	cubic feet per second
CO2	carbon dioxide
compact	Montana House bill 717–Bill to Ratify Water Rights Compact
CKST	Confederated Kootenai and Salish Tribes
CPR	cardiopulmonary resuscitation
CRP	Conservation Reserve Program
DOI	U.S. Department of the Interior
DDT	dichlorodiphenyltrichloroethane
district	Benton Lake Wetland Management District
DNC	dense nesting cover
EA	environmental assessment
EDRR	early detection, rapid response
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
°F	degrees Fahrenheit
Front	Rocky Mountain Front
FTE	full-time equivalent position
FY	fiscal year
GFPS	Great Falls Public Schools
GIS	Geographic Information System
GNLCC	Great Northern Landscape Conservation Cooperative
gpm	gallons per minute
GS	general schedule (pay)
HAPET	Habitat and Population Evaluation Team
HGM	hydrogeomorphic
HCPC	historical climax plant community
IMPLAN	Impact Analysis for Planning
Improvement Act	National Wildlife Refuge System Improvement Act of 1997
IPCC	Intergovernmental Panel on Climate Change
IPM	integrated pest management

LCC	landscape conservation cooperative
LIDAR	light detection and ranging
LWCF	Land and Water Conservation Fund
MFIS	Montana Fisheries Information System
MFWP	Montana Fish, Wildlife & Parks
MDEQ	Montana Department of Environmental Quality
MNHP	Montana Natural Heritage Program
NEPA	National Environmental Policy Act
NISC	National Invasive Species Council
NOAA	National Oceanic and Atmospheric Administration
NRIS	Natural Resource Information System
NRCS	Natural Resources Conservation Service
NWR	national wildlife refuge
PIF	Partners in Flight
PPPLCC	Plains and Prairie Potholes Landscape Conservation Cooperative
refuge	refuge within the Benton Lake National Wildlife Refuge Complex
refuge complex	Benton Lake National Wildlife Refuge Complex
Refuge System	National Wildlife Refuge System
RLGIS	Refuge Lands Geographic Information System
RONS	Refuge Operations Needs System
RRS	Refuge Revenue Sharing Act
Se	selenium
Service	U.S. Fish and Wildlife Service
SHC	strategic habitat conservation
STEM Expo	Science, Technology, Engineering, and Math Exposition
TMDL	total maximum daily load
TNC	The Nature Conservancy
µg/g	micrograms per gram
µg/gDW	micrograms per gram dry weight
µg/L	micrograms per liter
U.S.	United States
U.S.C.	United States Code
USDA	U.S. Department of Agriculture
USDA FSA	U.S. Department of Agriculture Farm Service Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USGS–PASA	U.S. Geological Survey Policy Analysis and Science Assistance Branch
WG	wage grade (pay schedule)
WPA	waterfowl production area

Definitions of these and other terms are in the glossary, located after chapter 7.

CHAPTER 1—Introduction


Mitch Werner

Swan River National Wildlife Refuge.

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The Benton Lake Refuge Complex is part of the National Wildlife Refuge System (Refuge System), and is located in northwest and north-central Montana (figure 1). Spanning both sides of the Continental Divide, the refuge complex is a collection of diverse landscapes, from wetlands and mixed-grass prairie in the east to forests, intermountain grasslands, rivers, and lakes in the west. Likewise, animal species that inhabit the refuge complex lands are diverse and reflective of a variety of habitats. Large numbers of waterfowl and shorebirds inhabit wetlands in the east, while large predators such as grizzly bears make their home in the mountains and forests to the west.

The refuge complex oversees management of 27 units (2 refuges, 1 wetland management district containing 22 waterfowl production areas [WPAs], and 3 conservation areas [CAs]) and administers 216 easements within the Refuge System:

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The Service has developed this draft CCP to provide a foundation for the management and use of the refuge complex. Figure 1 shows the location of the refuge complex within the overall planning area. The CCP specifies the necessary actions to achieve the vision and purposes of the refuge complex. Wildlife is the first priority in refuge and district management, and public use (including wildlife-dependent recreation) is allowed and encouraged as long as it is compatible with the purposes of each management unit, in accordance with the National Wildlife Refuge System Improvement Act of 1997 (Improvement Act). During the planning process, it became evident that the issues surrounding the management of Benton Lake Refuge, and the wetland basin in particular, were unique within the refuge complex. Therefore, the issues, alternatives, proposed action, consequences, and objectives for Benton Lake Refuge have been addressed in a separate chapter. The material described in chapter 7 fits within the umbrella of the refuge complex but explores some aspects in detail. When completed, the management direction for the refuge complex, described in chapters 1–6, and the management direction for Benton Lake Refuge, described in chapter 7, 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. As part of implementing the final CCP (refer to section 6.3 in chapter 6) stepdown plans will be developed to guide management in further detail.

When the CCP process began in 2008, the Lost Trail Refuge and the Northwest Montana Flathead County Wetland Management District were administratively managed as a unit of the refuge complex. In 2012, the refuge complex was administratively reorganized, which resulted in the transfer of the Lost Trail Refuge and Northwest Montana Flathead County District to the National Bison Range Complex in Moiese, Montana. Although Lost Trail Refuge has a CCP that was completed in 2005 and remains in effect, several issues were identified during scoping for the refuge complex CCP. To address these issues, an amendment to the Lost Trail CCP will be prepared. Also during scoping for the refuge complex CCP, a few issues about management of waterfowl production areas in the wetland management district were identified. These issues will be forwarded to the staff of the National Bison Range Complex for consideration during their CCP efforts, which are currently in the preplanning phase.

This chapter introduces the process for development of the refuge complex's CCP, including descriptions of the involvement of the Service, the State of Montana, the public, and others. Chapter 1 also describes the conservation issues and plans that affect the refuge complex. The remaining chapters contain information the Service used and results of the Service's analysis that is the foundation of the draft plan:

- chapter 2 describes the refuge complex and planning issues.

- chapter 3 sets out the alternatives for management of the refuge complex.

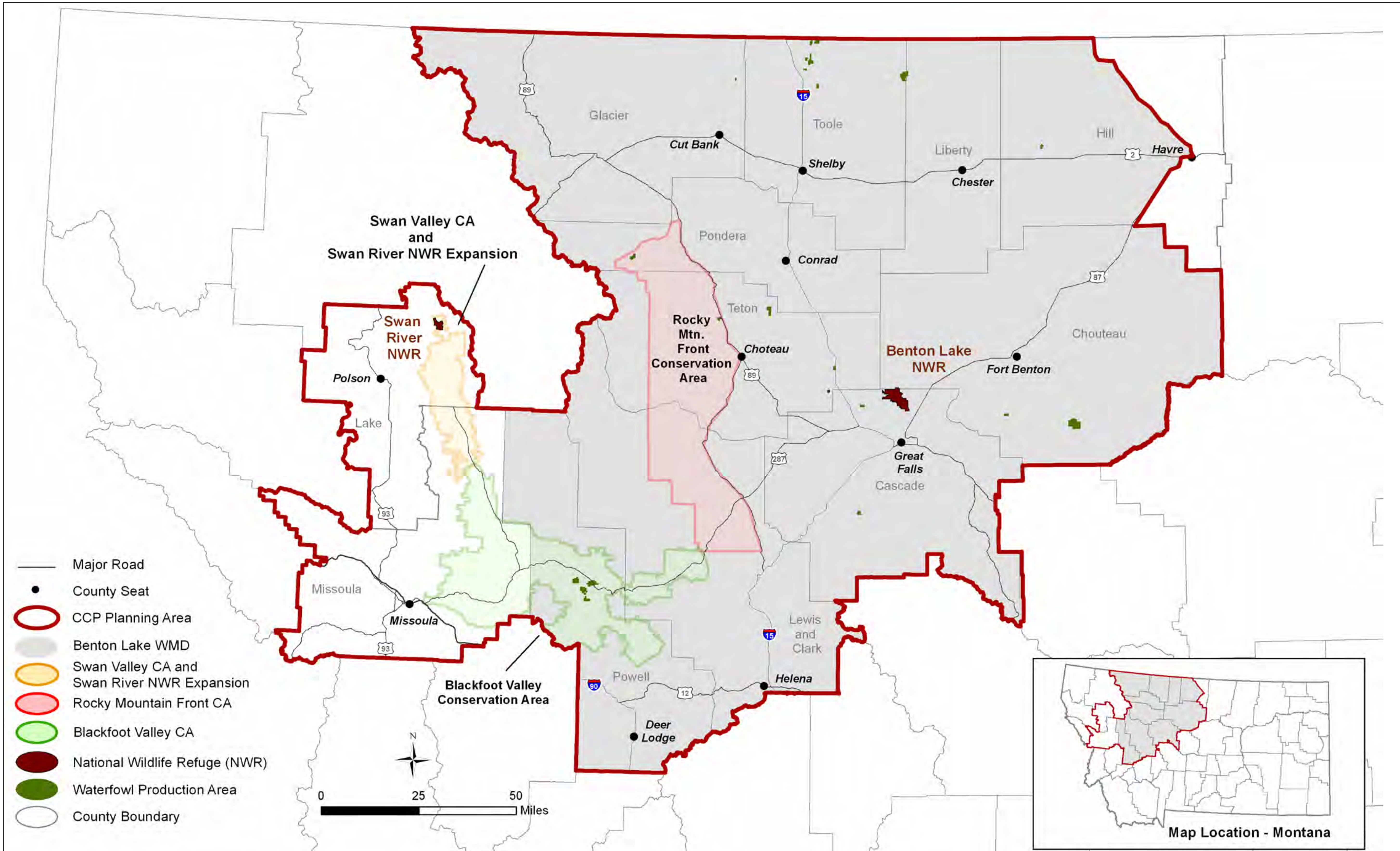


Figure 1. The comprehensive conservation planning area for Benton Lake National Wildlife Refuge Complex, Montana.

- chapter 4 describes the physical, biological, and social environment that the alternatives would affect.
- chapter 5 explains the expected consequences of carrying out each of the alternatives.
- chapter 6 describes objectives and strategies for the proposed action (alternative C) for the refuge complex, which compose the draft CCP.
- chapter 7 describes the issues, alternatives, background information, expected consequences, objectives, and strategies for the proposed action (alternative 4) for the Benton Lake Refuge.

1.1 Purpose and Need for the Plan

The purpose of this draft CCP is to show the role that the refuge complex will play in support of the mission of the Refuge System and to provide long-term guidance for managing programs and activities. The CCP is needed to help the Service achieve the following:

- communication with the public and other partners in efforts to carry out the mission of the Refuge System
- a clear statement of direction for managing the refuge complex
- providing neighbors, visitors, and government officials with an understanding of the Service's management actions on and around the refuge complex
- make sure that management actions by the Service are consistent with the mandates of the Improvement Act
- make sure that management of the refuge complex is consistent with Federal, State, and county plans
- formulate a basis for development of budget requests for the refuge complex's operation, maintenance, and capital improvement needs

1.2 The U.S. Fish and Wildlife Service and the National Wildlife Refuge System

The U.S. Fish and Wildlife Service is the principal Federal agency responsible for fish, wildlife, and plant conservation. The Refuge System is one of the Service's major programs.

U.S. FISH AND WILDLIFE SERVICE MISSION

The mission of the U.S. Fish and Wildlife Service, working with others, is to conserve, protect, and enhance fish and wildlife and their habitats for the continuing benefit of the American people.

NATIONAL WILDLIFE REFUGE SYSTEM MISSION

The mission of the National Wildlife Refuge System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

History of the National Wildlife Refuge System

In the late 19th and early 20th centuries, America's fish and wildlife resources were declining at an alarming rate, largely due to unrestricted market hunting. Concerned citizens, scientists, and hunting and angling groups joined and generated the political will for the first significant conservation measures taken by the Federal Government. These actions included the establishment of the Bureau of Fisheries in the 1870s and, in 1900, passage of the first Federal wildlife law—the Lacey Act—which prohibited interstate transportation of wildlife taken in violation of State laws. In 1892, Benjamin Harrison's order to protect Afognak Island, Alaska as a forest and fish culture reservation was the first presidential proclamation withdrawing public domain for wildlife conservation (Proclamation No. 39). Although the reservation was not deliberately established for the protection of sea lions and sea otters, its motivation was to sustain commercial harvest and recognized the need to regulate harvest and test the presidential power to rein in commercial excess (Fischman 2003).

Theodore Roosevelt viewed the conservation imperative as a moral issue as well as a necessary condition for sustaining national prosperity. Roosevelt had long expressed concern for the viability of birds targeted by plume hunters for fashion. In Florida's Indian River drainage, plume hunters were decimating egrets, ibises, roseate spoonbills, and other birds with colorful features (Cutright 1985). On March 14, 1903, President Theodore Roosevelt proclaimed Pelican Island as a "preservation and breeding ground for native birds." Between 1903 and 1909, Roosevelt decreed 52 bird and 4 big game reserves. In 1906, The U.S. Congress endorsed Roosevelt's Executive reservations.


Donna A. Dewhurst / USFWS

Sandhill cranes nest at Benton Lake Refuge.

Roosevelt inspired The U.S. Congress to reserve land that would become wildlife refuges beginning with Wichita Mountain Forest and Game Preserve in 1905, the National Bison Range in 1908, and the National Elk Refuge in 1912 (Fischman 2003).

The following growth of the Refuge System focused on particular geographic regions and broad national needs with the Migratory Bird Treaty Act of 1918. It established the first significant preemptive, Federal restrictions on hunting and implemented new treaty obligations to sustain populations of certain birds especially waterfowl populations. Refuge purchases were made to help accommodate the multistate north-south migrations (Fischman 2003).

In 1929, the Migratory Bird Conservation Act was authorized to acquire lands to serve as avian refuges or 'inviolate sanctuaries' for migratory birds. After a precipitous decline in waterfowl populations in the early 1930s, The U.S. Congress enacted the Migratory Bird Hunting Stamp Act of 1934, which dedicated money for acquiring waterfowl conservation refuges from sales of Federal Duck Stamps that all waterfowl hunters were required to affix to their State hunting license. With an assured source of money, the growth of the Refuge System accelerated. Money for refuge acquisition was augmented following the passage of the Land and Water Conservation Fund Act of 1964 (LWCF), which provides money from the receipts from motorboat fuel tax and payments for Federal offshore oil and gas leases.

In 1940 as part of the New Deal innovation, President Franklin Roosevelt established the U. S. Fish and Wildlife Service and placed it within the U.S. Department of the Interior (DOI), and existing Federal wildlife functions including law enforcement, fish management, animal damage control, and wildlife refuge management were combined into a single organization for the first time.

In 1956, the U.S. Congress gave the Executive branch the authority to acquire refuges not just for migratory birds but also for any wildlife through the Fish and Wildlife Act. There were 166 refuges established under this act (Fischman 2003).

In 1962, the passage of the Refuge Recreation Act marked the beginning of the modern trend to provide the Service with systematic management guidance. The Refuge Recreation Act mandated that public recreation use be permitted in a refuge "only to the extent that is practicable and not inconsistent with the primary objectives for which the particular area is established." In 1966, the National Wildlife Refuge System Administration Act (Administration Act) consolidated the land units managed by the Service, provided a comprehensive management mandate, and extended the applicability of the compatibility standard. It also provided for a program for the "conservation, protection, restoration, and propagation of selected species of native fish and wildlife threatened with extinction." This was the first establishment of the connection between refuges and endangered species, which remains strong today. More than 260 listed species under the Endangered Species Act (ESA) occur on refuges and 56 refuges have been added to the system specifically by ESA acquisition authority (Fischman 2003).

From 1903–97, the U.S. Congress had provided little guidance to the Service on consolidating refuges into a system. Conservation has always been the common theme for refuges mandates; however, conservation encompasses a range of concerns from ecosystem preservation, to endangered species recovery, to sustaining game populations for hunting. Without overarching guidance, coordinating and ensuring alignment of individual refuges toward a larger goal was difficult. In 1997, the Improvement Act was passed, which provided the Refuge System with an overall mission.

As conservation challenges have changed, the Service has adapted and responded. This has been shown repeatedly from such circumstances as the Service's response to marketing hunting in late 1880s, plume hunters of the 1900s, falling waterfowl populations in the 1930s, protection of endangered species in the 1960s and 1970s, loss of wetland and prairie habitat from 1920 through the 1980s, challenges facing forest landbirds and grassland bird species, and more recently effects from climate change. As conservation issues are identified, the Service has responded with shifts in management agendas and priorities in keeping with the original purpose for which the refuge unit was established.

The Nation's fish and wildlife heritage contributes to the quality of American lives and is an integral part of the country's greatness. Wildlife and wild places have always given people special opportunities to have fun, relax, and appreciate the natural world. Currently, the Refuge System has become the largest collection of lands in the world specifically managed for wildlife, encompassing more than 150 million acres within 550 refuges and more than 3,000 waterfowl production areas. Today, there is at least one refuge in every State including Puerto Rico and the U.S. Virgin Islands.

Today, the Service enforces Federal wildlife laws, conserves lands and resources, conducts landscape conservation, conserves and manages migratory bird populations, restores nationally significant fisheries, conserves and restores vital wildlife habitat, protects and recovers endangered species, and helps other governments with conservation efforts. In addition, the Service administers a Wildlife and Sport Fish Restoration program that distributes hundreds of millions of dollars to States for fish and wildlife restoration, boating access, hunter education, and related programs across the United States.

1.3 National and Regional Mandates

Refuge System units are managed to achieve the mission and goals of the Refuge System along with the designated purposes of the national wildlife refuges and wetland management districts (as described in establishing legislation, Executive orders, or other establishing documents). The key concepts and guidance for the Refuge System are in the Administration Act, Title 50 of the Code of Federal Regulations (CFR), "Fish and Wildlife Service Manual," and the Improvement Act.

The Improvement Act established a clear mission for the Refuge System. The act states that each national wildlife refuge (meaning every unit of the Refuge System, which includes wetland management districts) shall be managed to do the following:

- Fulfill the mission of the Refuge System
- Fulfill the individual purposes of each refuge and district
- Consider the needs of fish and wildlife first
- Support the biological integrity, diversity, and environmental health of the Refuge System
- Recognize that wildlife-dependent recreation activities including hunting, fishing, wildlife observation, photography, environmental education, and interpretation are legitimate and priority public uses
- Keep the authority of refuge managers to decide compatible public uses
- Fulfill the requirement of developing a CCP for each unit of the Refuge System and fully involve the public in preparation of these plans
- In addition to the mission for the Refuge System, the wildlife and habitat vision for each unit of the Refuge System supports the following principles:
- Wildlife comes first.
- Ecosystems, biodiversity, and wilderness are vital concepts in refuge and district management.
- Habitats must be healthy.
- Growth of refuges and districts must be strategic.
- The Refuge System serves as a model for habitat management with broad participation from others.

Following passage of the Improvement Act, the Service immediately began to carry out the direction of the new legislation including preparation of CCPs for all national wildlife refuges and wetland management districts. Consistent with the act, the Service prepares CCPs in conjunction with public involvement. Each refuge and each district is required to complete its CCP within the 15-year schedule (by 2012).

The Improvement Act amends the Administration Act by providing (1) a unifying mission for the Refuge System, (2) a new process for determining compatible public uses on refuges and districts, and (3) a requirement that each refuge and district be managed under a CCP. The Improvement Act states that wildlife conservation is the priority of Refuge System lands and that the Secretary of the Interior will make sure that the biological integrity, diversity, and environmental health of refuge lands are supported. Each refuge and district must be managed to fulfill the Refuge System's mission and the specific purposes for which the unit was established. The Improvement Act requires the Service to check the status and trends of fish, wildlife, and plants in each national wildlife refuge and wetland management district.

A detailed description of these and other laws and Executive orders that may affect the CCP or the Service's implementation of the CCP is in "Appendix A–Key Legislation and Policy." Service policies for planning and day-to-day management of refuges and districts are in the "Refuge Manual" and the "Fish and Wildlife Service Manual."

1.4 Contributions to Regional and National Plans

The refuge complex contributes to the conservation efforts outlined in the various regional and national plans described here.

FULFILLING THE PROMISE

A 1999 report, "Fulfilling the Promise, the National Wildlife Refuge System" (USFWS 1999a), is the culmination of a yearlong process by teams of Service employees to evaluate the Refuge System nationwide. The report contains 42 recommendations packaged with three vision statements for wildlife and habitat, people, and leadership. This CCP deals with all three of these major topics. The planning team looked to the recommendations in the document for guidance during CCP planning.

The Service has recently embarked on an effort to update the vision in "Fulfilling the Promise" through a new initiative, "Conserving the Future." A landmark conference was held in 2011 to solidify the direction of this effort. Updated guidance and documents will be developed in the near future. As the vision for "Conserving the Future" develops, these new ideas and directions will be incorporated into the management of the refuge complex.

PARTNERS IN FLIGHT

The Partners in Flight program began in 1990 with the recognition of declining population levels of many migratory bird species (Ruth 2006). The central premise of Partners in Flight has been that the resources of public and private organizations in North and South America must be combined, coordinated, and increased to achieve success in conserving bird populations in this hemisphere.

Montana Partners in Flight identified the highest priority habitats in Montana as mixed grassland, sagebrush-steppe, dry forest (ponderosa pine and Douglas-fir), riparian deciduous forest, and prairie pothole wetlands (Casey 2000). All of these key habitats occur within the refuge complex. The primary objectives in each priority habitat are to restore ecological processes necessary to provide suitable habitat for priority (target) species, find and protect those remaining blocks of habitats that have undergone drastic declines, and develop management prescriptions that can be applied at all geographic scales.

NORTH AMERICAN WATERBIRD CONSERVATION PLAN

The North American Waterbird Conservation Plan provides a contiguous framework for conserving and managing colonial-nesting waterbirds, seabirds, coastal waterbirds, wading birds, and marshbirds. The North American Waterbird Conservation Plan includes a goal to establish conservation action and exchange information and expertise with other bird conservation initiatives. The plan also calls for establishment of practical units for planning for terrestrial habitats (Kushlan et al. 2002). The refuge complex is located within the Northern Prairie and Parklands Region.

The challenge for the Northern Prairie and Parklands Regional Plan is operating in a landscape significantly affected by agriculture, oil, gas, and other human development activities that factor immensely in the region's conservation issues. Wetland loss and deterioration tops the list, which is further influenced by the region's natural cycles of drought and inundation as well as the widespread and uncertain ramifications of global climate change. Reliable, comprehensive population information that incorporates wetland availability and landscape context is the foremost information need in this area (Beyersbergen et al. 2004).

NORTH AMERICAN WATERFOWL MANAGEMENT PLAN

Recognizing the importance of waterfowl and wetlands to North Americans and the need for international cooperation to help in the recovery of a shared resource, the United States, Canadian and Mexican Governments have joined together to develop a strategy to restore waterfowl populations through habitat protection, restoration, and enhancement. Originally written in 1986, the North American Waterfowl Management Plan is innovative because of its international scope and its implementation at the regional level. Its success depends on the strength of partnerships called joint ventures, which involve Federal, State, provincial, tribal, and local governments; businesses; conservation organizations; and individual citizens. (USFWS and Canadian Wildlife Service 1986).

Joint ventures are regional, self-directed partnerships that carry out science-based conservation through a wide array of community participation. Joint ventures develop implementation plans that focus on areas of concern identified in the plan. The refuge complex lies within the Intermountain West and Prairie Pothole Joint Ventures. The North American Waterfowl Management plan and the supporting efforts of the Intermountain West and Prairie Pothole Joint Ventures have been considered throughout the planning process and will be supported and promoted in the CCP.

U.S. SHOREBIRD CONSERVATION PLAN

The U.S. Shorebird Conservation Plan is a partnership involving organizations throughout the United States committed to the conservation of shorebirds. The organizations and individuals working on the Plan have developed conservation goals for each region of the country, identified critical habitat conservation needs and key research needs, and proposed education and outreach programs to increase awareness of shorebirds and the threats they face (Brown et al. 2001).

The national plan has been stepped down by region, including the Intermountain West Region and the Northern Plains Prairie Pothole Region, which include the refuge complex. Managing for shorebirds in the prairies is challenging due to the dynamic nature of wetland conditions in time and space. Major issues for shorebirds in this area include conservation of declining species, habitat loss, and filling information gaps on threats (Skagen and Thompson 2003). The most important issue facing shorebird conservation in the Intermountain West is the availability of quality water. The shorebird plan for this area focuses on habitat management, monitoring, research, outreach, and planning (Oring et al. 2000).

STATE COMPREHENSIVE FISH AND WILDLIFE CONSERVATION STRATEGY

Montana's Comprehensive Fish and Wildlife Conservation Strategy (MFWP 2005) is for all vertebrate species known to exist in Montana including both game and nongame species. The plan recognizes that managing fish and wildlife more comprehensively is a natural progression in the effective conservation of the remarkable fish and wildlife resources of Montana. The goals of the plan are to identify all of Montana's fish and wildlife and related habitats in greatest need of conservation, identify management strategies to conserve fish and wildlife and related habitats in greatest need, work independently and in partnership to conserve, enhance, and protect Montana's diverse fish and wildlife resources, and address each species equitably regardless of classification as game or nongame, rare or at risk, improve the ability of the Montana Fish, Wildlife & Parks (MFWP) to address present and future money challenges and opportunities and integrate monitoring and management of game and nongame fish and wildlife species.

Several Tier I (greatest conservation need) focus areas and community types were identified that overlap geographically with the refuge complex and with the Service's management alternatives under consideration in this plan. These are the Rocky Mountain Front foothills, Mission/Swan Valley and Mountains, grassland complexes, riparian and wetlands, mountain and prairie streams. In addition, there are at least 15 Tier I wildlife species identified in this plan that are also trust responsibilities of the Service. The 15-year management direction for refuge complex outlined in this CCP has significant potential to complement and advance the conservation needs MFWP outlined in their comprehensive conservation strategy.

THE NATURE CONSERVANCY—NORTHERN GREAT PLAINS STEPPE ECOREGIONAL ASSESSMENT

The Northern Great Plains Steppe Ecoregional Assessment encompasses approximately 250,000 square miles (an area about one and half the size of California) and includes parts of five States and two Canadian provinces: Montana, Nebraska, North Dakota, South Dakota, Wyoming, Alberta, and Saskatchewan (TNC 1999). Historical and current land use practices have significantly affected many native species in the ecoregion. Grassland species have begun to show widespread declines—most notable are endemic Great Plains birds, which have shown steeper and more consistent declines than any other group of North American species. The Northern Great Plains Steppe Ecoregional Plan identified 42 primary species, 18 secondary species, 323 natural communities, and 2 general aquatic communities as targets of conservation. Portfolio sites that are also priorities for the refuge complex include the Rocky Mountain Front and the Sweet Grass Hills. Much of the portfolio is being supported by existing land management practices; however, significant threats persist that could either destroy or significantly degrade sites and their conservation targets. The Nature Conservancy (TNC) identified the need to strengthen existing partnerships and more effectively reach out to stakeholders in the ecoregion. The Service will consider its role in supporting this effort through the CCP and future management direction.

THE NATURE CONSERVANCY—CANADIAN ROCKY MOUNTAINS ECOREGIONAL ASSESSMENT

The Canadian Rocky Mountains ecoregional assessment covers approximately 27.1 million hectares (66.9 million acres) across a large part of the Rocky Mountains from southeastern British Columbia and southwestern Alberta to northern Idaho, northwestern Montana and a small part of northeastern Washington (Rumsey et al. 2004). This ecoregion is best recognized for its full complement of large mammals. Elk, Rocky Mountain bighorn sheep, mountain goats, mule deer, white-tailed deer, moose, and woodland caribou are among the large ungulate species. Some of the most threatened species are carnivores, and this ecoregion supports populations of grizzly bears, gray wolves, wolverines, fishers, and lynx. The ecoregional assessment for the Canadian Rocky Mountains represents the first step in developing a network of conservation areas that, with proper management, would make sure the long-term persistence of the ecoregion's species, communities, and ecological systems. The refuge complex is a key stakeholder in several of these conservation areas, including the Crown of the Continent. The goal is to conserve the entire portfolio of conservation areas, which will need a combination of strategies, including on-the-ground action at specific conservation areas and multiple-area strategies to abate pervasive threats to targets across the ecoregion.

PARTNERS FOR FISH AND WILDLIFE PROGRAM STRATEGIC PLAN

In 2004, Service directorate instructed the Partners Program to develop a national strategic plan. The plan included regional geographic areas in which to focus local projects to realize the greatest help to those fish and wildlife resources most in need. The guidance directed the preparation of regional and State stepdown plans. The 2007 Montana Step-down Strategic Plan identifies geographic focus areas, provides focus area habitat accomplishment targets, and describes benefits to Federal trust species. Focus areas within the refuge complex include the Rocky Mountain Front, Blackfoot River watershed, and the Swan Valley (USFWS 2007a). The Partners for Fish and Wildlife Program is currently updating their 5-year plan and the results of that effort will be considered in the management direction for the refuge complex.

RECOVERY PLANS FOR THREATENED AND ENDANGERED SPECIES

There are eleven threatened, endangered, or candidate species that occur, or have historically occurred, within the refuge complex (USFWS 2012). Recovery plans have been completed for the pallid sturgeon, black-footed ferret, grizzly bear, and piping plover.

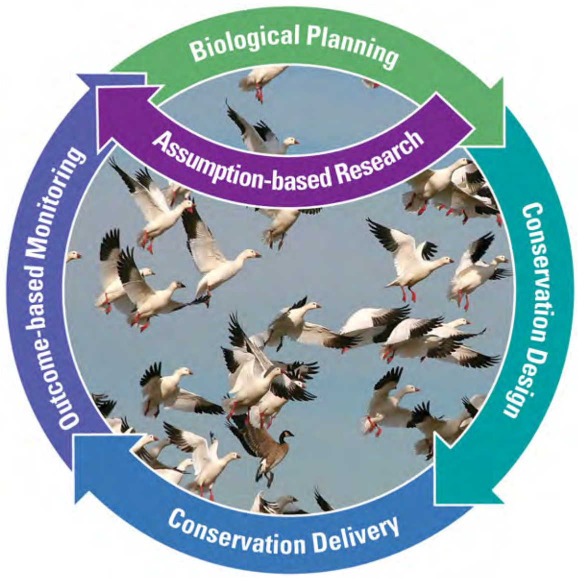


Figure 2. The strategic habitat conservation process.

Draft recovery plans are available for the bull trout and water howellia. The recovery needs of all listed species within the refuge complex are considered in the development of the CCP. Species that have a significant part of their population within the refuge complex and are likely to be most affected by this CCP, either through direct management of fee-title lands or through partnership in conservation easements, include the grizzly bear (threatened) Sprague's pipit (candidate) and bull trout (threatened).

CLIMATE CHANGE STRATEGIC PLAN

The Service expects that accelerating climate change will affect the Nation's fish, wildlife, and plant resources in profound ways. While many species will continue to thrive, some may decline and in some instances go extinct. In 2010, the Service completed a strategic plan to address climate change for the next 50 years titled, Rising to the Urgent Challenge—Strategic Plan for Responding to Accelerating Climate Change (USFWS 2010c). The strategic plan employs three key strategies: adaptation, mitigation, and engagement. In addition, the plan acknowledges that no single organization or agency can address climate change without allying itself with others in partnership across the Nation and around the world. This plan is an integral part of the DOI's strategy for addressing climate change as expressed in Secretarial Order 3289 (September 14, 2009).

The Service will follow five guiding principles in responding to climate change Service-wide and within the refuge complex:

- Continually evaluate priorities and approaches, make difficult choices, take calculated risks, and adapt to climate change.
- Commit to a new spirit of coordination, collaboration, and interdependence with others.
- Reflect scientific excellence, professionalism, and integrity in all work.
- Emphasize the conservation of habitats within sustainable landscapes, applying the Strategic Habitat Conservation (SHC) framework.
- Assemble and use state-of-the-art technical capacity to meet the climate change challenge.

1.5 Strategic Habitat Conservation

SHC is a means of applying adaptive management across large landscapes. SHC involves an ongoing cycle of biological planning, conservation design, conservation delivery, outcome-based monitoring, and assumption-based research (figure 2). SHC uses science to focus conservation in the right places (USGS, USFWS 2008).

In 2010, the Service started to expand its conservation easement programs in the Blackfoot Valley and

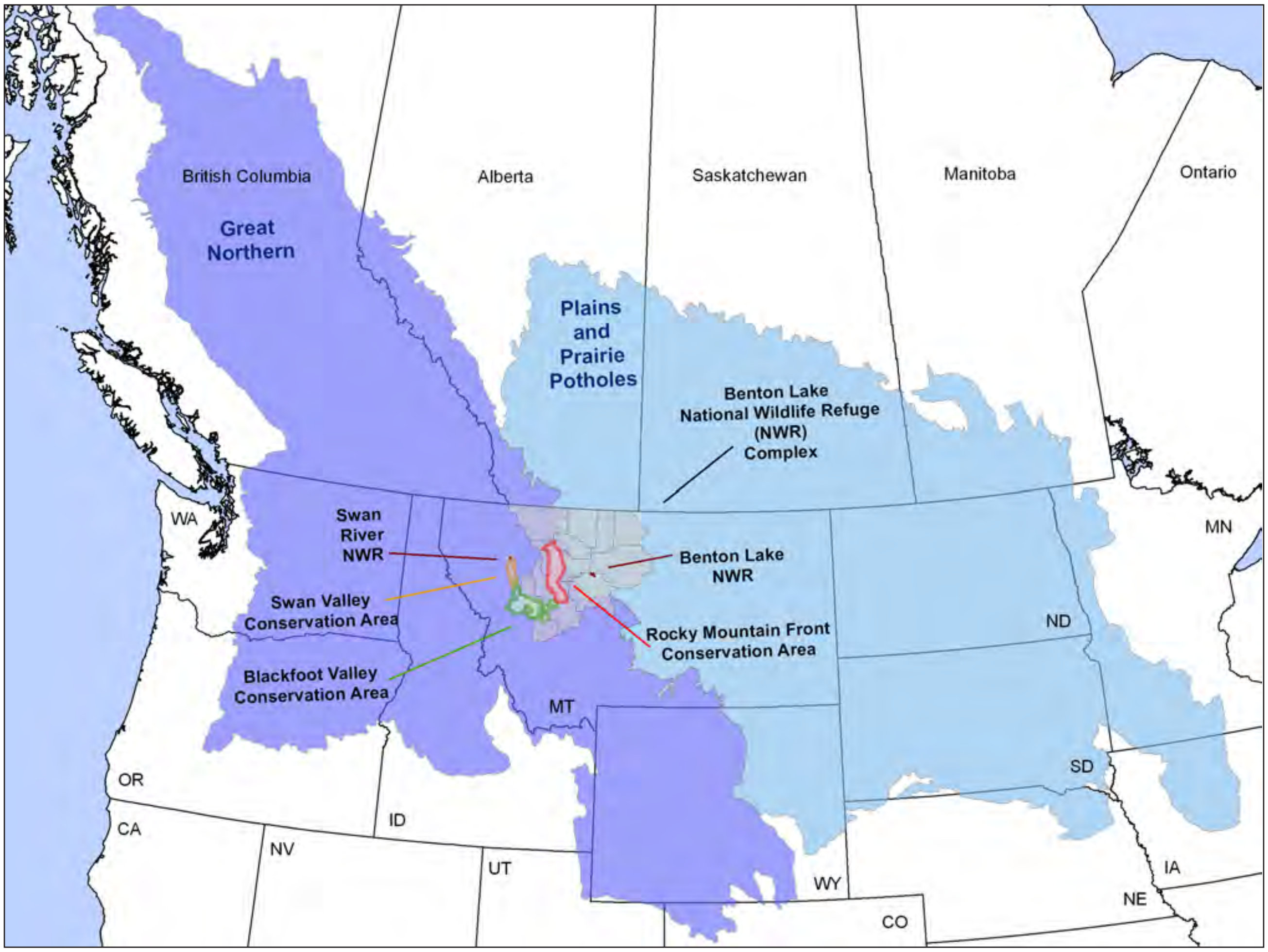


Figure 3. The Great Northern Landscape Conservation Cooperative and the Plains and Prairie Potholes Landscape Conservation Cooperative with Benton Lake National Wildlife Refuge Complex, Montana.

along the Rocky Mountain Front as well as establish a new conservation easement program in the Swan Valley. Input from the public was solicited in May 2010 and used to complete an EA and land protection plan for each Conservation Area. The land protection plans (USFWS 2011c,d,e) outline how the refuge complex will use SHC to focus the purchase of conservation easements to meet objectives for focal species such as the grizzly bear, bull trout, and Canada lynx. As new information on population objectives, habitat needs, and threats become available, the Service will continue to update the land protection plans. Efforts by key partners such as TNC, Trout Unlimited, MFWP, the Service's Ecological Services branch and the Great Northern Landscape Conservation Cooperative (GN-LCC) are essential to completing these monitoring and feedback parts of the SHC process and for keeping conservation efforts focused on the highest priorities.

1.6 Landscape Conservation Cooperatives

Landscape conservation cooperatives (LCCs) facilitate the application of adaptive management and SHC across large landscapes. These cooperatives are conservation-science partnerships between the Service and other Federal agencies, States, tribes, nongovernmental organizations, universities, and others. Designed as fundamental units for planning and science, the cooperatives have the capacity to help the Service carry out the elements of SHC—biological planning, conservation design and delivery, and monitoring and research. Coordinated planning and scientific information will strengthen the Service's strategic response to accelerating climate change.

The refuge complex lies within the Service's GNLCC and the Plains and Prairie Potholes Landscape Conservation Cooperative (PPPLCC) (figure 3). The GNLCC has identified priority species including bull trout, grizzly bear, Lewis's woodpecker, trumpeter swan, westslope cutthroat trout, Arctic grayling, wolverine, willow flycatcher, greater sage-grouse, burrowing owl, and Columbia spotted frog. Eight of these priority species exist within the refuge complex. The PPPLCC includes three main subunits, the Prairie Pothole Region, northern Great Plains, and the riparian corridors of several major river systems including the Missouri River, the Yellowstone River, and the Red River of the North. The refuge complex lies primarily within the PPPLCC's Prairie Pothole Region, which includes millions of wetlands that constitute one of the richest wetland and grassland systems in the world. The area provides habitat for both breeding and migrating birds, as well as a host of other wetland and native grassland-dependent species, including waterfowl, shorebirds, grassland birds, native stream fishes, and big river fishes such as the pallid sturgeon, and paddlefish.

As LCCs continue to develop, an overarching priority will be to serve as a convening body, bringing together partners to address existing and future issues related to climate change and landscape-scale conservation. LCCs will continue to:

- convene forums for the assessment of conservation needs and identification of key issues and decisions;
- collect and assimilate climate information to support vulnerability assessments for populations and habitats most susceptible to the effects of climate change;
- develop population and habitat models as necessary to enhance conservation delivery in response to climate change and other effects to landscapes;
- identify conservation delivery strategies;
- jointly figure out and address research needs for priority species and priority habitat conservation;
- provide decision support systems and tools that are accessible to partners and help define the

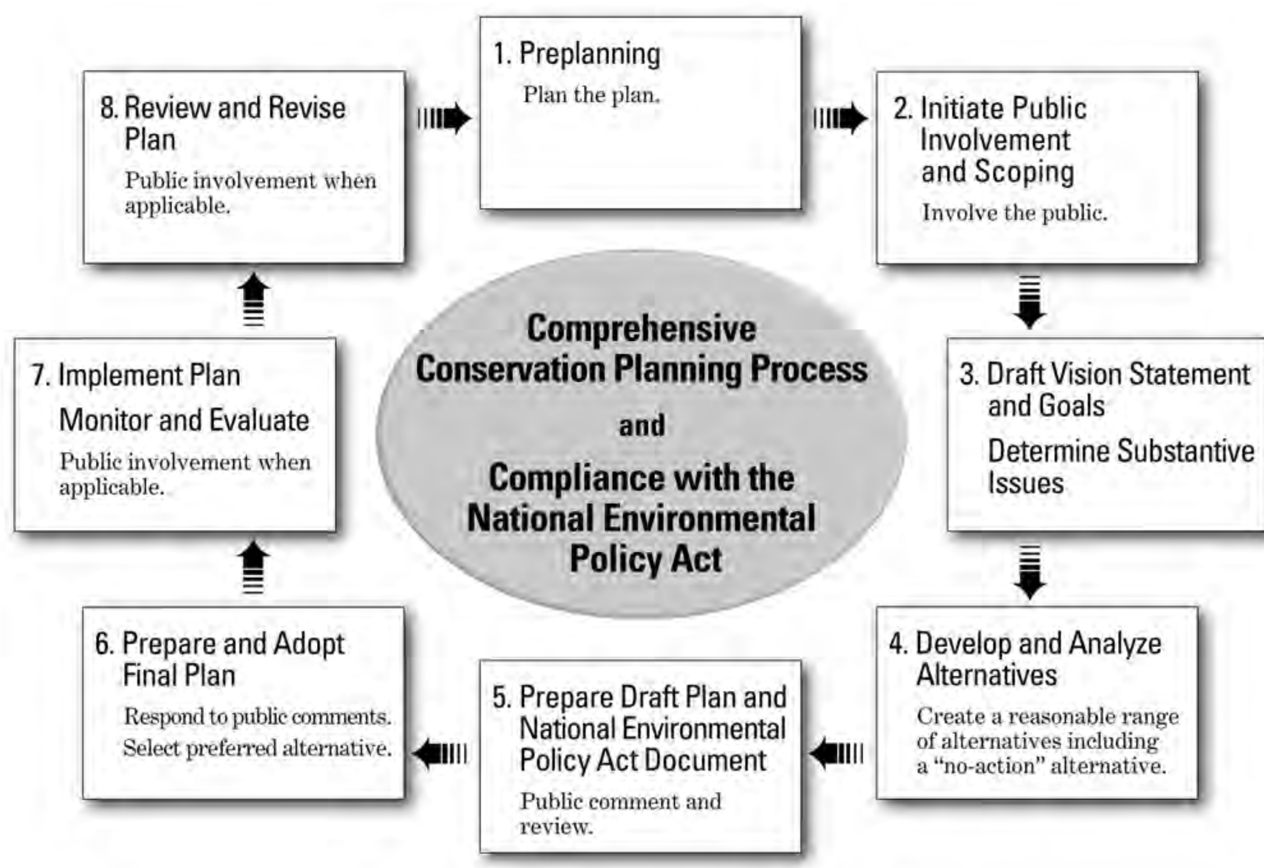


Figure 4. Process steps for comprehensive conservation planning and associated environmental analysis.

conservation actions needed including how much and where;

- support proper data sharing,
- develop monitoring and evaluation protocols;
- leverage existing capacities and avoid inefficiencies and redundancy in landscape conservation and monitoring.

The refuge complex intends to continue to be an active participant in LCCs and continue to consider opportunities where refuge management, partnership work, conservation delivery, and research needs coincide with the work of the LCCs (USFWS 2009a).

1.7 The Planning Process

The Improvement Act requires the Service to develop a CCP by 2012 for each national wildlife refuge. The final plan for the refuge complex is scheduled for completion in 2012 and will guide the management of the refuge complex for the next 15 years.

The Service prepared this draft CCP and EA in compliance with the Improvement Act and Part 602 (National Wildlife Refuge System Planning) of the "Fish and Wildlife Service Manual." The actions described in the draft CCP and EA meet the requirements of the Council on Environmental Quality regulations that carry out the National Environmental Policy Act of 1969 (NEPA). More requirements and guidance are contained in the Refuge System's planning policy, issued in 2000. This policy established requirements and guidance for refuge and wetland management district plans—including CCPs and step-down management plans—to make sure that planning efforts follow the Improvement Act. The planning policy identified several steps of the CCP and environmental analysis process (figure 4).

The Service began the preplanning process in February 2008 with the establishment of a planning team comprised primarily of Service staff from refuge complex and the Region 6 Division of Refuge Planning. A broader advisory planning team also was established due to the great interest by other refuge divisions. During workshops and other critical stages in the planning process, the broader team was part of the decision process. Contributors included other Service divisions stationed in regional office, U.S. Geological Survey (USGS), and Greenbrier Wetland Services, (refer to "Appendix B–Preparers and Contributors"). During preplanning, the team developed a mailing list, internal issues, and identified the unique qualities of the refuge complex (see section 2.2 in chapter 2). The planning team identified and reviewed current programs, compiled and analyzed relevant data, and defined the purposes of the refuge units within the refuge complex.

Public scoping started with a Notice of Intent to prepare the draft CCP and EA that was published in the Federal Register on August 18, 2008. Information was distributed through news releases, issuance of the first planning update, and holding a series of public scoping meetings. Meetings were held as follows:

- September 2, 2008, La Quinta Inn, Great Falls, Montana, 4–7 p.m.
- September 3, 2008, Stage Stop Inn, Choteau, Montana, 4–7 p.m.
- September 3, 2008, Ovando School, Ovando, Montana, 4–7 p.m.
- September 4, 2008, Red Lion Inn, Kalispell, Montana, 4–7 p.m.
- October 15, 2008, Benton Lake Refuge Headquarters, Great Falls, Montana, 5–7 p.m.
- November 16, 2010, Benton Lake Refuge Headquarters, Great Falls, Montana, 5–7 p.m.
- January 11, 2011, Benton Lake Refuge Headquarters, Great Falls, Montana, 4–6 p.m.
- June 9, 2011, Best Western Heritage Inn, Great Falls, Montana, 8 a.m.–3 p.m.

In addition to hosted meetings, several opportunities to meet with a variety of interest groups occurred. Service employees shared the CCP planning process, solicited issues and concerns from individuals attending meetings, and answered any questions. These opportunities provided staff greater understanding of issues, concerns, and effects shared by the public. Refuge staff attended meetings or met with the following: Ducks Unlimited, Great Falls Audubon, Montana Audubon, Russell Country Sportsmen's Association, Muddy Creek Watershed Group, Sun River Watershed Group, Montana Bird Conservation Partnership, Great Falls Public School, and Rocky Mountain Front Land Manager's Forum.

The planning team encouraged public comment during the planning process through the development and release of this draft CCP and EA. This project complies with public involvement requirements of NEPA, and the planning team incorporated public input throughout the planning process. Over the course of the planning process, the planning team collected available information about the resources of the refuge complex units and the surrounding areas. This information is summarized in chapter 4–Affected Environment. Table 1 lists the specific steps in the planning process to date for the preparation of this draft CCP and EA.

Table 1. Summary of the comprehensive conservation planning process for Benton Lake National Wildlife Refuge Complex, Montana.

Date	*Event*	*Outcome or purpose*
February 7, 2008	Preplanning meeting	Service staff discussed the initial planning team list, started the mailing list, discussed the planning schedule, and discussed the biological data needs.
April 30, 2008	Planning team invitation letters mailed	The Regional Director invited tribal nations and MFWP to take part on the planning team.
May 12–14, 2008	CCP kickoff and vision statement meeting	The planning team reviewed the refuge complex purposes, identified refuge complex qualities and issues, and developed a draft vision statement for the refuge complex.
July 15, 2008	Work plan	The work plan was completed.
August 18, 2008	Notice of Intent	The Notice of Intent to prepare a CCP was published in the Federal Register (volume 73, number 160, pages 48237–38).
August 2008	Planning update	The first planning update was sent to people and organizations on the mailing list. The update described the planning process and announced the upcoming public scoping meetings.
September 2, 2008	Public scoping meeting	A public meeting was held in Great Falls. The public had an opportunity to learn about the CCP process and provide comments.
September 3, 2008	Public scoping meeting	A public meeting was held in Choteau. The public had an opportunity to learn about the CCP process and provide comments.
September 3, 2008	Public scoping meeting	A public meeting was held in Ovando. The public had an opportunity to learn about the CCP process and provide comments.
September 4, 2008	Public scoping meeting	A public meeting was held in Kalispell. The public had an opportunity to learn about the CCP process and provide comments.
October 15, 2008	Public scoping meeting	A public meeting was held at the Benton Lake Refuge Headquarters. The public had an opportunity to learn about the CCP process and provide comments.
November 20, 2008–January 13, 2009	Six planning team conference calls	The process for developing goal statements for the refuge complex was agreed on, and goal statements were developed for the refuge complex.
April 28–30, 2009	Biological review planning meeting	The planning team met in Great Falls for a presentation by Greenbrier Wetland Services of the draft report, "An Evaluation of Ecosystem Restoration and Management Options for Benton Lake National Wildlife Refuge" followed by a question and answer session. The planning team discussed mCoordination anagement alternatives for the refuge.
July 29, 2009	Alternatives development planning meeting	The planning team met at the refuge to discuss management alternatives and environmental consequences for the refuge.
September 9, 2009–January 20, 2010	Ten planning team conference calls	The planning team developed and analyzed three management alternatives for the refuge complex.
February 16–18, 2010	Environmental consequences and selection of proposed action workshop	The planning team met in Great Falls to review the environmental consequences for the alternatives, and select a proposed action alternative.
November 2–30, 2010	Four planning team conference calls	The planning team began writing objectives and strategies for the proposed action alternative.
November 16, 2010	Public scoping meeting	A public meeting was held at the Benton Lake Refuge Headquarters. The public had an opportunity to learn about the CCP process and provide comments.

Table 1. Summary of the comprehensive conservation planning process for Benton Lake National Wildlife Refuge Complex, Montana.

December 7–9, 2010	Objectives and strategies work session	The planning team met in Great Falls to review and complete objectives and strategies for the proposed action alternative.
January 11, 2011	Public scoping meeting	A public meeting was held at the Benton Lake Refuge Headquarters. The public had an opportunity to learn about the CCP process and provide comments.
June 9, 2011	Options Workshop	A workshop was held in Great Falls to discuss management issues and options related to water management, selenium contamination, and public use at the Benton Lake Refuge.
January–November 2011	Draft plan p reparation	The planning team prepared the draft CCP and EA.
January 2012	Draft plan internal review	The planning team and other Service staff reviewed the draft CCP and EA and provided comments to help clarify the analyses and provide consistency.
March 2012	Draft plan public review	The planning team completed the draft plan for distribution to the public for review.

COORDINATION WITH THE PUBLIC

A mailing list of more than 450 names was prepared during preplanning. The mailing list includes private citizens; local, regional, and State government representatives and legislators; other Federal agencies; and interested organizations (refer to "Appendix C–Public Involvement").

The first planning update was sent in August 2008 to everyone on the mailing list. Information was provided on the history of the refuge and the CCP process and included an invitation to attend any of the four public scoping meetings being held in early September. The planning update included a mailing list consent form to be placed on the CCP mailing list. The update also provided opportunities for submitting comments including emails.

The Service held five public scoping meetings from September 2–October 15, 2008. Turnout was relatively low with 5–10 people attending each meeting and 28 attendees, primarily local citizens, including surrounding ranchers. The public meetings were conducted as open houses, where attendees could individually view a PowerPoint presentation about the refuge complex and an overview of the CCP and NEPA processes, as well as other supplemental information on the extent of the refuge complex, the purpose for each unit and the vision for the refuge complex. Attendees were encouraged to ask questions and offer comments. Verbal comments were recorded and each attendee was given a comment form to submit other thoughts or questions in writing.

Written comments for the initial scoping effort were due September 15, 2008. Sixty written comments were received orally and in writing throughout this scoping process. The Service received letters from five nongovernmental organizations (Sun River Watershed Group, Montana Audubon, Born Free USA, Friends of the Wild Swan, Flathead Wildlife) and two agencies (MFWP, Region One; and Montana Salinity Control Association). All comments were shared with the planning team and considered throughout the planning process.

One of the most significant issues identified for the refuge complex, by both the public and the planning team, was the declining condition of the Benton Lake Refuge wetlands. To fully understand what was causing this decline, the Service met with consultants from Greenbrier Wetland Service on April 28 and July 29, 2009, to develop a hydrogeomorphic (HGM) assessment of Benton Lake. The scientists from Greenbrier Wetland Services are recognized experts in the field of wetland ecology. They worked with Service staff to understand what changes had occurred in the Benton Lake wetlands over time and how this might relate to the observed declines in productivity, increases in invasive species and increasing selenium contamination (Heitmeyer et al. 2009). These findings and other information were used to analyze the management alternatives and to select a proposed action alternative for the refuge.

After choosing the proposed action alternative at the meeting in February 2010, refuge staff began another scoping effort to share the results with the public. Refuge staff focused on groups and individuals who had expressed interest or concern about Benton Lake during the first scoping effort. Refuge staff organized and led presentations to local interest groups (Russell County Sportsmen's Association, Upper Missouri Breaks Audubon, Sun River Watershed Group), MFWP, congressional representatives, and the public. Many people attended the meetings and provided comments that the Service recorded. These comments were considered by the planning team in preparation of this draft CCP and EA and are addressed in chapter 7, which describes the issues at Benton Lake Refuge in detail.

STATE COORDINATION

At the start of the planning process, April 2008, the Regional Director (Region 6 of the Service) sent a letter to MFWP, inviting them to take part in the planning process. MFWP did not designate a representative to take part on the planning team; however, several MFWP staff members have been involved in the planning process to date. Service staff met periodically with local, regional, and headquarters staff to discuss various planning issues and conduct an onsite tour of the Benton Lake Refuge. In June 2011, MFWP staff members took part in a workshop to discuss water management options at Benton Lake Refuge.

In MFWP Region 2, engagement with State employees occurred from initial planning process with attendance at open houses and requests to address particular issues including the River to Lakes Initiative, expanding conservation protection around the Lost Trail National Wildlife Refuge and enhancement of elk hunting at this refuge. Due to the subsequent administrative reorganization of the refuge complex in 2011, issues raised by MFWP about the Lost Trail Refuge will be incorporated in an amendment to the CCP for the Lost Trail Refuge.

At the start of the process, the offices of each of the three State Congressmen (then Senator John Tester, Senator Max Baucus, and Representative Dennis Rehburg) were sent letters telling them about the planning process and inviting them to comment on the plan. The refuge complex manager met with each local office representative informing them of the planning process and opportunity to comment. Seven other Montana State senators and representatives and Governor Brian Schweitzer were sent similar letters.

TRIBAL COORDINATION

Early in the planning process, April 2008, the Regional Director (Region 6 of the Service) sent a letter to tribes identified as possibly having a cultural and historical connection to the area in which the refuge complex is located. Those contacted were the Confederated Salish Kootenai, Blood, Fort Belknap Assiniboine and Gros Ventre, Blackfeet, and Peigan tribal councils. The tribal councils did not submit responses to the Region 6 letter; nevertheless, the councils were provided opportunities to comment.

RESULTS OF SCOPING

Comments collected from scoping meetings and correspondence were used in the development of a final list of issues to be addressed in this draft CCP and EA. The planning process makes sure that issues with the greatest effect on the refuge complex resources and programs are resolved or given priority over the life of the final CCP. These issues, as well as changes suggested to current refuge management, are summarized in chapter 2. The Service subsequently developed alternatives that could best address these issues. A description of these alternatives can be found in chapter 3.

SELECTING AN ALTERNATIVE

After the public reviews and provides comments on the draft CCP and EA, the planning team will present this document along with a summary of all substantive public comments to the Regional Director (Region 6 of the Service). The Regional Director will consider the environmental effects of each alternative including information gathered during public review.

The Regional Director will select a preferred alternative for each of the two analyses in the draft CCP and EA: (1) management of declining wetland productivity, selenium contamination, and visitor services at Benton Lake Refuge; and (2) all other management aspects of the refuge complex. If the Regional Director finds that no significant impacts would occur, the Regional Director's decision will be disclosed in a finding of no significant impact included in the final CCP. If the Regional Director finds a significant impact would occur an environmental impact statement will be prepared. If approved, the actions in the preferred alternatives will compose the final CCP.

After the planning team prepares the final CCP for publication, a notice of availability will be published in the Federal Register, and copies of the final CCP or accompanying summary will be sent to individuals on the mailing list. Subsequently, the Service will carry out the CCP with help from partner agencies, organizations, and the public.

The CCP will provide long-term guidance for management decisions; support achievement of the goals, objectives, and strategies needed to accomplish the purposes of the refuge complex; and describe the Service's best estimate of future needs. The CCP will detail program-planning levels that may be substantially above budget allocations and, thus, are primarily for strategic planning purposes. The CCP does not constitute a commitment for staff increases, operation and maintenance increases, or money for future land acquisitions.

CHAPTER 2—The Refuge Complex

Dave Hanna

Rocky Mountain Front Conservation Area.

The refuge complex consists of 163,304 acres of lands and waters encompassing the Benton Lake National Wildlife Refuge, Benton Lake Wetland Management District, Blackfoot Valley Conservation Area, Rocky Mountain Front Conservation Area, Swan River National Wildlife Refuge, and Swan Valley Conservation Area.

The Service is responsible for the protection of 7,098 acres of wetland easements, 4,294 acres of grassland easements, 628 acres of Farmer's Home Administration conservation easements, 120,838 acres of conservation easements, 16,498 acres of waterfowl production areas (16,218 fee title and 280 leased from the State), and 14,028 acres of refuge lands.

The refuge complex spreads across a 12-county area in northwestern Montana: Cascade, Chouteau, Glacier, Hill, Lewis and Clark, Liberty, Missoula, Lake, Pondera, Powell, Teton, and Toole. The refuge complex headquarters is located at the Benton Lake Refuge, 12 miles north of Great Falls.

Chapter 7 has more information specific to the Benton Lake Refuge.

2.1 Establishment, Acquisition, and Management History

The following section describes the establishment, acquisition, and management history of the national wildlife refuges, wetland management districts, and conservation areas within the refuge complex. Table 2 summarizes the land acquisition history for the refuge complex.

Table 2. Land acquisition history for units of the Benton Lake National Wildlife Refuge Complex, Montana.

Complex Unit	*County*	*Date Acquired or Established*	*Acres*	*Means of Acquisition*
Benton Lake National Wildlife Refuge	Cascade, Chouteau, Teton	1929	12,234.92	Primary withdrawal
		1958–62	147.64	Fee title
		1958–62	76.88	Right-of-way easement
Benton Lake Wetland Management District	Cascade, Chouteau, Glacier, Hill, Lewis and Clark, Liberty, Pondera, Powell, Teton, Toole	1975	16,138	Fee title
			280	State lease land
			7,098	Wetland easement
			4,294	Grassland easement
			628	Farmers Home Administration easement
Blackfoot Valley Conservation Area	Lewis and Clark, Missoula, Powell	1994	23,845	Migratory Bird Conservation Funds
			19,361	Land Water Conservation Funds
			311	Donation
			474	North American Wetlands Conservation Act grant
Rocky Mountain Front Conservation Area	Teton, Lewis and Clark	2005	31,479	Migratory Bird Conservation Funds
	Pondera		45,368	Land Water Conservation Funds
Swan River National Wildlife Refuge	Lake	1973	1,568.81	Fee title
Swan Valley Conservation Area	Lake, Missoula	2011	0	None to date
Total	12 counties	1929–present	163,304.25	Various

BENTON LAKE NATIONAL WILDLIFE REFUGE

Originally owned and managed by the Bureau of Reclamation as part of the Sun River Reclamation Project, the Benton Lake Refuge (figure 5) was withdrawn from the public domain and became part of the National Wildlife Refuge System by Executive order of President Herbert Hoover in 1929. The original area of the refuge was 12,235 acres, of which about 3,000 was flooded wetland in 1928 (Great Falls Tribune 1929a).

The refuge was unstaffed, with infrequent visits from refuge managers at the National Bison Range until 1961, when local support from the Cascade County Wildlife Association prompted a major effort to increase the water supply and management capabilities of the refuge. A pump station, pipeline, and water control structures were constructed from 1958–62 to bring irrigation return water from Muddy Creek, about 15 miles to the west, to the Benton Lake Refuge. The acquisition of the pumping station near Power, Montana brought the refuge to its current fee-title acreage of 12,383 acres. In addition, 76.88 acres of right-of-way easement were bought to accommodate the pipeline.

In 1962, the first water was pumped from Muddy Creek and managed by the new, permanent staff on the refuge. The historical Benton Lake bed was divided into six wetland management units (Unit 4 was later subdivided into three subunits) by dikes, ditches, and water control structures to facilitate management of water.

Water management at Benton Lake Refuge, since the Muddy Creek pumping system was developed, has typically sought to consistently flood some wetland pools each year to provide breeding and migration habitat for waterfowl. In the uplands, management of the early 1960s included the breaking of more than 600 acres of native prairie for agricultural production, planting of many shelterbelts, and a reduction in haying and grazing activities that had dominated the refuge's first 30 years.

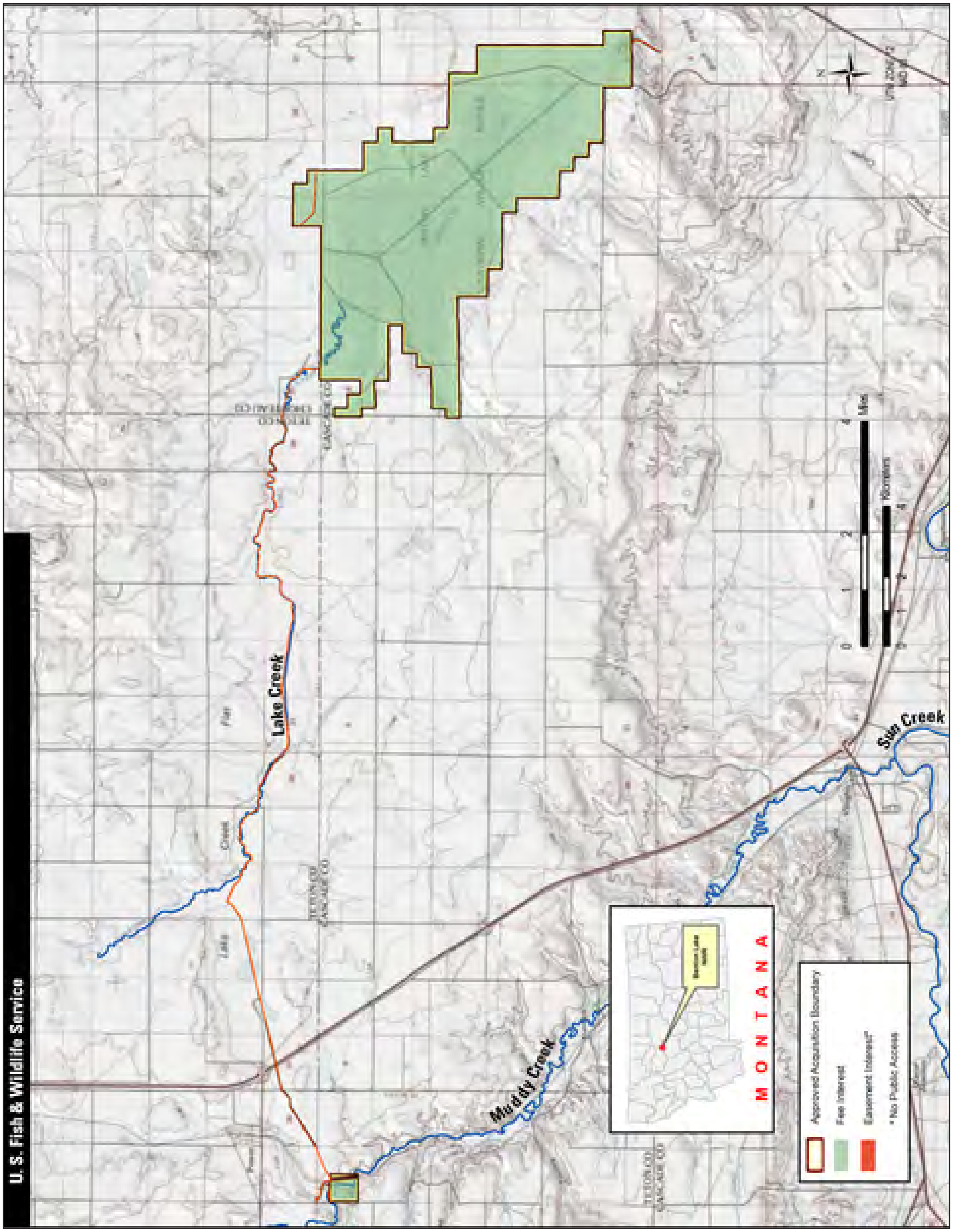


Figure 5. Map of Benton Lake National Wildlife Refuge, Montana.

A more detailed description of the establishment, acquisition and management history of Benton Lake Refuge is in chapter 7.

BENTON LAKE WETLAND MANAGEMENT DISTRICT

The district, established in 1975, is spread over a 10-county area consisting of Cascade, Chouteau, Glacier, Hill, Lewis and Clark, Liberty, Pondera, Powell, Teton, and Toole Counties in north-central Montana (figures 6 and 7). There are several types of Refuge System lands within the wetland management district:

- waterfowl production areas, which are acquired in fee title
- perpetual wetland easements, which protect privately owned wetlands from being drained, filled, or leveled, while the landowner keeps all other rights
- perpetual grassland easements, which protect privately owned rangeland and hayland from conversion to cropland, and the landowner keeps all other rights
- perpetual Farmers Home Administration conservation easements, which help farmers reduce their debt load on farmland and protect wetlands and grasslands
- perpetual conservation easements, which primarily protect wetland and grassland habitats from being subdivided and developed on privately owned property
- a grassland and wetland parcel leased from the State and managed similarly as a waterfowl production fee-title unit.

Waterfowl production areas and wetland and grassland easements are bought or donated from willing sellers through the Small Wetlands Acquisition Program authorized by The U.S. Congress in 1958—as an amendment to the Migratory Bird Hunting and Conservation Stamp Act of 1934. This program is funded by the sale of Federal Duck Stamps and loans against future duck stamp sales. The purpose of this important program is to make sure the long-term protection of breeding habitat, primarily within the PPPLCC's Prairie Pothole Region of the United States, for waterfowl and other migratory bird species.

The Service owns waterfowl production areas in fee title and manages them to provide breeding waterfowl with quality wetlands for courtship and brood rearing, as well as suitable grasslands for nesting. Habitats are managed using techniques such as prescribed grazing, haying, and fire, including farming and reseeding of former croplands to herbaceous cover. Most of the wetlands on waterfowl production areas within the refuge complex are subject to natural flooding and drying cycles and are not intensively managed or manipulated. These areas are open to migratory gamebird hunting, upland gamebird hunting, big game hunting, fishing, and trapping according to State seasons. Hunting opportunities attract hunters from across the United States and Canada. The Sands WPA and the H2-O WPA are closed to hunting in accordance with property deed restrictions.

Wetland easements are perpetual and prohibit filling, leveling, draining, and burning of wetlands under easement. Wetland easements are real property interests that the Service buys from willing landowners and are permanent fixtures to land titles. The land remains in private ownership and the landowner decides on public access. Since 1958 when the Small Wetlands Acquisition Program began, the Service has acquired a perpetual, real property interest in more than 2 million wetland acres for waterfowl production in the Great Plains States, which include Montana. The district currently manages 7,098 acres of perpetual wetland easements.

Conversion of grassland to cropland has generated a need for protection of upland habitat next to wetlands. The loss of upland nesting cover has reduced the value and productivity of wetlands for nesting waterfowl and their broods, other migratory birds, and other wildlife. Grassland easements, like wetland easements, are perpetual and protect both existing and restored habitat. The purposes of the perpetual, grassland easement program are (1) to improve and protect the water quality of wetlands, (2) support upland nesting habitat for ground-nesting birds, (3) protect highly erodible soils, and (4) provide an alternative to buying uplands in fee title, leaving land in private ownership. Grassland easements are real property interests that the Service buys from willing landowners to prohibit a loss of grassland cover from cropland conversion and development. Grassland easements also protect nesting birds by prohibiting haying or mowing until after July 15. Typically, haying and mowing is only conducted on tame grasslands. Grazing is not prohibited or regulated under the grassland easement. Money for grassland easements comes primarily from the Migratory Bird Hunting and Conservation Stamp Act and North American Wetland Conservation Act

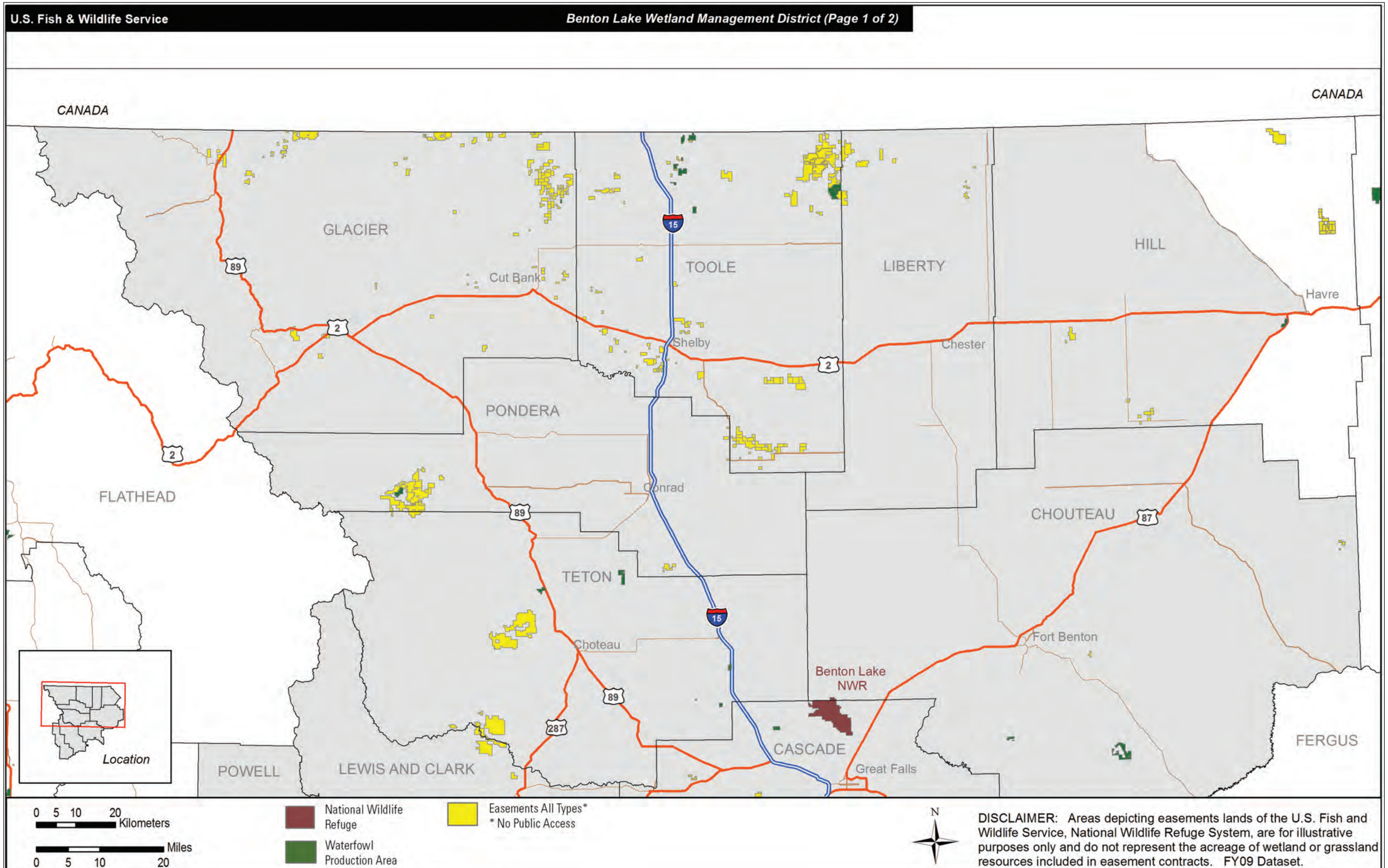


Figure 6. Map of easements and waterfowl production areas in the Benton Lake Wetland Management District (north), Montana.

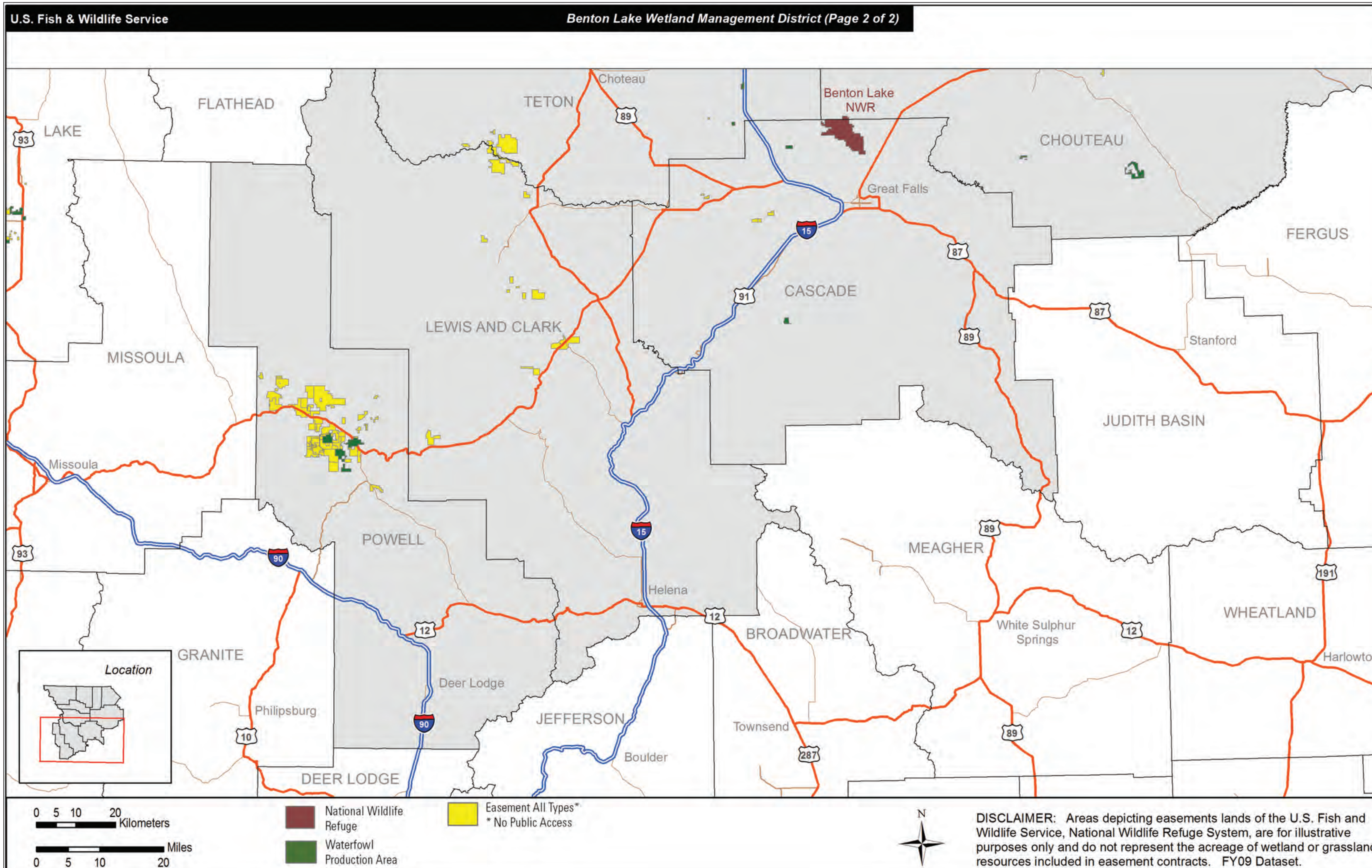


Figure 7. Map of easements and waterfowl production areas in the Benton Lake Wetland Management District (south), Montana.

grants. The district currently manages 4,294 acres of perpetual grassland easements.

Farmers Home Administration conservation easements were developed by The U.S. Congress under the Consolidated Farm and Rural Development Act of 1985 to establish easements for conservation, recreation, and wildlife purposes on properties that were foreclosed on by the Federal Government (inventory properties). The Service was designated as the easement manager on those easements worthy of inclusion into the Refuge System. The district currently manages 628 acres of perpetual Farmers Home Administration conservation easements.

As of 2011, the district has 22 waterfowl production areas totaling 16,498 (16,218 fee title and 280 leased from the State) acres, which are described in table 3.

More wetland and grassland easements may be acquired based on the availability of money from the North American Wetland Conservation Act grants, the Migratory Bird Conservation Fund, and the availability of willing sellers.

Table 3. Waterfowl production areas in the Benton Lake Wetland Management District, Montana.

Waterfowl production area	*Purchase year*	*Location*	*Total size (acres)*	*Habitat*		
				Tame grassland (acres)	Native grassland (acres)	Wetland (acres)
Arod Lakes	1992	8.5 miles southwest of Brady	797	628	0	169
Big Sag	1980	3 miles northeast of Highwood	350	181	0	169
Blackfoot	1978, 1988, 2004, 2010	7 miles southeast of Ovando	1,713	0	1,548	165
Blackhurst	1979	4 miles north of Ferdig	320	277	0	43
Brown	1980	3.5 northeast of Sunburst	260	215	0	45
Brumwell	1976	4 miles north of Power	252	73	0	179
Cemetary	1982	3 miles east of Sunburst	109	37	0	72
Danbrook	1979	6 miles east of Sweetgrass	327	220	0	107
Dunk	1980	5 miles northeast of Sunburst	80	52	0	28
Ehli	1978	8 miles east of Sweetgrass	475	171	154	150
Furnell	1976	2.5 miles south of Whitlash	1,995	0	1,871	124
H2–O	Donated in 2000	3 miles northwest of Helmville	1,803	863	705	235
Hartelius	1979	5 miles north of Vaughn	307	173	0	134
Hingham Lake	Leased from the State	2 miles northeast of Rudyard	280	0	167	113
Jarina	1986	12.5 miles west of Dupuyer	640	0	555	85
Kingsbury Lake	1980	4 miles southwest of Geraldine	3,734	248	2,054	1,432
Kleinschmidt Lake	1992	6 miles southeast of Ovando	1,120	0	1,062	58
Long Lake	1980	3.5 miles northeast of Sunburst	646	349	0	297
Peterson	1977	10 miles northeast of Santa Rita	94	51	15	28
Sands	Donated in 1983	3 miles west of Havre	379	84	129	166
Savik	1982	1.5 miles southwest of Bynum	397	0	143	254
Schrammeck Lake	1980	8 miles southeast of Cascade	420	122	0	298

BLACKFOOT VALLEY CONSERVATION AREA

The Blackfoot Valley Conservation Area (figure 8)—originally the Blackfoot Valley Wildlife Management Area—was established on February 3, 1997, under the Fish and Wildlife Act of 1956 (16 United States Code [U.S.C.] 742a–j) and Emergency Wetlands Resources Act of 1986 (16 U.S.C. § 3901(b), 100 Stat. 3583). The Blackfoot Valley CA overlaps the district in Powell County. By establishing the conservation area, the Service expanded its authorization to protect habitat in Powell County beyond the district's Small Wetlands Acquisition Program to include the authority to buy easements with LWCF money within the conservation area boundary. This was important because some high-priority conservation areas that could not qualify under the Small Wetlands Acquisition Program were now eligible for easements under the LWCF.

In 2009–10, efforts were made to expand the project area for LWCF acquisition authority after overwhelming support for the expansion was received during CCP scoping meetings. Refuge staff completed a preliminary project proposal in November 2009, which was approved April 8, 2010. Detailed planning began in May 2010 including a public scoping meeting in Ovando on May 19, 2010. A draft EA and land protection plan was released for a 30-day public review from July 25–August 25, 2010. The expansion of the existing conservation area and subsequent LWCF acquisition authority from 23,500 acres to 103,500 acres was authorized and the name of the project area was changed from Blackfoot Valley Wildlife Management Area to Blackfoot Valley Conservation Area on January 5, 2011. This expanded the project area from Powell County to included parts of Missoula and Lewis and Clark Counties.

The project area encompasses an 824,024-acre ecosystem that includes parts of Missoula, Powell, and Lewis and Clark Counties. Parts of these counties make up the Blackfoot River watershed in western Montana and include the Ovando Valley and the Helmville Valley. The watershed is bordered to the east by the Continental Divide, to the south by the Garnet Range, to the north by the Bob Marshall

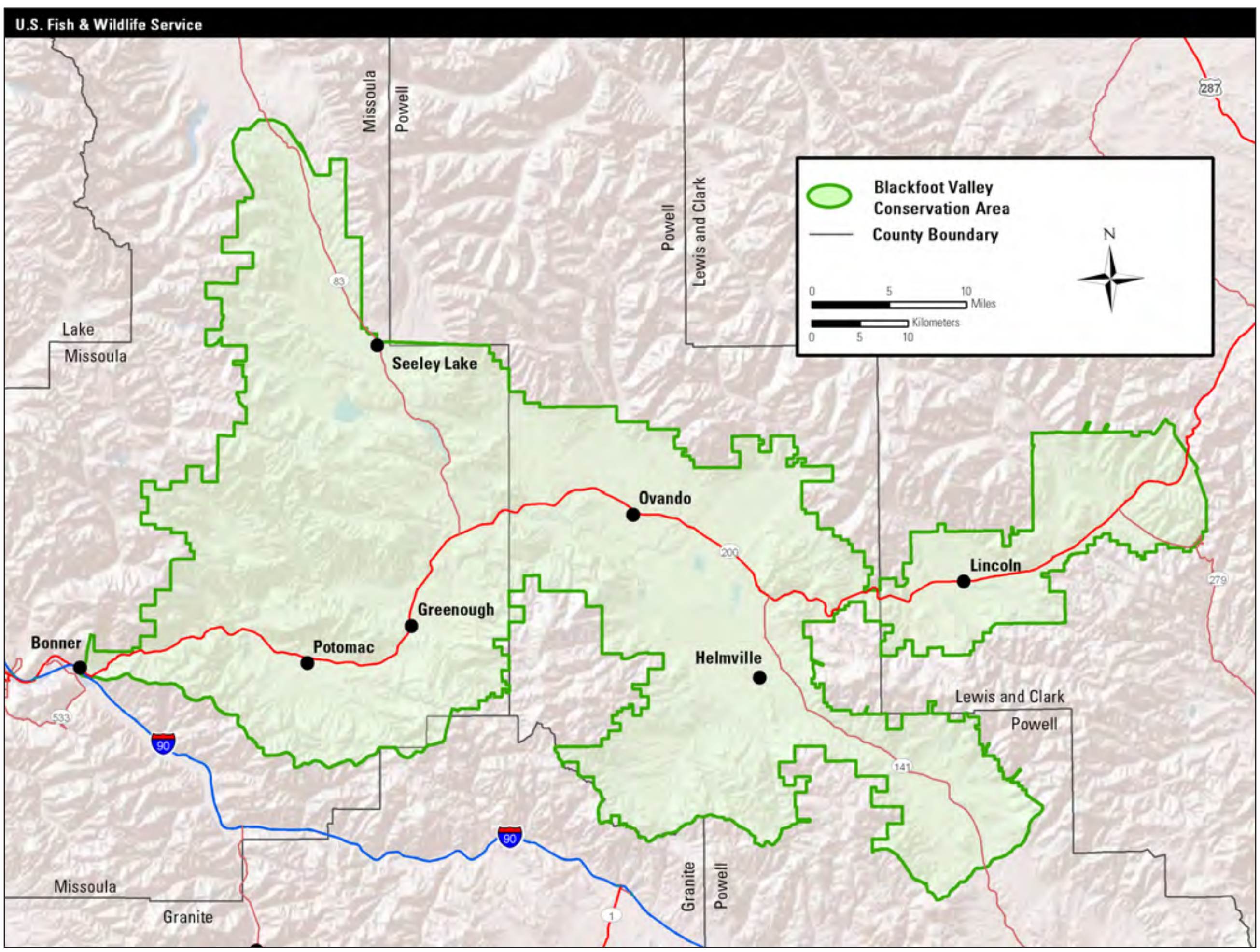


Figure 8. Map of the Blackfoot Valley Conservation Area, Montana.

and Scapegoat Wilderness, and to the west by the Rattlesnake Wilderness. The center of the project area lies about 55 miles east of Missoula.

Because the project area contains acquisition authority for both the Small Wetlands Acquisition Program and the Land and Water Conservation Fund (LWCF), these options allow for purchases of fee-title waterfowl production areas and grassland, wetland, and conservation easements. Each individual easement has a variety of rights secured in the purchase including protection of grasslands from being plowed under, the draining, burning, or filling of wetlands or protection of habitats from being subdivided and developed. This integration of acquisition authorities provides a variety of choices for conservation in the Blackfoot Valley.

The Blackfoot, Kleinschmidt Lake, and H2–O WPAs form the anchor of the conservation area. The conservation easement program and waterfowl production areas located within the project are administratively managed by the refuge complex office and maintenance facilities located on the H2–O WPA in Helmville, by a permanent full-time position cofunded by the refuge complex and the Partners for Fish and Wildlife Program.

To date, 43,991 acres of wetland, grassland, and conservation easements have been obtained within the project area. LWCF accounted for 19,361 acres of conservation easements and the remaining acreage includes 23,845 acres with Migratory Bird Conservation Funds, 474 acres with North American Wetlands Conservation Act money, and 311 acres from donation.

The Blackfoot Valley Conservation Area is part of a conservation strategy to protect one of the last undeveloped, low-elevation river valley ecosystems in western Montana. The area complements other components of a broad partnership known as the Blackfoot Challenge. These efforts include the Service's Partners for Fish and Wildlife Program working with private landowners to restore and enhance habitat on private lands and coordinated management activities on public lands throughout the entire Blackfoot Valley.

ROCKY MOUNTAIN FRONT CONSERVATION AREA

The Rocky Mountain Front CA was established on August 10, 2005 under the Fish and Wildlife Act of 1956 (16 U.S.C. 742a–j) for the development, advancement, management, conservation, and protection of fish and wildlife resources (figure 9). The conservation area is nested within the district including parts of Lewis and Clark, Teton, and Pondera Counties. As with the Blackfoot Valley CA, the project area contains acquisition authority for both the Small Wetlands Acquisition Program and the LWCF. These options allow for purchases of grassland, wetland, and conservation easements. Each individual purchase has a variety of rights secured, including protection of grasslands from being plowed under, the draining, burning, or filling of wetlands or protection of habitats from being subdivided and developed. This integration of acquisition authorities provides a variety of choices for conservation along the Front.

In 2009–10, efforts were made to expand the conservation area for LWCF acquisition authority after overwhelming support for the expansion was received during CCP scoping meetings. Refuge staff completed a preliminary project proposal in November of 2009, which was approved April 8, 2010. Detailed planning began in May 2010 including a public scoping meeting in Choteau on May 17, 2010. A draft EA and land protection plan was released for a 30-day public review from July 25–August 25, 2010. The expansion of the existing conservation area and subsequent LWCF acquisition authority from 170,000 acres to 295,000 acres was authorized on January 5, 2011.

The expanded project area skirts along the eastern edge of the Crown of the Continent Ecosystem and is centered 65 miles northwest of Great Falls, Montana. Lying in the shadow of the rugged Continental Divide, the Bob Marshall Wilderness and Lewis and Clark National Forest marks its western boundary. The 1.5 million acre Blackfeet Indian Reservation borders the project to the north and the eastern boundary is dictated by the distribution of fescue grasslands, which generally follows highways 89 and 287. The southern boundary falls approximately along the watershed of the south fork of the Dearborn River.

To date, a total of 76,847 acres have been protected by the Service through conservation easements. The Service bought 31,479 acres with Migratory Bird Conservation Funds and 45,368 acres with LWCF. Current activities include cooperation and partnerships with a variety of nongovernmental organizations to significantly leverage available Federal money to complete the approved acquisitions within the project area. The conservation easement program is administratively managed by the refuge complex headquarters facilities located north of Great Falls, by two permanent full-time positions.

The Rocky Mountain Front CA has been a successful model for partnerships with and connecting to lands already owned by the State of Montana, TNC, the U.S. Department of Agriculture (USDA) Forest Service, the Montana Land Reliance, the

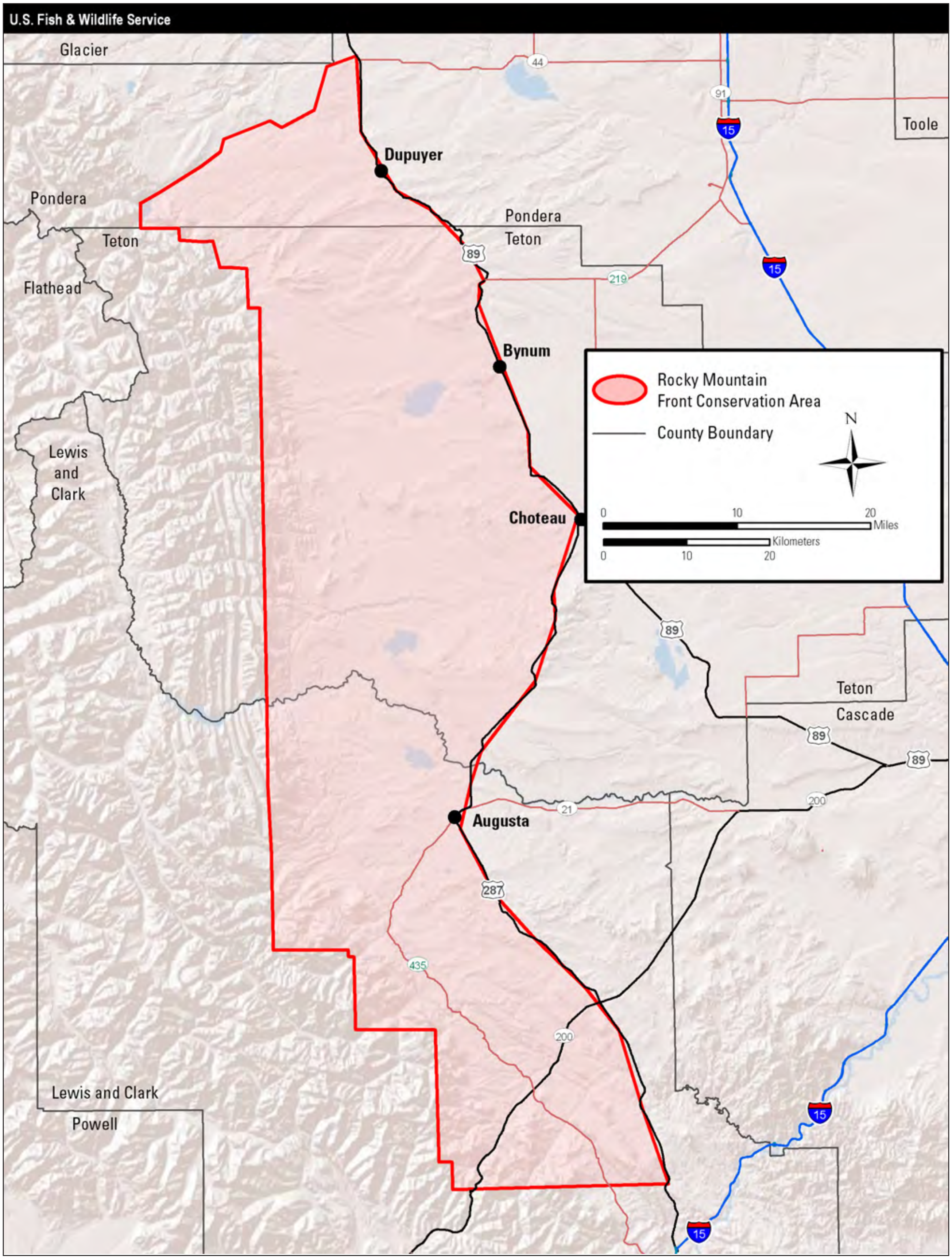


Figure 9. Map of the Rocky Mountain Front Conservation Area, Montana.

Boone and Crockett Club, and the Bureau of Land Management (BLM). In addition, local ranchers, business owners, and representatives of local governments have formed a landowner advisory council to find options and strategies for supporting ranching and rural lifestyles in the area. Conservation easements are a tool that they strongly support as a means of conserving the ranching lifestyle along the Front.

SWAN RIVER NATIONAL WILDLIFE REFUGE

The Swan River Refuge is located in northwest Montana (figure 10), 38 miles southeast of the town of Creston, in the Swan Valley. The refuge was established May 14, 1973, at the request of Montana Senator Lee Metcalf, who often hunted the area and who desired to see it preserved. The refuge was established under the authority of the Migratory Bird Conservation Act. The 1,568.81-acre refuge lies within the floodplain of the Swan River above Swan Lake and between the Swan Mountain Range to the east and the Mission Mountain Range to the west. The Swan River Valley was formed when glacial water poured down the steep slopes of the Mission Range into Flathead Lake. The valley floor is generally flat, but rises steeply to adjacent forested mountain sides. Approximately 80 percent of the refuge lies within this valley floodplain. Deciduous and coniferous forests compose the remaining 20 percent. Swan River, which once meandered through the floodplain, has been forced to the west side of the refuge by past earthquakes and deposits of silt. These geologic events have created a series of oxbow sloughs within the refuge floodplain.

Figure 10. Map of Swan River National Wildlife Refuge, Montana.

The refuge's objectives include providing for waterfowl habitat and production and to provide habitat for other migratory birds. It also provides nesting for bald eagles and a variety of other avian species. In addition, deer, elk, moose, beaver, otter, bobcat, black bear, and threatened species including grizzly bears, bull trout, and water howellia are known to inhabit the area. There are no significant developments; however, a small parking area with access to a kiosk and overlook with interpretive panels do exist.

When the refuge was under private ownership, it served as a cattle operation and, later, as a fur farm. Old ditches and dikes constructed during private ownership have altered the hydrology of flooding events across the refuge, the degree, to which, has yet to be decided but is being explored through new light detection and ranging (LIDAR) technology. Haying and grazing for habitat management have not been conducted in recent years. Finding willing cooperators is hampered by the distances farmers and ranchers need to travel to get to the refuge. Prescribed fire is still used as an alternate habitat management tool; however, concerns about the effects of burning on bull trout habitat, smoke management, and the U.S. Department of Agriculture (USDA) Forest Service inholding suggest the need for interagency planning which may result in more challenging burns.

SWAN VALLEY CONSERVATION AREA

The Swan Valley is located on the western edge of the Crown of the Continent Ecosystem, approximately 30 miles southeast of Kalispell, Montana. The Bob Marshall Wilderness and Glacier National Park mark the eastern boundary, with the Mission Mountains Wilderness and Confederated Salish and Kootenai tribal lands on the western boundary, and the Blackfoot Valley flanking the southern side of the watershed. The project area encompasses an 187,400-acre landscape on the valley floor of the 469,000-acre Swan River watershed. The watershed contains approximately 332,000 acres in protected public ownership.

The Swan Valley Conservation Area (figure 11) was designated to help protect one of the last undeveloped, low-elevation coniferous forest ecosystems in western Montana. The Swan Valley is situated between the roadless areas of the Glacier National Park–Bob Marshall Wilderness Complex, the Mission Mountains Wilderness, and the Selway-Bitterroot Wilderness to the southwest. As such, it provides an avenue of connectivity between the Canadian Rockies and the central Rockies of Idaho and Wyoming.

In 2009–10, efforts were made to establish the conservation area after support for the establishment was received during CCP scoping meetings. Refuge staff completed a Preliminary Project Proposal in November of 2009, which was approved April 8, 2010. Detailed planning began in May 2010 including two public scoping meetings in Condon, Montana on May 18 and June 2, 2010. A draft EA and land protection plan were released for a 30-day public review from July 26–August 26, 2010. A finding of no significant impact was signed by the Region 6 Director on September 24, 2010. The establishment of the conservation area and LWCF acquisition authority for up to 10,000 acres of conservation easements and up to 1,000 acres in fee title

Figure 10. Map of Swan River National Wildlife Refuge, Montana.

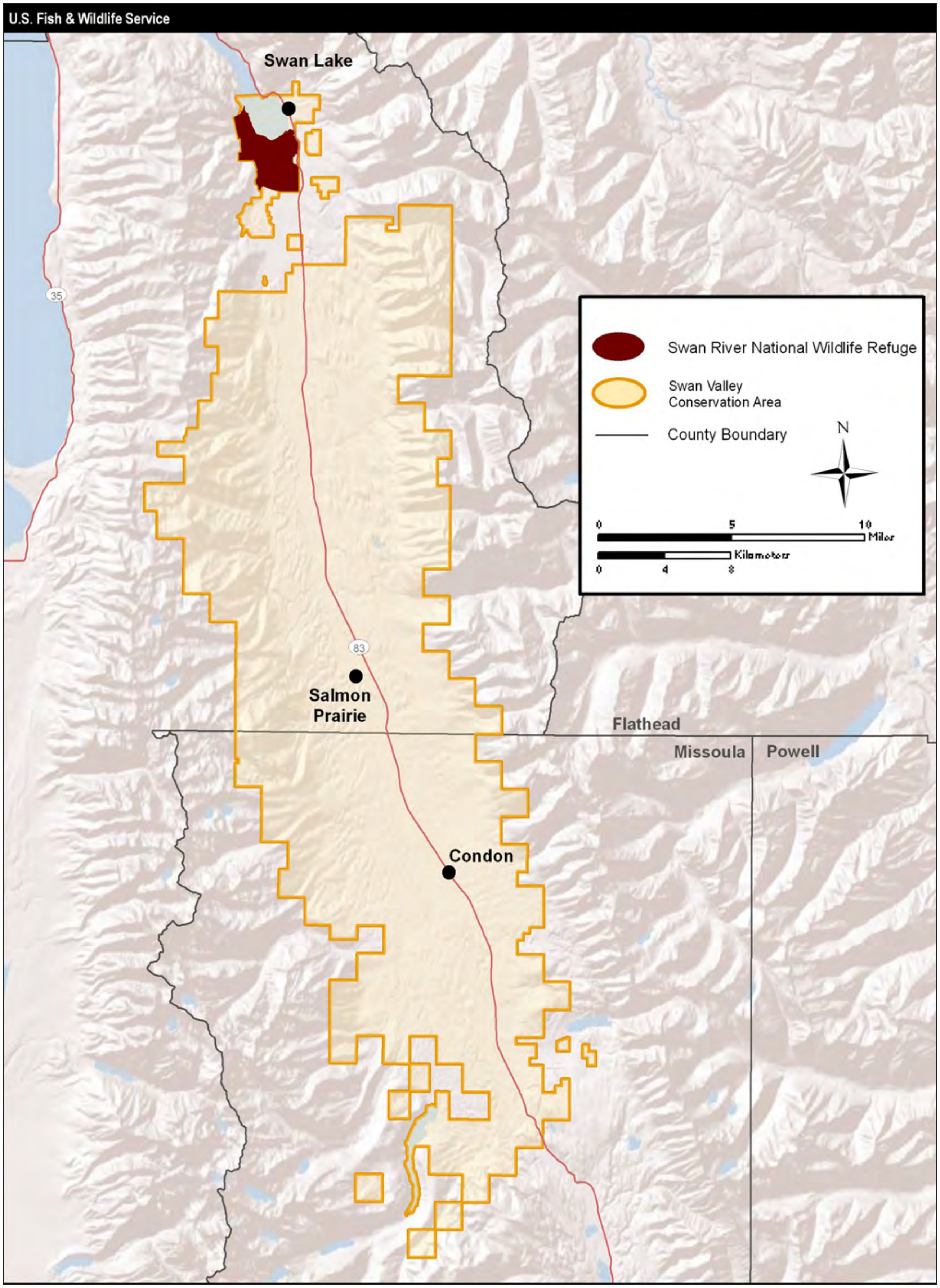


Figure 11. Map of the Swan Valley Conservation Area, Montana.

immediately next to the Swan River Refuge was authorized on May 18, 2011.

Due to its very recent establishment, no easements or fee title lands have yet been purchased within the Swan Valley Conservation Area. The conservation easement program is administratively managed by the refuge complex headquarters, which is located north of Great Falls. If future money is available, the refuge complex will consider placement of a full-time permanent position within the valley to manage and administer the conservation area.

2.2 Purposes of the Refuge Complex Units

Every national wildlife refuge, wetland management district, and conservation area has a purpose for which it was established. This purpose is the foundation on which to build all refuge, district, and conservation area programs—from biology and public use, to maintenance and facilities. No action undertaken by the Service or public may conflict with this purpose. The refuge, district, and conservation area purposes are found in the legislative acts or executive actions that provide the authorities to either transfer or acquire a piece of land for one of these units. Over time, an individual refuge or district may contain lands that have been acquired under various transfer and acquisition authorities, giving the unit more than one purpose. The goals, objectives, and strategies proposed in the draft CCP (refer to chapter 6) are intended to support the individual purposes for which each refuge, district, and conservation area was established.

BENTON LAKE NATIONAL WILDLIFE REFUGE

The purposes of the Benton Lake Refuge are:

- As a refuge and breeding ground for birds (Executive Order 5228, dated November 21, 1929).
- For use as an inviolate sanctuary, or for any other management purpose, for migratory birds (Migratory Bird Conservation Act).

BENTON LAKE WETLAND MANAGEMENT DISTRICT

The purposes of the district are:

- As "Waterfowl Production Areas subject to all of the provisions of such Act [Migratory Bird Conservation Act] except the inviolate sanctuary provisions" (Migratory Bird Hunting and Conservation Stamp).
- For "any other management purpose, for migratory birds" (Migratory Bird Conservation Act).
- For "conservation purposes" (Consolidated Farm and Rural Development Act).

BLACKFOOT VALLEY CONSERVATION AREA

The purposes of the Blackfoot Valley Conservation Area are:

- For "conservation of the wetlands of the Nation to support the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions" (Emergency Wetlands Resources Act of 1986).
- For "the development, advancement, management, conservation, and protection of fish and wildlife resources" (Fish and Wildlife Act of 1956).

ROCKY MOUNTAIN FRONT CONSERVATION AREA

The purposes of the Rocky Mountain Front Conservation Area are:

- For "the development, advancement, management, conservation, and protection of fish and wildlife resources" (Fish and Wildlife Act of 1956).

SWAN RIVER NATIONAL WILDLIFE REFUGE

The purposes of the Swan River Refuge are:

- For "use as an inviolate sanctuary, or for any other management purpose, for migratory birds" (Migratory Bird Conservation Act).

SWAN VALLEY CONSERVATION AREA

The purposes of the Swan Valley Conservation Area are:

- For "the development, advancement, management, conservation, and protection of fish and wildlife resources" (Fish and Wildlife Act of 1956).

2.3 Vision for the Refuge Complex

A vision is a concept, including desired conditions for the future, which describes the essence of what the Service is trying to accomplish. The following vision for the refuge complex is a future-oriented statement designed to be achieved through refuge, district, and conservation area management throughout the life of this CCP and beyond.

USFWS

Blackfoot Valley Conservation Area.

The spirit of the American West resonates on both sides of the Continental Divide in the prairies, mountains, rivers, and wetlands of the Benton Lake National Wildlife Refuge Complex.

Here, migratory birds fill the sky, bull trout thrive, and grizzlies and wolves still roam. Visitors experience many of the same landscapes that Lewis and Clark explored on their journey through the "Crown of the Continent."

Conservation efforts in the refuge complex protect intact landscapes, manage productive habitats, and offer people opportunities to connect with wildlife in solitude under Montana's big sky.

These efforts rely on innovative public and private partnerships, are supported by the region's people, and harmonize with the historic rural economy.

2.4 Goals for the Refuge Complex

The Service developed a set of goals for the refuge complex based on the Improvement Act, the purposes of the refuge complex, and information developed during project planning. A goal is a descriptive, broad statement of desired future conditions that conveys a purpose, but does not define measurable units. The goals direct efforts toward achieving the vision and purposes of the refuge complex and outline approaches for managing refuge resources. The Service established seven goals for the entire refuge complex.

LANDSCAPE CONSERVATION GOAL

Actively pursue and continue to foster relationships within the Service, other agencies, organizations, and private partners to protect, preserve, manage, and restore the functionality of the diverse ecosystems within the working landscape of the refuge complex.

HABITAT GOAL

Actively conserve, restore, and manage upland and wetland habitats across the northern prairies and intermountain valleys of the refuge complex, through management strategies that perpetuate the integrity of ecological communities.

WILDLIFE GOAL

Support diverse and sustainable continental, regional, and local populations of migratory birds, native fish, species of concern, and other indigenous wildlife of the northern prairies and intermountain valleys of northern Montana.

CULTURAL RESOURCES GOAL

Identify and evaluate the cultural resources of the refuge complex and protect those that are found to be significant.

VISITOR SERVICES GOAL

Provide opportunities for visitors of all abilities to enjoy wildlife-dependent recreation on Service-owned lands and increase knowledge and appreciation for the refuge complex's ecological communities and the mission of the National Wildlife Refuge System.

ADMINISTRATION GOAL

Provide facilities, strategically allocate staff, and effectively use and develop sources of money, partnerships, and volunteer opportunities to support the long-term integrity of habitats and wildlife resources of the refuge complex.

VISITOR AND EMPLOYEE SAFETY AND RESOURCE PROTECTION GOAL

Provide for the safety, security, and protection of visitors, employees, natural and cultural resources, and facilities throughout the refuge complex.

2.5 Special Values

Early in the planning process, the planning team and public identified the outstanding qualities, or special values, of the refuge complex. These special values are characteristics and features of the refuge complex that make it special and valuable for wildlife. Identifying the special values of the refuge complex emphasizes the refuge complex's worth and makes sure that the refuge complex is conserved, protected, and enhanced through the planning process. These special values can be unique biological resources, as well as something as simple as a quiet place to see a variety of birds and enjoy nature.

PART OF A NATIONAL SYSTEM

The refuge complex is part of a national system of lands. In the 1920s, public agencies and private organizations attempted to elevate the public's awareness of wetland loss and to take positive steps to slow it. The Migratory Bird Conservation Act of 1929 authorized the Federal Government to acquire wetlands and associated uplands to conserve them as migratory bird habitat and thus create a chain of stepping stones along major migration routes. The law also established a commission of Federal and State officials to evaluate lands for possible acquisition, and in so doing, it established the National Wildlife Refuge System (Adair 2003).

INTACT LANDSCAPES

Some areas keep the same composition of habitat and wildlife as 100 years ago. Refuge complex lands and waters are important corridors for birds, fish, and other wildlife.

CONSERVATION EASEMENTS

The refuge complex's conservation easement programs protect existing native prairie areas and wetlands in perpetuity through the acquisition of grassland, wetland, and conservation easements on private lands. The Service, with the willing seller interest of private landowners, has protected more than 132,858 acres of grassland and wetland habitats throughout the refuge complex.

INTACT NATIVE PRAIRIE

Large, intact native prairie communities can still be found throughout the refuge complex. Since approximately 50 percent of native grasslands have been lost in the PPPLCC's Prairie Pothole Region of Montana, preservation of native prairie is extremely important (Ducks Unlimited 2003). Visitors to the refuge complex can experience the vastness and "big sky" of relatively undisturbed prairie landscapes. Native prairie areas are important to grassland-dependent species such as northern pintail, burrowing owl, chestnut-collared longspurs, and Sprague's pipits as well as other species of concern. These wildlife species favor large expanses of native prairie and are sensitive to its development and conversion to agricultural uses. Species Diversity

Across the refuge complex, there exists a very high level of diversity. Wildlife ranges from migratory waterfowl to grassland birds, to native trout, to "charismatic megafauna'" such as elk, gray wolf, and grizzly bear.

DIVERSITY OF WATER FEATURES

A variety of waterbodies occurs within the refuge complex boundaries, including depressional wetlands, semipermanent wetlands, riparian corridors, and wild rivers. These wetland habitats serve many ecological functions as well as agricultural purposes.

RARE SPECIES

Refuge complex lands harbor Federal and State species of concern. Threatened and endangered species include bull trout, grizzly bear, gray wolf, Canada lynx, and water howellia.

MIGRATORY BIRDS

The lands of the refuge complex were established to protect and provide habitat for migratory birds that cross State lines and international borders and are by law a Federal trust responsibility.

The refuge complex is of great value to waterfowl and shorebirds, as well as other migrating water-dependent bird species, because of the diversity of wetland and upland habitats that provide for the diverse life cycle needs of these species. Furthermore, the refuge complex has large, intact areas of native prairie that provide habitat for grassland birds that are one of the most imperiled groups of migratory birds nationwide. In addition, the refuge complex serves as a valuable research site for the study of migratory birds, plant communities, and grassland and wetland management.

CULTURAL HISTORY

The refuge complex has a rich cultural history of Native American inhabitants, explorers, frontiersmen, outlaws, and early settlers. Evidence of early human occupation in the State of Montana dates back 11,000 years (Brumley 2006).

The Lewis and Clark expedition traveled the Missouri River, and extensively throughout the refuge complex through parts of the district and the Blackfoot Valley, Swan Valley, and Rocky Mountain Front Conservation Areas.

PUBLIC USE

The refuge complex is valued by hunters for its variety of hunting opportunities and by other visitors for its opportunities to view and photograph wildlife and their habitats.

The refuge complex attracts many visitors and tourist dollars to the communities surrounding the refuges and waterfowl production areas.

RURAL ECONOMIES

The Service works closely with agricultural landowners in the surrounding communities and has an interest in preserving these working landscapes.

2.6 Planning Issues

Several key issues were identified following the analysis of comments collected from refuge complex staff and the public and a review of the requirements of the Improvement Act and NEPA. Eight public meetings, news releases in the local and regional press, presentations to local agencies and organizations, an announcement in the Federal Register, and planning updates were used to solicit public input on which issues the CCP should address. Substantive comments (those that could be addressed within the authority and management capabilities of the Service) were considered during formulation of the alternatives for future management. Issues relating to the Benton Lake Refuge are described in section 7.2 in chapter 7. Key issues pertaining to the rest of the refuge complex are summarized below.

CLIMATE CHANGE

Climate change is anticipated, but there are many unknowns. The Service does not fully understand the effects that climate change will have on precipitation or temperatures, or the corresponding effects to habitat and wildlife species. The refuge complex's unique attributes of intact landscapes and diversity in terms of habitat and elevation gradient changes, positions the refuge complex in a unique situation. The intact landscapes with functioning ecological processes are characterized by ecosystem resiliency and resistance and better suited for adapting to extreme changes predicted by global climate change. For example, these relatively intact landscapes (the Rocky Mountain Front, Swan Valley, and Blackfoot Valley Conservation Areas) provide opportunities for corridors for wide-roaming species and gradients for elevation migrations.

In areas of the refuge complex that are not as intact, for example the landscape around Benton Lake Refuge, managing the refuge to maximize its resiliency and long-term sustainability becomes even more critical with climate change (see section 7.2).

This planning issue carries through all alternatives under the Climate Change planning element heading in chapter 3.

AGRICULTURAL CONVERSION

A loss of native prairie due to agriculture (tilling, plowing) is occurring. These habitats are especially important for nesting migratory birds, including many shorebirds, waterfowl, and grassland bird species. Current and changing Farm Bill Policy continues to be a driving force in the profitability of converting native prairie into tillable land. This affects the Service ability to protect native prairie landscapes through easement programs.

The geographic area immediately east of the Rocky Mountain Front Conservation Area has been largely converted to small grain production. The presence of large cattle ranches, depressed grain prices, frequent high winds, and fragile soils has largely prevented grassland conversion in this area. Changes in global commodity prices or Federal farm policies could quickly change this situation.

This planning issue involves several planning elements and carries through all alternatives under Elements Common to All Alternatives and under the Preserving Intact Landscapes planning element heading in chapter 3.

DEVELOPMENT

Due to increasing development pressure, many opportunities to protect habitat for wildlife may be permanently lost as these areas are developed for residential, commercial, agricultural, and other purposes. Increased fragmentation of habitat from housing developments and associated road development is a threat to the refuge complex. The latest published statistics by the U.S. Census Bureau, reported the State of Montana experienced a 9.7-percent increase in population from 2000-2010. Population change within the refuge complex varied with Lake, Liberty, Missoula, and Lewis and Clark County experiencing the largest population growth rates of 5–15 percent. Cascade, Glacier, Pondera, and Toole County experienced moderate growth rates of 0–5 percent within the same period (U.S. Census Bureau 2011b). The Rocky Mountain Front CA is comprised mainly of large-scale private ranches and Federal, State, and private conservation properties, which have allowed it to remain significantly intact. Recently, demand for recreational property and development of vacation home "ranchettes" has been spilling over from western Montana and that constitutes the single greatest threat to this ecosystem. In particular, the canyon mouths of the Dearborn, Sun, and Teton Rivers have become targets for several small recreational subdivisions. Many new homes and resorts are "view properties" situated in low- and mid-elevation forests, native grassland–sagebrush communities, and riparian habitats along the major rivers such as the Blackfoot and Swan Rivers and their associated tributary streams.

Extractive industries such as coal mining, and wind, oil, and gas development, pose immediate threats to this landscape and contribute to further fragmentation of the landscape. Historically, the predominant industries in many western Montana rural counties were timber or mining production. Clearcuts, mining activity, and logging roads were the major threats to wildlife habitat in the region. However, mining reclamation and clean-up has become more predominant than exploration and development. In the 1990s, mining, logging, and wood-product industries were declining while health services, trade contractors, business services, and real estate development were growing.

A major difference between the old economy (timber, mining, and ranching) and the new economy (residential development and amenities) is the level of permanence. Effects from logging and, to a lesser extent, mining can be reclaimed; trees and other vegetative cover can regenerate; and logging roads can be closed and obliterated. However, subdivisions and developments are more permanent and offer fewer possibilities of wildlife habitat restoration in the future. In most instances, the Service does not own the subsurface mineral rights of the units in the refuge complex. In the district, renewed oil and gas exploration, in combination with new interests in wind development, has heightened the threat of accelerated fragmentation.

This planning issue involves several planning elements and carries through all alternatives under Elements Common to All Alternatives and under the Preserving Intact Landscapes planning element heading in chapter 3.

INVASIVE PLANTS, NONNATIVE PLANTS, AND NOXIOUS WEEDS

Management of invasive plants, nonnative plants, and noxious weeds has been an issue throughout the refuge complex for many years.

Priority noxious weeds include spotted knapweed, leafy spurge, yellow and Dalmatian toadflax, common tansy and tansy ragwort. Other nonnative grasses such as crested wheatgrass, reed canarygrass, Garrison creeping foxtail, Kentucky bluegrass, Japanese brome and cheatgrass are also expanding rapidly on refuge lands. Nonnative grasses, forbs, and woody species are of concern because they can diminish the quality and suitability of habitat and reduce its potential to support many native wildlife species. Nonnative grasses often develop into a monoculture. Invasive species spread easily, replace native habitat, reduce diversity, and cause great expenditure of financial and human resources.

USFWS

A male sharp-tailed grouse performs a courtship display at a lek.

A large percentage of the Service's fee-title land is comprised of nonnative grasses that should be replanted or restored to native species to provide optimal habitat conditions for wildlife. Planted nonnative tree and shrub species shelterbelts occur on Benton Lake Refuge, and several waterfowl production areas throughout the district where woody vegetation did not naturally occur. Whether or not these shelterbelts should be removed or supported needs to be evaluated.

The Blackfoot Valley has experienced the spread of nonnative plant species as development and land use conversion have occurred. The Rocky Mountain Front has largely avoided the explosive spread of noxious weeds that has plagued much of western Montana over the past few decades. However, spotted knapweed and leafy spurge infestations have become established in the lower reaches of several riparian corridors. With plentiful weed sources in the region and limited government or private resources for noxious weed control, the spread of weeds into the area is a serious concern.

This planning issue carries through all alternatives under Elements Common to All Alternatives in chapter 3.

LOSS OF ECOLOGICAL PROCESSES

Natural fluctuations in water levels (seasonal flooding and drying)—integral to a healthy functioning wetland system—have been lost at Benton Lake Refuge and altered to some extent at the Swan River Refuge. This is having a negative effect on health and long-term sustainability of the refuge complex's wetland habitat. Improving, supporting, and protecting the health and long-term sustainability of wetland habitat on these two units is a continual challenge. Wetlands on and off of Service lands are susceptible to key stressors such as draining, sedimentation, alteration, pollution, and invasive species. Many of the wetlands on the refuge complex are subject to natural flooding and drying cycles that help support resiliency, health, and sustainability over the long term, protecting the wetlands from outside stressors. The most striking manifestation of the loss of fluctuating water levels and flooding intervals is the domination of nonnative species such as Garrison creeping foxtail, reed canarygrass, and other species that depend on stable water levels. (See chapter 7 for more information on Benton Lake Refuge.)

The use of fire and grazing in supporting native grasslands has declined. Grazing by cattle and prescribed fire mimic historical disturbance regimes (such as herbivory by bison and lightning storms). Cattle grazing is used on approximately half of the waterfowl production areas within the refuge complex; however, livestock grazing does not currently occur on all units of the refuge complex.

The presence of USDA Forest Service lands within the refuge boundary complicates the Service's ability to conduct prescribed fires at the Swan River Refuge. The prescribed fires are critical for management, to rejuvenate vegetation as well as reduce litter and the associated fire hazard. Similarly, there is resistance to burning in populated areas due to safety concerns.

This planning issue involves several planning elements and carries through all alternatives under Elements Common to All Alternatives and under the Partnerships for Conservation, Grassland Habitat Management, Wetland and Riparian Habitat Management, and Forest and Woodland Habitat Management planning element headings in chapter 3.

WATER QUALITY

Elevated levels of selenium and salinity (as measured by high salinity concentrations) are present in the refuge complex and pose a threat to water quality. Many seepage areas exist in the refuge complex, especially surrounding the Benton Lake Refuge and across the district where native grasslands have been converted to agriculture. Both selenium and salinity, if their levels are high enough, can negatively affect wildlife, particularly reproduction. Selenium concentrations in the water, sediment, and biota of the Benton Lake Refuge are elevated and have reduced production of species, including waterfowl species, which are particularly sensitive to selenium (See chapter 7 for more information on Benton Lake Refuge.)

This planning issue involves several planning elements and carries through all alternatives under Elements Common to All Alternatives and under the Preserving Intact Landscapes planning element heading in chapter 3.

WILDLIFE MANAGEMENT

The refuge complex provides habitat for several wide-ranging carnivores of concern including the grizzly bear, Canada lynx, and gray wolf. Supporting the large landscapes that these species need is an issue for the refuge complex.

Protecting habitat and managing for a wide variety of migratory birds is a priority for the refuge complex. Waterfowl and other waterbirds, grassland songbirds, and riparian area-dependent birds are some of the highest priority groups. Grassland birds, in particular, have experienced the most severe declines of any group of birds across the U.S.

Several wildlife diseases are of concern within the refuge complex either due to a history of occurrence, human health concerns, or a concern that the disease could spread to the immediate area in the near future. These include botulism, West Nile virus, and chronic wasting disease among others.

This planning issue involves several planning elements and carries through all alternatives under Elements Common to All Alternatives and under the Preserving Intact Landscapes, Species of Concern, Migratory Birds, and Visitor Services planning element headings in chapter 3.

FISHERIES MANAGEMENT

Bull trout are known to occur within the part of the Swan River that flows through the Swan River Refuge. Northern pike (a nonnative fish species) migrates up Spring Creek and may be negatively affecting bull trout and waterfowl on the refuge. The refuge is closed March 1–July 15 to reduce disturbance to nesting migratory birds during the pike spawning period, which prevents anglers from removing some of these fish.

This planning issue involves several planning elements and carries through all alternatives under Elements Common to All Alternatives and under the Wetland and Riparian Habitat Management; Species of Concern, and Visitor Services planning element headings in chapter 3.

Bill Byrne / USFWS

The piping plover nests on open shorelines.

VISITOR SERVICES

Visitor service programs and facilities are lacking throughout the refuge complex to support the wildlife-dependent uses of hunting, fishing, wildlife observation, photography, environmental education, and interpretation.

Some of the public is interested in more hunting opportunities on Service-owned lands. Others commented that there were too many hunters on some units, which has lowered the quality of their hunting experience (see chapter 7, section 7.2 for hunting on Benton Lake Refuge). In another aspect of the hunting program, a local outfitter requested a formalized permit system for guided waterfowl hunting on the Swan River Refuge.

One request was received from a commercial outfitter to conduct guided hunting on the Swan River Refuge. A formal evaluation was conducted, and it was found that this is not an appropriate refuge use. See chapter 4, section 4.6, appropriateness and compatibility, for more details.

Some people have expressed interest in fishing Spring Creek during the pike spawning run, but this would be a conflict with the Swan River Refuge closure to reduce disturbance to nesting migratory birds.

The public enjoys viewing wildlife on the refuges and waterfowl production areas. Benton Lake Refuge, in particular, because of its close location to the city of Great Falls, is especially valued by birdwatchers. Opportunities throughout the refuge complex to expand the birdwatching experience for a wide variety of birds has been requested.

The refuge complex is not meeting public demand for environmental education and interpretation programs. Expanding and updating these programs could enhance the public's knowledge of wildlife management issues and encourage support, which would help wildlife populations in the future. There is some public confusion about which areas are open or closed and which uses are authorized or prohibited; updated brochures, signs, and interpretive panels have been suggested to improve this situation.

This planning issue involves several planning elements and carries through all alternatives under Elements Common to All Alternatives and under the Visitor Services and Visitor and Employee Safety planning element headings in chapter 3.

NONWILDLIFE-DEPENDENT USES

On the Swan River Refuge, Bog Road was once believed to be county road; this four-wheel drive road has a history of being used for motorized recreation. The future administration of this road needs to be evaluated.

Another concern at the Swan River Refuge is noncompliance with a designated no-wake zone (boating) on the Swan River. The designation needs to be verified and enforcement efforts may need to be redirected to increase compliance and reduce wildlife disturbance.

This planning issue involves several planning elements and carries through all alternatives under Elements Common to All Alternatives and under the Visitor Services, Visitor and Employee Safety, and Resource Protection planning element headings in chapter 3.

CULTURAL RESOURCES

Many of the cultural resource sites on the refuge complex are not adequately identified or protected, and it is likely there are many undiscovered sites.

This planning issue carries through all alternatives under Elements Common to All Alternatives in chapter 3.

OPERATIONS

Money and staff are not sufficient to fulfill the purposes and meet the goals of the refuge complex. The number of full-time equivalent positions (FTEs), a measure indicating the amount of available workforce, averaged 9.1 FTEs through the 1990s, and increased to an average of 10.80 during the last 10 years. Currently the refuge complex has 9.5 permanent FTEs, and 2 seasonal FTEs as money permits.

The refuge complex has grown from a single refuge with a moderately sized wetland management district in 1988, to two refuges, one wetland management district, and three conservation areas. This, coupled with the fact that several units are up to 5 hours away from the refuge complex headquarters, makes daily management and operations difficult to coordinate.

In addition to the increase in land base, the organizational structure of the refuge complex has changed as well. The refuge complex houses the following Service programs: Partners for Fish and Wildlife program, regional invasive species program, the zone law enforcement program, Refuge Inventory and Monitoring program, Montana Habitat and Population Evaluation Team (HAPET), and Montana realty program. Sharing resources across programs allows the Service to effectively use facilities and other resources, but also creates administrative challenges. Refuge complex staff needs to identify, describe, and set priorities for unfunded needs to be able to compete effectively for money from within the Service and from partners and other sources. Creative partnerships and volunteerism, although helpful, are not a complete or always reliable solution. Visitor numbers and associated demands would increase in coming years. With more resources, the Service could accomplish more of the goals and objectives of the refuge complex described in this CCP.

This planning issue involves several planning elements and carries through all alternatives under Elements Common to All Alternatives and under the Staff and Funding, Visitor and Employee Safety, and Resource Protection planning element headings in chapter 3.

NOMENCLATURE

Naming the refuge complex after one refuge is confusing to the public. It was suggested to change the name so it better encompasses all the lands within the refuge complex's designated area.

Added nomenclature confusion occurs for the Benton Lake Refuge. "Lake" in the refuge name suggests a deep, permanent water source. Many visitors comment that (1) the refuge is not managed properly because the "lake" is dry, or (2) that certain lake-dependent recreational activities should be provided.

This planning issue carries through all alternatives under Elements Common to All Alternatives and under the Visitor Services planning element heading in chapter 3.

CHAPTER 3—Alternatives

USFWS

Partnerships at work in the Rocky Mountain Front Conservation Area.

The purpose of this chapter is to describe the management alternatives considered for the Benton Lake National Wildlife Refuge Complex, Montana. Alternatives are different approaches to management that are designed to achieve the refuge complex purposes, vision, and goals; the mission of the Refuge System; and the mission of the Service. Alternatives are developed to address the substantive issues, concerns, and problems identified by the Service, the public and other partners during public scoping, and throughout the development of the draft CCP.

Alternatives A–C for the refuge complex, as described below, apply to all units of the refuge complex (two refuges, one wetland management district, three conservation areas). In addition, it was found that a separate analysis would be conducted, and that a broader range of alternatives would be developed, for just Benton Lake Refuge because the issues that applied to this refuge were more complex. The alternatives that are specific to Benton Lake Refuge do not apply to the rest of the refuge complex. However, they are extensions of alternatives A, B, and C that would apply to the entire refuge complex (see table 4). Chapter 7 describes the analysis for Benton Lake Refuge and how the proposed action relates to the refuge complex.

Table 4. Each Benton Lake National Wildlife Refuge Complex-level alternative is linked to one or more alternatives for Benton Lake National Wildlife Refuge, Montana.

Refuge Complex Alternative	A	B	C
Benton Lake Refuge Alternative	A1	B1, B2	C1, C2

3.1 Development of Alternatives for the Refuge Complex

The Service assessed the planning issues identified in chapters 2 and 7, the existing biological conditions described in chapters 4 and 7, and external relationships affecting the refuge complex. This information contributed to the development of alternatives; as a result, each alternative presents different approaches for meeting long-term goals. More alternatives were developed and analyzed for Benton Lake Refuge in chapter 7. Each alternative was evaluated according to how well it would advance the vision and goals of the refuge complex and the Refuge System and how it would address the planning issues.

Several planning elements came out of this assessment. Approaches for meeting long-term goals have been grouped under each planning element. These have been carried across each alternative to help in comparing alternatives. Approaches for meeting long-term goals are also addressed under elements common to all alternatives.

Long-term goals, planning elements, and their accompanying planning issues from chapter 2 are as follows:

LANDSCAPE CONSERVATION GOAL

- Elements common to all alternatives
- Climate change: climate change
- Preserving intact landscapes: agricultural conversion, development, water quality, wildlife management

HABITAT GOAL

- Elements common to all alternatives
- Grasslands: invasive plants, nonnative plants and noxious weeds; loss of ecological processes
- Wetlands and riparian areas: invasive plants, nonnative plants and noxious weeds; loss of ecological processes, fisheries management
- Forests and woodlands: invasive plants, nonnative plants and noxious weeds; loss of ecological processes

WILDLIFE GOAL

- Elements common to all alternatives
- Species of concern: invasive plants, nonnative plants and noxious weeds; wildlife management; fisheries management
- Migratory birds: wildlife management

CULTURAL RESOURCES GOAL

- Elements common to all alternatives

VISITOR SERVICES GOAL

- Elements common to all alternatives
- Visitor services: wildlife management, fisheries management, visitor services, nonwildlife-dependent uses and nomenclature

ADMINISTRATION GOAL

- Elements common to all alternatives
- Staff and funding: operations

VISITOR AND EMPLOYEE SAFETY AND RESOURCE PROTECTION GOAL

- Elements common to all alternatives
- Visitor and employee safety: visitor services, nonwildlife-dependent Uses, operations
- Resource protection: nonwildlife-dependent Uses, operations

ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

- No alternatives were considered and eliminated from detailed study.

3.2 Elements Common to All Alternatives

There are some consistencies in the three alternatives. This section identifies the following key elements that will be included in the CCP, regardless of the alternative selected:

- The Service would make sure that management of the refuge complex complies with all Federal laws and regulations that provide direction for managing units of the Refuge System.
- Attempts to control invasive species would be made through an integrated pest management (IPM) approach that includes biological, chemical, and mechanical treatment methods.
- Cultural resources would be provided equal protection and management. New cultural resources would be documented and protected as they are discovered.
- Research efforts would be conducted internally, or generated externally, to help reach management objectives.
- Wildlife and habitat inventory, monitoring, and research efforts would be conducted.
- Surveillance for key wildlife diseases such as botulism and West Nile virus would occur as needed.
- Strong and diverse partnerships would be promoted to help meet objectives and achieve complex goals. These partnerships, among other things would help link protected areas, leverage financial resources and increase community support, and preserve the rural way of life.
- A coordination of activities, monitoring, and collaboration with industrial, commercial, or agricultural development interests would continue to protect existing and potential Service interests.
- Water rights throughout the refuge complex would be supported.
- Sagebrush-steppe habitat would continue to be protected through conservation easements, fee title acquisition, and land exchanges or donations. On fee-title lands, mechanical methods for tree removal, fire, and grazing would be used to rejuvenate sagebrush-steppe habitat. Work with landowners through Partners for Fish and Wildlife to support and manage sagebrush-steppe habitat would continue.
- Fishing would continue at some units of the refuge complex in accordance with State regulations.
- Recreational trapping would continue to be allowed on waterfowl production areas in the district, with the exception of the H2-O and Sands WPAs, in accordance with State seasons and regulations. No recreational trapping at Swan River Refuge would be authorized; however, trapping by special use permit would continue for wildlife and infrastructure management purposes only.
- Facilities, infrastructure, vehicles, and other equipment would continue to be supported in good working condition to achieve management goals. Fences in the refuge complex that serve no management purpose would continue to be removed.

3.3 Alternative A (Current Management–No Action)

Alternative A is the no-action alternative, which represents the current management of the refuge complex. This alternative provides the baseline against which to compare the other alternatives. It also fulfills the requirement in NEPA that a no-action alternative be addressed in the analysis process.

Management activity being conducted by the Service would remain the same. The Service would not develop any new management, restoration, or education programs at the refuge complex. Current habitat and wildlife practices that help migratory species and other wildlife would not be expanded or changed. Habitat management within the refuge complex would continue to focus, primarily, on helping migratory birds, especially during breeding. Other species would be considered through land protection programs and partnerships (for example, grizzly bear and bull trout). Staff would continue monitoring, inventory, and research activities at their current level. Money and staff levels would remain the same with little change in overall trends. Programs would follow the same direction, emphasis, and intensity as they do now.

CLIMATE CHANGE

Baseline monitoring of habitat conditions that could potentially be related to the effects of climate change would continue. Existing weather stations and stream gauges would be supported. Staff would continue to collaborate with the USGS to obtain climate-related information.

Climate change stressors would be addressed primarily through preservation of large blocks of functional land that have natural processes that maximize resiliency. The refuge complex would work cooperatively with partners to improve condition of landscapes to increase resiliency, and seek other opportunities to work with partners to address climate change issues including restoration projects on Service-interest lands. Efforts would be made throughout the refuge complex to restore grasslands, forests, and wetlands and prevent conversion to enhance carbon sequestration.

Attempts would be made to reduce the carbon footprint of existing facilities. Activities would include weatherproofing facilities, upgrading furnaces, doors, and windows. These would be modest improvements to facilities and increased use of Webinars and other virtual meeting devices to reduce the carbon footprint from traveling. A major project to reduce the carbon footprint was completed December 2009, through the American Recovery and Reinvestment Act. The project included the installation of a 10 kilowatt wind generator and three photovoltaic panels at the headquarters building.

PRESERVING INTACT LANDSCAPES

Conservation of intact, native landscapes would remain a high priority. The mechanisms to conserve valuable lands for wildlife would include, but not be limited to, pursuing easements, land exchanges, donations, and limited fee title purchases of wetland, riparian, forest, sagebrush-steppe, and grassland habitats.

Refuge complex staff would continue to build relationships and work with private landowners that are interested in easements, annually inspect easements and follow up with easement holders when questions or concerns arise.

Refuge complex staff would also continue to engage in activities (such as educational tours and outreach) that build support for meeting acreage goals for habitat protection.

In 2011, the ability to preserve intact landscapes increased significantly within the refuge complex. The project area for the Rocky Mountain Front Conservation Area was expanded to 918,000 acres from 560,000 acres and the total easement acquisition goals were increased from 170,000 acres to 295,000 acres. The Blackfoot Valley Conservation Area was also expanded from 165,000 acres to a new boundary encompassing 824,024 acres with a new easement acquisition goal of 103,500 acres. In addition, a new conservation area was established in the Swan Valley with a goal of protecting 10,000 acres with easements and up to 1,000 acres in fee title.

GRASSLANDS

At present, a high priority is placed on the preservation and management of native grasslands. Within currently authorized areas, conservation easements are regularly used to protect native grasslands from conversion. Easements are proactively monitored and enforced. Easement contacts, evaluations and preliminary acquisition work, are supported by a

Jeff Van Tine

Haystack Butte in the Rocky Mountain Front Conservation Area.

shared Partners for Fish and Wildlife and realty full-time position. Other easement programs (Farmers Home Administration, grassland, wetland) outside of the conservation areas are administered, but there is little to no time to cultivate interests for acquisition.

Fee-title native grasslands are managed to sustain grassland health, composition, and native plant diversity. This is done by emulating historical disturbance regimes such as fire, grazing, treatment of invasive species using IPM, "early detection, rapid response" (EDRR), and proper periods of rest.

Tame grasslands are managed to support stands in a productive condition using a rotational management system to sustain the longevity of the grass stand. Grassland health is assessed using species composition, vigor, and litter accumulation. When tame grass stands degrade to the point when reseeding is the only viable choice, careful consideration is given to establishing native versus tame grass species.

Nonnative tree plantings in grasslands (shelterbelts) are present, but not actively managed.

Monitoring of grasslands occurs across the refuge complex in varying degrees of intensity, and with a focus on adaptive management.

WETLANDS AND RIPARIAN AREAS

Wetlands on private land are also protected with easements. The Service is currently conducting landscape-level analysis to rank wetland resources based on their importance to breeding waterfowl, which may be expanded to other priority wetland-dependent birds in the future. This prioritization would help identify the highest priority wetland resources in the district for future protection. Currently, wetland easements outside of the conservation areas are administered, but there is little to no time to cultivate interests for acquisition.

Many of the wetlands on fee title lands in the refuge complex are subject to natural flooding and drying cycles. However, where the capability exists, natural runoff is impounded or supplemental water is pumped into wetlands. In these wetlands, water is managed to extend the natural flooding cycle in the spring, summer, and fall, to provide consistent wetland habitat from year-to-year and flood wetlands more deeply than the original basin. Water-level management would continue to be accomplished with existing water control structures.

Where feasible, wetland vegetation is managed using prescribed fire, grazing, and haying. Wetland vegetation is also managed to reduce or end invasive species. Treatment of invasive species using IPM and EDRR would continue.

Throughout the refuge complex, wetlands are created, enhanced, and restored. Wetland creation occurs when a wetland is created where it did not occur before. Wetland restoration occurs when a wetland basin was present historically, but has been drained or altered. Restoration returns the wetland to as close to its functional, historical condition as possible. Enhancement means a wetland has been modified to hold water longer or more deeply that the natural basin. Enhancements may occur in combination with restoration.

Before 2000, wetland enhancement, creation, and restoration projects were all done within the refuge complex. However, wetland restoration is currently the highest priority and wetlands are rarely enhanced or created. Less than 50 acres of wetlands have been created by the Service within the refuge complex over the last 5 years and only on private land with conservation easements.

Most riparian areas in the refuge complex are on private land. The focus would be on working with private landowners to better manage and improve health and vigor of these important and biologically diverse areas through conservation easements and partnerships. The riparian areas on fee-title lands are mostly treated with rest and protection.

FORESTS AND WOODLANDS

Forest and woodland habitat occurs on the Swan River Refuge and the Blackfoot WPA. At present, active timber management within the refuge complex is limited. A timber harvest plan is required and must be approved by the Service before commercial timber harvest is permitted on private lands protected with conservation easements.

SPECIES OF CONCERN

Staff would continue to informally check and document federally listed species on refuge complex lands, such as grizzly bear and bull trout. Refuge complex staff would consult with the Endangered Species Program before implementing any management action that may affect listed species. Conservation easements would continue to be used as a strategy to protect landscape-level habitat and wildlife linkage corridors.

Staff would also continue to check and document other species of concern as needed. Recent examples include black tern breeding and foraging monitoring that has been conducted on parts of the district. Reintroduction efforts for trumpeter swans have been conducted for several years in the Blackfoot Valley. Within the Swan Valley, common loon breeding surveys have been conducted by MFWP.

MIGRATORY BIRDS

Most of the support for migratory birds would continue to be accomplished through habitat management to provide nesting, resting, brood-rearing, and migration habitat.

Staff would continue to annually take part in population level or landscape-level monitoring of migratory birds such as the breeding bird survey, annual midwinter waterfowl survey, prairie pothole breeding waterfowl survey, mourning dove survey, and preseason waterfowl banding.

More measures to support migratory birds would continue, including the implementation of seasonal closures on Service-owned lands to reduce disturbance to migratory birds during nesting season, limited predator removal, and supporting a limited number of artificial nesting structures.

VISITOR SERVICES

Visitor service programs throughout the refuge complex are administered based on the type of unit (such as a national wildlife refuge or waterfowl production area) and the policies and regulations that establish the guidelines for the appropriate use of each unit type.

National wildlife refuges are encouraged to provide wildlife-dependent recreation where feasible and compatible with the purpose of the refuge. Wildlife-dependent recreation is defined as a use of a Refuge System unit involving hunting, fishing, wildlife observation and photography, environmental education and interpretation. Other activities may be allowed, such as boating, to facilitate compatible wildlife-dependent recreation.

Waterfowl production areas are open to migratory bird hunting, upland gamebird hunting, big game hunting, fishing, and trapping subject to the provisions of State laws and regulations. All forms of hunting or entry on all or any part of individual areas may be temporarily suspended by posting on occasions of unusual or critical conditions of, or affecting land, water, vegetation, or wildlife populations. The Sands WPA in Hill County and the H2–O WPA in Powell County would remain closed to hunting in accordance with property deed restrictions.

Priority public uses for the Benton Lake Refuge are described in chapter 7.

Hunting

Hunting programs in the refuge complex would not change. No new areas, expansions of season, and no new species would be open to hunting. Only approved nontoxic shot would be used or possessed while hunting upland gamebirds and migratory gamebirds on refuges and waterfowl production areas within the refuge complex. The Benton Lake and Swan River Refuges would continue to limit migratory bird hunting to no more than 40 percent of the refuge. These restrictions make sure that habitat without disturbance is available for migrating birds. Commercial outfitting in support of hunting would continue to be prohibited. See chapter 7 for information on Benton Lake Refuge hunting actions across alternatives.

BENTON LAKE WETLAND MANAGEMENT DISTRICT

Migratory gamebird, upland gamebird, and big game hunting on waterfowl production areas throughout the district would continue. Approximately 14,127 acres of upland and wetland habitat would continue to be available for hunting. The Sands WPA in Hill County and the H2–O WPA in Powell County would remain closed to hunting in accordance with property deed restrictions.

BLACKFOOT VALLEY, ROCKY MOUNTAIN FRONT, AND SWAN VALLEY CONSERVATION AREAS

Hunting access on lands under easement is controlled by the private landowner. Some landowners may choose to enroll in block management program administered by the State.

Carmen Luna / USFWS

SWAN RIVER NATIONAL WILDLIFE REFUGE

Hunting of migratory gamebirds including ducks, geese, coots, and swans (by permit only) would continue in designated areas of the refuge with approximately 40 percent of refuge lands open to hunting. Upland game, big game, and guided hunting would continue to be prohibited on the refuge.

Wildlife Observation and Photography

Wildlife observation and photography opportunities would continue to be provided throughout the refuge complex, and would be supported by providing observation blinds, supporting an up-to-date bird species list for the refuges, and allowing the public the opportunity to use portable viewing and photography blinds through the issuance of special use permits. Seasonal closures to protect sensitive wildlife areas and reduce disturbance to fish and wildlife would be supported. Dogs would continue to be required to be leashed and remain on designated roads and trails, except in the hunt area during hunting season. Commercial photography requests would be evaluated on a case-by-case basis and authorized through special use permit. No new facilities for observing and photographing wildlife (such as observation decks, trails, auto tour routes, and photography blinds) would be developed, but existing facilities would be supported. See chapter 7 for wildlife observation and photography actions across the alternatives for Benton Lake Refuge.

BENTON LAKE WETLAND MANAGEMENT DISTRICT

Waterfowl production areas would be open to wildlife observation and photography year round. No conflicts are currently occurring to suggest seasonal closures would be necessary. Foot traffic, including hiking, cross-country skiing, and snowshoeing, would be permitted throughout the waterfowl production areas. Equestrian use would continue to be prohibited, and bicycle use would continue to be restricted to roads open to vehicular traffic. Boating would continue to be permitted in accordance with state regulations.

SWAN RIVER NATIONAL WILDLIFE REFUGE

Bog Road would continue to provide wildlife-viewing opportunities and access to the interior of the refuge. The existing observation platform, informational kiosk, and interpretive panel would continue to be supported and provide opportunity for wildlife observation and photography. The entire refuge, with the exception of the information kiosk and wildlife viewing platform, would continue to be closed to all public access from March 1 through July 15. Foot-traffic, including cross-country skiing and snowshoeing, would continue to be authorized north of Bog Road between July 16 and the end of February. Equestrian and bicycle use would continue to be prohibited. The use of boats on Swan River would continue to support wildlife viewing, photography, and fishing opportunities. State "no wake" regulations would continue to be enforced and a Federal no-wake regulation would not be established.

Environmental Education and Interpretation

The environmental education program would continue to be opportunistic, as time and staff allow. Staff would take part in offsite special events and activities to bring the refuge complex message to large numbers of people, and participation in these events would continue as time and staff allow. Tasks would be performed as collateral assignments and no specific specialists are assigned to environmental education or interpretation programs on the refuge complex, nor is growth in this area expected. Interpretive panels, brochures, factsheets, Web sites, and maps would be updated as money allows. No new facilities or programs would be developed. Geocaching would continue to be prohibited; however, virtual geocaching would be authorized if requested. See chapter 7 for environmental education and interpretation actions across the alternatives for Benton Lake Refuge.

BENTON LAKE WETLAND MANAGEMENT DISTRICT

Waterfowl production areas would remain open for environmental education and interpretation. Area schools would continue to visit waterfowl production areas to study birds, wetland wildlife, and water quality. Staff would continue to host several on and offsite events attracting more than 250 attendees annually.

A facility at the H2–O WPA would continue to provide on-site education within the Blackfoot Valley, and an interpretive display would continue to be available at the north parking area of the Blackfoot WPA.

SWAN RIVER NATIONAL WILDLIFE REFUGE

An interpretive kiosk, updated in 2011, would continue to provide interpretive information to the visiting public. There would continue to be limited outreach and environmental education programs and minimal resources to update signs and brochures.

BENTON LAKE WETLAND MANAGEMENT DISTRICT

Cross-country skiing and snowshoeing on waterfowl production areas would continue to be authorized in support of wildlife-dependent recreation. Equestrian and bicycle use would continue to be restricted to public roads open to vehicular traffic. Boating would continue to be permitted in accordance with state regulations. Waterfowl production areas, with the exception of the H2-O and Sands WPAs, would remain open to recreational trapping in accordance with State seasons and regulations.

SWAN RIVER NATIONAL WILDLIFE REFUGE

The entire refuge, with the exception of the information kiosk and wildlife viewing platform, would continue to be closed to all public access from March 1 through July 15. Cross-country skiing and snowshoeing would continue to be authorized between July 16 and the end of February. Equestrian and bicycle use would continue to be prohibited. The use of boats on Swan River would continue to support wildlife viewing, photography, and fishing opportunities. State “no wake” regulations would continue to be enforced and a Federal no-wake regulation would not be established. No recreational trapping would be authorized; however, trapping by special use permit would continue for wildlife and infrastructure management purposes only.

STAFF AND FUNDING

Current staff consists of 9.5 full-time employees. Temporary, term, and seasonal employees are used to supplement staff as money allows. Capacity for active management is constrained by limited staff and money. Current staff levels are insufficient to meet program mandates, resulting in limited management on some units. More staff would be acquired as money became available through the Refuge Operations Needs System (RONS).

VISITOR AND EMPLOYEE SAFETY

Employee and visitor safety would continue to be emphasized in all operations throughout the refuge complex. Currently, only one dual-function officer exists within the refuge complex. Efforts would be made to replace the recently vacated full-time law enforcement position to promote visitor and employee safety.

Potential for employees and visiting public to encounter insects, venomous snakes, mosquitoes (West Nile virus), extreme heat, cold, wind, all contribute to possible injury or illness. More signage warning visitors of these potential hazards may be considered.

RESOURCE PROTECTION

One dual-function law enforcement officer would continue to provide quality public use experiences, and protect habitat resources on fee-title and easement lands. Efforts to replace recently vacated full-time law enforcement officer would occur.

3.4 Alternative B

Management efforts would focus on supporting the resiliency and sustainability of native grasslands, forests, shrublands, and unaltered wetlands throughout the refuge complex by emulating natural processes. Prescribed fire, grazing, and other management techniques would be used to replicate historical disturbance factors. Where feasible, restoration of native uplands would occur.

For altered wetlands where water management capability exists, management efforts would focus on minimizing the effects of drought periods of the northern Great Plains and Rocky Mountains. Management would be active and intensive to keep these wetland conditions in a consistent state for wildlife using artificial flooding and drawdowns. Management would be active and intensive to support consistency for wildlife using tools such as artificial flooding, drawdowns, fire, rest, and grazing.

Changes in the refuge complex’s research and monitoring, staff, operations, and infrastructure would likely be required to achieve this alternative’s goals and objectives. The success of these efforts and programs would depend on added staff, research, and monitoring programs, operations money, infrastructure, and new and expanded partnerships.

Please refer to chapter 7 for more details on the Benton Lake Refuge alternatives (B1,B2) linked to this alternative.

ACTIONS SAME AS ALTERNATIVE A

Management actions would be the same as under alternative A for preserving intact landscapes, grassland habitat management, wetland and riparian habitat management, and environmental education and interpretation.

CLIMATE CHANGE

Management actions would be the same as alternative A, plus staff would take part in all aspects of the GNLCC and PPPLCC to understand climate change impacts locally, improve the condition of the landscape and increase resiliency.

Increasing resiliency on Service lands and addressing climate change stressors would be accomplished through active monitoring, adaptive management and, where feasible, using management practices that emulate natural processes. Data acquired from other sources would be used to analyze or check for climate change effects.

FORESTS AND WOODLANDS

Active forest management would be increased to support resiliency and sustainability by emulating natural processes. Natural fire regimes would be emulated with prescribed fire, which may require some thinning or fuel reduction before burning. Silvicultural practices may be used to decrease the spread of insects or disease and support or increase carbon sequestration.

SPECIES OF CONCERN

Management actions would be the same as alternative A, and the effects of management actions on other species of concern that are not threatened or endangered would be assessed before implementation.

MIGRATORY BIRDS

Habitat management actions and seasonal closures would be the same as alternative A, plus the migratory bird monitoring program would be expanded. Indicator species would be used to provide feedback for evaluating the success of management actions and to help achieve national and State migratory bird goals. The migratory bird program and its objectives would be periodically reviewed to figure out whether efforts are still a priority for the refuge complex; if not, efforts would be discontinued.

A limited number of artificial nesting structures would be supported based on a specific species need and only when other habitat management options have been exhausted.

VISITOR SERVICES

Hunting

The Service would explore opportunities for increased hunting on two fee-title refuges within the refuge complex. Decisions and details related to the above hunting elements, as well as other possible hunting season framework changes, would be evaluated against wildlife and human disturbance thresholds.

The Service would also increase regulatory hunting signage (for example, closed to hunting area signs, nontoxic shot required signs) and interpretive materials (for example, an updated and more comprehensive complex hunting leaflet, hunting factsheets) in an effort to reduce unintentional hunting violations throughout the refuge complex.

Management actions would vary across alternatives for the Benton Lake Refuge (see chapter 7).

Wildlife Observation and Photography

SWAN RIVER NATIONAL WILDLIFE REFUGE

Management actions would be the same as alternative A, except foot traffic, including hiking, cross-country skiing, and snowshoeing, would be restricted to designated roads and trails. Public access would be available year-round at the parking lot, informational kiosk, wildlife observation platform, and Bog Road trail, and seasonally during waterfowl hunting season, when the hunting area north of Bog Road would be open to public use.

STAFF AND FUNDING

Same as alternative A, plus the Service would add to the refuge complex's current staff 4.0 permanent, full-time positions to achieve the goals and supporting objectives: 1 law enforcement officer, 1.0 maintenance worker, 1.5 wildlife refuge specialist, and 0.5 generalist.

VISITOR AND EMPLOYEE SAFETY

Same as A, plus efforts would be expanded to provide dependable and improved communication throughout the complex.

RESOURCE PROTECTION

Management actions would be the same as alternative A, and special emphasis would be placed on preventative law enforcement efforts to make sure compliance with regulations. In addition, cooperative law enforcement efforts would be pursued to improve relationships with other law enforcement entities.

3.5 Alternative C (Proposed Action)

Emphasis would be placed on achieving self-sustaining systems with long-term productivity. Management efforts would focus on supporting and restoring ecological processes, including natural communities and the dynamics of the ecosystems of the northern Great Plains and northern Rocky Mountains in relationship to their geomorphic landscape positioning. Conservation of native landscapes would be a high priority accomplished by protecting habitats from conversion using a combination of partnerships, easements and fee-title lands, and through active management and proactive enforcement of easements. Management actions, such as prescribed fire, grazing, and invasive species control, would be used to support the resiliency and sustainability of Service-owned lands throughout the refuge complex.

Whenever possible, habitat conditions would be allowed to fluctuate with climatically driven wet and dry cycles, which are essential for long-term productivity. The success of these efforts and programs would depend on added staff, research, and monitoring programs, operations money, infrastructure, and new and expanded partnerships.

ACTIONS SAME AS ALTERNATIVE B

Management actions would be the same as alternative B for forest and woodland habitat management, species of concern, hunting, and visitor and employee safety.

CLIMATE CHANGE

Management actions would be the same as alternative A, plus more stations and gauges to check climate change would be installed. The refuge complex would vigorously take part in all aspects of the GNLCC and PPPLCC as available to field stations. Use of scaled-downed climate change models would be applied to habitat objectives and determining land preservation priorities to a greater degree than alternatives A and B. Refuge complex staff would actively take part in, and cooperate with, data acquisition, monitoring, and analyzing management actions in respect to climate change.

The complex would also pursue installation of another photovoltaic system to support the expanded headquarters office.

PRESERVING INTACT LANDSCAPES

Management actions would be the same as alternatives A and B, plus the refuge complex would actively pursue opportunities for cooperative landscape-level monitoring of new and expanded conservation areas. This would include active participation in applying the principles of SHC to continually refine and focus landscape-level conservation priorities. In addition, new areas and partnership opportunities would be explored within the refuge complex to establish more conservation areas and increase the opportunities for landowners to take part in conservation easement programs.

GRASSLANDS

Management actions would be the same as alternative A, plus, where feasible, degraded tame grass stands across the complex would be prioritized and planted back to native grass species. Starting with those in native grasslands, all nonnative tree plantings would be removed across the complex.

Formal monitoring of grasslands would be focused on native prairie with an emphasis on adaptive management. Restoration of habitats (native grass planting and tree removal) would be formally monitored to evaluate success. Opportunities for cooperative landscape-level monitoring would be actively pursued in new and expanded conservation areas. Monitoring of tame grasslands would be minimal and informal.

WETLANDS AND RIPARIAN AREAS

Management actions would be the same as alternative A, except management treatments such as grazing and fire may be used to mimic historical disturbances and support sustainability and resiliency when natural flooding and drying cycles allow. More treatments for invasive species may be applied.

Formal monitoring of wetlands would focus on wetland health and sustainability through adaptive management. Monitoring would track long-term trends in wetland cycles, health, and wildlife use. For restoration efforts, monitoring would be especially important to figure out if systems are recovering.

MIGRATORY BIRDS

Management actions would be the same as alternative B, plus monitoring efforts within conservation area boundaries as part of SHC would be expanded. Artificial nesting structures would be phased out.

VISITOR SERVICES

Wildlife Observation and Photography

Management actions would be the same as alternative B, plus potential for more walking trails throughout the refuge complex would be evaluated and a park ranger would be hired to help support and expand wildlife observation and photography infrastructure and opportunities.

Environmental Education and Interpretation

Same as alternatives A and B, plus programming would be increased and expanded to enhance public knowledge and understanding of restoration efforts, unique habitat and wildlife values and attributes, and landscape-scale conservation programs. Efforts would be made to promote and educate the public about the new and expanded easement programs and to reach out and tap into available resources, especially in Great Falls.

Dr. Thomas G. Barnes / USFWS

Silver sagebrush is an important habitat component for sage-grouse.

STAFF AND FUNDING

Same as alternative B, plus the Service would add 2.0 permanent, full-time positions to achieve the goals and support objectives: 1 full-time park ranger (one person working half time on the refuge complex, half time at Benton Lake Refuge exclusively), and 1 full-time supervisory biologist.

RESOURCE PROTECTION

Management actions would be the same as alternative B, except replacing a full-time law enforcement officer position, that was part of the refuge complex in fiscal year (FY) 2009, would have high priority. The recently expanded Rocky Mountain Front and Blackfoot Valley Conservation Areas and the newly established Swan Valley Conservation Area would need more inspection and enforcement. In addition, more opportunities for easement protection may be established during the life of this plan.

3.6 Summary of the Alternatives' Actions and Consequences

Table 5 summarizes all aspects of management of the refuge complex under alternatives A–C. Actions and impacts for Benton Lake Refuge can be found in chapter 7.

Table 5. Summary of the actions and consequences of the management alternatives for the Benton Lake National Wildlife Refuge Complex, Montana..

Alternative A (current management–no action)	*Alternative B*	*Alternative C (proposed action)*
Landscape Conservation Goal. Actively pursue and continue to foster relationships within the Service, other agencies, organizations, and private partners to protect, preserve, manage, and restore the functionality of the diverse ecosystems within the working landscape of the refuge complex..		
Climate change—actions		
■ Do baseline monitoring of habitat conditions. ■ Support existing weather stations. ■ Collaborate with USGS to obtain information. ■ Minimally take part in GNLCC and PPPLCC ■ Preserve large blocks of land that have functioning natural processes. ■ Reduce carbon footprint of facilities.	■ Same as alternative A, plus: ■ Actively take part in GNLCC and PPPLCC. ■ Address climate change stressors through management that emulates natural processes and increased monitoring feedback.	■ Same as alternative A, plus: ■ Install more weather stations to watch climate change. ■ Vigorously take part in GNLCC and PPPLCC. ■ Use scaled-downed climate change models to a greater extent. ■ Actively take part in data acquisition, monitoring, and analysis related to climate change. ■ Install photovoltaic system to support headquarters office expansion.
Climate change—environmental consequences		
Utility and scope of baseline data limited. Monitoring water usage will protect water rights. Opportunities to collaborate on climate change issues limited. Preventing habitat conversion through easements would increase resiliency to climate change. Protection and restoration of habitats would support or improve carbon sequestration. Modest reduction in carbon footprint.	Same as alternative A, plus increased opportunities to collaborate on climate change issues and connection to complex improved. Increased ability to detect climate change effects at the local level.	Same as alternative A, plus expanded monitoring can be tied to regional and national trends. Collaboration on climate change issues with LCCs and partners maximized. Resiliency to climate change in habitats maximized through greater prevention of habitat conversion. Greatest reduction in carbon footprint.
Preserving intact landscapes—actions		
■ Place conservation of intact landscapes as a high priority. ■ Continue to build relationships with private landowners. ■ Engage in outreach.	■ Same as alternative A.	■ Same as alternative A, plus: ■ Pursue opportunities for cooperative landscape-level monitoring of conservation areas. ■ Use SHC principles to continually refine landscape-level conservation priorities.

Table 5. Summary of the actions and consequences of the management alternatives for the Benton Lake National Wildlife Refuge Complex, Montana..

Alternative A (current management–no action)	*Alternative B*	*Alternative C (proposed action)*
Preserving intact landscapes—environmental consequences		
Transitional zones of valley floors to montane forests would be preserved and help fish and wildlife resources and enhance the resiliency of the ecosystem. Protecting large, intact blocks of native habitat, including wildlife corridors in the conservation areas, would help trust species and wide-ranging species. Existing conservation partnerships would support working landscapes in which fish and wildlife resources coexist with the ranching community, forestry, and other agricultural operations. Current staff and money may not be able to fully carry out easement programs.	Same as alternative A.	Same as alternative A, plus a greater help to trust resources by actively applying SHC.
Habitat Goal. Actively conserve, restore, and manage upland and wetland habitats across the northern prairies and intermountain valleys of the refuge complex, through management strategies that perpetuate the integrity of ecological communities. .		
Grasslands—actions		
■ Place high priority on preservation and management of native grasslands. ■ Use easements to protect native grasslands from conversion. ■ Manage fee-title native grasslands to sustain grassland health, composition, and native plant diversity. ■ Manage tame grasslands with a rotational management system. ■ Provide limited monitoring.	Same as alternative A.	Same as alternative A, plus: ■ Rank degraded tame grass stands and plant back to native species. ■ Remove all nonnative tree plantings. ■ Focus formal monitoring on native prairie and restoration efforts. ■ Pursue cooperative landscape-level monitoring in conservation areas.

Table 5. Summary of the actions and consequences of the management alternatives for the Benton Lake National Wildlife Refuge Complex, Montana..

Alternative A (current management–no action)	*Alternative B*	*Alternative C (proposed action)*
Grasslands—environmental consequences		
Potential for protecting great expanses of native prairie to reduce soil erosion, support water quality, effectively sequester carbon, and increase resiliency and resistance to disturbance. Management is assumed to increase the health of native prairie, but monitoring feedback would be limited. Native prairies would have varying levels of invasion by nonnative species. Productivity of tame grass would be sustained, but would be less diverse and provide habitat for fewer trust species than native prairies.	Same as alternative A.	Same as alternative A, plus more acres of native prairie would be protected through reallocation of complex resources. Tame grass replanted to native species should have increased diversity, replenished soil, improved nutrient cycles. Replanting native species is more expensive and difficult than replanting to tame grass. Removal of nonnative tree plantings would restore contiguous grassland and reduce the negative effects of fragmentation, depredation, and parasitism to grassland-dependent migratory birds. There may be a decrease in the diversity of migratory and resident bird species, which depend on planted tree habitats, but other nearby habitats are available. Increased monitoring would improve management effectiveness and grassland health.
Wetlands and riparian areas—actions		
■ Create, enhance, and restore wetlands. ■ Impound natural runoff or pump supplemental water into wetlands to extend the natural flooding cycle and to provide consistent wetland habitat year to year. ■ Manage vegetation with prescribed fire, grazing, haying, and herbicides. ■ Watch water quantity and quality.	Same as alternative A.	Same as alternative A, except: ■ Use grazing and fire to mimic historical disturbances and support resiliency when natural flooding and drying cycles allow. ■ Apply more treatments for invasive plants. ■ Watch wetland health, recovery, and sustainability through adaptive management.

Table 5. Summary of the actions and consequences of the management alternatives for the Benton Lake National Wildlife Refuge Complex, Montana..

Alternative A (current management–no action)	*Alternative B*	*Alternative C (proposed action)*
Wetlands and riparian areas—environmental consequences		
Extended drying periods would help remove the salts and selenium that can build up during wet cycles. After a few years of stable water levels, emergents would decline and sites would eventually revert to open water. Prescribed fire, mowing, and herbicide applications to consume litter, rejuvenate vegetation, or control exotic species may only be possible when wetland basins are sufficiently dry. While this may limit the ability to control invasive plants, the wet–dry cycle may act as a natural control by favoring native vegetation adapted to this cycle and by changing conditions that no longer favor invasive plants. During drier periods, extensive mudflat areas would likely attract large numbers of shorebirds and other species that could feed on invertebrates. Reducing invasive wetland vegetation would improve 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. Where natural runoff was impounded or supplemental water diverted or pumped, the natural drying cycle would be reduced or ended. These wetlands would have more predictable flooding cycles. 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. Wetlands that were impounded or receive supplemental water would provide a breeding opportunity for waterbirds and other wetland-dependent wildlife almost every year. 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. Selenium would likely increase and nonnative plants would increase, which would likely lower values.	Same as alternative A.	Same as alternative A, plus more focus on invasive plants should reduce the negative effects such as monotypic stands, reduced native plant diversity, and lower productivity.

Table 5. Summary of the actions and consequences of the management alternatives for the Benton Lake National Wildlife Refuge Complex, Montana..

Alternative A (current management–no action)	*Alternative B*	*Alternative C (proposed action)*
Forests and woodlands—actions		
■ Conduct minimal forest management. ■ Approve a timber harvest plan before commercial timber harvest on easement lands.	■ Same as alternative A, plus: ■ Use prescribed fire and silvicultural practices to manage forests.	■ Same as alternative B.
Forests and woodlands—environmental consequences		
Forests may be less vigorous and more susceptible to stand-replacing fires or disease and insect outbreaks.	Introducing fire would help natural ecosystem processes and reduce the chance of catastrophic fire. A reduction in stand density (silviculture) would increase forest health, reduce the vulnerability to insects and disease and increase carbon sequestration. There would be reduced chance of catastrophic wildfire and insect and disease outbreaks that could potentially destroy culturally significant trees.	Same as alternative B.
Wildlife Goal. Support diverse and sustainable continental, regional, and local populations of migratory birds, native fish, species of concern, and other indigenous wildlife of the northern prairies and intermountain valleys of northern Montana..		
Species of concern—actions		
■ Informally watch and document Federally threatened and endangered species. ■ Consult with Endangered Species program as needed. ■ Use conservation easements to protect habitat for species of concern. ■ Watch and document other species of concern as needed.	■ Same as alternative A, plus: ■ More formally assess the effects of management actions on species of concern before implementation.	■ Same as alternative B.
Species of concern—environmental consequences		
Monitoring and considering species of concern in management decisions would not only help the individual species but would also help make sure that there is ecosystem health and biodiversity. Considering species of concern in management decisions may affect public use because area or seasonal closures may be necessary.	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.	Same as alternative B.

Table 5. Summary of the actions and consequences of the management alternatives for the Benton Lake National Wildlife Refuge Complex, Montana..

Alternative A (current management–no action)	*Alternative B*	*Alternative C (proposed action)*
Migratory birds—actions		
■ Support migratory bird populations through effective habitat management. ■ Take part in annual population and landscape level surveys. ■ Carry out seasonal closures on fee-title lands to reduce disturbance to migratory birds during nesting season. ■ Conduct limited predator removal. ■ Support a limited number of artificial nesting structures.	■ Same as alternative A, except: ■ Increase monitoring and use indicator species to provide feedback for evaluating the success of management actions to help achieve national and State migratory bird goals. ■ Use artificial nesting structures only when other habitat is not available.	■ Same as alternative B, except: ■ Increase monitoring in conservation areas. ■ Gradually phase out the use of artificial nesting structures.
Migratory birds—environmental consequences		
Population and landscape level studies help inform management by providing a larger context for evaluating success. By establishing seasonal closures on fee-title lands subject to frequent disturbance, the negative effects of human-caused disturbance would be reduced and the reproductive success of migratory birds protected. Predator removal and nest structures likely help migratory birds, but are not monitored.	Same as alternative A, plus choosing migratory bird species that can serve as indicators for evaluating management actions would provide information to help staff make adjustments to management and engage others at a landscape level. This could result in greater benefits to migratory birds such as higher nest success.	Same as alternative B, plus increased efforts to watch conservation areas would provide more information to target land protection that helps high-priority migratory birds. Since none of the nesting structures are for bird species whose populations are in decline or that cannot find other habitat options, the removal of the structures would not affect target species.
Visitor Services Goal. Provide opportunities for visitors of all abilities to enjoy wildlife-dependent recreation on Service-owned lands and increase knowledge and appreciation for the refuge complex's ecological communities and the mission of the National Wildlife Refuge System.		
Visitor Services: Hunting—actions		
■ Benton Lake Wetland Management District—continue migratory gamebird, upland game, and big game hunting on Waterfowl production areas, except continue closure of the Sands and H2–O WPAs to hunting in accordance with property deed restrictions. ■ Blackfoot Valley, Rocky Mountain Front, and Swan Valley CAs—landowners continue to decide hunting opportunity on conservation easements. ■ Swan River Refuge—continue hunting of migratory gamebirds in designated areas on no more than 40% of refuge lands, and continue to prohibit hunting of upland game, bird, big game, and guided hunting.	■ Same as alternative A, plus: ■ Explore opportunities to increase hunting at Benton Lake and Swan River refuges. ■ Increase the number of regulatory signs and informational materials.	■ Same as alternative B.

Table 5. Summary of the actions and consequences of the management alternatives for the Benton Lake National Wildlife Refuge Complex, Montana..

Alternative A (current management–no action)	*Alternative B*	*Alternative C (proposed action)*
Visitor Services: Hunting—environmental consequences		
▪ Benton Lake Wetland Management District—annually, approximately 1,350 visits to the district for hunting would be expected. ▪ Swan River Refuge—annually, approximately 100 visitor use-days would be expected for waterfowl hunting.	Same as alternative A, plus hunting may increase on the refuges and unintentional violations should decrease.	Same as alternative B.
Visitor Services: Wildlife observation and photography—actions		
▪ Support existing observation blinds, bird species lists, and portable viewing and photography blinds. ▪ Support seasonal closures to protect sensitive wildlife areas and reduce disturbance to fish and wildlife. ▪ Evaluate commercial photography requests on a case-by-case basis and authorize through special use permit. ▪ Benton Lake Wetland Management District—open waterfowl production areas to wildlife observation and photography. ▪ Swan River Refuge—provide wildlife-viewing opportunities and access to the interior of the refuge via Bog Road; and support the existing observation platform, kiosk, and interpretive panel.	Same as alternative A.	Same as alternative A, plus: ▪ Evaluate the opportunity for added walking tours throughout the refuge complex. ▪ Hire a park ranger to support increased wildlife observation and photography infrastructure opportunities.

Table 5. Summary of the actions and consequences of the management alternatives for the Benton Lake National Wildlife Refuge Complex, Montana..

Alternative A (current management–no action)	*Alternative B*	*Alternative C (proposed action)*
Visitor Services: Wildlife observation and photography—environmental consequences		
Annual visitation to the refuge complex for wildlife observation and photography would remain similar to existing visitation rates: 8,230 visits/year and 490 visits/year, respectively. ▪ Benton Lake Wetland Management District—wildlife observation and photography would account for 580 and 50 annual visits, respectively. ▪ Blackfoot Valley, Rocky Mountain Front, and Swan Valley CAs—private landowners would control public access to easement lands. ▪ Swan River Refuge—the refuge would remain a popular destination point while traveling through Swan Valley due to Bog Road and associated wildlife-viewing opportunities, cross-country skiing, and snowshoeing; annual visitation is expected to be approximately 400 visits for wildlife observation and 40 visits for photography.	Same as alternative A.	Same as alternative A, plus increased disturbance from wildlife would be possible. More staff and resources would be required to manage the increased public use. Significant increases in public use would be possible, as well as, increased participation and visitation and improved visitor experience.
Visitor Services: Environmental education and interpretation—actions		
▪ Continue the opportunistic environmental education program as time and staff allow. ▪ Update interpretive panels, brochures, factsheets, Web sites, and maps as money allows. ▪ Benton Lake Wetland Management District—keep waterfowl production areas open for environmental education and interpretation, staff would host several on and offsite events attracting more than 250 attendees annually.	Same as alternative A.	Same as alternative A, plus: ▪ Increase programming to enhance public knowledge and understanding of the restoration efforts and the emphasis on landscape-scale conservation. ▪ Hire park ranger to support environmental education and interpretive programming.

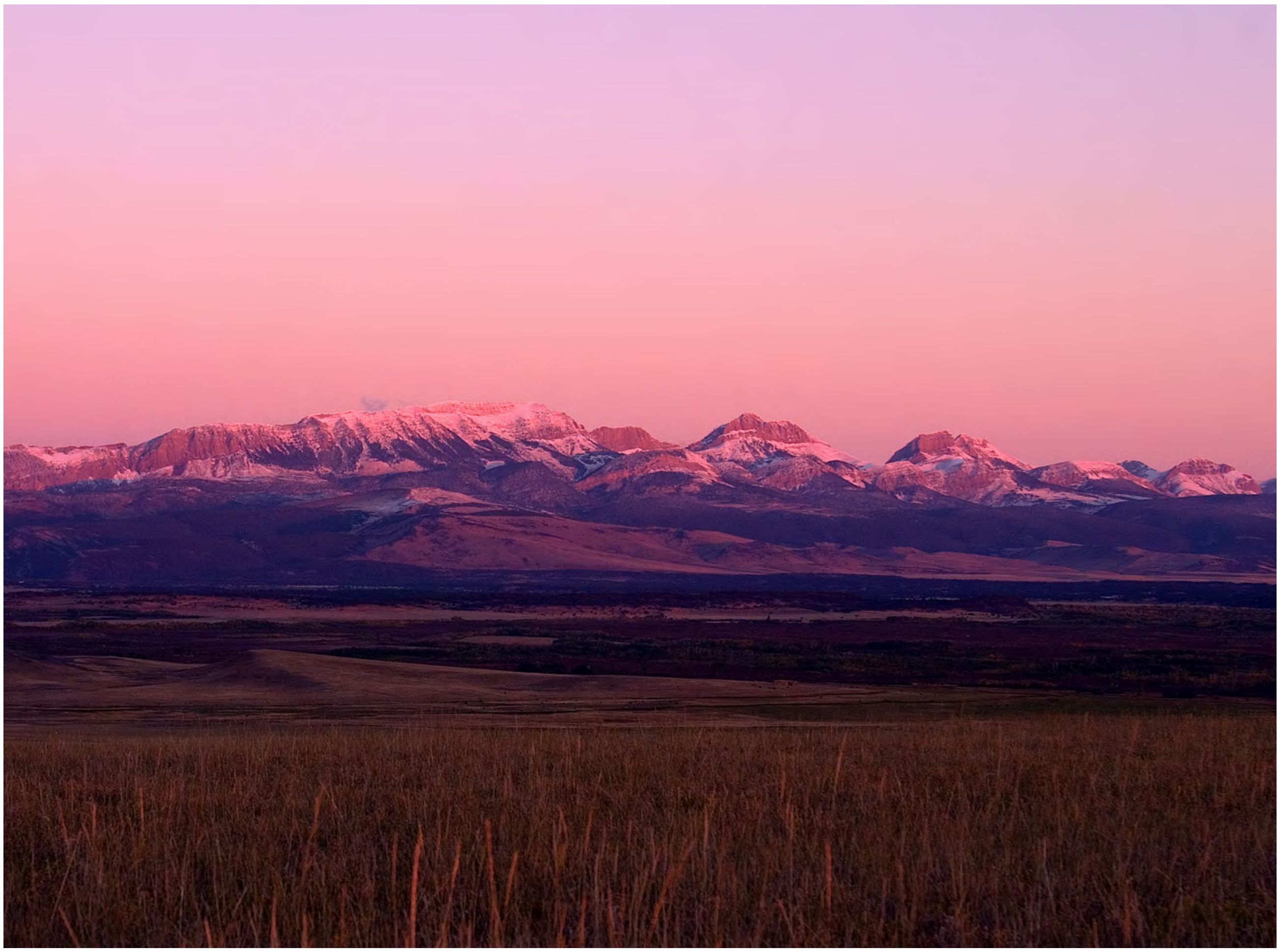
Table 5. Summary of the actions and consequences of the management alternatives for the Benton Lake National Wildlife Refuge Complex, Montana..

Alternative A (current management–no action)	*Alternative B*	*Alternative C (proposed action)*
Visitor Services: Environmental education and interpretation—environmental consequences		
Activities would continue at current rate of approximately 1,765 visits/year for environmental education programs on and offsite occur on the refuge complex. ■ Benton Lake Wetland Management District—activities would continue at current rate of approximately 100 participants annually. ■ Swan River Refuge—less than 10 visits per year.	Same as alternative A.	Same as alternative A, plus increased programming would enhance public knowledge, understanding of restoration efforts, and emphasis on landscape-scale conservation efforts through easement programs. Community engagement would increase, especially in Great Falls, from educational efforts including field exploration kits, workshops for teachers, special events, job shadows, and Web site and other social networking tools.
Administration Goal. Provide facilities, strategically allocate staff, and effectively use and develop funding sources, partnerships, and volunteer opportunities to maintain the long-term integrity of habitats and wildlife resources of the refuge complex.		
Staff and funding—actions		
■ Support current staff of 9.5 full-time employees. ■ Supplement staff with temporary, term, and seasonal employees as money allows. ■ Acquire more staff as money becomes available through RONS.	Same as alternative A, plus: ■ Add 4.0 staff: 1 full-time law enforcement officer, 1.0 FTE maintenance worker in the district, 1.5 FTE wildlife refuge specialist , and 0.5 FTE generalist.	Same as alternative B, plus: ■ Add 2.0 FTEs: 1 FTE park ranger (one person working half time on the refuge complex, half time at Benton Lake Refuge exclusively), 1 FTE supervisory biologist.
Staff and funding—environmental consequences		
Special emphasis would be placed on the management, and some monitoring, of the wetland and grassland habitats as well as on preserving intact landscapes throughout the refuge complex. Money and staff would be allocated accordingly with the greatest concentration of operations and maintenance money (more than $160,000) 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 would not be expected to grow significantly. Without significant base money increases or help from other programs, it would be extremely difficult to adequately manage the efforts toward preserving intact landscapes.	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). Without significant base money increases, it would be not be possible to carry out the landscape preservation efforts.	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 decommissioning or changing of the system, money would be distributed to other programs within the refuge complex such as preserving intact landscapes, grassland restoration, and visitor services.

Table 5. Summary of the actions and consequences of the management alternatives for the Benton Lake National Wildlife Refuge Complex, Montana..

Alternative A (current management–no action)	*Alternative B*	*Alternative C (proposed action)*
Visitor and Employee Safety and Resource Protection Goal. Provide for the safety, security, and protection of visitors, employees, natural and cultural resources, and facilities throughout the refuge complex.		
Visitor and employee safety—actions		
■ Continue to emphasize employee and visitor safety in all operations. ■ Assign one collateral duty law enforcement officer to promote visitor and employee safety. ■ Consider more signage warning visitors of potential hazards.	Same as alternative A, plus expand efforts to provide dependable and improved communication throughout the complex.	Same as alternative B.
Visitor and employee safety—environmental consequences		
Because of a historical issue with dead zones for radio and cell phone coverage in remote parts of the refuge complex, the potential exists for someone to be stranded, injured or in need of aid with no way of contacting immediate help.	The safety of visitors and employees would be increased.	Same as alternative B.
Resource protection—actions		
■ Continue to assign one dual-function law enforcement officer to protect habitat resources on fee-title and easement lands. ■ Replace recently vacated full time officer.	Same as alternative A, plus: ■ Place special emphasis on preventative law enforcement efforts to comply with regulations. ■ Pursue cooperative law enforcement efforts and improve relationships with other law enforcement entities.	Same as alternative B, plus: ■ Place higher priority on replacing previous full-time law enforcement officer.
Resource protection—environmental consequences		
The presence of law enforcement officers on the refuge complex would result in greater compliance with regulations.	Same as alternative A, plus officers would increase efforts to educate the public about rules and regulations, leading to increased compliance and resulting in less resource damage.	Same as alternative B, plus there would be more resource protection due to an added law enforcement officer.

CHAPTER 4—Affected Environment



Jeff Van Tine

Rocky Mountain Front Conservation Area.

This chapter describes the characteristics and resources of the refuge and how existing or past management or other influences have affected these resources. The affected environment addresses the physical, biological, and social aspects of the refuge that could be affected by management under the CCP. The Service used published and unpublished data, as noted in the bibliography, to quantify what is known about the refuge complex.

4.1 Physical Environment

CLIMATE

The refuge complex covers more than 2,700 square miles and spans the Continental Divide in northwestern and north-central Montana. The Continental Divide exerts a marked influence on the climate of adjacent areas. West of the Divide the climate might be termed a modified, north Pacific Coast type, while to the east, climatic characteristics are decidedly continental. On the west of the mountain barrier winters are milder, precipitation is more evenly distributed throughout the year, summers are cooler in general, and winds are lighter than on the eastern side. According to the National Oceanic and Atmospheric Administration (NOAA), there is more cloudiness in the west in all seasons, humidity runs a bit higher, and the growing season is shorter than in the eastern plains areas (NOAA 2011).

Cold waves, which cover parts of Montana on the average of 6–12 times a winter, are confined mostly to the eastern part of the refuge complex. The coldest temperature ever observed was –70 °F at Rogers Pass, 40 miles northwest of Helena, on January 20, 1954. Between cold waves, there are periods, sometimes longer than 10 days, of mild but often windy weather along the eastern slopes of the Divide. These warm, windy winter periods are popularly known as "Chinook" weather. Chinook winds frequently reach speeds of 25–50 miles per hour or more and can persist, with little interruptions, for several days. Most complex lakes and wetlands freeze over every winter. All rivers carry floating ice during the late winter or early spring. Few streams freeze solid; water generally continues to flow beneath the ice. During the coldest winters, anchor ice that builds from the bottom of shallow streams on rare occasions causes some flooding (NOAA 2011).

During the summer months, hot weather occurs often in the eastern parts of the refuge complex. Temperatures higher than 100 °F sometimes occur in the lower elevation areas west of the Divide during the summer, but hot spells are less frequent and of shorter duration than in the Plains sections. Summer nights are almost invariably cool and pleasant. In the areas with elevations above 4,000 feet, extremely hot weather is almost unknown. Much of the State has average freeze-free periods longer than 130 days, allowing plenty of time for growing a wide variety of crops. There is no freeze-free period in many higher valleys of the western mountains, but hardy and nourishing grasses thrive in such places, producing large amounts of quality grazing for stock (NOAA 2011).

Precipitation varies widely across the refuge complex and depends largely on topographic influences. Generally, nearly half the annual long-term average total falls from May through June (NOAA 2011). The western part of the refuge complex is the wettest and the east side the driest. Average annual precipitation in the intermountain valleys west of the Continental Divide is 16–22 inches, while most of the eastern part of the refuge complex only receives an average of 8–14 inches (NRIS 2011a) (figure 12).

Figure 12. Map of average annual precipitation in Montana, 1971¬–2000. Source: NRIS 2011a.

Drought in its most severe form is practically unknown, but dry years do occur in some areas. All parts of the State rarely suffer from dryness at the same time. The only exceptions on record occurred during the 1930 decade (NOAA 2011). In the eastern parts of the refuge complex, the last 100 years of weather data show a long-term "boom and bust" cycle of 10–20 years of alternating wet and dry periods (NOAA 2009).

Annual snowfall varies from quite heavy, 300 inches, in some parts of the mountains in the western half of the refuge complex, to around 20 inches east of the Continental Divide. Most of the larger cities have annual snowfall within the 30- to 50-inch range. Most snow falls during the November–March period, but heavy snowstorms can occur as early as mid-September or as late as May 1. Mountain snowpacks in the wetter areas often exceed 100 inches in depth as the annual snow season approaches its end around April 1–15. The greatest volume of flow of Montana's rivers occurs during the spring and early summer months with the melting of the winter snowpack (NOAA 2011). Table 6 summarizes precipitation and temperature throughout the refuge complex.

Table 6. Weather information for units of the Benton Lake National Wildlife Refuge Complex, Montana.

Unit	*Average annual precipitation (inches)*	*Highest precipitation months*	*Average snowfall (inches)*	*Average annual temperature (°F)*	*Average low temperature (°F)*	*Average high temperature (°F)*
Benton Lake National Wildlife Refuge (Great Falls)	15	May, June	61	45	33	57
Benton Lake Wetland Management District	6–22	May, June	41–80	39–44	24–33	54–55
Blackfoot Valley Conservation Area (Ovando)	17	May, June	79	39	25	54
Rocky Mountain Front Conservation Area (Augusta)	14	May, June	41	43	29	57

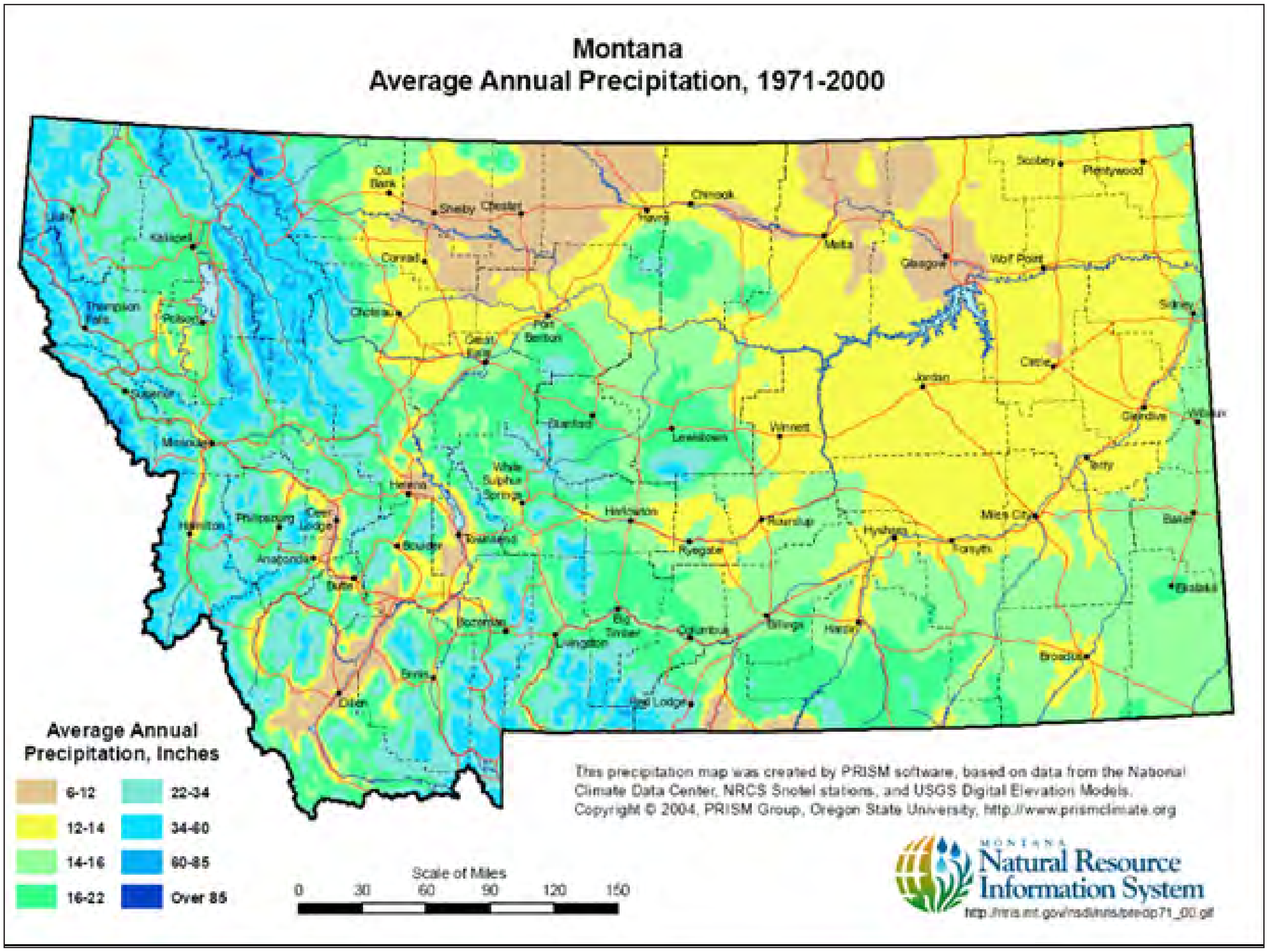


Figure 12. Map of average annual precipitation in Montana, 1971¬–2000. Source: NRIS 2011a.

Average annual precipitation across the district varies from a high of 22 inches near the foothills of Rocky Mountains and Sweet Grass Hills to a low of 6 inches in the center of the district around the towns of Shelby and Chester. At Benton Lake Refuge, the average annual precipitation is 14.98 inches. During the period of record at Great Falls, yearly precipitation extremes have ranged from 6.68 inches in 1904 to 25.24 inches in 1975. Precipitation generally falls as snow during winter, late fall, and early spring, whereas, the highest rainfall months are May and June.

Long-term temperature and precipitation data show dynamic patterns of recurring peaks and lows on a 10–20 year cycle. Regional precipitation decreased and temperatures rose from the late 1910s to the late 1930s (NOAA 2009). A steady rise in precipitation and declining temperatures occurred from the early 1940s to the mid-1950s followed by another decline in precipitation and local runoff in the 1960s. Precipitation rose again during the late 1970s and early 1990s, and remained about average during the 1980s and late 1990s to early 2000s. Currently, precipitation appears to be gradually increasing again.

Blackfoot Valley Conservation Area

In the Blackfoot Valley, the climate is generally cool and dry, but there is considerable variability corresponding to the east–west elevational gradient that greatly influences vegetation and habitat. July and August are the warmest months with an average high around 81 ºF and a low near 40 ºF. On average, the warmest month is July. The highest recorded temperature was 99 °F in 2003. January is the average coldest month. The lowest recorded temperature was –48 °F in 1982.

Rocky Mountain Front Conservation Area

Along the Rocky Mountain Front, the climate is generally cool and dry, but there is considerable variability corresponding to the east–west elevational gradient that greatly influences vegetation and habitat. July and August are the warmest months with an average high around 77 ºF and a low near 45 ºF. The Augusta climatic station at the eastern boundary of the Front has similar above-freezing winter average highs, but is colder at night with January having average lows of 10 °F. Average summer temperatures are also warmer in Augusta with July and August having highs slightly greater than 80 °F and lows around 47 °F. Gibson Dam receives almost 18 inches of precipitation annually; May and June are the wettest months with about 3 inches per month, and the winter months receive less than 1 inch of precipitation per month. Augusta has a similar pattern with relatively wet springs and dry winters although the total precipitation annually averages only about 14 inches. This precipitation gradient (along with soils) is vital in structuring vegetation communities across the Front (Kudray and Cooper 2006).

Swan River National Wildlife Refuge and Swan Valley Conservation Area

The upper Swan Valley is at the eastern limit of the Pacific maritime climatic influence, common to northern Idaho and northwestern Montana. The Mission Range experiences more of the maritime influence than the Swan Range. The climate is generally cool and dry with precipitation increasing from south to north in the valley. Precipitation in the form of snow and rain varies between an average of 30 inches on the valley floor to more than 100 inches along the Swan and Mission divides. The highest precipitation usually comes from late October to mid-February and again from mid-May to early July. The highest precipitation intensity occurs when a moist weather front from the Pacific collides with cool continental weather.

Occasionally, cold arctic air slips over the Continental Divide from the northeast and down the valley, bringing extreme subzero temperatures from the continental weather system. Summer temperatures average in the 80s at the lower elevations with extreme temperatures of 90–100 °F during drought years. The relatively short growing season (2–3 months) limits widespread agricultural development. Frosts can occur any month of the year. Therefore, conversion of forest types to cultivated crops has been limited in comparison to other western Montana valleys.

CLIMATE CHANGE

Warming of the global climate is considered by the Intergovernmental Panel on Climate Change (IPCC 2007) to be unequivocal. Over the last 100 years, the average global temperature has risen 1.3 °F. In the Northern Hemisphere, the temperature rise over the last 50 years is very likely higher than any other 50-year period in the last 500 years. 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).

Increases in temperature have been associated with decreases in mountain glacier and snow cover, earlier spring melt, higher runoff and warmer lakes and rivers. In Montana, precipitation changes have varied across the State. In general, the northern Rockies are now seeing less winter snow while the southeastern plains are receiving slightly more spring and fall rain. However, that added rain is coming in fewer, more severe, storms (TNC 2009).

Climate change adaptation is the emerging discipline that focuses on helping people and natural systems prepare for and cope with the effects of climate change. Adaptation refers to measures designed to reduce the vulnerability of systems to the effects of climate change (Glick et al. 2011). Adaptation efforts generally include (1) building resistance, which is the ability of an ecosystem, species, or population to withstand change without significant ecological loss, (2) building resilience, which is the ability of system to recover from a disturbance or change without significant loss and return to a given ecological state and (3) facilitation of ecological transitions. Promoting and supporting resilience is the most commonly recommended approach, but related to the success of this is the ability to reduce existing stressors that would be magnified with climate change, protect refugia and habitat connectivity and implementing proactive management and restoration (Glick et al. 2011).

The refuge complex is part of the GNLCC and the PPPLCC. The LCCs work with a variety of science partners to address existing and future issues related to climate change and landscape-scale conservation. These partnerships have the potential to be a major conduit for stepping down global and regional climate change models and helping to target this work to the highest priority needs for land managers and conservation within the refuge complex.

GEOLOGY AND PHYSIOGRAPHY

The landscape of the refuge complex is extremely diverse. Elevations across the refuge complex range from as little as 3,000 to more than 10,000 feet above mean sea level (amsl). Changes in elevation are especially significant along the Rocky Mountain Front Conservation Area, which encompasses up to 4,000 feet of topographic relief over a few miles. The landscape features vary from large rivers to intermittent prairie streams, small temporary wetlands to large lakes, intermountain valleys to alpine peaks and prairie grasslands to conifer forests.

The geology that underlies the visible topography within the refuge complex is also diverse. Up until approximately 175 million years ago, the landscape of the modern day complex was fairly uniform. Most of Montana was below sea level and vast areas were shallowly flooded. This changed with the shifting of the tectonic plates that form the earth's crust that led to the collision of the continental plate bearing North America with the floor of the Pacific Ocean. That collision led to the literal crumpling of the continent along deep fault lines. As the earth's surface continued to bulge, it eventually became unstable and the top sedimentary layers peeled off and came to rest to the east, piling on top of each other to form the eastern front of the Rocky Mountains. The mountains in northwest Montana are comprised of the older formations that were exposed when the veneer slipped off.

Around 65 million years ago, the crust beneath central Montana rose sufficiently that the inland sea retreated. Subsequent to this, volcanic activity led to igneous intrusions into the older, surrounding sedimentary rocks and the formation of the island mountain chains in north-central Montana, including the Sweet Grass Hills. This was followed by a relatively calm geologic period in Montana where crustal movements subsided. Alternating dry and warm, tropical periods from the Oligocene to the Pliocene (35 to 2.5 million years ago) led to deposition of sedimentary layers including gravel, sand, mud, volcanic ash, limestone, coal and laterite.

Today, these earlier sedimentary layers are buried throughout most of the refuge complex by glacial till and debris left by the enormous glaciers that covered northern Montana during the last ice ages. The glaciers had a profound effect on the landscape within the refuge complex by sculpting mountains, changing riverflows and leaving behind many wetlands. The first, and largest, of these recent ice ages was the Bull Lake Ice Age, approximately 70,000–130,000 years ago. This was followed by a less extensive ice age, the Pinedale, approximately 10,000–15,000 years ago (Alt and Hyndman 1989).

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Rocky Mountain Front Conservation Area.

Benton Lake National Wildlife Refuge

The Benton Lake basin is characterized by gently dipping sedimentary bedrock formed during the Cretaceous Period (145–65 million years ago) overlain in many places by glacial and alluvial deposits from the last ice ages (Maughan 1961). Bedrock in most of the Benton Lake basin is seleniferous marine shale of the Cretaceous Colorado Group, often referred to as Colorado Shale (Maughan 1961). The ancient sedimentary bedrock that lies beneath the Benton Lake basin is important because of the effect it has on water quality today as a source of selenium.

During the last Pleistocene ice sheet, Glacial Lake Great Falls covered low-lying parts of the Benton Lake region. Glacial lake deposits near Benton Lake are primarily clay and silty clay and are up to 100 feet thick (Lemke 1977). Glacial drift associated with the last ice sheet was deposited northeast of Benton Lake and east of Priest Butte Lakes and formed the closed Benton Lake basin. Glacial drift deposits are primarily glacial till consisting of unsorted and unstratified clay, silt, sand, and some coarser material. Locally, glacial drift may include stratified sand and gravel alluvial deposits (Mudge et al. 1982, Lemke 1977).

The topography of the refuge reflects the dominant geological surfaces and features of the region. Within Benton Lake proper, elevation gradients are relatively subtle ranging from about 3,614 feet amsl in the lowest depressions in the middle of the historical lakebed to about 3,622 feet amsl on the edge of the lake that defines its full-pool water level.

Benton Lake Wetland Management District

The glaciers that covered the Plains of the district originated from the northeast near Hudson Bay and reached their southern edge in central Montana at the end of the ice ages. As a consequence, the glacial imprint on this area is relatively light as glaciers were thinner and present for a relatively brief time. The inland mountain ranges, for example the Sweet Grass Hills were surrounded, but not covered by these glaciers. Nevertheless, as the glaciers retreated they left a layer of glacial till and debris covering northern Montana. The classic hummocky landscape left behind by this debris can be seen on the Furnell WPA at the base of the Sweet Grass Hills.

The southern edge of the glaciers approximated the modern-day Missouri River. The edges of the glaciers dammed rivers and created lakes in central Montana. The largest was Glacial Lake Great Falls, which was 600 feet deep in Great Falls and extended all the way to Cut Bank. As Glacial Lake Great Falls rose, it formed a spillway north of the Highwood Mountains washing out a large valley known today as the Shonkin Sag. The repeated flooding and spilling by Glacial Lake Great Falls through the Shonkin Sag left behind several depressions that are now shallow, brackish lakes including those found on the Kingsbury Lake and Big Sag WPAs. Similarly, the Milk River may have been diverted during the last ice age, forming the Sweetgrass Sag and leaving behind depressions that created wetlands on the waterfowl production areas in northern Toole County.

Most of the district lies within the Great Plains, a relatively flat landscape sloping slightly to the east. The area is punctuated by large rivers including the Missouri and Milk and their associated tributaries as well as isolated mountain groups such as the Highwood Mountains and Sweet Grass Hills. The Sweet Grass Hills consist of three distinct buttes with scattered hills connecting them. The three buttes are West Butte (elevation of 6,983 feet), Gold Butte (elevation of 6,512 feet), and East Butte (elevation of 6,958 feet). The three buttes, and the hills between them, run for about 50 miles east to west and are about 10 miles in distance from north to south.

The sedimentary rocks of north-central Montana are also of particular interest because some harbor oil and gas or coal. A large structural warp in the bedrock between Shelby and Cut Bank, known as the Sweetgrass arch, has trapped several oil and gas fields. Crude oil production peaked in 1960 in central Montana but has declined since then, as new discoveries did not keep up with depletion. The Cut Bank Field, Pondera Field west of Conrad and a large reservoir near Kevin and Sunburst are some of the largest resources, but many of the wells today produce only a few barrels per day (Alt and Hyndman 1986).

Blackfoot Valley Conservation Area

The Blackfoot Valley was strongly influenced by large continuous ice sheets that extended from the mountains southward into the Blackfoot and Clearwater River Valleys (Witkind and Weber 1982) during the Bull Lake and Pinedale ice ages. When the glaciers receded, large deposits of glacial till, glacial outwash, and glacial lakebed sediments were left behind. These deposits cover much of the Blackfoot Valley floor, shaping the topography of the valley and the geomorphology of the Blackfoot River and the lower reaches of most tributaries. Glacial features evident on the landscape today include moraines, outwash plains, kame terraces, and glacial potholes (Whipple et al. 1987, Cox et al.1998). The Blackfoot and Kleinschmidt Lake WPAs, in particular, reflect this glacial influence in the pothole wetlands present on these parcels. The landscape between Clearwater Junction and Lincoln is characterized by alternating areas of glacial moraines and their associated outwash plains. In this area, ice pouring down from the mountains to the north spread out to form large ponds of ice several miles across, known as piedmont glaciers. Muddy meltwater draining from these piedmont glaciers spread sand and gravel across the ice-free parts of the valley floor to create large outwash plains. The town of Ovando sits on one of these smooth outwash plains (Alt and Hyndman 1986). In addition, during the latter part of the Pleistocene Era, the Blackfoot Valley was further shaped by the repeated filling and catastrophic draining of Glacial Lake Missoula, which extended upstream as far as Clearwater Junction (Alt and Hyndman 1986).

The Blackfoot River watershed totals nearly 1.5 million acres. The 132-mile long Blackfoot River drains 2,320 square miles and hosts a 3,700-mile stream network. The headwaters of the Blackfoot begin atop Roger's Pass at the Continental Divide and flow west to its confluence with the Clark Fork River near Missoula. The Blackfoot Valley floodplain varies in width from several hundred feet to several miles and has many tributaries. Historically, the river meandered back and forth across the valley floor. The remnants of these old oxbows formed the wetland basins managed today on the H2–O WPA.

Rocky Mountain Front Conservation Area

The highest elevation landforms are located in the most western section of the Front and are Paleozoic Era sedimentary rock composed of sandstone, shale, and limestone (including dolomite). These relatively hard materials kept their shape during formation and are not as prone to erosion. The Kootenai Formation from the Mesozoic Era is found adjacent at lower elevations and is also sedimentary rock, but is composed of conglomerate, sandstone, shale, and mudstone. These materials formed tight folds and are prone to erosion, resulting in low hills that look more like the Plains to the east than the craggy mountains to the west. The Colorado Shale Formation of shale and siltstone is typically found at the next lowest topographic position. At lower elevations, alluvial deposits are common with layers of gravel, sand, and silt. There are also significant low-elevation glacial deposits from the Pleistocene Age that have variable, mostly coarse textures. These have left behind hummocky pothole wetlands in some areas. The Two Medicine Formation from the Cretaceous Era is one of the most common lower elevation types and is sedimentary with clay, limestone, and sandstone. There is also a prominent area of Cretaceous volcanic rock in the far southern part of the Front (Kudray and Cooper 2006).

The Rocky Mountain Front in Montana transitions from eastern foothill grasslands between 3,500 and 5,500 feet in elevation to mountain peaks at nearly 9,000 feet in elevation. The area is drained by several rivers including the Sun, Teton, and Marias, which eventually drain into the Missouri River.

Although geologically speaking, the Front has the potential for oil and gas reserves, the complexity of the formation suggests that any fields are likely to be small (Alt and Hyndman 1986).

Swan River National Wildlife Refuge and Swan Valley Conservation Area

During the shifting of tectonic plates that led to the formation of the Rocky Mountains, the Swan Valley was created along a fault by a large block of rock being pushed up on the east side of the valley forming the Swan Range, and the west side of the fault dipping down, forming the Mission Range. The general direction of the faulting was northwest to southeast, with the mountain ranges tilted in an easterly direction. This faulting history generally left steeper and more rugged mountains in the Swan Range. Both the Mission Range and the Swan Range are Precambrian sedimentary formations.

Further alteration of the geological landscape in the Swan Valley resulted from the Bull Lake Ice Age when the northern end of the Mission Range split the glacier, which flowed south from British Columbia. One lobe of the glacier went through the Swan Valley south to the Blackfoot River, forming a continuous sheet over the mountains, especially the northern part of the Mission Range. Only the highest peaks and ridges remained uncovered.

Ice again advanced through the valley to the lower end of Salmon Lake during the Pinedale Ice Age. Additionally, long tongues of ice thrust out of the mountains into the valley, depositing moraines at their edges. The last fingers of ice formed the high ridges or high moraines that now enclose glacial lakes such as Holland and Lindbergh Lakes, as well as others at the mouths of canyons in the Mission Range and Swan Range. As the valley glacier melted, dirt and debris were left behind. Large piles of these sediments remained as humps on the valley floor or were pushed into ridges or eskers as the glaciers moved. In other areas, pockets of ice were left behind. When they melted, they left depressions that became lakes, ponds, potholes, or wetlands. This complex of wetlands intermingled with upland terrain is unique (Swan Ecosystem Center 2004).

The Swan River basin, tributary to Flathead Lake and the Flathead River in the headwaters of the Columbia River, is approximately 1,286 square miles in area. A wide diversity of lakes, riparian areas, rivers, creeks, alpine and subalpine glacial lakes, and springs feed the basin (Friessell et al. 1995). The Swan and Mission Ranges reach peak elevations higher than 9,000 feet. The Swan River flows through the mountains, winds across the morainal foothills and through the valleys forming braided delta areas. The river travels over a dense forest floor comprised of variously graded porous glacial till and alluvium, averaging 6.2 miles wide at an elevational range of 2,500–9,000 feet. (Friessell et al. 1995). Several large lakes (250 to 2,700 acres) occur along the course of the river and its main tributaries. Hundreds of kettle lakes, fens, bogs, and other lake-like systems and small, shallow and vegetated wetlands, with many perched aquifers not directly connected to surface streams, lie scattered across the glacial and alluvial valley floors and foothills (Frissell et al. 1995). Forested riverine and small, shallow and vegetated wetlands fringe the river channel and dominate its extensive floodplains and relict paleochannels (an ancient inactive stream channel filled by the sediments of younger overlying rock).

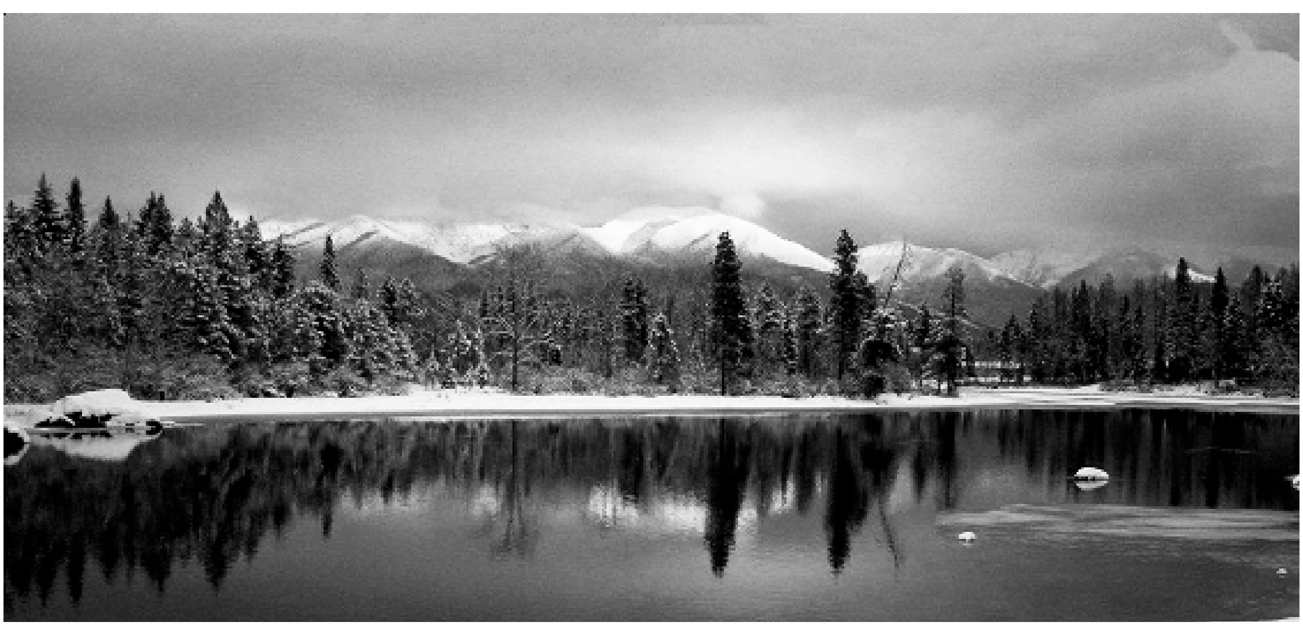
The Swan River refuge lies within the floodplain of the Swan River on the southern edge of Swan Lake between the Swan Mountain Range to the east and the Mission Mountain Range to the west. The valley floor is generally flat but rises steeply to adjacent forested mountain sides. Eighty percent of the floodplain is comprised of wetlands and the other 20 percent consists of forests of old growth fir, spruce, cedar, and larch. The Swan River, which once meandered through the floodplain, has been forced to the west side of the refuge by deposits of silt, leaving a series of oxbow sloughs within the refuge floodplain.

SOILS

Soils in the refuge complex are extremely variable due to the diverse influences of climate, topography, and geology. In general, the soils are strongly related to the geologic substrates and landforms. The State soil geographic database provides a consistent method of assessing generalized soil characteristics on a regional scale (NRCS 2006). This has been used in conjunction with the Ecoregions of Montana (Woods et al. 2002) to provide a generalized description of the common soil characteristics within the refuge complex. More detailed soils data are available from the county soil survey geographic databases that will be used as stepdown management plans are developed for individual units. Information on the soil geographic databases is available from the USDA Natural Resources Conservation Service (NRCS) (NRCS 2011c).

Benton Lake National Wildlife Refuge

Surface soils are predominantly clays and silty clays (Vertisols) deposited in the lake-system environments of Glacial Lake Great Falls and Benton Lake. The Benton Lake bed and surrounding lower elevation areas are mostly plastic clays and exceed 100 feet deep under parts of Benton Lake. These are Pendroy, Thebo Vanda, and Marvan clays (NRCS 2011c). In the area where Lake Creek enters Benton Lake, soils are mostly silt and sand with minor clay and gravel present in soil stratigraphy. Thickness of these soils range from 10 to 40 feet where they become intermixed with underlying lake-system-type deposits. Higher elevation terrace-type soils along the western and southern edges of Benton Lake are mostly 10–30 feet thick silty clay loam types overlying reddish-brown, poorly sorted sand and gravel dominantly of subangular to slabby sandstone and subrounded quartzite, shale, granite, and argillite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Swan River.

(Maughan and Lemke 1991). Some of these surfaces have interesting, stratified soils indicating various depositions from historical marine environments, Lake Great Falls, and underlying Colorado Shale (Condon 2000).

Benton Lake Wetland Management District

The materials left by the glaciers during the last ice ages are the most widely distributed parent material of soils in the district today. The thickness of these deposits varies widely from more than 100 feet deep in preglacial valleys and depressions to very thin on higher divides and benches. Mollisols—dark, base-rich mineral soils typically formed under perennial grasses—cover much of the area (NRCS 2011a). Common mollisol soils series include Scobey, Telstad, Vida, Joplin, Bearpaw, and Kevin, which are very deep, well drained soils formed in glacial till across the Plains, and in the case of Kevin soils, are typical of glacial moraines and hummocky areas (Woods et al. 2002, NRCS 2011b). Native vegetation on these soils is typically western wheatgrass–needlegrass (Woods et al. 2002). In areas where there are steep, actively eroding slopes, floodplains, or glacial outwash plains, Entisols are common (Woods et al. 2002). Entisols show little or no soil horizons as deposition or erosion rates are often faster than soil development (NRCS 2011a). The Hillon soil series is found on several waterfowl production areas and is a common Entisol across the district (Woods et al. 2002, NRCS 2011b). The third common soil order in the northern glaciated plains is vertisols. Vertisols are clayey soils that have deep, wide cracks for some time during the year. Vertisols generally have gentle slopes and are associated with grass cover (NRCS 2011a). The Pendroy series are common vertisols in the district (Woods et al. 2002). The Pendroy series consists of deep, well drained soils formed in clayey glacial river or lake material or in alluvium from shale uplands (NRCS 2011b). These soils are on alluvial fans, floodplains, stream terraces, and lake plains. Because the permeability of these soils is slow, irrigation can result in the buildup of salinity and nearly all mature soils in the area carry a constituent of alkali salts (Gieseker et al. 1933).
Blackfoot Valley Conservation Area

The floor of the Blackfoot Valley was shaped by the glaciers and is characterized by hummocky moraines, outwash plains, terraces, fans, poorly developed drainage networks, and many wetlands (Woods et al. 2002). Most soil types present in the watershed have similar surface textures, are moderately well to well drained, and have a depth to water table between 3 and 6 feet. These dominant soils are neither prime farmland nor hydric soils supporting wetlands. Fescue grasslands within the valley are commonly underlain by Mollisols soils including Quigley, Perma, Raynesford, Leavitt, Burnette, and Winspect (Woods et al. 2002). These soils are very deep, well drained and were formed by alluvium, colluvium, alpine till, or slide deposits derived from limestone, shale, sandstone, limestone and calcareous sedimentary rock. They are typically found on alluvial fans, stream terraces, hills, outwash plains, and moraines (NRCS 2011b). In areas that support timber, such as ponderosa pine and Douglas-fir, Inceptisol series such as Totelake and Winfall are common (Woods et al. 2002). These soils are very deep, well drained and formed either by glacial outwash (Totelake) or loamy till (Winfall). The Totelake soils are found on alluvial fans and stream terraces whereas the Winfall soils are found on moraines and mountains (NRCS 2011b).

Rocky Mountain Front Conservation Area

At the foot slopes of the Rocky Mountains and the smaller mountain chains, such as the Sweet Grass Hills, Mollisols and Entisols are the prevalent soil orders. Within these, there is a wide variety of common soils series. Mollisols soil types that support western wheatgrass–needlegrass prairies include Farnuf, Fairfield, Delpoint, Marmarth, Reeder, and Regent (Woods et al. 2002). These are very deep to moderately deep, well drained soils formed from either glacial deposits (Farnuf, Fairfield, Delpoint) or from weathered sedimentary materials such as sandstone, siltstone, mudstone or shale (Marmarth, Reeder, Regent) (NRCS 2011b). Fescue grasslands can be commonly found on Mollisols series such as Castner, Work, Absarokee, Michelson, and Redchief. These are shallow to very deep, well drained soils formed from alluvium or colluvium over bedrock, or in case of Redchief soils, from glacial deposits. Redchief soils can also support scattered lodge pole, aspen and alpine fir as elevations increase (NRCS 2011b). Entisols soil series common to the Rocky Mountain Front include Cabbart and Cabba (Woods et al. 2002). Both are shallow, well drained soils derived from semiconsolidated, loamy sedimentary beds. These soils are found on hills, escarpments, and sedimentary plains and typically support wheatgrass–needlegrass prairies (NRCS 2011b).

Swan River National Wildlife Refuge and Swan Valley Conservation Area

The Swan Valley has a wide diversity of soils from steep mountain formations that are minimally developed and consist mainly of bedrock of various belt supergroup formations—to deep fertile soils of the valley floor consisting of recent alluvium along the floodplains.

Valley soils consist of glacial moraine, outwash, lakebeds, or other sediments associated with the last glacial activity and its associated lake and flood sediments. Parent materials are sands, silts, and gravels underlain by siltstones or glacial deposits. The valley floor is generally flat with slopes of from 2 to 20 percent. Steep slopes occur at the front edge of some terraces. Soils in the valley bottom consist of two broad types. One is rocky and poorly drained and is underlain by unsorted glacial till. These soils generally support timber production. The second type of soil consists of deep, well-drained, and well-structured silty substrate with thick, dark nutrient rich surface horizons up to 1 foot thick.

The soils of the Swan River Refuge were largely formed by the Swan River moving back and forth across the floodplain over time. Nearly 30 percent are Aquepts formed by alluvium deposited in the floodplain. The soils in the valley bottom are gravelly or silty loams that typically support shrub and forest vegetation. The edges of the refuge that transition from the floodplain to the forested uplands are Andeptic Cryoboralfs formed by glacial till and also typically support forested vegetation (NRCS 2011c).

WATER RESOURCES

Water resources for the refuge complex consist of precipitation, runoff, ground water flows, and established water rights. On fee-title lands within the refuge complex, just more than half of the approximately 12,000 acres of wetlands are subject to natural flooding and drying cycles. In Montana, precipitation is cyclical, causing a series of wet and dry years, often in 10–20 year cycles (Hansen et al. 1995, Heitmeyer et al. 2009). Therefore, whether or not most of the wetlands within the refuge complex are flooded or dry in any given year depends on natural climatic cycles. For the remaining wetlands, water resources may be augmented by water rights associated with diversions from streams, irrigation return flows and impoundments.

Benton Lake National Wildlife Refuge

The refuge was established by Executive order of President Hoover in 1929. For the first 30 years of the refuge history, the refuge was not staffed and was administered by the National Bison Range in western Montana. During this time, the hydrological regime in Benton Lake mirrored seasonal and long-term regional precipitation patterns (for example, Nimick 1997).

In 1957, local support from the Cascade County Wildlife Association prompted a major effort to construct major pumping and water delivery structures from Muddy Creek to the refuge. A pump station and pipeline were constructed 1958–62 to bring irrigation return flow in Muddy Creek from the central and northeast parts of the Greenfields Bench to the refuge. In 1961, full-time Service staff were assigned to, and housed on, the refuge. The first water pumped to Benton Lake from Muddy Creek occurred in 1962. Water from the Muddy Creek pump station is moved 4 miles through an underground pipeline over a low-drainage divide and then is discharged into the natural Lake Creek channel where it flows for about 12 miles to its mouth in Benton Lake. Pumping from Muddy Creek corresponds to times of irrigation return flow in the Greenfields Irrigation system and is generally from May until mid-October. The refuge has rights for up to 14,600 acre-feet of water from Muddy Creek each year depending on adequate flows in the creek (Palawski and Martin 1991). Water from Muddy Creek is free, but the refuge must pay electrical costs for the three pumps (two 350-horsepower and one 250-horsepower).

Benton Lake Wetland Management District, Blackfoot Valley Conservation Area, and Rocky Mountain Front Conservation Area

Within the 10-county district, there are approximately 500,000 acres of wetlands (MNHP 2010b). Areas with particularly high densities include the Rocky Mountain Front, the Sweet Grass Hills, and the Blackfoot Valley. In the Blackfoot Valley, wetland densities exceed 100 basins per square mile.

The Service currently holds conservation, grassland, and wetland easements on 132,858 acres of land in the district. Wetlands associated with lands in all of these easement programs are protected. The Service is currently conducting landscape-level analysis to rank wetland resources based on their importance to breeding waterfowl, which may be expanded to other priority wetland-dependent birds in the future. This prioritization will help identify the highest priority wetland resources in the district for future protection.

Currently, there are approximately 4,300 acres of wetlands protected and managed on waterfowl production areas within the district (MNHP 2010b). Roughly one-third of these wetland acres are permanent or semipermanent, one-third are seasonal and the remaining third are temporary (MNHP 2010b). Most of these wetlands receive water primarily through precipitation and runoff from snow or rain events. The catchment area for most waterfowl production area wetlands is generally small and limited to the area immediately surrounding the basin. One exception is Kingsbury Lake WPA, where the main wetland basin receives runoff from the nearby Highwood Mountains via Alder Creek.

On approximately 400 acres of waterfowl production area wetlands, the basins have been impounded to hold precipitation and runoff higher or longer than would otherwise occur, thus extending the period of flooding. These include some or all of the wetlands on the Blackfoot, Hartelius, Arod Lakes, Kingsbury Lake, and Sands and Furnell WPAs. On the H2–O WPA in the Blackfoot Valley, water is diverted from the Blackfoot River to flood oxbow wetlands on the waterfowl production area.

H2–O WPA

The H2–O WPA is located next to the Blackfoot River and near the mouth of Nevada Creek. The 630-acre parcel south of the Blackfoot River supports 35 wetlands totaling approximately 229 acres within and immediately next to the property. The Montana Department of Natural Resources and Conservation described the hydrology of the H2–O in 2005 based on 2 years of monitoring on the waterfowl production area (Roberts and Levens 2005). Inflows into the H2–O are supplied by surface water (McCormick ditch), shallow ground water, and precipitation. Outflows were made up of evapotranspiration, and surface and ground water returns to the Blackfoot River and Nevada Creek.

Water is delivered to the wetlands by an irrigation ditch that conveys water from a head gate located 1.1 miles below the Highway 141 crossing on the Blackfoot River, through four neighboring properties, to the H2–O WPA. The ditch, referred to as the McCormick ditch, enters the waterfowl production area in two locations. After traveling 3.24 miles in a southwestern direction the ditch splits, sending water 0.95 miles west to the H2–O WPA near Pond #4. The other branch of McCormick ditch flows 1.95 miles south before entering the eastern edge of the waterfowl production area near Alkali Lake. The total water right in the ditch for all users is 122.5 cubic feet per second (cfs). The H2–O WPA part of this is 75 cfs. The Service currently supports the ditch. The percent of water diverted from the Blackfoot River that actually reaches the H2–O ranges from 6 percent to more than 200 percent. The wide range in these values is a function of adjacent irrigation. For example, when the McCormick turnout is pulling water from the ditch, the deliverable part is much lower. Conversely, on those days when the McCormick turnout is not pulling water, and there is substantial tail water runoff from adjacent flood irrigation, the deliverable part exceeds 100 percent (ditch is gaining).

Swan River National Wildlife Refuge and Swan Valley Conservation Area

Within the refuge, wetlands are mostly meandered loops of the Swan River that have been cut off from the main channel. Under natural conditions, floodwater and ground water would be the dominant inputs. Currently, the hydrology of the refuge is not well understood. It is possible that there have been significant modifications to the water resources that are hidden by thick vegetation. A detailed hydrogeomorphic analysis of the refuge would help to understand and manage the hydrology more effectively.

WATER QUALITY

A comprehensive evaluation of water quality across the refuge complex has not been conducted. Given the significant land use changes in parts of the refuge complex (for example, conversion of grasslands to agriculture in the district) water quality problems may currently be undiscovered.

Benton Lake National Wildlife Refuge

In the late 1980s, it was discovered that the refuge had concentrations of selenium in water, bottom sediment and biota that were moderately to considerably higher than regional background values or reference concentrations associated with biological risk (Knapton et al. 1988). Since that time, considerable effort has been focused on understanding and characterizing the selenium contamination issues at Benton Lake Refuge (Nimick et al. 1996; USFWS 1991; Zhang and Moore 1997; Henney et al. 2000; unpublished data on file at Benton Lake Refuge 2006, 2008, 2011). Concerns have focused on reducing the selenium levels on the refuge and in the Lake Creek watershed to prevent concentrations that would cause reproductive failure in sensitive birds.

High salinity was also a concern before on the refuge. However, a review of long-term salinity data on the refuge found that, while salinity may increase within a season as wetlands dry, there were no detectable increasing trends over a 10-year period (Nimick 1997).

For further discussion of water quality at Benton Lake Refuge, see chapter 7.

Benton Lake Wetland Management District

In 1995, a survey of contaminants from 10 sites within the district was conducted to find out if trace elements were accumulating in either sediment or the aquatic food chain of wetlands (Gilbert et al. 1995). Elevated levels of lead, boron, and selenium were detected in several locations. The concentrations did not appear to pose an immediate threat to wildlife resources but continued monitoring was recommended. Given the alkaline nature of many of the soils in the district and the fact that evaporation rates can exceed precipitation, the potential for accumulation of toxins in wetland basins, particularly impoundments that do not dry out, deserves further attention.

Blackfoot Valley Conservation Area

The Blackfoot River, from the headwaters downstream to Landers Fork, shows varying levels of metals-related impairment. Water quality data show that the upstream part of this stream segment routinely exceeds numeric water quality criteria for metals cadmium, copper, iron, lead, and zinc. Metals concentrations decrease in the downstream direction to the point where exceedences of metals-related numeric water quality criteria typically occur during high flows only. Water quality data from Blackfoot River from Landers Fork to Nevada Creek occasionally exceeds numeric water quality criteria during high flows for cadmium, iron, aluminum, and zinc. Sources of metals-related impairment and acidity from the upper river segments are associated with the Upper Blackfoot Mining Complex. Reclamation activities including the restoration strategies for metals listed segments of the Blackfoot River rely on the completion of the water quality restoration commitments from the Upper Blackfoot Mining Complex.

In 2005, a basin-wide restoration action plan for the Blackfoot River watershed was completed. This action plan serves as a guiding document to identify, rank, and plan for the implementation of restoration projects in the Blackfoot River watershed.

Rocky Mountain Front Conservation Area

Watersheds in the Rocky Mountain Front include the Sun River, Teton River, and Dearborn River. The Sun River watershed is connected to the Teton River watershed via human-built canals and irrigation works.

SUN RIVER WATERSHED

The Sun River watershed spans several land types from the forested headwaters in the Rocky Mountain wilderness, to the prairies at its confluence with the Missouri River near the city of Great Falls, Montana. Agricultural land use predominates in the watershed. The links between water quality, land use, and the natural variability of land types in the watershed are complex. The potentially impaired waters identified by the State of Montana in the Sun River watershed are Ford Creek, Gibson Reservoir, Willow Creek Reservoir, upper Sun River, lower Sun River, Freezeout Lake, and Muddy Creek.

The upper Sun River was identified as impaired on Montana's 2000 and 2002 list of impaired waterbodies because of excess nutrients. This segment is approximately 80 miles long and runs from Gibson Dam to Muddy Creek. Landowners, local watershed organizations, and many Federal, State, and local government agencies collaborated to carry out agricultural best management practices in the upper Sun River and its tributaries. Water quality improved as a result, allowing the Montana Department of Environmental Quality to remove the upper Sun River from the list for nutrients in 2006. The Sun River watershed project is a classic example of using the watershed approach to address nonpoint source pollution (EPA 2012).

TETON RIVER WATERSHED

The Teton River watershed is located on the eastern side of the Rocky Mountain Front in west-central Montana. Recorded conditions in the Teton basin begin with the Lewis and Clark expedition of 1804–6. The expedition journals, as translated by Moulton (1999), documented several points of interest that can be used today to gain an understanding of the historical landscape and riparian vegetation. On June 3, 1805, the Fields brothers noted the Teton's riparian areas as "containing much timber in its bottom, consisting of the narrow and wide leafed cottonwood with some birch and box alder undergrowth, willows, rosebushes, and currents."

White settlers soon followed, using the expansive lands to raise large herds of cattle and horses. Where possible, rich river bottomlands were cleared to increase forage production. Irrigation of the land soon followed to increase the amount of hay that could be produced and stored for winter. Land use along the river bottoms and floodplain has changed significantly, some reaches of the river were channelized (straightened), permanent bridges for transportation were installed, and riparian areas were being heavily used, which reduced bank-stabilizing vegetation.

The Teton River flows into the Marias River near Loma, in west-central Montana and then into the Missouri River. In 1996, 13 stream segments or waterbodies in the Teton River watershed were listed with threatened or impaired beneficial use. In 2002, nine stream segments or waterbodies have impaired status, and five stream segments or waterbodies have been found to fully support all beneficial uses. The type and magnitude of water quality impairments vary across the watershed. Primary causes of water quality impairments include salinity, total dissolved solids, and chlorides or sulfides, selenium, organic enrichment (dissolved oxygen), siltation (suspended solids), temperature, and nutrients. Other listed causes include stream flow alteration (dewatering), bank erosion, riparian degradation, fish habitat alteration, and other habitat alteration. Sources are varied, but predominantly result from the effects of the 1964 flood or relate to agricultural land uses and associated practices. Agricultural activities dominate the watershed with 84 percent of the land cover and land use identified as cropland, rangeland, or pasture. Irrigated and dryland agriculture practices have a cumulative effect on the river system and resultant water quality either by altering stream flows or by raising ground water levels and augmenting flows that contribute to saline seeps. Riparian grazing activities also have an effect on the health of the riparian zones, stability of stream banks, and ultimately, water quality (MDEQ 2003).

DEARBORN RIVER WATERSHED

In 1996, 2002, and 2004 the State of Montana reported that several stream segments in the Dearborn River watershed in west-central Montana have impaired beneficial uses. The segments of concern are the Dearborn River, middle fork Dearborn River, south fork Dearborn River, and Flat Creek. Causes of impairment in these stream segments include flow alteration, thermal modifications, other habitat alterations, and siltation (MDEQ 2005).

Swan River National Wildlife Refuge and Swan Valley Conservation Area

Clear, cold waters emerge from the Mission Range and Swan Range and flow through the 410,000-acre Swan River watershed joining the Flathead River and eventually reaching the Pacific Ocean by way of the Columbia River. The Swan Valley holds more surface water than any other Montana watershed; 16 percent of the land is wet. Water collects in more than 4,000 potholes, ponds, lakes, marshes, and wetlands, and a 1,300-mile network of streams transports water throughout the valley. Two key water quality problems facing the Swan Lake watershed follow: (1) sediment contributed from past activities has degraded water quality; and (2) forest land has been converted to residential use. Development of roads and homesites has created water quality problems in the Swan Valley. Water quality in Swan Lake is generally excellent; however, dissolved oxygen levels in two deep basins reach unexpected low levels in the fall of each year. Low dissolved oxygen levels are of concern due to potential harm to aquatic life and as an indication of possible basin-wide increases in pollutants reaching Swan Lake (Swan Ecosystem Center 2011).

WATER RIGHTS

Montana waters, in all their varied forms and locations, belong to the State. The Montana constitution states that all surface, underground, flood, and atmospheric waters within the boundaries of the State are the property of the State for the use of its people. (Article IX, section 3[3]). Since water belongs to the State, anyone that holds a water right does not own the water itself, instead, they possess a right to use the water within State guidelines.

Water rights in Montana are guided by the prior appropriation doctrine, that is, first in time is first in right. A person's right to use a specific quantity of

USFWS

Wetland in the Rocky Mountain Front Conservation Area.

water depends on when the use of water began. The first person to use water from a source established the first right; the second person could establish a right to the water that was left, and so on. During dry years, the person with the first right has the first chance to use the available water to fulfill that right. The holder of the second right has the next chance. Water users are limited to the amount of water that can be beneficially used. In Montana, the term "beneficial use" means, generally, a use of the water for the benefit of the appropriator, other persons, or the public, including but not limited to agricultural (including stock water), domestic, fish and wildlife, industrial, irrigation, mining, municipal, power, and recreational uses.

Water rights are appurtenant to the land on which they are used and may, but do not have to transfer with sale of the land. Water rights are summarized in table 7 and described in this section for the units of the refuge complex.

Table 7. Water rights and use on Benton Lake National Wildlife Refuge Complex, Montana.

Claim number (priority date)	*Refuge complex unit*	*Use (period)*	*Source*	*Diversion means*	*Flow rate**	*Claimed volume (acre-feet)*	*Annual used volume (acre-feet)*	*Other information*
Benton Lake Wetland Management District for the 2010 water year								
41R–W–188250	Kingsbury Lake WPA	(annual)	Stock Dam #1	Dam	Natural Flow	1		
41R–W–188251	Kingsbury Lake WPA	(annual)	Stock Dam #2	Dam	Natural Flow	2.5		
41R–W–188252	Kingsbury Lake WPA	(annual)	Stock Dam #3	Dam	Natural Flow	2.5		
41R–P–098648	Kingsbury Lake WPA	(annual)	Stock Dam #4	Dam	Natural Flow	0.4		
41R–W–211490	Kingsbury Lake WPA	(annual)	Stock Dam #5	Dam	Natural Flow	6		
41R–W–011810	Kingsbury Lake WPA	(seasonal)	Alder Creek	Direct Use	Max Flow 12 cfs	3.25		
41R–W–011812	Kingsbury Lake WPA	(seasonal)	Well 5-inch Casing	Windmill and tank	0.5 gpm	3.5	0	
41R–W–011806	Kingsbury Lake WPA	(seasonal)	Unnamed Couleeor Dry Runs	Dam	Old claim	2		
41R–W–011807	Kingsbury Lake WPA	(seasonal)	Unnamed Couleeor Dry Runs	Dam	Old claim	2		

Table 7. Water rights and use on Benton Lake National Wildlife Refuge Complex, Montana.

Claim number (priority date)	Refuge complex unit	Use (period)	Source	Diversion means	Flow rate*	Claimed volume (acre-feet)	Annual used volume (acre-feet)	Other information
41R–W–011808	Kingsbury Lake WPA	(seasonal)	Unnamed Couleeor Dry Runs	Dam	Old claim	2		
41R–W–011809	Kingsbury Lake WPA	(seasonal)	Unnamed Couleeor Dry Runs	Pit	Old claim	2		
41R–W–011811	Kingsbury Lake WPA	(seasonal)	Unnamed Couleeor Dry Runs	Pit	Old claim	2		
76F–W–033714	Blackfoot WPA	(seasonal)	Unnamed Springs	Direct Use	Max Flow 15 cfs	160	160	Supplies water to 4 ponds
76F–P–78265	Blackfoot WPA	(annual)	Unnamed tributary of the Big Blackfoot River	Headgate	Surface water	319	319	Permit is associated with water right No. 76F–W–033714 and supplies water to 4 ponds. Total appropriation is 479 acre-feet
76F–P–003472	Blackfoot WPA	(seasonal)	Big Blackfoot River	Pump	700 gpm	370	0	Irrigates 123 acres
76F–W–097791	Kleinschmidt Lake WPA	(seasonal)	Kleinschmidt Lake	Direct Use	Unknown			
	Sands WPA	(annual)	Beaver Creek Water Contract	Headgate	Unknown	50	50	
40J–W–118716	Sands WPA	(seasonal) Apr.1–Nov.31	Squaw Coulee	Dam	0.66 cfs	0.66	0.66	
40J–W–118717	Sands WPA	IrrigationApr.1–Oct.31	Squaw Coulee	Headgate	2.92 cfs			
40J–P–011694	Sands WPA	(annual)	Unnamed tributary of Halfway Lake	Reservoir	Natural Flow	0.95	0.95	

Table 7. Water rights and use on Benton Lake National Wildlife Refuge Complex, Montana.

Claim number (priority date)	*Refuge complex unit*	*Use (period)*	*Source*	*Diversion means*	*Flow rate**	*Claimed volume (acre-feet)*	*Annual used volume (acre-feet)*	*Other information*
40J 30042409	Sands WPA	Livestock (May 15–September 30)	Indian Woman Coulee	Pit		0.25		
410 30022505	Savik WPA	Livestock (May 1–October 31)	Unnamed tributary of Foster Creek	Pit	Surface water	0.14		
410 30025677	Savik WPA	Livestock (May 1–October 31)	Unnamed tributary of Foster Creek	Pit	Surface Water	0.14	0.14	
41N–W–183215	Furnell WPA	(annual)	Trail Creek	Head-gate	2 cfs	480.80	0	No Available Runoff 2009
40F–W–159045	Ehli WPA	(annual)	Willshaw	Direct Use	Runoff	28	0	
40F–B–214983	Ehli WPA	(annual) Apr.1–Oct.1	Willshaw Coulee	Dam		770.6	0	Early Summer Runoff
76F–G–117710	H2–O WPA	Irrigation (Apr.1–Nov.1)	Blackfoot River	Single head-gate				Authorization applies to 76F–W–117710, 76F–W–11711, 76F B–214348. Irrigates 515 acres, many ponds, and wetlands
76F–W–117702	H2–O WPA	Domestic (annual)	Ground water	Well	35 gpm	4	4	Artesian well, residence
76F–W–117703	H2–O WPA	Livestock (annual)	Ground water	Well	35 gpm	6.72	0	Artesian well (same as above)
76F–W–117704	H2–O WPA	No use (May 1–Dec.1)	Ground water	Well	20 gpm	6.72	0	Old windmill no longer in use
76F–W–117705	H2–O WPA	Livestock (annual)	Ground water	Well	35 gpm	6.72	6.72	Artesian well by Alkali Lake

Table 7. Water rights and use on Benton Lake National Wildlife Refuge Complex, Montana.

Claim number (priority date)	Refuge complex unit	Use (period)	Source	Diversion means	Flow rate*	Claimed volume (acre-feet)	Annual used volume (acre-feet)	Other information
76F–P–017006	H2–O WPA	Irrigation (April 15–October 19) Livestock (annual)	Blackfoot River	Pump	1,500 gpm	375	0	Irrigates 250 acres
76F–W–117707	H2–O WPA	Livestock (annual)	Ground water	Well	35 gpm	6.72	6.72	Aunt Molly
76F–C–069182	H2–O WPA	Livestock (June 7–20)	Ground water	Well	25 gpm	5.95	0.08	Section 29
76F–B–214346	H2–O WPA	Fish and wildlife (annual)	Ground water	Well	66 gpm	106	106	Artesian well by house (overflow)
76F–B–214347	H2–O WPA	Fish and wildlife (annual)	Blackfoot River	Diversion	25 cfs	88	88	
76F–B–214349	H2–O WPA	Fish and wildlife (annual)	Ground water	Well	75 gpm	120	120	Alkali Lake, well overflow
76F–B–214350	H2–O WPA	Fish and wildlife (annual)	Waste and seepage	Irrigation	12.5 cfs	88	88	Overflow collects in McCormick ditch, waste and seepage along ditch
Swan River National Wildlife Refuge								
76K–190563 (2/10/1925)	Swan River Refuge	Irrigation (Apr.15–Oct.19)	Swan River	Dike	Unknown	3,395	3,395	To irrigate 1397 acres
76K–188249 (4/21/1927)	Swan River Refuge	Fish and Wildlife (annual)	Bond Creek	Dike	Unknown	Unknown	268 Max. volume	
76K–190565 (10/22/1919)	Swan River Refuge	Fish and Wildlife (annual)	Stopher Creek	Pipeline	Unknown	Unknown	1,900 Max. volume	
76K–190566 (9/20/1926)	Swan River Refuge	Fish and Wildlife (annual)	Lime Creek	Pipeline	Unknown	Unknown	1,807 Max. volume	
76K–190564 (5/3/1923)	Swan River Refuge	Fish and Wildlife (annual)	Lime Creek	Pipeline	Unknown	Unknown	1,793 Max. volume	
76K–188247 (2/10/1925)	Swan River Refuge	Fish and Wildlife (annual)	Swan River	Dike	Unknown	Unknown	3,395 Max. volume	

Table 7. Water rights and use on Benton Lake National Wildlife Refuge Complex, Montana.

Claim number (priority date)	*Refuge complex unit*	*Use (period)*	*Source*	*Diversion means*	*Flow rate**	*Claimed volume (acre-feet)*	*Annual used volume (acre-feet)*	*Other information*
76K–188248 (4/21/1927)	Swan River Refuge	Fish and Wildlife (annual)	Spring Creek	Dike	135 cfs	Unknown	8,260 Max. volume	7,240 acre-feet is non-consumptive

*Flow rate measures: cfs=cubic feet per second, gpm=gallons per minute.

Benton Lake National Wildlife Refuge

The refuge has two primary water rights. One is for 14,600 acre-feet of surface water from Muddy Creek(41K 188174 00) with a priority date of April 28, 1958. The other is for the natural flow in the Lake Creek drainage, including the unnamed tributaries to Benton Lake, where the drainage enters the refuge in the amount of natural flow remaining after the satisfaction of the following rights:

- all rights recognized under State law with a priority date before the effective date of the Compact
- any rights for stock watering ponds with a priority date after the effective date of the Compact and a maximum capacity of the impoundment or pit of less than 15 acre-feet and an appropriation of less than 30 acre-feet per year from a source other than a perennial flowing stream
- any right to appropriate ground water with a priority date after the effective date of the Compact by means of a well or developed spring with a maximum appropriation of 35 gallons per minute (gpm) or less that does not exceed a total appropriation of 10 acre-feet per year

The refuge also has a ground water right to 2 acre-feet per year diverted at a maximum rate of 45 gpm from ground water beneath the Benton Lake Refuge.

The "Montana House bill 717–Bill to Ratify Water Rights Compact" (compact) is a water rights compact between the State of Montana and the Service signed July 17, 1997. The parties to this agreement recognize that the water rights described in the compact are junior to any tribal water rights with a priority date before the effective date of the compact, including aboriginal rights, if any, in the basins affected.

Benton Lake Wetland Management District

Water rights in the district exist for eight waterfowl production areas and include stock water, irrigation, domestic use, fish, and wildlife. The rights cover natural runoff, instream flows, artesian wells, and springs. Table 7 includes all district water rights.

The Blackfoot River watershed is currently going through the adjudication process.

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

All water rights associated with the conservation areas in the refuge complex remain under the control of the landowner.

Swan River National Wildlife Refuge

The refuge has seven water rights for irrigation and fish and wildlife purposes and all are associated with instream flows (table 7).

AIR QUALITY

Air quality is a global concern. The U.S. Environmental Protection Agency (EPA) has lead responsibility for the quality of air in the United States. Through the 1990 Clean Air Act, the agency sets limits on the amount of pollutants that can be discharged into the air. More than 170 million tons of pollution is emitted annually into the air within the United States, through either stationary sources (such as industrial and power plants) or mobile sources (such as automobiles, airplanes, trucks, buses, and trains). There are also natural sources of air pollution such as fires, dust storms, volcanic activity, and other natural processes. The EPA has identified six principal pollutants that are the focus of its national regulatory program: carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter, and sulfur dioxide.

Air quality problems in Montana are usually related to more urban areas and mountains or river valleys that are sensitive to temperature inversions. Carbon monoxide and particulate matter are the air pollutants that have the greatest adverse effect on Montana's air quality. Particulate matter is tiny liquid or solid particles in the air that can be breathed in through the lungs.

Most of the refuge complex is located in rural settings where soot from slash burning, forest fires, wood burning fireplaces and stoves and dust associated with windblown sand and dirt from roadways, fields and construction sites are the main factors that contribute to particulate matter. The major sources of carbon monoxide in Montana are motor vehicles and residential wood burning.

Air quality for the refuge complex is considered good with few manufacturing sites or major air pollution sources.

The Federal Clean Air Act requirements provided the framework for Montana's air quality program. However, the State has exceeded the Federal requirements in many areas by:

- adopting tougher ambient air quality standards for certain pollutants;
- requiring a permitting program for smaller sources of pollution;
- providing emission control analyses to the regulated public to make sure that smaller sources of air pollution have the best emission control technology available;
- developing local air quality programs to regulate residential wood burning and road dust (the primary sources of particulate air pollution in Montana), as well as smaller sources of air pollution;
- developing the Montana Smoke Management Plan and Open Burning Program to control the amount of harmful particulate matter that is released with smoke from prescribed fires.

The State of Montana, through the Department of Environmental Quality and local governments, continues to actively address air quality problems throughout the State. At present, urban development is more of a threat to Montana's air quality than industrial activities (MDEQ 2011).

Areas that violate Federal air quality standards are designated nonattainment areas. EPA declares each area nonattainment for a specific pollutant such as carbon monoxide or particulate matter. The only area designated to have attainment problems in the refuge complex was Great Falls (carbon monoxide). Great Falls met attainment standards for carbon monoxide in 2002.

4.2 Biological Resources

The following sections describe the biological resources and habitat management activities that may be affected by the implementation of the CCP. The biological features detailed below are vegetative habitat types and the associated species of concern, birds, mammals, amphibians, reptiles, fishes and insects. The quality of these habitats varies throughout the refuge complex due to water quality and quantity, the presence of invasive and nonnative species, effects from surrounding land uses, and the Service's ability to properly manage and protect a particular area.

The major habitat types that occur on the refuge complex follow:

- Grasslands—comprised primarily of mixed-grass prairie with limited tame grasslands consisting of dense nesting cover (DNC) scattered throughout the refuge complex on fee-title land
- Wetlands and riparian areas—natural and enhanced freshwater and saline wetlands including lakes, rivers, and ponds
- Forests and woodlands
- Sagebrush-steppe

Habitat management activities include cooperative farming, prescribed fire and haying, and prescriptive grazing.

GRASSLANDS

Benton Lake National Wildlife Refuge and Benton Lake Wetland Management District

The district is the largest geographical district in the country encompassing ten counties, with nine counties on the east side of the Continental Divide and one on the west side. Historically, the northern mixed-grass prairie system stretched from northern Nebraska into southern Canada and westward through the Dakotas to the Rocky Mountain Front in Montana; now it covers only approximately 104,000 square miles. Dominant grass species include rough fescue, Idaho fescue, western wheatgrass, and green needlegrasses. Other common species include blue grama, needle and thread grass, and threadleaf sedge. Shrub species such as snowberry and prairie sagewort also occur. Fire and grazing, along with drought, constitute the primary dynamics affecting this system.

The northern mixed-grass prairie is one of the most disturbed grassland systems with an estimated 75 percent of the region having been heavily altered. Agricultural crops are common in the central part of the district also known as the Golden Triangle. This agricultural designation, includes Great Falls as its apex, and then roughly runs northeast through Havre, west to Cut Bank and back to Great Falls. The area produces approximately half of Montana's wheat, primarily winter and spring wheat, and is the most productive of the State's farming areas that are not irrigated. Only a few remaining areas have escaped conversion to agriculture (NatureServe 2008). These grasslands are prominently represented in the district along the Rocky Mountain Front, surrounding the Sweet Grass Hills and in Glacier County on the Blackfeet Indian Reservation.

Benton Lake Refuge also has nearly 6,000 acres of intact, northern mixed-grass prairie. The dominant plant community is represented by green needlegrass, western wheatgrass, thickspike wheatgrass, prairie Junegrass and bluebunch wheatgrass. Other grasses and sedges include plains reedgrass, threadleaf sedge and needleleaf sedge. Blue grama is the only common warm-season grass. Grasses represent about 80 percent of the total annual production in this community (NRCS 2005).

Al Schneider / USDA–NRCS PLANTS Database

Blue grama is a common prairie grass.

Common forbs on Benton Lake's clayey soils include dotted gayfeather, American vetch, white prairie clover and purple prairie clover. American vetch and the prairie clover are nitrogen-fixing species and are valuable forage producing plants. Groundplum milkvetch, scurfpea and prairie thermopsis are lower successional forbs that have the ability to fix nitrogen. White milkwort, biscuitroot, wild onion and western yarrow may be present as minor components of the plant community. Forbs represent about 15 percent of the total annual production (NRCS 2005).

Winterfat and Nuttall's saltbush are common warm and cool-season shrubs, respectively on Benton Lake Refuge. They are valuable forage for wildlife and livestock. Silver sagebrush, fringed sagewort, broom snakeweed and prickly pear cactus may also represent minor shrub components. Overall, shrubs account for about 5 percent of the annual plant production (NRCS 2005).

There are approximately 4,516 acres of tame grasslands existing on fee-title lands scattered throughout the refuge complex. Most of the tame grasslands were inherited as former farmland when the waterfowl production areas or refuges were bought. However, there were some limited areas of native prairie on Benton Lake Refuge that were broken and seeded to tame grass in the 1960s and early 1970s. The predominant herbaceous cool-season species used were varying combinations of intermediate wheatgrass, tall wheatgrass, slender wheatgrass, pubescent wheatgrass, western wheatgrass, and crested wheatgrass; the legumes were alfalfa and sweetclover. The basic seeding rates were comprised of 75 percent wheatgrass and 25 percent legumes. These species, commonly referred to as DNC, were chosen based on research that showed they are highly attractive and beneficial to waterfowl (Duebbert 1969). Rationale was based on research conducted in the late 1960s and 1970s, which showed ducks were experiencing higher nesting success in DNC than in surrounding upland habitats (Duebbert 1969, Duebbert and Lokemoen 1976, Kaiser et al.1979). DNC fields throughout the refuge complex range from excellent to poor conditions. Most stands are in some type of rotational management scheme to rejuvenate and extend the longevity of the planting.

ASSOCIATED WILDLIFE

Grassland bird species on refuge complex lands are considered priority species due to the conversion of the landscape grassland ecosystems in surrounding areas and the overall trend of grassland bird species decline. During the past quarter-century, grassland birds have experienced steeper, more consistent, and more widespread population declines than any other avian guild in North America (Vickory et al. 2000). A 6-year study done in Northwest Montana showed that grasslands in the northern Great Plains represent unique characteristics that support a composition of all the species that are endemic to the landscape (Hendricks et al. 2007). On the refuge complex, priority grassland bird species include the Federal candidate species, Sprague's pipit. Other grassland priority species include ferruginous hawk, upland sandpiper, long-billed curlew, marbled godwit, burrowing owl, short-eared owl, grasshopper sparrow, chestnut-collared longspur, Baird's sparrow, and bobolink.

Grassland bird point counts were conducted for 4 years (1994–7) consecutively at the Benton Lake Refuge. More than 800 individuals and 41 species of grassland birds were detected. Over the course of these surveys, there was a steady decline of the chestnut-collared longspurs, grasshopper sparrows, and horned larks.

Grassland-bird point counts were also conducted for 3 years (1995–7) at the Kingsbury Lake and Furnell WPAs. There was high species richness, and grasshopper sparrow, Baird's sparrow and Sprague's pipits were the most abundant species (Benton Lake Refuge Non-game Monitoring Program, Piercy 1997).

Grassland bird conservation and management recognizes the historical dynamics under which these habitats have evolved and, where feasible, incorporate the ecological processes that have generated and supported these distinctive grassland biotas (Vickory et al. 2000). Further management and conservation of these lands by refuge managers would ultimately continue to support a diverse assemblage of grassland bird species.

Blackfoot Valley Conservation Area

Sweeping expanses of native bunchgrass prairie are one of the most striking visual elements of the Blackfoot River watershed. Grassland areas in the watershed were targeted by early European settlers for grazing and farm lands. Today, most of the grassland communities are located on private land in the watershed. Some have been converted to irrigated and dryland pastures or used for hay production. Nonnative species include creeping foxtail, orchard grass, timothy, tall wheatgrass, meadow brome, smooth brome, alfalfa and sainfoin. Large bunchgrass prairies occur throughout the valley bottoms. The dominant bunchgrass is rough fescue; other common native grasses include bluebunch wheatgrass, Idaho fescue, prairie Junegrass, and several species of needlegrass. Native grassland often occurs in a matrix throughout the watershed.

ASSOCIATED WILDLIFE

Grasslands support a variety of wildlife including reptiles such as eastern racer, northern alligator lizard, rubber boa, and terrestrial garter snake (MNHP 2009a). A variety of small mammals use grasslands in the Blackfoot Valley including shrews, voles, gophers, squirrels and rabbits. Large mammals include grizzly bears, white-tailed and mule deer and elk.

In addition to grassland birds such as vesper sparrows and western meadowlarks, the Blackfoot Valley is perhaps also the best breeding and nesting area for the long-billed curlew in western Montana. This species is declining nationally and has been identified as a priority in both the shorebird and Partners in Flight conservation plans. Local surveys on Kleinschmidt Flat in 1997 found 31 pairs on 3,840 acres or more than 8 pairs per 1,000 acres. Production was not monitored, but many broods were noted. This species is highly reliant on grassland-nesting habitat, but will also nest in sagebrush-steppe, and relies more heavily on wetlands during migration.

Rocky Mountain Front Conservation Area

The Front contains the largest intact expanse of fescue grasslands left in the northern Great Plains (Lesica 1994). Higher elevations include fescue grasslands and a large acreage recently changed by a wildfire that is now a mix of mostly Douglas-fir regeneration, among burned tree trunks over relatively lush fescue grasslands. The fescue is often mixed with shrubs, creeping juniper and kinnikinnick occur on somewhat drier sites, and shrubby cinquefoil is common in more mesic areas. Shrubby cinquefoil is particularly common in the northern extreme of the Front, but also follows the greater eastward expansion of the fescue-type habitat in the southern end, where it is more closely associated with stream terraces. The fescue grasslands at higher elevation (and correspondingly greater precipitation) transition at lower elevations to grasslands dominated by various grass species in response to soil and topography. Western wheatgrass is the dominant species in swales (lower elevation land that remains moist) with heavier soils. Needle and thread is the most common species on sandier soils, which tend to occur somewhat higher in the local landscape. Bluebunch wheatgrass is associated with steeper slopes; mixtures of any or all these grasses can occur with the variable conditions found in this diverse landscape. Blue grama can become very common with sustained heavy grazing. The

USFWS

Rocky Mountain Front Conservation Area

absence of sagebrush is notable and currently unexplained.

ASSOCIATED WILDLIFE

Lying next to Bob Marshall Wilderness, the diverse habitats of the Front play a critical role in sustaining the Northern Continental Divide's free-ranging wildlife populations. It is one of the last remaining areas in the lower 48 United States with an intact assemblage of large mammalian carnivores, and it is the only place in the world where grizzly bears still roam from the mountains onto the prairies as they did nearly 200 years ago. An estimated 100–150 bears frequent the project area, which is included in much of the recovery plan for the northern Continental Divide grizzly bear population. Gray wolf numbers are estimated to be 835 individuals making up approximately 110 packs in the Montana Portion of the Northern Continenental Divide ecosystem. The Front once supported a large concentration of swift fox, which were nearly extirpated from the State. Swift fox are now being reintroduced just north of the project area through a partnership between Defenders of Wildlife and the Blackfeet Indian Nation and would eventually move back into the project area.

The Rocky Mountain Front provides essential habitat for many grassland birds, many of which are experiencing significant population declines. These include chestnut-collared longspurs, Sprague's pipits, ferruginous hawks, long-billed curlews and McCown's longspur. In addition, the most common birds found on grasslands along the Front during an inventory in 2004 include vesper sparrows, western meadowlarks, horned larks, Brewer's blackbirds, Savannah sparrows and upland sandpipers (Lenard and Hendricks 2005).

The grasslands provide critical winter range for all large ungulates found within the eastern Bob Marshall Wilderness. Thousands of elk and mule deer winter primarily on State wildlife management areas along the Front. Shiras moose, a subspecies found in the central Rocky Mountains, occasionally frequent the project area. The grasslands along the eastern part of the project boundary also sustain small populations of pronghorn.

Swan River National Wildlife Refuge and Swan Valley Conservation Area

The current grasslands of the Swan Valley and the Swan River Refuge are the result of conversions of other habitat types. Settlers to the valley often converted forested areas and wet meadows and seasonal wetland habitats to haying and grazing areas. Trees were removed and fields destumped and attempts were made to drain wetlands and plant timothy and reed canarygrass for forage. These areas remain today as grasslands awaiting restoration of forested habitat or wetlands (personal communication, Mike Pallidinie, October 2011).

WETLANDS AND RIPARIAN AREAS

Exceptional diversity of wetland and riparian types exists within the refuge complex. This includes major riparian areas (including the Missouri River, Blackfoot River, and the Swan River), smaller riparian tributaries, glacial prairie potholes, depressional wetlands, emergent marshes, lakes, bogs, fens, and swamps. Many systems have been developed to classify and describe wetland types. The Service has adopted as its national standard the "Classification of Wetlands and Deepwater Habitats of the United States" (Cowardin et al. 1979). Added hydrologic and vegetation characteristics for the refuge complex wetlands that are also specific to Montana are described here by crossing the Cowardin classification system with the Ecological Systems described by Comer and others (2003) and produced by the Montana Natural Heritage Program (MNHP 2011b).

Wet–dry climatic cycles in Montana, often in 10 to 20-year periods, exert a strong influence on the wetlands and riparian systems in the refuge complex (Hansen et al. 1995). During this climatic cycle, wetlands go through a dry marsh, regenerating marsh, degenerating marsh and a lake phase that is regulated by periodic drought and deluge (van der Valk 1981, Mitsch and Gosselink 2000, Euliss et al. 2004). During drought periods, seeds from annuals and perennials germinate and cover exposed mudflats. When precipitation floods the depressions, the annuals drown and the perennials survive, regenerating the marsh. Over a series of years, perennials dominate and submersed and floating-leaved hydrophytes return. After a few years of the regenerating phase, emergent vegetation begins to decline and eventually the marsh reverts to an open-water system. Muskrats may play an important role in the decline of emergent vegetation in some of these systems. During drought, the drawdown to mudflats is necessary so that emergent vegetation can become reestablished. Flooding, drawdown and the eventual exposure of mudflats drive the water-level vegetation cycle.

Wet–dry cycles are important for supporting water quality that supports vegetation and wildlife in wetlands. During wet cycles, contaminants such as salts, metals and nutrients are washed into wetlands. Agriculture and forestry operations, when adjacent, may cause nutrient and herbicide runoff. In saline soil marshes, increase in precipitation during exceptionally wet years can dilute the salt concentration in the soils, allowing less salt-tolerant species to occur. The dry cycles create periods where these toxins can be neutralized by wind, sun and chemical transformation to remove them from wetlands (Zhang and Moore 1997, Smith et al. 2008, Heitmeyer et al. 2009).

Similar to wetlands, healthy, productive riparian areas are supported by dynamic processes (MNHP 2011b). Random and variable flood events scour and redistribute sediments which create new locations for vegetation to become established. Once vegetation becomes established, it can further trap sediments which can elevate gravel bars and create backwater channels. This variability creates a variety of vegetation communities at different successional stages.

Benton Lake National Wildlife Refuge

Benton Lake historically was a large, seasonally flooded marsh that likely supported emergent vegetation during some years. Currently, portions of the wetland are permanently flooded and are more like a lake with relatively large areas of open water (see chapter 7 for more detail). The wetland is completely isolated from the regional ground water system by the presence of an impermeable layer of clay. Subsurface soil layers are restrictive to water movement and root penetration. The water can have increased salinity and be somewhat brackish. The historical gradation of vegetation zones within Benton Lake from robust emergents in deeper depressions to grasslands on uplands has been altered over time. Most historical vegetation communities are still present on the refuge, but their distribution and extent have changed. Developments for water management and subsequent altered hydrology and water chemistry in Benton Lake pools are responsible for most changes. Generally, communities have shifted from drier wetland vegetation such as western wheatgrass, foxtail barley and sedges to a more extensive distribution of wetter and more alkaline-tolerant species (for example, alkali bulrush and cattails). Increasing amounts of exotic and invasive species also now occur on the refuge (Heitmeyer et al. 2009).

ASSOCIATED WILDLIFE

A rich diversity of wildlife species use the Benton Lake basin ("Appendix D–Species List"). Aquatic invertebrates include a variety of Crustacea (such as Daphnia sp., Gammarus sp., and Hyalella azteca) and insects such as Corixid beetles, damselflies and dragonflies, Notonectid backswimmers, and Chironomids (Heitmeyer et al. 2009).

Several amphibian and reptile species also used Benton Lake including tiger salamanders, boreal chorus frogs, painted turtles, and common, western and plains garter snakes. There is one historical record of northern leopard frog on the refuge, but no recent occurrences. Fathead minnows are the only fish species occasionally present on the refuge.

Mammal species diversity and abundance in the Benton Lake wetland basin is relatively low, except for many small rodents such as mice and voles. Several species of bats likely use wetlands as foraging areas, but no formal surveys have been conducted. Muskrat often create openings in wetland vegetation with den building, but shallow water that freezes completely every year may be limiting numbers. Additionally, many mammal species that mostly use the uplands, such as coyote, white-tailed deer, mule deer, and pronghorn, use dry parts of the wetlands to forage and breed.

Many waterbirds breed in the Benton Lake area. The most common breeding species included eared grebe, mallard, northern pintail, gadwall, blue-winged teal, cinnamon teal, American wigeon, northern shoveler, redhead, lesser scaup, ruddy duck, Canada geese, American coot, American avocet, Wilson's phalaropes, marbled godwits, willets, Franklin's gull, white-faced ibis, black-necked stilt, and black-crowned night-heron.

Benton Lake Wetland Management District

Wetlands within the district, both on Service lands and throughout the landscape, are typically located in shallow depressions created by glacial activity during the last ice age. They are often found in complexes and in Montana, depressional wetlands are most concentrated to the north of Montana State Highway 2, from Glacier National Park to the North Dakota border. Individual depressions can also be found across the Northwestern Glaciated Plains north of the Missouri River.

SMALL, SHALLOW AND VEGETATED WETLANDS

Most wetlands within the district are relatively small, shallow, and vegetated and are typically known as marshes, swamps, bogs, fens and wet meadows (Cowardin et al. 1979). The underlying soils, hydrology, and water chemistry strongly influence the vegetation found in these wetlands in any given year.

Some of these small, shallow, and vegetated wetlands are isolated from both ground water and other wetlands by an impermeable layer such as dense clay. The major sources of inputs are precipitation and snowmelt, and water loss occurs through evapotranspiration. These wetlands are temporarily or seasonally flooded, with most filling with water only occasionally and drying quickly, which affects the plant communities that are present. The drawdown zone is typically dominated by western wheatgrass, foxtail barley, povertyweed, common spikerush, hardstem bulrush or willow dock. Species richness can vary considerably among individual wetlands and it is especially influenced by adjacent land use such as agriculture and grazing (MNHP 2011b).

Wetlands like these with more consistent water (for example, seasonal, semipermanent, and permanent) usually have a larger watershed and significant connection to ground water. Species diversity can often be high. These wetlands usually contain emergent vegetation such as cattails, sedges, spikerushes, rushes and bulrushes, as well as floating vegetation such as pondweeds, arrowhead, or common hornwort. When water recedes along the edges or during drought years, annuals and perennials, such as sedges, will germinate in exposed mudflats (MNHP 2011b).

Some of the small, shallow, and vegetated wetlands within the district have increased soil salinity due to high evaporation and the accumulation of minerals dissolved in the water. Salt-tolerant plants such as alkali bulrush, common three square, inland saltgrass, Nuttall's alkali grass, foxtail barley, red swampfire and freshwater cordgrass, and shrubs such as black greasewood are typical of these wetlands. Less salt-tolerate plants may occur in wet years when the salts are diluted (MNHP 2011b).

Prairie potholes occur in shallow depressions scraped out by glaciers in the northern Great Plains of Montana. The concentration of dissolved solids can vary considerably, even within the same year, although most prairie potholes contain alkaline water. Vegetation within these wetlands is highly influenced by hydrology and salinity. If water persists through the summer, monotypic stands of hardstem bulrush may occur with minor components of softstem bulrush or common threesquare along slightly drier margins. In permanently flooded sites, aquatic buttercups, aquatic smartweeds, pondweeds or duckweeds are common. In seasonal and temporary wetlands, vegetation generally occurs in bands from a wetter middle dominated by spikerush through a drier ring of foxtail barley and an outer margin of western wheatgrass or thickspike wheatgrass (MNHP 2011b). Potholes are most common in the district around the Sweet Grass Hills and the northern end of the Rocky Mountain Front.

Such wetlands with mineral soils that are subjected to long periods of anaerobic conditions can be found in the district as fringes around lakes or oxbows, and along slow-flowing streams and rivers as riparian marshes. The wetlands are typically seasonal or semipermanent. Seasonal wetlands typically have a central shallow marsh zone dominated by graminoids and sedges, while the deeper central marsh zone of semipermanent wetlands are dominated by cattails and bulrushes. Dominant vegetation often includes western wheatgrass, Northwest Territory sedge, Nebraska sedge, broadleaf cattail, and hardstem bulrush. Alkaline communities include western wheatgrass, freshwater cordgrass, and seashore saltgrass (MNHP 2011b).

More than 30 wetland basins, of this type, now exist on the H2–O WPA. These wetlands are primarily the remnants of natural oxbows basins that were created as the Blackfoot River meandered back and forth across the valley. Many of these wetlands were drained under earlier ownership, but have since been restored. With recent restoration of many of the wetlands, some of the wetter areas are beginning to revert to sedge and rush communities. However, quackgrass continues to dominate in many areas and it will take active management practices to convert these areas back to a more native composition.

LAKE-SYSTEM WETLANDS

Lake systems are less common on fee title lands across the district. These wetlands typically have deeper, more permanent water with <30 percent emergent vegetation (typically restricted to the edges) (Cowardin et al. 1979). Species associated with lake-system wetlands include sedges, creeping spikerush, broadleaf cattail and bulrush. Floating-leaved hydrophytes may be present in shallower areas of lakes, ponds and reservoirs, or in river backwaters. These include water lilies, yellow pondlily, buttercup, pondweed and duckweed. Submergents such as common hornwort, horned pondweed, mare's tail and water milfoil are also found in warm, shallow areas of lakes, ponds and reservoirs (MNHP 2011b). Examples of this type can be found on Arod Lakes WPA.

RIPARIAN AREAS

Riparian areas are associated with perennial to intermittent or ephemeral streams throughout the northwestern Great Plains. Flooding is important in riparian areas for seed dispersal, vegetation establishment and creating a diversity of vegetation communities such as forest, shrubland, wet meadows as well as gravel and sand flats. In the western part of Montana, the overstory is often dominated by species such as black cottonwood with narrowleaf cottonwood and Plains cottonwood occurring as co-dominants . Further east, narrowleaf cottonwood and Plains cottonwood become dominant. In wetter systems, the understory is typically willow and redosier dogwood with graminoids such as western wheatgrass and forbs like American licorice. Sagebrush may dominate in areas where the channel is incised. Overgrazing or agriculture can degrade riparian systems causing saltcedar and Russian olive to replace native woody vegetation (MNHP 2011b).

Riparian areas along the foothills and valleys of the mountains are generally comprised of a mosaic of trees and shrubs. Black cottonwood is the key indicator species. Other dominant trees may include boxelder maple, narrowleaf cottonwood, eastern cottonwood, Douglas-fir, peachleaf willow, or Rocky Mountain juniper. Dominant shrubs include Rocky Mountain maple, thinleaf alder, river birch, redosier dogwood, hawthorn, chokecherry, skunkbush sumac, willows, rose, silver buffaloberry, or snowberry. These riparian areas may be next to sage-steppe in moderately high intermountain basins (MNHP 2011b).

ASSOCIATED WILDLIFE

A rich diversity of animal species use the wetlands and riparian habitats of the district. The relative abundance of species and specific food and cover resources used by animals vary with the long-term dynamics of flooding and drying in the systems (Frederickson and Reed 1988, Batzer et al. 1999, Wrubleski 2005). Aquatic invertebrates reach high abundance and biomass during wet periods of long-term water cycles in Great Plains wetlands and include a rich diversity of Crustacea such as Daphnia sp., Gammarus sp., and Hyalella azteca and insects such as Corixid beetles, damselflies and dragonflies, Notonectid backswimmers, and Chironomids (Heitmeyer et al. 2009).

Several amphibian and reptile species use the district wetlands and riparian areas on the Plains. Amphibians include three species of frogs (boreal chorus, northern leopard, and Columbia spotted), four species of toads (plains spadefoot, Great Plains, Woodhouse's and western) and tiger salamanders. Reptiles include the common garter snake, plains garter snake, terrestrial garter snake, painted turtle and spiny softshell turtles (MNHP 2011). In the Blackfoot Valley, the Rocky Mountain tailed frog and long-toed salamander have also been documented (MNHP 2011). The presence and abundance of some common species like tiger salamanders, gartersnakes and boreal chorus frogs varies among years as flooding and drying changes resource availability and species susceptibility to being prey for other species groups (Heitmeyer et al. 2009).

Smaller prairie streams support native fish such as fathead minnows, white suckers and lake chubs (Holton and Johnson 1996). Several streams and rivers along the Rocky Mountain Front support pure strains of westslope cutthroat trout, and are considered highly significant for the east slope population. The Sun River was historically a stronghold for fluvial Arctic grayling, which vanished from the system because of habitat degradation. In the spring of 1999, grayling were reintroduced above Gibson Dam into the upper Sun River tributaries. A rare hybrid of the northern redbelly dace also occurs along the Rocky Mountain Front. There are currently 12 native fish species and 13 nonnative fish species in the Blackfoot River watershed, as well as several hybrid salmonids (MFWP 2010. Montana Fisheries Information System. MFWP, Helena, MT. http://fwp.mt/gov/fishing/MFish).

Mammal species diversity and abundance in the district wetlands is relatively low, except for many small rodents such as mice and voles. The relative abundance and productivity of wetland-dependent species like muskrat and mink tracks long-term hydrological and vegetation dynamics. Several species of bats may use wetlands as foraging areas, especially when flooded. Additionally, many mammal species that mostly used the uplands surrounding wetlands, such as coyote, white-tailed deer, mule deer, pronghorn, and elk may move into wetlands during dry seasons and years to forage and breed.

Many waterbirds use the district wetlands, but species richness, abundance, and production vary with the extent and duration of flooding in the basins. The most common breeding species included eared grebe, mallard, northern pintail, gadwall, blue-winged teal, cinnamon teal, American wigeon, northern shoveler, redhead, lesser scaup, ruddy duck, Canada goose, American coot, American avocet, Wilson's phalaropes, marbled godwits, willets, and black tern. During wetter periods of the long-term precipitation and flooding cycle many waterfowl, shorebirds, wading birds, gulls and terns, and other wetland-dependent species are present and productivity is high. Breeding waterbird productivity in the district wetlands ecosystem follows long-term dynamics of production in other northern prairie systems as vegetation, invertebrate, and nutrient cycling changes when wetlands dry, reflood, reach peak flooding extent, and then begin drying again (for example, Murkin et al. 2000).

Waterbird use across the district is high during fall and spring migration periods, both in wet and dry periods. During drier periods, extensive mudflat areas can attract shorebirds that use rich benthic and terrestrial invertebrate resources and drying wetlands concentrate aquatic prey that is used by wading birds, some terrestrial birds, and mammals.

George F. Russell / USDA–NRCS PLANTS Database

Broadleaf cattail is an emergent plant species in wetland habitat.

As water in the district rises during wetter periods, more of the basins are flooded in both spring and fall and provided critical migration stopover areas for waterfowl, shorebirds, wading birds, and other species such as birds of prey, songbirds, rails, and blackbirds. Bald eagle and peregrine falcon, raptor species of concern, are attracted to the region when large numbers of waterfowl and waterbirds are present (Heitmeyer et al. 2009).

Blackfoot Valley Conservation Area

As with other areas of the refuge complex, the Blackfoot Valley conservation area includes a rich diversity of wetland and riparian systems. Approximately 5 percent of the area is made up of wetland and riparian areas. The dominant riparian feature is the Blackfoot River and its associated tributaries. This is a cool to cold-water system with strong seasonal variability due to melting snow pack from higher elevation mountainous areas. The Blackfoot is a classic freestone trout river with boulder/cobble riffles, cobble/gravel runs and pools, and silt on the margins or in the deepest pools. Deep runs and pools with undercut banks and large woody debris provide the best fish habitats, while the riffles harbor diverse macroinvertebrate communities. The Blackfoot is a clear running river, except during spring run-off or where heavy livestock use, bank erosion or stream incisement has occurred in the watershed (MNHP 2011b).

As with other parts of the district, the Blackfoot Valley contains small, shallow and vegetated wetlands and lake-system wetlands that have already been described, however, it is more likely in these higher elevation areas that wetland may be dominated by woodland and forest vegetation.

In northwestern Montana, wooded small and shallow wetlands, or vernal pools, occur on valley bottoms, lower benches, toe slopes, and flat sites from elevations of 2,840-5,200ft. Wooded vernal pools glacially created, small, shallow, freshwater wetlands that partially or totally dry up by fall. Wooded vernal pools are often surrounded by grand fir, subalpine fir, western larch, Engelmann spruce, lodge pole pine, Douglas-fir, black cottonwood, and, to a lesser extent, quaking aspen and paper birch. Other common species include water starwort, inflated sedge, common spikerush, and reed canarygrass (MNHP 2011b).

In northwestern Montana, small, shallow and vegetated wetlands dominated by conifers with permanent or seasonal flooding are also known as conifer swamps. This is an uncommon wetland type often next to lakes, fens or wet meadows with areas of moving and stagnant water. Vegetation includes western red cedar, western hemlock, subalpine fir and Engelmann spruce forests. Some of the most typical understory species include American ladyfern, woodfern, skunk cabbage, field horsetail, arrowleaf groundsel, and bluejoint reedgrass. This system frequently borders fens and wet to mesic coniferous forest (MNHP 2011b).

ASSOCIATED WILDLIFE

There are currently five amphibians that have been documented in the Blackfoot Valley including Columbia spotted frog, long-toed salamander, Pacific tree frog, Rocky Mountain tailed frog, and western toad.

There are currently 12 native fish species and 13 nonnative fish species in the Blackfoot River watershed, as well as several hybrid salmonids (MFIS 2009).

The Blackfoot River watershed also provides quality breeding, nesting, migratory, and wintering habitat for a diversity of wetland-dependent bird species. Wetland complexes in the watershed provide important breeding habitat for 22 species of waterfowl:

- northern pintail
- mallard
- lesser scaup
- wood duck
- redhead
- ring-necked duck
- canvasback
- American wigeon
- Canada goose
- green-winged teal
- blue-winged teal
- cinnamon teal
- northern shoveler
- gadwall
- common goldeneye
- Barrow's goldeneye
- harlequin duck
- bufflehead
- hooded merganser
- common merganser
- red-breasted merganser
- ruddy duck

During the nesting season in 1995, 1996, and 1997, the University of Montana Wildlife Cooperative Unit and the Service conducted breeding-bird productivity studies in three separate properties within the Blackfoot River watershed including the Blackfoot WPA. Nest success for upland nesting waterfowl (measured by the Mayfield method), including pintail, mallard, and lesser scaup, was found to be 49, 30, and 45 percent, respectively (Fondell and Ball 1997). These nest success estimates are some of the highest in North America for upland nesting ducks. Fondell and Ball (1997) stated that "Because the [Ovando] Valley is relatively undisturbed these estimates may reflect nest success over large areas of the watershed."

Brood surveys of northern shoveler, gadwall, American wigeon, cinnamon and blue-winged teal, canvasback, redhead, ring-necked, ruddy, and Barrow's goldeneye ducks in 1995 and 1996 on the waterfowl production areas in the Blackfoot Valley averaged 63 broods on 5 wetlands totaling 104 acres, or 0.62 broods per acre, with prefledge brood sizes of 5.2 in 1995, and 5.9 in 1996, higher than brood sizes reported in studies conducted at Freezeout Lake Wildlife Management Area and at Benton Lake Refuge on the east side of the Continental Divide (Fondell and Ball 1997). This high productivity is due to the large expanses of relatively undisturbed native grassland in association with wetland habitat, a coyote-dominated predator base, and a high concentration of glaciated wetlands. Breeding waterfowl pair counts have shown relatively high pair densities per square section for redhead and canvasback ducks. Redhead duck numbers over the past 15 years have averaged 12 pairs per section and canvasback ducks at 9 pairs per section.

The Blackfoot Conservation Area has also had a successful trumpeter swan reintroduction project for the last several years. Please see the Species of Concern section for more details.

Rocky Mountain Front Conservation Area

This conservation area lies within the district and has a similar diversity of wetlands and riparian types as already described for the district. The Dearborn, Sun, and Teton Rivers form major riparian corridors running from the mountains eastward onto the prairies. Approximately 30 percent of the 700-plus plant species documented on the Front are associated exclusively with wetland or riparian habitats, including some of the largest remaining fens in the Pacific Northwest.

Fens are confined to specific environments defined by ground water discharge, soil chemistry, and peat accumulation. Fens form at low points in the landscape where ground water supports a constant water level at or near the surface most of the time. Constant high water levels typically lead to an relatively deep accumulation of organic material. Fens can be very diverse with a large number of rare and uncommon bryophytes and vascular plant species, and provide habitat for uncommon mammals, mollusks and insects.

Fens usually occur as a mosaic of herbaceous communities dominated by sedges, spikerushes, and rushes and woody plant communities of willow and birch carr shrubland. Forb diversity is especially high in fens. Fens are often found in association with other wetlands such as marshes, wet meadows, riparian shrublands, conifer swamps or wet to mesic coniferous forests (MNHP 2011b).

ASSOCIATED WILDLIFE

Several amphibians occur along the Front including three species of frogs (boreal chorus, northern leopard, and Columbia spotted), two species of toads (plains spadefoot and western), and two species of salamanders (tiger and long-toed). The common garter snake, plains garter snake, terrestrial garter snake, and painted turtle are reptiles known to occur along the Front (Maxell et al. 2003).

Several streams and rivers along the Front support pure strains of westslope cutthroat trout, and are considered highly significant for the east slope population. The Sun River was historically a stronghold for fluvial Arctic grayling, which vanished from the system because of habitat degradation. In the spring of 1999, grayling were reintroduced above Gibson Dam into the upper Sun River tributaries. A rare hybrid of the northern redbelly dace also occurs within the project area.

Lying at the western end of the PPPLCC's Prairie Pothole Region within the refuge complex, the Rocky Mountain Front provides habitat for a significant diversity of wetland-dependent bird species. Seventeen species of waterfowl breed within the project area, including the harlequin duck, which is found in several mountain streams. Three nesting pairs of rare trumpeter swans have been documented in the Bean Lake–Nylan Reservoir complex, one of the few breeding occurrences outside of the Centennial Valley in southwest Montana. Hundreds of thousands of snow geese migrate along the Front, including 40,000 Wrangel Island snow geese, representing 50 percent of the entire known population. Peak flights of waterfowl along the Front during spring and fall migration often exceed several million birds. Six species of grebes are known to nest including the red-necked grebe, a species in serious decline in many other areas. Eleven different species of shorebirds breed in the wetlands and adjacent grasslands scattered throughout the area. Several thousand sandhill cranes from the Rocky Mountain population use the river corridors during their spring and fall migration, and some of the cranes breed in these areas as well.

Swan River National Wildlife Refuge and Swan Valley Conservation Area

Most wetlands on the Swan River refuge are seasonal or semipermanent emergent or scrub-shrub wetlands (Cowardin et al. 1979, MNHP 2011b) that occur around Swan Lake or in oxbows of the Swan River. Historically, dominant vegetation in the Swan River wetlands may have included western wheatgrass, Northwest Territory sedge, Nebraska sedge, broadleaf cattail, and hardstem bulrush; however, today reed canarygrass is common (MNHP 2011b). The federally threatened wetland plant, water howellia, can be found on the Nature Conservancy Preserve that borders the southern edge of the refuge, but the plant has not been confirmed to exist on the refuge to date. The Swan River also flows through the refuge. Historically, the river corridor would have been prone to annual to episodic flooding, which would create a mosaic of multiple communities that are tree-dominated with a diverse shrub component. However, the extent to which modifications to the hydrology may be disrupting these processes is unknown.

The Swan Valley is unique among Montana's spectacular valleys in that it contains more than 4,000 glacially derived wetlands. In fact, approximately 16 percent of the land in Swan Valley is considered wetland habitat (lakes, rivers, ponds, marshes, wet meadows, peatlands, and riparian areas). By comparison, the remainder of Montana averages 1-percent wetland habitat. As with other parts of the district and the Blackfoot Valley, the Swan Valley contains small, shallow and vegetated wetlands, fens, and foothill/valley riparian areas and conifer swamps. In addition, Rocky Mountain wooded vernal pools are particularly well represented in the Swan Valley (MNHP 2011b).

ASSOCIATED WILDLIFE

Seventeen species of waterfowl breed on the refuge including common waterfowl species such as Canada geese, mallards, cinnamon teal and common goldeneye. Red-necked grebes, horned grebes, eared grebes, sora, Virginia rails, and marsh wrens are also common breeders. In addition, the refuge provides nesting sites for bald eagles. Yellow-headed blackbirds nest and forage on the refuge. White-tailed deer are the most common large mammal seen. Elk, moose, beaver, bobcat, grizzly and black bear are known to inhabit the area. Other resident wildlife are coyotes, muskrat and raccoons. Game fish include yellow perch, bull trout, northern pike, kokanee salmon, largemouth bass, cutthroat trout, brook trout and mountain whitefish.

Sixteen species of amphibians and reptiles are known to inhabit the diverse habitats within the Swan Valley. Many of the documented species include S4 Status Species (apparently secure, though it may be quite rare in parts of its range or is suspected to be declining) such as common garter snake, painted turtle, rubber boa, Columbia spotted frog, long-toed salamander, and Rocky Mountain tailed frog (MNHP 2011). The western toad is listed as a S2 Status Species (species at risk because of very limited or potentially declining population numbers, range or habitat, making it vulnerable to global extinction or extirpation in Montana). The northern leopard frog is listed as an S1 Status Species (at high risk because of extremely limited or rapidly declining population numbers, range or habitat, making it highly vulnerable to global extinction or extirpation in Montana). Species not listed in the Natural Heritage Database, but known to occur in the valley are Pacific tree frog, western skink, eastern racer, gopher snake, terrestrial garter snake, and western rattlesnake (Werner et al. 2004).

Common fish species of the Swan Valley include longnose suckers, largescale suckers, and slimy sculpin. In addition, potential species of concern within the project area include the brook stickleback and pygmy whitefish. Westslope cutthroat trout are currently a species of special concern, and use clear, cold lakes and streams found in the project area. Swan Valley Conservation Area is within the designated recovery area for the federally threatened bull trout. Critical habitat has been designated for bull trout within the project area.

Wetland complexes in the Swan Valley provide important breeding habitat for 21 species of waterfowl:

mallard
lesser scaup
wood duck
redhead
ring-necked duck
canvasback
American wigeon
Canada goose
green-winged teal
blue-winged teal
cinnamon teal
northern shoveler
gadwall
common goldeneye
Barrow's goldeneye
harlequin duck
bufflehead
hooded merganser
common merganser
red-breasted merganser
ruddy duck

The Swan Valley is one of the only watersheds in the western continental United States that supports breeding common loons. Currently, there are six breeding pairs in the Swan Valley on the Van, Loon, Summit, Lindbergh, Swan, and Holland Lakes. Historical records show Shey and Peck Lakes as being occupied by common loons.

Gene Nieminen / USFWS

Mallard Pair

Donna Dewhurst / USFWS

Redheads feed in large, open areas.

FORESTS AND WOODLANDS

Large parts of the Blackfoot Valley and Swan Valley CAs include forested lands. Healthy forests and wetland systems provide a host of watershed services, including water purification, ground water and surface flow regulation, erosion control, and stream bank stabilization. Carbon sequestration is the process by which atmospheric carbon dioxide is taken up by trees, grasses, and other plants through photosynthesis and stored as carbon in biomass (trunks, branches, foliage, and roots) and soils. The sink of carbon sequestration in forests and wood products helps to offset sources of carbon dioxide to the atmosphere and mitigate climate change.

Blackfoot Valley Conservation Area and Blackfoot Waterfowl Production Areas

There are approximately 260 acres of fee-title forest lands on the Blackfoot WPA. Management of the forest has consisted mainly of invasive plant control; there has been no logging or burning since the waterfowl production area was added to the Refuge System in the 1970s.

Stands of large ponderosa pine historically dominated most dry forest sites in western Montana. These dry forests are also comprised of a mix of ponderosa pine and Douglas-fir. Logging and fire suppression has resulted in an alteration of age-class structure, physical structure, tree density, and tree species composition (Barrett 1979, Shepperd et al. 1983). Large, old-growth trees in more open settings have been replaced with dense stands of younger trees.

Swan River National Wildlife Refuge and Swan Valley Conservation Area

There are approximately 300 acres of fee-title forest lands on the Swan River Refuge. Management has consisted mainly of invasive plant control; there has been no logging or burning since the refuge was added to the Refuge System.

The Swan Valley lies at the border of the maritime and continental climates and thus has a mixture of Pacific Coastal Forest and intermountain tree species. Western red cedar, grand fir, western hemlock, and western larch grow in the valleys, along with more familiar species such as Douglas-fir, Engelmann spruce, ponderosa pine, and lodge pole pine.

Cottonwood and spruce also dominate much of the Swan River's floodplain. Most of the lower elevation uplands consist of mixed conifers dominated by Douglas-fir, western larch, ponderosa pine, and lodge pole pine. Other common species include grand fir and subalpine fir. Stand types at most of the low-elevation lands range from regenerated seedling and pole stands, to mixed-aged stands of mature timber. For the lower elevations, typical forest rotations for saw timber range from 50–75 years. Forest types on the higher lands consist primarily of subalpine fir and lodge pole pine, with components of western larch, Douglas-fir, whitebark pine, and other species.

ASSOCIATED WILDLIFE

Many priority bird species are closely associated with old forest stages and snags, such as the Lewis's woodpecker, pileated woodpecker, olive-sided flycatcher, flammulated owl, white-breasted nuthatch, and Williamson's sapsucker. Regional populations of these species have decreased due to the reduction of old forest stages. Olive-sided flycatchers, flammulated owls and black-backed woodpeckers are all level one priority species for the Montana Partners In Flight program. They are found in open canopy woodlands, open-canopy ponderosa pine and closed-canopy lodge pole pine, respectively.

Sixty-nine species of mammals are known to inhabit the diverse habitats within the Swan Valley. Many of the species documented include S2 Status Species such as the grizzly bear and Townsend's bat. Other species include S3 Status Species such as the wolverine, fisher, hoary bat, fringed myotis, hoary marmot, and Canada lynx, a federally threatened species. The refuge complex does not have enough fee-title forested habitat to provide all life needs for species such as lynx, gray wolf, and grizzly bear. However, complex fee-title and easement lands secure important linkage and connectivity between critical habitats on adjacent forested lands.

Game species known to occur in the valley are moose, elk, white-tailed deer, mule deer, bighorn sheep gray wolf, and mountain goat (Foresman 2001). The forest units are located in areas with robust deer and elk populations. A diverse forest with varying age classes and stand types is important to ungulate survival. Early successional forests provide abundant shrubs and forbs that are important forage species for elk and deer. Older forests with dense canopy cover are important for thermal regulation. Forests also provide important hiding and escape cover.

Other species documented to occur within the valley follow (Foresman 2001):

northern pocket gopher
southern red-backed vole
long-tailed vole
montane vole
heather vole
northern grasshopper mouse
house mouse
Norway rat
northern bog lemming
yellow-bellied marmot
northern flying squirrel
coyote
red fox
striped skunk
long-tailed weasel
mink
badger
raccoon
white-tailed jackrabbit
mountain cottontail
porcupine

SAGEBRUSH-STEPPE

In the refuge complex, most of this system is dominated by mountain big sagebrush. Three tip sagebrush is found where it functions primarily as a seral component, increasing in frequency following fire. Antelope bitterbrush may codominate, but as a codominant is of very limited occurrence, being found primarily on intrusive volcanics in western and west-central Montana. Other shrubs may be present, but usually at low cover values (5–10 percent). Species include rubber rabbitbrush, and green rabbitbrush, wax currant, Woods' rose, deerbrush ceanothus, snowberry and serviceberry (MNHP 2010a).

The herbaceous layer is usually well represented. Graminoids that can be abundant include rough fescue, Idaho fescue, bottlebrush squirreltail, pinegrass, needlegrass, spike fescue, poverty oatgrass, western wheatgrass, mountain brome, slender wheatgrass, prairie Junegrass, bluebunch wheatgrass, Sandberg's bluegrass, and are variety of dry, upland sedges such as threadleaf sedge and Geyer's sedge (MNHP 2010a).

Forb diversity is moderate to high, commonly exceeding 30 species in a 400 m2 macroplot. Species may include arrowleaf balsamroot, Indian paintbrush, cinquefoil, fleabane, phlox, milkvetch, prairie smoke, lupine, buckwheat, yarrow, rosy pussytoes, wild strawberry, and western sagewort (MNHP 2010a).

Fire is critical to supporting native grassland–sagebrush communities. The historical fire regime in rough fescue communities, for example, was characterized by frequent return-interval (5–10 years), low-severity fires. The historical fire regime in sagebrush communities was characterized by longer return-interval (more than 25 years) stand-replacement fires.

Sagebrush-steppe areas in the refuge complex were targeted by early European settlers for grazing and farm lands. Today, most of the native grassland–sagebrush communities are located on private land. The big sagebrush-dominated plant community type is most prevalent in the middle Blackfoot Valley south of the Blackfoot River. The big sagebrush–rough fescue plant association, endemic to west- and north-central Montana, is common in the Kleinschmidt Flat area. The three-tip sagebrush–rough fescue plant association is common in the Ovando area, yet found nowhere else in the world.

Sagebrush-steppe habitat occurs in the Blackfoot River watershed on approximately 56,000 acres (4 percent of total watershed acres). The Service owns in fee title 2,585 acres of sagebrush–steppe and has 12,750 acres of sagebrush-steppe under Western Montana conservation easements.

Associated Wildlife

High-priority species such as the Brewer's sparrow and loggerhead shrike build nests aboveground in shrubs or rely specifically on shrubs for cover. Brewer's sparrows, in particular, have experienced significant declines in the last 10–20 years and are good habitat indicator species because they appear to be sensitive to habitat changes at multiple scales (Knick et al. 2003). Brewer's sparrow is strongly associated with sagebrush, preferring sites with more than 13 percent sagebrush cover with an average canopy height less than 5 feet and more than 25 percent of cover in native, climax species (Bock and Bock 1987, Rotenberry et al. 1999). This sagebrush obligate was the most abundant breeding species found at sagebrush sites on the Blackfoot and Kleinschmidt Lake WPAs during Service productivity surveys in 1996 (Fondell and Ball 1997). The long-term viability of Brewer's sparrows in Montana depends on the maintenance of large stands of sagebrush in robust condition (PIF 2000).

INVASIVE AND NONNATIVE PLANTS

Benton Lake National Wildlife Refuge

The refuge is generally free from highly invasive, noxious weeds. Through EDRR, early colonizing plants of spotted knapweed and leafy spurge, in particular, have been eradicated every year and prevented from spreading. Canada thistle has been present for many years on the refuge; thistle patches are found near many roads, dikes, wetland edges and other disturbed areas. Some dense stands have been treated with success, but most areas go untreated.

Across the wetland and grassland habitat on the refuge; however, several nonnative species are of concern for their effect in changing the native habitat, even if they are not on the State's noxious weed list.

CRESTED WHEATGRASS

Crested wheatgrass has been the most commonly planted exotic grass in western North America since the early 1900s. Invasion of this species into native rangeland can have a negative effect on plant and wildlife diversity (Reynolds and Trost 1981, Christian and Wilson 1999, Davis and Duncan 1999). Crested wheatgrass was used to landscape areas around the refuge headquarters area in the 1960s and to revegetate roadsides and other areas of disturbance. Since then, it has spread throughout the refuge to varying degrees and covers approximately 400 acres. The refuge has begun a pilot program to evaluate the most effective methods for controlling crested wheatgrass and restoring the native vegetation.

RUSSIAN OLIVE

This species is adaptable in semiarid and saline environments and has been promoted as a source of food and cover for some wildlife species (NRCS 2002), particularly ring-necked pheasant. With this in mind, refuge staff planted Russian olive trees on the refuge until the 1970s. Since that time, research has shown that Russian olive and other nonnative trees fragment native prairie by causing avoidance of these areas by some nesting grassland birds and increased predation of nests, adults, and juvenile grassland-dependent birds (Delisle and Savidge 1996, Gazda et al. 2002, Helzer 1996, Johnson and Temple 1990). Fortunately, at Benton Lake, Russian olive trees have not spread and are generally confined to shelterbelts where they were planted or single individuals scattered on the refuge.

JAPANESE BROME

This grass has been present in the refuge complex for many years with almost no attention given to treatment. Efforts are currently underway to map and estimate the extent and density of the infestation on the refuge. The degree to which this species affects wildlife use of native prairie is unknown. It is possible that Japanese brome decreases naturally during wetter periods (NRCS 2005), making aggressive control unnecessary.

KENTUCKY BLUEGRASS

This grass has been present in the refuge for many years with almost no attention given to treatment. Efforts are currently underway to map and estimate the extent and density of the infestation. Recent inventories in the Dakotas have shown that many areas of native sod on fee-title lands in the northern Great Plains have become heavily invaded with Kentucky bluegrass, which is associated with loss of floristic and avian diversity as well as negatively affected nutrient pools, energy flows, soil invertebrate and mycorrhizal relationships, and water cycles (Murphy and Grant 2005, Grant et al. 2009).

GARRISON CREEPING FOXTAIL

Creeping foxtail is an introduced rhizomatous perennial species. It has regenerative advantage on sites with conditions transitional between the more regularly flooded alkaline communities such as alkali bulrush and areas formerly dominated by foxtail barley at higher elevations. Its distribution has expanded substantially through the Benton Lake Refuge in recent years and generally occurs in bands or zones lying immediately above the zone occupied by cattail.

CHEATGRASS

This grass has been present in the refuge complex for many years with almost no attention given to treating it. It is mostly restricted to the southeast part of the refuge east of the Bootlegger Road. It is of concern because of its interaction with fire. Prescribed fire is the primary management tool at Benton Lake; however, cheatgrass can readily spread after burning. Work to map the infestations and to develop a preburn treatment plan is in progress.

Other nonnative species that occur in low numbers or to a limited extent but could become an invasive problem include smooth brome, reed canarygrass, salsify, alfalfa and yellow sweetclover.

Benton Lake Wetland Management District

All 22 waterfowl production areas have been surveyed for noxious weeds at least once over the past 5 years, through the efforts of the Invasive Species Strike Team. Most of the waterfowl production areas have relatively small and annually variable infestations of Canada thistle, houndstongue, and a few other noxious weeds. Known infestations are treated on an annual basis as time allows. High priority noxious weed infestations are described below:

- Jarina WPA has one known patch of leafy spurge approximately 0.1 acre in size and scattered patches of spotted knapweed that collectively amount to approximately 2 acres.

- Arod Lakes WPA has scattered patches of Russian knapweed over approximately 5 acres.

- Schrammeck Lake WPA has scattered patches of Dalmatian toadflax which collectively cover approximately 1 acre.

Cool-season exotic invasive grasses in the district are primarily Kentucky bluegrass, smooth brome, and crested wheatgrass. Prescribed grazing and fire are the management tools currently used to combat these species on native prairie. The district is part of the collaborative Native Prairie Adaptive Management Project within Region 6 designed to find management scenarios to reverse Kentucky bluegrass and smooth brome infestations across the region.

Blackfoot Valley Conservation Area

Since 1994, the Blackfoot Challenge Weeds Committee, which the Service is a participant of, has coordinated and implemented a holistic strategy for managing undesirable, invasive and noxious weeds in the watershed. Combining action with education, the core of the program is the locally led Vegetation Management Areas program, where neighbors work across property boundaries to manage weeds.

Almost 475,000 acres are under active weed management with 380 private landowners participating in the project. Integrated weed management strategies include herbicides, biocontrol, revegetation, multispecies grazing, hand pulling, plowing, mowing, prevention and EDRR (Blackfoot Challenge and Trout Unlimited. 2009).

On fee-title lands, the local manager and Invasive Species Strike Team have mapped infestations and are actively managing these infestations through biocontrol, chemical control and monitoring. The species of most concern are leafy spurge, yellow toadflax, Russian and spotted knapweed, common tansy, hound's-tongue, oxeye daisy, and Canada thistle.

Rocky Mountain Front Conservation Area

The Service recognizes the Front as one of the Nation's most significant wildlife areas and identifies invasive weeds as one of three primary threats to the Front's ecological integrity. Of the 2 million acres on the Front, noxious weeds infest an estimated 32,000 acres. Weeds have negative economic effects by reducing the productivity of farms and ranches, degrading water quality, reducing the quality and quantity of forage for elk, deer, pronghorn and other wildlife and adversely affecting outdoor recreation.

Cassondra Skinner / USDA–NRCS PLANTS Database

Crested wheatgrass is a nonnative species that can have a negative effect on plant and wildlife diversity.

Concerned private landowners, nongovernmental organizations, State agencies, Federal agencies and the Service have active partnerships along the Front to address noxious weed issues. These groups have organized, generally, along major watersheds to map and treat weeds as well as educated others on prevention and control. Spotted knapweed and leafy spurge are currently the primary noxious weed infestations along the Front.

Swan River National Wildlife Refuge

Much of the native vegetation in the wetlands of the refuge has been replaced with reed canarygrass. A complete inventory of reed canarygrass and other invasives has not been done on the refuge.

Swan Valley Conservation Area

The most common noxious weeds in the Swan Valley are spotted knapweed and oxeye daisy. The noxious orange and yellow hawkweeds are relatively new but rapidly spreading. The possibility of purple loosestrife, tansy ragwort, and yellow flag iris becoming new invaders is also of concern in the Swan Valley.

THREATS

Primary threats to native habitats and wildlife within the complex include energy development, housing development and agricultural conversion. Oil, gas and wind development activity has increased recently in the wetland management district. Loss and fragmentation of habitat are among the significant ecological impacts from access roads, drill pads, pipelines, waste pits, and other components of the oil and gas project infrastructure. These impacts extend beyond the physical structures. Studies show that the actual ecological footprint of oil and gas extraction stretches across rangelands and forested lands for a considerable distance (Weller et al. 2002).

During strong markets for scenic western properties, especially when cattle prices are low, there is concern that ranches, particularly in the Blackfoot Valley and the Rocky Mountain Front, will be vulnerable to sale and subdivision for residential and commercial development. Housing development, and the associated infrastructure, can disrupt wildlife migration patterns. Nesting raptors and grassland bird species may be especially vulnerable to habitat fragmentation in the Blackfoot Valley. Riparian habitat loss due to development is also a key concern. Riparian habitat is a key component to grizzly bear movement between the mountains, valleys and prairies. Livestock grazing and ranching practices tend to be compatible with grizzly bears, which move unimpeded up and down riparian corridors. Riparian areas also provide nest sites for many species of migratory birds that may be negatively impacted by development. In addition, housing developments can add sewage-derived nutrients to streams and lakes, increase wetland drainage and water diversion, and introduce invasive species which can affect threatened species, such as the bull trout.

Historically, the northern mixed-grass prairie system stretched from northern Nebraska into southern Canada and westward through the Dakotas to the Rocky Mountain Front in Montana; now it covers only approximately 104,000 square miles. This is one of the most disturbed grassland systems, where an estimated 75 percent of the region has been heavily altered. Much of the conversion, and continued threat, within the complex is in the central part of the wetland management district, also known as the "Golden Triangle". This agricultural designation, includes Great Falls as its apex, and then roughly runs northeast through Havre, west to Cut Bank and back to Great Falls. The area produces approximately half of Montana's wheat, primarily winter and spring wheat, and is the most productive of the State's farming areas that are not irrigated. Only a few remaining areas of mixed-grass prairie in the complex have escaped conversion to agriculture (NatureServe 2008). These grasslands are prominently represented in the district along the Rocky Mountain Front, surrounding the Sweet Grass Hills and in Glacier County on the Blackfeet Indian Reservation.

WILDLIFE DISEASE

Regular surveillance and response preparedness for wildlife diseases are on-going within the refuge complex. Currently, the high priority wildlife diseases are botulism, West Nile virus and chronic wasting disease.

Botulism

Avian botulism outbreaks, caused by the ingestion of a toxin produced by the bacterium Clostridium botulinum, have occurred at Benton Lake at least since the mid-1960s (USFWS 1961–99). Occurrence of botulism at Benton Lake before the 1960s is unknown (no records or monitoring data are available), but documentation of historic outbreaks in other large wetland basins in the western U.S. suggest it probably occurred at least in some years (for example, Wetmore 1915, Giltner and Couch 1930, Kalmbach 1930, Wobeser 1981). Arod Lakes WPA also has a history of botulism outbreaks. District staff conduct periodic checks during late summer at this area.

West Nile Virus

A surveillance program for West Nile virus is ongoing at the Benton Lake Refuge. Cascade County conducts annual mosquito trapping in conjunction with weekly surveillance routes for avian mortality conducted by refuge staff.

Chronic Wasting Disease

Weekly surveillance and opportunistic sampling for chronic wasting disease has occurred on the refuge complex since 2004. To date, no occurrences of chronic wasting disease has been detected in wild ungulates in Montana.

HABITAT MANAGEMENT ACTIVITIES

The Service manages habitats through several refuge management activities under specific, prescribed conditions to meet habitat demands for a diverse suite of species—cooperative farming, prescribed fire and haying, and prescriptive grazing.

Cooperative Farming

When lands are included into the Refuge System as waterfowl production areas they often contain cropland or degraded stands of tame grasses instead of native habitat conditions. In these cases, the cropland is usually seeded back to native cover or DNC for waterfowl. Native grass seed is generally more expensive and native grass stands are often more difficult to establish.

If tame grass stands are in very poor condition or have serious weed problems, farming to create a clean seedbed may be required for 2–4 years. Farming and seeding is used only to reestablish grassland or nesting cover and return an altered landscape to a more native condition. The interim crops such as grain can provide some short-term, immediate benefits to local and migrating wildlife and as an erosion control measure. In the long term, the real benefit is the increase in nesting habitat that result from this activity.

Often the Service conducts farming and seeding operations in cooperation with local farmers. Benefits to the local economy are limited but the farming permittee should experience some economic gain. However, finding a cooperator willing to farm can be a limiting factor.

Prescribed Fire

Prescribed fires have been used in the northern Great Plains and Rocky Mountains for native species management by both public and private agencies. Fire is used to remove litter and ladder fuel, control noxious weeds, reduce woody vegetation or to improve the height and density of planted cover. Prescribed fire has been used as a management tool to manage grasslands in the refuge complex since 1975. Fire can be very important to the natural health and vigor of grasslands and shrublands. Fire releases nutrients tied up in vegetative matter, and removes dead vegetation that inhibits new growth. Fire can suppress exotic plant species and prevent the invasion of woody species such as juniper into native grasslands. However, fire may also allow invasion of fire tolerant species such as cheat grass and spotted knapweed.

Application of burning to grasslands that have evolved with fire can enhance vegetative growth, improve plant reproduction, and attract or concentrate wildlife. Regrowth following fire can be especially attractive to wildlife because of increased nutrition and palatability, and plants are often larger and more vigorous after a short recovery period. Blackened soil warms more quickly in the spring resulting in more rapid plant growth and seed germination and can make soil invertebrates more available for wildlife. Nutrients are released from dead vegetation and are more readily available for new plant growth. Prescribed fires, when done properly, can increase habitat diversity by creating edges between habitat associations, which makes the area more attractive to wildlife. However, burning of upland vegetation results in a very intense removal of cover and the temporary loss of fire sensitive species such as sagebrush.

Haying and Mowing

Haying and mowing management strategies are generally used to enhance tame grass or tame grass–legume stands and to control spread of invasive weeds. Haying temporarily removes residual, dead, and matted vegetation, and stimulates new growth, which improves habitat structure and diversity. Seed production, seed germination and growth of desirable plants can result from properly timed haying. The duration of the treatment period is relatively short and manageable. Haying is very selective relative to location of treatment. Removal of vegetation allows early warming of soils in the spring, which stimulates earlier green up and invertebrate production.

Proper management of DNC may provide quality habitat up to 8 years without disturbance, it is


James Graham / USFWS

The Service uses prescribed fire to rejuvenate grasses and reduce vegetative litter.

the periodic vegetation treatments such as haying that capitalize on the relationship between young, vigorous stands of vegetation and higher wildlife production (Duebbert et al. 1981). With a rotational management plan that periodically rejuvenates the tame grass stand productivity can be greatly increased.

Prescriptive Grazing

Grazing effects on grassland communities and woody riparian habitats have also been the subject of many studies. The effects of grazing on plant diversity depend on grazing intensity, the evolutionary history of the site and climatic regimes. Hoof impact by grazing animals can break up capped soils, improve the water cycle, stimulate vegetative reproduction of stoloniferous grasses, and enhance the decomposition of old plant material by breaking up plant litter. Hoof action can also distribute and trample seeds into soils, increasing chances of successful germination (Laylock 1967). Nutrients are returned to the soil in the form of urine and feces. Cattle may return 80–85 percent of the nitrogen ingested with plant tissue.

Grazing intensity and frequency can be regulated to enhance species diversity of both plants and animals. For example, summer grazing can create fresh fall and winter regrowth as forage for elk and mule deer. Certain levels of grazing can provide habitat diversity and patchiness, particularly in areas of higher precipitation. Cattle dung hosts invertebrate production, undigested plant parts, and newly germinated seedlings, which in turn can be used by wildlife as food. Grazing can be much more species selective than mowing, burning, or chemical treatments. For example, grazing in uplands can stimulate germination and production of grasses without affecting the sagebrush and other species that are important elements of the habitat, while fire removes all flammable material with which it comes in contact.

Grazing is a tool that, when used properly, removes old vegetation, stimulates new plant growth, restructures vegetation, affects plant species composition, and enhances animal diversity. Development of proper grazing strategies is essential to using this tool properly. The objectives of grazing are to help the wildlife species first and foremost, and economic benefits are a secondary consideration. The needs of wildlife and their habitats are the primary determining factors of any habitat management strategy. Determining the proper number of animals to be placed on an area is the principal factor affecting the relative success of any grazing management strategy (Heitschmidt and Sluth 1991). The timing, frequency, and intensity of grazing are the three main variables available to managers when designing a grazing plan.

- Timing refers to the period when livestock will be placed on a parcel of land. It is generally related to the plant phenology (spring=growth period, summer=active growth and reproduction period, fall=reproduction and carbohydrate storage, and winter=dormancy).

- Frequency is the time interval between applications of active treatment strategies. These can range from more than one treatment per year, to annual, alternate year, or greater than 1 year (periodic).

- Intensity has been defined as the proportion of current years forage production that is consumed or destroyed by grazing animals. This classical definition refers to the amount of palatable plant matter physically removed by cattle from a parcel of land and this is generally expressed in animal unit months (AUMs). AUMs are determined by multiplying the number of animals by the number of days spent on the grazed area, divided by 30.4 (the average number of days in a month). The amount of forage in an AUM is approximately 794 pounds. For example, 55 cows graze an area for 21 days. (55x21)/30.4=38 AUMS. This is approximately 30,172 pounds of forage or 15 tons (38x94=30,172 pounds).

Grazing intensity as it relates to wildlife habitat and cover may be more accurately defined as the amount of standing residual and current vegetation (cover) that is removed or destroyed by grazing animals in relation to the pretreatment standing cover. This definition is different because it addresses the factor of cover in the management of uplands and other areas where the objective is to provide nesting cover. In areas where grazing is to be used to reinvigorate and restore cover, the measure of cover removal will be more meaningful. This can be expressed in a percentage figure of removal of aboveground biomass for planning purposes, and then after monitoring, it can be converted into an AUM figure for ease of developing future grazing prescriptions for that specific field.

Specific management plans can be prepared for each unit (where grazing is used) to address the timing, frequency and intensity of treatment and make sure that wildlife objectives are being met. Short-duration, high-intensity grazing will be the most commonly used form of grazing. A sufficient number of animals will be placed on a given parcel of land to remove the desired amount of standing vegetation within a short period. Under this system, the animals are forced to consume available vegetation instead of being allowed to be so selective that they repeatedly graze only the more palatable plants. Ideally, the plants should be grazed only once during the growing period, and even longer periods of rest will be used to make sure that there is enough vegetation regrowth and accumulation for proper wildlife cover.

4.3 Species of Concern

For the purposes of this planning document, species of concern are defined as follows:

- Those species listed under the ESA as endangered, threatened, or candidate species.

- Bald and golden eagles as protected under the Bald and Golden Eagle Protection Act.

- Native species that are considered to be at risk in Montana due to declining population trends, threats to their habitat, or restricted distribution as defined by the MNHP (2009).

FEDERALLY LISTED SPECIES

The ESA (Endangered Species Act of 1973, 16 U.S.C. 1531 et.seq.) requires Federal agencies to carry out conservation (recovery) programs for listed species and to make sure that agency actions are not likely to jeopardize the continued existence of listed species or adversely change or destroy their critical habitat. Section 7(a) of the act requires Federal agencies to evaluate their actions with respect to any species that is listed as endangered or threatened and with respect to its critical habitat, if any is being designated. Further, regulations implementing the interagency cooperation provision of the act codified at 50 CFR part 402. Section 7(a)(2) requires Federal agencies to make sure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of any species listed as endangered or threatened, or to destroy or adversely change its critical habitat.

Key federally listed species that occur in the refuge complex include the threatened bull trout, grizzly bear, water howellia and Canada lynx (table 8). Candidate species that occur on the refuge complex include greater sage-grouse, Sprague's pipit and wolverine. The piping plover, pallid sturgeon, black-footed ferret and arctic grayling are all species that are listed under the ESA, but they are either no longer present on refuge complex lands or the Service's management strategies are not expected to affect them.

Bull Trout

Bull trout are a cold-water fish of relatively pristine stream and lake habitat in the Pacific Northwest of the United States. Bull trout need the coldest water temperatures of any northwest salmonid, and they need the cleanest stream substrates for spawning and rearing. These trout need complex habitats: streams with riffles and deep pools, undercut banks, and lots of large logs. In addition, bull trout need connections from main river, lake, and even ocean habitats to headwater streams for annual spawning and feeding migrations.

For listing purposes, the Service divided the range of bull trout into distinct population segments consisting of 27 recovery units. The Blackfoot River and Swan River watersheds lie within the Clark Fork River Recovery Unit and the Upper Clark Fork Recovery Subunit. Within this subunit, both the Swan River and Blackfoot River watersheds have been identified as core recovery areas (USFWS 2002a). The watersheds also have multiple stream reaches identified as critical habitat within the Clark Fork River Basin (USFWS 2010b).

Within the Blackfoot River watershed, bull trout densities are very low in the upper Blackfoot River, but increase downstream of the North Fork. Streams that appear to be particularly important for the spawning of migratory bull trout include Monture Creek, the north fork Blackfoot River, Copper Creek, Gold Creek, Dunham Creek, Morrell Creek, the west fork Clearwater River, and the east fork Clearwater River. Bull trout spawner abundance is indexed by the number of identifiable female bull trout nesting areas (redds). Data show that Monture Creek has an upward trend from 10 redds in 1989 to an average of 51 redds in subsequent years (Pierce et al. 2008). The North Fork also shows an upward

Table 8. Federally listed endangered, threatened, and candidate animal species within the Benton Lake National Wildlife Refuge Complex, Montana.

	Status	*National Wildlife Refuges*		*Wetland Management District*	*Conservation Areas*		
		Benton Lake	Swan River	Benton Lake	Blackfoot Valley	Rocky Mountain Front	Swan Valley
Pallid sturgeon	LE			x			
Black-footed ferret	LE			x		x	
Bull trout	LT,CH		x	x	x		x
Arctic grayling	C			x	x	x	x
Grizzly bear	LT		x	x	x	x	x
Canada lynx	LT,CH		x	x	x	x	x
Piping plover	LT			x			
Water howellia	LT		x				x
Sprague's Pipit	C	x		x		x	
Greater sage-grouse	C			x			
Wolverine	C		x	x	x	x	x

(C = Candidate species, LE = Listed endangered, LT = Listed threatened, CH =Critical habitat identified)
Note: The gray wolf was delisted in May, 2011. Management of the species has been turned over to individual states with oversight by the Service. On June 30, 2011, the Service found that listing the fisher in the U.S. northern Rocky Mountains as threatened or endangered is not warranted at this time.

trend from 8 redds in 1989 to an average of 58 redds between 1989 and 2008. The Copper Creek drainage (including Snowbank Creek) has experienced a resurgence of bull trout redds—from 18 in 2003 to 117 in 2008—since the 2003 Snow Talon Fire. The total number of redds counted in these three streams (Monture Creek, North Fork, and Copper Creek) increased from 39 in 1989 to 217 in 2000. With the onset of drought, bull trout redd counts then declined to 147 in 2008. These changes are attributed to protective regulations first enacted in 1990, restoration actions in spawning streams during the 1990s and a period of sustained drought between 2000 and the present (Pierce et al. 2008).

Within the Swan watershed, the bull trout population has remained strong. The Swan Lake population is stable because fish can access about 150 miles of quality tributary spawning habitat. Most other bull trout populations are declining, because of habitat degradation, but many of the Swan Valley's tributary streams are in good to excellent condition.

Continuous, identifiable female bull trout nesting areas (redd) count history dating to 1982 is available for bull trout for four index streams in the Swan River watershed (MFWP 2009). Bull trout may have reached equilibrium in this system at a population level of about 2,000 adults and the current trend appears stable. The total redd count was 598 in 2008, representing roughly 2,000 adults in the spawning run. Given that some adults do not spawn every year, the total adult population is likely more than 2,500 adult bull trout.

One of the biggest threats to bull trout survival is increased development, which exacerbates temperature problems, increases nutrient loads, decreases bank stability, alters instream and riparian habitat, and changes hydrologic response of affected watersheds.

Canada Lynx

The Canada Lynx Recovery Outline categorized lynx habitat and occurrence within the contiguous United States as (1) core areas, (2) secondary areas, and (3) peripheral areas. Core areas are defined as the areas with the strongest long-term evidence of the persistence of lynx populations. Core areas have both persistent verified records of lynx occurrence over time and recent evidence of reproduction. Six core areas and one provisional core area are identified within the contiguous United States (Nordstrom et al. 2005). The Blackfoot and Swan watersheds contain lands designated in the Northern Rocky Mountain–Northeastern Idaho Core Area, which supports the highest density lynx population in the northern Rocky Mountain region of the lynx's range. It acts as a source for lynx and provides connectivity to other parts of the lynx's range in the Rocky Mountains, particularly in the Yellowstone area (Federal Register 2009).

The Swan River and Blackfoot River watersheds are a stronghold for the Canada lynx in the northern Rocky Mountains. Based on ongoing research in these watersheds, lynx populations appear stable, although low reproductive rates are characteristic of this population. Since 1998, more than 80 lynx have been monitored in this area, providing information on habitat use, reproduction, mortality, and movement. This research has shown that these watersheds contain some of the best remaining habitat for lynx in the continental United States. Large, intact spruce–subalpine fir forests above 4,000 feet in this area provide quality habitat for lynx and for snowshoe hares, the primary lynx food source. Regenerating forest stands are often used as foraging habitat during the snow-free months while older, multistoried stands serve as denning and year-round habitat (Blackfoot Challenge 2005).

Grizzly Bear

Grizzly bears are currently listed as a federally threatened species in the Northern Continental Divide Ecosystem (USFWS 2011a). This ecosystem is an area of the northern Rocky Mountains with large blocks of protected public land containing some of the most pristine and intact environments found in the contiguous United States. Despite dramatic losses of habitat throughout North America, the grizzly bear has supported a presence in Montana and occurs in parts of the Blackfoot and Swan watersheds and along the Rocky Mountain Front.

The Northern Continental Divide Ecosystem supports the largest population (765 individuals) of grizzly bears in the lower 48 States. In 2003 and 2004, 29 individual grizzly bears were confirmed in the Blackfoot River watershed and 45 grizzly bears were confirmed in the Swan Valley watershed. The USGS estimates that at least 40 bears are present during all or part of the year in the Blackfoot River watershed (USGS 2004) with 61 present in the Swan Valley.

Lakes, ponds, fens and spring-fed creeks, common in parts of the Swan River and Blackfoot River valley floors, provide excellent bear habitat. Additionally, the vegetation found along certain reaches of both rivers and their tributaries provide bears with cover, food, and natural movement corridors.

Supporting linkage areas is important to the continued survival of the grizzly bear. The grizzly bear has an increased risk of extinction because the population consists of a limited number of individuals that live in several distinct populations geographically isolated from one another. Small populations are less able to absorb losses caused by random environmental, genetic and demographic changes (Serveen et al. 2001). Linkage zones are areas between separated populations that provide adequate habitat for low densities of individuals to exist and move between isolated populations. The resulting exchange of genetic material helps support demographic vigor and diversity, increasing the viability of individual populations. For the grizzly bear, preserving the linkage between populations is as critical to long-term conservation of the species as managing the individual populations.

The Blackfoot River watershed contains important habitat links for grizzly bears that are recolonizing historical ranges to the south. Grizzly bears breed, forage, and migrate throughout the watershed and den above 6,500 feet. They move from high mountain elevations to lower valley bottoms to forage seasonally for available food.

The Swan Valley area has been identified as an important habitat link for grizzlies moving between the Glacier National Park–Bob Marshall Wilderness Complex and the Mission Mountains Wilderness. The Swan Valley is also believed to be the key linkage zone to the large and important Selway–Bitterroot Wilderness to the southwest. As such, it provides an avenue of connectivity between the Canadian Rockies and the central Rockies of Idaho and Wyoming.

An estimated 100–150 bears frequent the Rocky Mountain Front project area, which is included in much of the recovery plan for the northern Continental Divide grizzly bear population. Some of the units in the district are located along the Rocky Mountain Front and have documented grizzly bear use.

Water Howellia

Water howellia is a federally listed threatened plant restricted in Montana to depressional wetlands in the Swan Valley, typically occupying small basins where the water level recedes partially or completely by the fall. Montana contains the largest number of occupied ponds and wetlands though population numbers are generally small and the occupied habitat is clustered in a very small part of the State. Reed canarygrass has invaded some wetlands in the Swan Valley and it has the potential to form dense monocultures, thereby decreasing the amount of available habitat. Additionally, water howellia is an annual species that is solely dependent on recruitment from seed; it has very narrow habitat and moisture requirements, which leaves it vulnerable to extirpation as a result of consecutive years of unfavorable growing conditions (MNHP 2012). Water howellia is on land owned by TNC next to the Swan River Refuge and on other sites in the Swan Valley. Similar habitat is found on Swan River Refuge.

CANDIDATE SPECIES

Candidate species are plants and animals for which the Service has sufficient information on their biological status and threats to propose them as endangered or threatened under the ESA, but for which development of a proposed listing regulation is precluded by other higher priority listing activities. A candidate species status is reviewed annually.

Candidate species receive no statutory protection under the ESA. However, the Service encourages the formation of partnerships to conserve these species because they are by definition species that may warrant future protection under the act. Since candidate species do not receive regulatory protection under the ESA, the definition of "take" as identified in the act does not apply to these species. However, Service policy requires that candidate species be treated as "proposed for listing" for purposes of Intra-Service section 7 conference procedures (USFWS 1998).

Sprague's Pipit

Sprague's pipit is a candidate for listing as endangered or threatened under the ESA (16 U.S.C. 1531 et seq.; USFWS 2008b, 2010) Sprague's pipits have been documented on the Benton Lake Refuge and in the district.

Sprague's Pipits breed in the northern Great Plains, with the highest density occurring in north-central and eastern Montana to North Dakota. (Stewart 1975, American Ornithologists' Union 1998, Robbins and Dale 1999, Tallman et al. 2002 as cited in Jones 2010).

Sprague's Pipits are closely associated with native grassland throughout their range (Sutter 1996, 1997; Sutter and Brigham 1998; Madden et al. 2000; Grant et al. 2004 as cited in Jones 2010) and are less abundant (or absent) in areas of introduced grasses than in areas of native prairie (Kantrud 1981, Johnson and Schwartz 1993, Dale et al. 1997, Madden et al. 2000, Grant et al. 2004 as cited in Jones 2010). Generally, pipits prefer to breed in well-drained native grasslands with high plant species richness and diversity. They prefer higher grass and sedge cover, less bare ground, and an intermediate average grass height when compared to the surrounding landscape, less than 5–20 percent shrub and brush cover, no trees at the territory scale, and litter cover less than 4.7 inches (Sutter 1996, Madden et al. 2000, Dechant et al. 2003, Dieni and Jones 2003, Grant et al. 2004 as cited in Jones 2010). The amount of residual vegetation remaining from the prior years' growth also appears to be a strong positive predictor of Sprague's Pipits occurrence (Madden 1996, Sutter 1996, Prescott and Davis 1998, Sutter and Brigham 1998 as cited in Jones 2010) and where they put their nests (Dieni and Jones 2003, Davis 2005).

Sprague's Pipits rarely occur in cultivated lands, and are uncommon on nonnative planted pasturelands (Owens and Myres 1973, Sutter 1996, Davis et al. 1999, McMaster and Davis 2001 as cited in Jones 2010). They have not been documented to nest in cropland (Owens and Myres 1973, Koper et al. 2009), in land in the Conservation Reserve Program (CRP) (Higgins et al. 2002) or in DNC planted for waterfowl habitat (Prescott 1997).

Projects that alter grassland habitat with permanent structures, such as wind towers, oil wells, roads and buildings, can make the areas unsuitable for Sprague's pipit use. Because Sprague's pipits avoid not only the structure but also an area around the structure, the effective impact of the disturbance is much greater than its actual footprint. While the grassland habitat on which Sprague's pipits breed can be disturbance dependent, negative effects on the pipit can largely be avoided by doing habitat manipulation such as mowing or prescribed fire outside of the breeding season. These actions may make an area unsuitable for several years until the grassland plant association has partially returned. However, adverse effects can be avoided by performing management actions on a subunit of the grassland area in any given year, so that some suitable grassland habitat is available at all times.

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Sprague's Pipit

Wolverine

Suitable wolverine habitat in the conterminous U.S. is limited to high-elevation, alpine areas that occur in island-like fashion. One of the last strongholds for wolverines in the contiguous U.S. is the northern Continental Divide region of Montana.

On December 13, 2010, the Service found that the North American wolverine in the contiguous United States is a distinct population segment that warrants protection under the ESA, but that listing the distinct population segment under the act is precluded by the need to address other listing actions of a higher priority. The wolverine was listed as a candidate species under the act (78032 Federal Register. 2010).

Wolverines are indigenous to high mountain habitats that are separated from like habitats forming isolated populations. Since wolverines naturally occur at low densities and reproduce infrequently, protected linkage areas are crucial for dispersal, genetic flow and survival of the species. While most core wolverine habitat is in public ownership, many areas inbetween these islands are subject to rapidly increasing pressure from urban development and roads.

ARCTIC GRAYLING, BLACK-FOOTED FERRET, GREATER SAGE-GROUSE, PALLID STURGEON, AND PIPING PLOVER

Arctic grayling, black-footed ferret, greater sage-grouse, pallid sturgeon, and piping plover, are species that have historical records of occurrence on the refuge complex but are either no longer present on the refuge complex or the Service's management strategies are not expected to affect these species.

Arctic Grayling

On September 8, 2010, the upper Missouri River basin's "distinct population segment" of Arctic grayling was listed as a candidate species under the ESA. Fluvial Arctic grayling currently occupy only a fraction (about 5 percent) of their historical range within the Missouri River watershed upstream of the Great Falls. Kaya (1992) concluded that the major factors causing the range-wide decline of fluvial Arctic grayling in the upper Missouri River system include habitat degradation, angling exploitation and overfishing, and interactions with introduced nonnative salmonid fishes. Fluvial Arctic grayling in Montana are presently restricted to an approximately 80-mile long segment of the upper Big Hole River.

Reintroduction efforts began in 1997 in the upper Ruby River and expanded to the north and south forks of the Sun River in 1999, the lower Beaverhead River in 1999, and the Missouri River headwaters near Three Forks, Montana, in 2000. Due to drought conditions and limited resources, the Montana Arctic Grayling Workgroup in 2002 recommended focusing reintroduction efforts on the upper Ruby River, and to continue with other sites as money, workload and resources allow. Reintroduction efforts in 2008 took place in the upper Ruby River and the north fork of the Sun River. At both of these locations, remote site incubators were used to introduce grayling fry into the restoration reach (Magee and McCullough 2008).

Black-Footed Ferret

Black-footed ferrets are listed in several counties in the district and likely occurred here historically; however, no known populations currently exist within the district.

Greater Sage-Grouse

On March 5, 2010, the Service found that the greater sage-grouse warrants protection under the ESA, but that listing the species under the act is precluded by the need to address other listing actions of a higher priority. Evidence suggests that habitat fragmentation and destruction across much of the species' range has contributed to significant population declines over the past century. If current trends persist, many local populations may disappear in the next several decades, with the remaining fragmented population vulnerable to extinction. Greater sage-grouse may be present in Chouteau, Hill, and Liberty Counties in the district.

Pallid Sturgeon

Records show that pallid sturgeon have been documented in the district in the Missouri River in Chouteau County; however, management actions within the refuge complex would not be expected to have any effects on the Missouri River or the pallid sturgeon.

Piping Plover

A 5-year review of the piping plovers' ESA listing was completed in September 2009. The current recovery plan was completed in 1988. The northern Great Plains population of piping plovers nest on the shorelines and islands of alkali (salty) lakes in North Dakota and Montana. They nest on sandbar islands and reservoir shorelines along the Missouri River and reservoirs in Montana, North Dakota, South Dakota, and Nebraska.

The only records of piping plover on the refuge complex are in Pondera county in the district where one to four pair of piping plover were observed at Alkali Lake from 1990 until 2007.

OTHER SPECIES OF CONCERN

The MNHP serves as the State's information source for animals, and plants, with a focus on species and communities that are rare, threatened, or have declining trends and as a result are at risk of extinction in Montana. The MNHP assesses species' status based on methods developed by NatureServe (Regan et al. 2004). These criteria include population size, area of occupancy in Montana, short- and long-term trends, threats, inherent vulnerability, and specificity to environment. Based on these factors, a preliminary rank is calculated and is reviewed by key experts.

According to the MNHP database (MNHP 2011a), there are 126 animal species of concern that could occur on lands administered by the refuge complex. These include 15 mammal, 55 birds, 19 fish, 9 amphibian and 28 invertebrate species (see appendix D).

Trumpeter swans were endemic to the Blackfoot Valley but have been absent for 200 years. Meriwether Lewis first documented trumpeter swans in the Blackfoot Valley in 1806. A pair of trumpeter swan naturally returned to the valley in 2000. This pair eventually bred but the female was killed. The male raised the 3 cygnets through the fall but none of the swans returned the following spring. A partnership of private landowners, foundations, conservation groups, as well as State and Federal agencies was formed to restore the swan to the Blackfoot Valley. Eggs from trumpeter swans in Canada were collected and transported to a facility in Jackson, Wyoming, where they were raised to a suitable age for release. The cygnets were then trucked to the Blackfoot Valley and released on suitable habitat. Since 2005, 83 trumpeter swans have been released. In 2011, swans that were part of the reintroduction effort successfully bred producing seven cygnets.

Black terns are considered a species of special concern by the Service in Region 6. They are listed at a Level II on the Montana Priority Bird Species List, which dictates that Montana has a high responsibility to watch the status of this species, and design conservation actions. Black terns are found throughout the district and the Blackfoot River watershed hosts the largest black tern colony documented in Montana.

The Blackfoot Valley supports western Montana's largest population of Brewer's sparrow, one of the highest priority songbirds in Montana (Casey 2000). This sagebrush obligate was the most abundant breeding species found at sagebrush sites on the Blackfoot and Kleinschmidt Lake WPAs during Service productivity surveys in 1996 (Fondell and Ball 1997). The long-term viability of Brewer's sparrows in Montana depends on the maintenance of large stands of sagebrush in robust condition (PIF 2000).

The Blackfoot Valley is perhaps also the best breeding and nesting area for the long-billed curlew in western Montana. This species is declining nationally and has been identified as a priority in both the shorebird and Partners in Flight conservation plans. Local surveys on Kleinschmidt Flat in 1997 found 31 pairs on 3,840 acres or greater than 8 pairs per 1,000 acres. Production was not monitored, but many broods were noted. This species is highly reliant on grassland-nesting habitat, also nests in sagebrush-steppe, and relies more heavily on wetlands during migration. Small population size and negative population trends, combined with threats of habitat degradation on both breeding and wintering grounds, make the long-billed curlew a high conservation priority (National Audubon Society 2007).

The Bald and Golden Eagle Protection Act (16 U.S.C. 668–668d), enacted in 1940, and amended several times since then, protects bald and golden eagles by prohibiting the take, possession, sale, purchase, barter, offer to sell, purchase or barter, transport, export or import, of any bald or golden eagle, alive or dead, including any part, nest, or egg, unless allowed by permit (16 U.S.C. 668(a), 50 CFR 22). "Take" includes pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb (16 U.S.C. 668c, 50 CFR 22.3). Species Protected under the Bald and Golden Eagle Protection Act include the Golden Eagle and Bald Eagle.

One of the Nation's densest populations of golden eagles and prairie falcons lives in the rock escarpments along the Rocky Mountain Front. The Front also hosts relatively robust populations of bald eagles, peregrine falcons, ferruginous hawks, and goshawks.

Montana supports the largest breeding population of common loons in the western United States with a 10-year average summer count of 216 individuals. This population consists of an average of 62 territorial pairs, 52 nonbreeding single adults, and 41 chicks. Since surveys began in the late 1980s, the population has remained remarkably stable. Fecundity in Montana appears to be above average in comparison to many other States ranging between 0.66 and 0.70 chicks fledged per territorial pair. Most loon observations range from the Rocky Mountain Front west to the Idaho–Montana border with breeding limited to the northwest corner. As of 2009, there were 12 breeding pairs in the Swan Valley and 5 in the Blackfoot Valley (Hammond 2009).

The refuge complex includes one of the largest remaining expanses of native prairie left in the northern Great Plains. This sea of grass provides essential habitat for many grassland birds, many of which are experiencing significant population declines. These include chestnut-collared longspurs, Le Conte's sparrows, bobolinks, Sprague's pipit, burrowing owls, marbled godwits, long-billed curlews, and lark buntings.

4.4 Cultural Resources

Cultural resources for the refuge complex are described in terms of the area's prehistoric occupation and historic period and the refuge complex-specific history and archaeology.

PREHISTORIC OCCUPATION

The cultural sequence for prehistoric occupation in this area is often split into three major subdivisions based on these phases—early, middle, and late prehistoric.

Early Prehistoric

The Paleo-Indian Period dates to 12,000 years before Christ (B.C.)–6,500 B.C. in the region surrounding Benton Lake Refuge. Paleo-Indian people had an economy based primarily on communal big game hunting with distinctive Clovis and Folsum fluted projectile points (spear points). The period is associated with the end of glaciation in North America. The climate was cooler and drier than today, supporting several now-extinct large mammal species. Based on archaeological bones excavated in sites of this period, these hunters subsisted primarily on giant bison, mastodon, camel, horse and mammoth.

Middle Prehistoric

Middle Prehistoric Period ranges from 6,500 B.C.–Anno Domini (A.D.) 200 depending on location. Archaeologically it appears that these people were largely focused on exploiting bison, but the tool kit expanded from paleo-Indian times suggesting dependence on a broader spectrum of plant and animal resources in more varied habitats. Climatologically it was becoming drier and Plains Archaic populations tended to inhabit areas with protected water sources. Sites typically occur in basin and foothill regions, river valleys and in open prairie. There is a wide variation of projectile point (spear or atlatl) types associated with the Middle Prehistoric, no doubt due to the varied species, environments, and hunting techniques used to get game in this fluctuating climatic regime. The atlatl or spear thrower was introduced allowing greater range than spear throwing and necessitating smaller projectile points. Communal hunting continued, but researchers have suggested that smaller hunting groups were used at various times of the year. There is also more evidence of processing of vegetal resources suggesting reliance on a broader spectrum of resources.

Late Prehistoric

Late Prehistoric Period lasts from A.D. 200–1750 A.D. During this phase prehistoric people moved out onto the prairies and new technologies were introduced including the bow and arrow and pottery. Complexes included in this tradition include Besant, Avalonea, Benson's, Butte–Beehive, and Old Women's. The Besant complex represents the earliest adoption of pottery and bow and arrow use in this area of the northern Great Plains.

Horses were not in widespread use in the northern plains until A.D. 1725-A.D. 1750. Bison continued to be the primary resource exploited by Protohistoric groups, but the addition of the horse to hunting techniques drastically affected social organization, settlement patterns and effectiveness of bison hunting. Protohistoric people were able to react more quickly to the movements of the bison herds, were able to hunt further away from basecamps and began to leave women and children in camps while hunting.

HISTORIC PERIOD

During this period, trade goods and interaction between European settlers and tribal people began to directly affect aboriginal lifeways. This process started well before European settlers reached the area. Trade goods and the desire for them changed Native American lifeways by shifting hunting activities for household consumption to a means to obtain trade goods. As more aboriginal people were being pushed into the northern Great Plains, conflict between tribes in search of bison became more frequent. Taking control of territories for hunting grounds and high mobility became increasingly important.

Native American History

The origin of aboriginal groups in Montana before 1500 is debated by archaeologists and linguists. In eastern Montana, by the 1600s, it is generally accepted that the River Crow were situated on the Missouri River and the Mountain Crow along the Yellowstone. The Blackfoot were situated northwest of the River Crow into Canada and the Assiniboine to the northeast of the River Crow into Canada. Western and northwestern Montana were inhabited by the Bitterroot Salish, upper Pend d'Oreilles and Kootenai who are now known as the Confederated Kootenai and Salish Tribes (CKST).

J. Salisbury

Highway 200 near Ovando, Montana, in the Blackfoot Valley Conservation Area.

In the late 18th century, increased movement of European settlers in the northern plains caused the first outbreaks of smallpox among Montana's native people (Fandrich and Peterson 2005). By 1781 reports in Saskatchewan Canada relate that 30–60 percent of the native population was lost. Diseases introduced by European settlers would greatly affect tribal politics and warfare because the loss of population numbers forced certain tribes to create partnerships that would allow them to defend themselves against native enemies. Anglo contacts grew more frequent with ongoing movement of riverboats associated with the fur trade and discovery of gold in western Montana. This increased opportunities for diseases to spread through the native populations. With the introduction of the steam-powered riverboats using the Missouri River to ship supplies, diseases were able to move faster across the region. In 1837 the riverboat St. Peter carried smallpox to Fort Union (Fandrich and Peterson 2005). The Captain, Alexander Culbertson, wanted to halt the progress of the riverboat until the outbreak of smallpox had ended. However, the Piegan and Bloods were awaiting supplies and the boat continued to Fort McKenzie spreading smallpox. The Gros Ventre, Sioux and Plains Cree did not experience radical population losses from the outbreak.

During the 1880s the climate and conditions for native people in Montana were at their worst. The bison were now gone from the area and a series of harsh winters left most tribal populations without adequate food. Government supplies were not sufficient to feed the tribal populations and without bison hunting for supplemental nutrition, starvation ensued.

Lewis and Clark

In 1802, Thomas Jefferson organized the Corps of Discovery after the Louisiana Purchase from the French ended any European claim to the land. At this time, this part of the western United States was largely undocumented. Jefferson realized the need to survey the area in preparation for settlement and was in search of a Northwest Passage to the Orient. At that time there was no navigable route that connected Eastern and Western North America, requiring ships to sail around South America and Africa. Ultimately this goal of the Corps was not realized because the route was difficult to navigate and required several portages making movement of large watercraft unpractical. When the Corps of Discovery returned to Saint Louis they brought with them field maps documenting the locations of waterways and resources they had encountered. The Corps found large numbers of wild furs and wildlife that inhabited the region and would later spur the fur trade. Several Lewis and Clark campsites are known along the upper Missouri River and Meriwether Lewis is known to have camped in Lincoln Gulch in the Blackfoot Valley.

Although the Lewis and Clark expeditions of the region are generally thought of as the first Anglo visitors to the Upper Missouri, they were predated by French Canadian trappers and traders in the 18th century working with the Hudson's Bay Company. Historians believe that one major reason for the Corps of Discovery expedition was to thwart the Hudson's Bay Company's interest in the area. This is suggested by the 1816 amendments to trade laws preventing foreign agents from doing business on American soil without obtaining a license.

Historic Euro-Americans

The post-Lewis and Clark historic period in central and northern Montana can be divided into three generalized periods based on the major type of economic activity—fur trade era, ranching era, and railroad era.

FUR TRADE ERA

With the rise of beaverpelt prices, in the 19th century, more European settlers came to the upper Missouri River to trap and trade furs. Once the beaver were trapped out of the region, the fur trade shifted to the bison robe trade. Fort Benton was constructed to support these industries as the furthest inland port in the continental United States. Fort Lewis was constructed in 1831 and was abandoned after the Blackfeet requested that the fort be moved to the north side of the river in 1846. Several smaller forts were established downstream on the Missouri River from Fort Benton to the North Dakota border for two reasons: (1) forts allowed the tribes easy access to traders for their furs; and (2) the riverboats coming from Saint Louis often could not get further up river from Fort Benton because the river became shallower upstream. Fort Benton served as a hub of transport for supplies and people because the town was connected by a road network leading to gold mining communities, which were becoming established in the mountainous areas of western Montana.

By the 1820s, the American Fur Company began to sponsor small forts along the river to secure a share of the trade in animal products from native and white trappers. This company was owned by John Jacob Aster who was later to become one of the wealthiest men in the country by taking the money made in this enterprise and buying real estate. Several forts were established to compete with the American Fur Company, but most failed due to the fierce competition with the company or frequent attacks by native people. One reason so many forts, trading posts and riverboat landings were constructed was due to the difficulty with getting up river from the area of modern day Fred Robinson bridge (at the boundary of Phillips and Fergus Counties) to Fort Benton. The stretch of river from Cow Island to Fort Benton was known as Rocky River marking the point where elevation increased approximately 2 foot per mile as one went upstream (Davy 1992). From the area downstream of Rocky River, riverboats could be unloaded and freight put on wagons to be hauled to Helena, Fort Benton or the Judith Mountains. In sum, 31 trading posts were built on the Missouri River between the North Dakota boundary to Fort Benton between 1828 and 1885 (Davy 1992).

Throughout the 19th century, the fur trade in Montana depended on riverboats to move the goods to and from the region. The tribes as well as Anglo trappers were involved in the trade and there were frequent conflicts between the two groups. Some of the aboriginal groups opposed trading with European settlers altogether. The Assiniboine supported the establishment of Fort Union while the Blackfoot and Gros Ventre did not. Originally the trade consisted of beaverpelts, but in the 1840s the animals had been overexploited and fur prices dropped, changing the focus of trade to bison robes. Growth of this industry was rapid as 2,600 bison robes were sent east annually in the early 1800s, whereas approximately 90,000 or more would be shipped annually from St. Louis by the 1850s. By 1850, the tribes depended on trade goods, which they obtained through the bison robe trade. Tribal involvement increased conflict between aboriginal groups because the tribal hunting grounds were the key to supporting trade.

With the discovery of gold in western Montana in the 1860s and the development of the fur trade, steamboat travel was a vital supply line to towns such as Fort Benton and Helena who had few other choices for travel because of the lack of well-established roads or railways to supply these towns. Food, supplies and trade goods required for miners and trappers would be hauled up from St. Louis and goods such as furs, bison robes, and gold, would be sent downstream to the markets. Steamboat traffic was common on the river from 1859 until 1888 averaging about 20 boats a year. In the years between 1860 and 1869 the river averaged 34 boats per year, making this the highlight of riverboat use on the Upper Missouri.

Mullan Road was constructed from 1858 to1862 by the Federal Government to connect Fort Walla Walla in Washington State to Fort Benton. It was designed to bring settlers into the region and make military expeditions possible due to the rising conflicts between European settlers and native people. The road also provided a route to carry supplies into western Montana for the early mining operations and link the west coast to the Missouri River. Before the introduction of railways to Montana, this route was the first established passageway from the Rocky Mountains to the inland Northwest. During its active life, the road is estimated to have brought 20,000 civilians to the region. Mullan Road was listed on the National Register of Historic places in 1975. A section of the road is thought to occur on the Benton Lake Refuge, however, documentation confirming this is currently lacking.

RANCHING ERA

Because of the difficulty of transporting locally produced products from Montana, ranching began as small operations providing beef to miners, primarily in the western part of the State. Early mining was focused on deposits of placer gold. This work began in 1862–4 and was situated at Bannack, Virginia City, Helena, and Confederate Gulch. Because the railroads had not been constructed, goods were transported between Saint Louis and Fort Benton by keel boat, which added cost to food (as well as other products) and allowed small, local ranching outfits to make profits on these developing local markets. Due to the difficulty of agriculture, ranching was the preferred mode of food production at this time. Eventually steam-powered riverboats were used to move the goods. In 1866 the first cattle drive from Texas took place, which started open-range ranching in the grasslands that were vacant after the destruction of the bison herds. Mid-nineteenth century ranching operations in Montana were fairly unorganized and consisted of both corporate interests and small ranches. Cattle depended on open range for grazing because there was little hay production due to the cost of irrigating. The management styles of the different operations and the lack of fencing caused difficulties from many sources including overstocking, loss of cattle from mavericking and outright theft. Mavericking was the process of branding unbranded calves (calves that lacked a branded mother by which to identify the owner). Because cattle were left on the open range, there were two roundups held in the fall and spring used to manage the cattle. By the early 1880s, 17 districts statewide had been established to make rules for the roundups. These districts were based on natural boundaries. In each of the districts, the ranches worked communally during the roundup to gather the free-ranging cattle in their district. The cattle were sorted by brand and rules were established among the districts to encourage fairness in branding. For instance, use of branding irons was prohibited at any time except during the roundups (Malone et al. 1976). Decisions were also made about unbranded calves at the roundup. In some cases, the calves would be branded with the brand in the area managed by the ranch in which they were found. Some districts considered unbranded calves as district property and sold them to help the district. Mavericking was common and was a way to quickly increase the size of the owner's herd at no cost. Also during the 1880s, railways had been constructed across the State linking it more directly with large cattle markets in the east and west, making the business of ranching cattle more profitable. The long drives, used before the railroad, reduced the value of the herd and were more expensive than loading the cattle onto a train.

This system of ranching was successful until the winter of 1886–7 when particularly severe weather and overstocking caused the loss of a great deal of the State's cattle. Overgrazing on the ranges and a very hot, dry summer left the forage in poor condition that fall. Low temperatures and precipitation kept the forage covered for most of the winter, which resulted in a massive die-off because storage of hay had not become common practice and there was no reserve of food for the cattle in winter. Although losses varied in different parts of the State, overall about 60 percent of the cattle were lost (Davy 1992). Of the 220 cattle operations statewide, before that winter, 120 financially survived.

The winter of 1886–7 changed cattle ranching in Montana in several significant ways. Open range grazing was practiced in fewer and fewer areas during the following decades because of the risk of a similar catastrophe. Large operators, who were financed with money from the east, lost support from their investors and downsized or ceased operations completely. Many of the small operators fared the winter better because they were more prone to store up hay to feed their cattle over winter. Between 1887 and 1889 the number of ranches increased significantly, and by 1890 the ranges carried more cattle than before the 1886–7 winter. The amount of land devoted to hay cropping tripled during this period. Sheep, which are more able to withstand the severe weather, were less affected by the 1886–7 winter and many ranchers converted to sheep ranching in the 1890s. This change was so profound that by 1900 Montana was the Nation's largest wool producer with 6 million head.

RAILROAD ERA

During the 1880s, railroads were established, linking eastern Montana to large cities and markets for the natural resources that were available for exploitation at the time. With the establishment of the railways, movement of goods was faster, more predictable and cheaper than riverboat travel along the Missouri. With the addition of the railroad to the State's transportation system, the reliable movement of cattle to large markets in the east was made sure.

© Bob Gress

Baird's sparrow

By 1900, a homestead boom began that would last until 1918. Initial settlement of the region was in river bottoms that were readily cultivated. Settlement was spurred by the cheap transportation by railways, profitable shipment of grain to market and advertisement campaigns by the railroad companies for free land. The Federal Government had given the railways land along tracks to pay them for the construction costs. When an area was settled, the railroads would not only be able to sell the land, but would also create more traffic for freight as the settlers would need to move their products to market. The homestead boom was so intense that Montana had more homestead entries than any other State. The boom continued successfully as high moisture during the period of 1909–16 made dry farming of cereal grains successful. Shipping grain by rail made moving the grain to large eastern markets financially profitable and reliable. Once conditions became drier, the farming boom ended as farmers began to understand the lack of predictable moisture in the eastern part of the State limited dryland farming. This, in combination with the Great Depression, caused a mass exodus from Montana in which half of Montana farmers lost their farms between 1921 and 1925. Predictable water for farming in most of Montana would be addressed at this time with large-scale Federal Government supported irrigation.

HISTORY AND ARCHAEOLOGY OF THE REFUGE COMPLEX

The refuge complex has a rich history, including several cultural resource sites.

Benton Lake National Wildlife Refuge

Originally Benton Lake was known as Alkali pond. In 1887, local farmers attempted to use the lake's water for irrigation and constructed Benton Lake Canal. Promoters of the project believed it would open a million acres for settlement by farmers. Unfortunately the promoters did not anticipate the shallow nature of the lake and its vulnerability to drought. At the urging of local sportsman in 1929, Montana Congressman Scott Leavitt proposed having several thousand acres of the project set aside for a refuge. The county commissioners did not initially support the idea because they believed the land would be best used for settlement by farmers. In the fall of 1929, President Hoover established the refuge by Executive order. In 1931, the lake dried up and a canal project was started by sportsmen and women to bring water back into the lake. The proposed canal would have to be 30 miles long, connecting the lake to the Sun River. This project was cancelled and the issue would not be revisited until 1957 when The U.S. Congress appropriated $90,000 for a pump station and ditches to divert water from Muddy Creek.

The main county road bisecting the refuge to the north called Bootlegger Trail received its name during the Prohibition Era (1916–33). The road is known from the 19th century as a thoroughfare connecting farms to Great Falls. During Prohibition, it became the major route in the area for obtaining legally produced alcohol from Canada. This alcohol would be resold illegally to northwestern Montana residents.

ARCHAEOLOGY

Limited archaeological surveys have taken place on the refuge associated with the construction of dikes, a prescribed fire survey and several canal segment constructions. The refuge supports a section of both Mullan Road and Benton Lake Canal. The section of Mullan Road on the refuge was listed on the National Register in 1975. It is located in native prairie and the refuge has no immediate plans for disturbing the area.

The most substantial cultural resources survey conducted on the refuge is a 560-acre survey of Bootlegger Trail for a Montana Department of Transportation road improvement. During this project, three sites were identified on Service land including Benton Lake Canal 24CA974, Bootlegger Ponds 24CA975 and Slate Pit 24CA976. The Benton Lake Canal was found eligible for the National Register while Bootlegger Ponds and Slate Pit were found not eligible (Frontier Historical Consultants 2004). Benton Lake Canal was conceived in 1887 when local farmers cut a 1.25-mile-long canal 26 feet deep to obtain Benton Lake's water for irrigation. Slate pit was a historic and modern mining operation, which was mostly removed at the time of recording in 2004. Bootlegger Ponds consist of 2 erosion check dams and 1 stock water pond presumed to have been built during the 1931 road construction project.

Recently, miscellaneous small surveys have been conducted for refuge projects. Loflin (2006) conducted survey for 180 acres for a control burn next to Benton Lake. No cultural resources were observed. In 2005 Loflin surveyed 6.5 acres near the Lake Creek ditch next to Benton Lake in preparation for an upgrade of the ditch. Although no sites were found the researcher observed an isolated lithic flake suggesting that there was some prehistoric occupation of the lake margin, but because the lake size has been altered, it is likely that the sites may have been inundated (Loflin 2005).

In 2008, Alberta Tie, LTD, contracted with the University of Arizona to conduct a Traditional use study along a corridor just east of the refuge with the Blackfeet and Piegan tribes (Zedeno and Murray 2008). This study was in preparation for a 120-mile-long electrical transmission line connecting Great Falls to Canada. Four traditional use areas including locations of burials, plant gathering areas and ceremonial locations were identified suggesting that the Blackfeet have traditional use and ongoing interest in the area.

Benton Lake Wetland Management District

Beginning in the early 1900s, efforts to increase opportunity for small grain farming in the region began with the initiation of the Sun River Reclamation Project, later known as the Sun River Irrigation Project. This Sun River project was authorized by the Secretary of the Interior in 1906 and contains more than 100,000 acres of potentially irrigated land along the Sun River and its tributaries west of Benton Lake (Knapton et al. 1988). The Sun River project contains two major divisions. The Fort Shaw Irrigation Division that borders the Sun River contains about 10,000 acres and the Greenfields Irrigation Division, contains about 83,000 acres.

Construction of the Fort Shaw Division began in 1907, and the first water was delivered to Division farmlands in 1909 (Knapton et al. 1988). Construction of facilities within the Greenfields Irrigation Division began in 1913, and the first water was delivered to area grain farmers in 1920. The main storage structure, Gibson Reservoir was constructed on the upper Sun River during 1922–9. Approximately 300 miles of canals and lateral distribution ditches distribute water across the Greenfields Bench.

The development of the Greenfields Irrigation Division dramatically changed the landscape within large parts of the district and influenced land use near Benton Lake Refuge. During this time, native grassland was converted to irrigated cropland, mostly wheat and barley, and pasture–hayland. The advent of increased small grain production in the region and accompanying storage, transportation, and milling facilities encouraged grain production outside of the irrigation division also. Much of the native grassland in the district was converted from native grassland to dryland cropland. The predominant crops grown in this area until the 1980s were wheat, barley, oats, and flax using crop–fallow rotations where alternating linear fields were either cropped or kept fallow (free of vegetation using tillage or chemical treatments) for 1–2 years. Since the mid-1980s, more than 60 percent of the cropland in the Greenfields Division has been contracted for growing malting barley, which has improved the financial sustainability of cropping lands in the area and has provided more than $20 million annual return.

ARCHAEOLOGY

Three of the district's waterfowl production areas have documented, prehistoric and historic sites.

Blackfoot WPA

Based on the limited amount of field inventory conducted on Service land, seven cultural resource sites have been recorded: six are prehistoric and one is historic. The prehistoric sites consist of lithic scatters, and their ages are unknown. The historic site consists of an old road that was the main road to the area. None of the sites have been formally evaluated for eligibility to the National Register of Historic Places. A cultural resource survey on timbered parts of the Blackfoot WPA is planned.

Three areas on lands next to the Blackfoot WPA have been identified as containing culturally significant ponderosa pine peeled trees and vegetatively significant ponderosa pine trees (BLM 2010).

These pine peeled trees have also been documented in Colorado and Utah, and are referred to as culturally modified trees. It is believed the peeled trees were used occasionally by native people as a sealant, glue, medicine, or sweetener (Loosle 2003). 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.

Ehli WPA

A single, historic, late-nineteenth- to mid-twentieth century farmstead has been recorded at Ehli WPA (Loflin 2007). This work was done in preparation for debris removal for a farmstead on the waterfowl production area and no other survey was conducted. At the time of recordation, all of the buildings except a recycled rail car had collapsed. The site was found not eligible for the National Register and the debris associated with the farmstead has been removed. The Montana State Historic Preservation Office has concurred with the findings.

H2–O WPA

About 470 acres of archaeological survey have been conducted at H2–O WPA (Schwab 1994). During this survey for wetland repairs, four prehistoric lithic scatters and two historic sites were found. The two historic sites (McCormick ditch 24PW623 and McCormick farmstead 24PW618) were found potentially eligible for the National Register and need further investigation if work is proposed near them. The McCormick farmstead (24PW618) was found not eligible by the contractor, but the Montana State Historic Preservation Office did not concur. The unresolved National Register eligibility of 24PW618 is an ongoing issue for the waterfowl production area. In 2005, the Service proposed to build a new office at the H2–O headquarters. Service staff again found that 24PW618 was not eligible for the National Register due loss of integrity of the farmstead (Loflin 2005). The Montana State Historic Preservation Office disagreed stating that not enough historic research had been conducted. The Service forwarded the project to the Advisory Council on Historic Preservation who has requested more information. This issue will be revisited when the refuge decides to pursue the project again.

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

These lands remain in private ownership; therefore, Federal laws pertaining to the protection and management of cultural resources do not apply to these units.

Swan River National Wildlife Refuge

Although no formal survey of this refuge has been conducted, in 2009 refuge cultural resources staff recorded a historic muskrat farm on the refuge (Loflin 2010). This work was done in preparation for the disposal of a small log building known as Trapper's

Cabin. The cabin is on the river's edge and refuge staff were concerned it was going to fall into the river. The residence associated with this building has completely collapsed and Service cultural resources staff documented that the building had lost too much integrity to be considered National Register eligible. The Montana State Historic Preservation Office has concurred (Brown 2011) and the cabin is in the process of being transferred.

4.5 Special Management Areas

Management of areas with official designations takes into consideration the special features that led to their designation.

WILDERNESS REVIEW

A wilderness review is the process used for deciding whether to recommend Service lands or waters to the U.S. Congress for designation as wilderness. The Service is required to conduct a wilderness review for each refuge as part of the CCP process. Lands or waters that meet the minimum criteria for wilderness would be identified in a CCP and further evaluated to decide whether or not they merit recommendation for inclusion in the Wilderness System. To be designated a wilderness, lands must meet certain criteria as outlined in the Wilderness Act of 1964:

- Generally appears to have been affected primarily by the forces of nature, with the imprint of human work substantially unnoticeable.
- Has outstanding opportunities for solitude or a primitive and unconfined type of recreation.
- Has at least 5,000 acres of land or is of sufficient size to make practicable its preservation and use in an unimpaired condition.
- May also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.

The Benton Lake Refuge meets the wilderness criteria for size and for scientific, scenic, and ecological value, but are affected by roads, fences, and extensive human effects from livestock grazing and wetland modifications, which preclude the refuge from being designated as a wilderness.

IMPORTANT BIRD AREAS

The Benton Lake Refuge and approximately 13,284 acres of the Blackfoot Valley have been designated as an important bird area through a program administered by the National Audubon Society. Important bird areas are sites that provide essential habitat for one or more species of birds. These areas include sites for breeding, wintering, or migrating birds. Important bird areas may be a few acres or thousands of acres, but usually they are discrete sites that stand out from the surrounding landscape. Important bird areas may include public or private lands, or both, and they may be protected or unprotected (National Audubon Society 2010). To qualify as an important bird area, sites must satisfy at least one of the following criteria to support the following types of bird species groups:

- Species of conservation concern (for example, threatened and endangered species)
- Restricted-range species (species vulnerable because they are not widely distributed)
- Species that are vulnerable because their populations are concentrated in one general habitat type or biome
- Species or groups of similar species (such as waterfowl or shorebirds) that are vulnerable because they occur at high densities due to their behavior of congregating in groups
- Of the more than 240 species of birds documented on the Benton Lake Refuge, 17 species of global and continental conservation concern breed on the refuge:
- Global Concern—ferruginous hawk, piping plover, long-billed curlew, Sprague's pipit, Brewer's sparrow, chestnut-collared longspur
- Continental Concern—northern harrier, Swainson's hawk, upland sandpiper, marbled godwit, Wilson's phalarope, common tern, burrowing owl, short-eared owl, loggerhead shrike, Baird's sparrow, McCown's longspur

WESTERN HEMISPHERE SHOREBIRD RESERVE NETWORK

Because of the concentrations of migrating shorebirds that have been observed in some years, the Western Hemisphere Shorebird Reserve Network recognizes the Benton Lake Refuge as a site of regional importance.

4.6 Visitor Services

Visitors to the refuge complex enjoy a variety of wildlife-dependent public use activities such as hunting, fishing, wildlife observation, photography, environmental education, and interpretation (figure 13). Brochures containing area maps, public use regulations, bird species, and general information are available for the units in the refuge complex. Table 9 shows the number of visitors participating in various wildlife-dependent activities and volunteer hours for each unit of the complex. All visitor services information for Benton Lake Refuge can be found in chapter 7.

Table 9. Actual Annual Performance Plan for 2011for Benton Lake National Wildlife Refuge Complex, Montana.

	Refuge Complex Total	*Benton Lake Refuge*	*Benton Lake Wetland Management District*	*Swan River Refuge*
Total number of visitors	13,280	10,000	2,780	500
Number of Special Events hosted on- and off-site	10	3	7	0
Number of participants in special events onsite	525	75	450	0
Visitors to Visitor Center or Contact Station	1,000	1,000	n/a	0
Waterfowl hunt visits	555	300	155	100
Other migratory bird hunt visits	12	0	12	0
Upland game hunt visits	825	75	750	0
Big game hunt visits	455	0	455	0
Total hunting visits	1,847	375	1,372	100
Fishing visits	425	50	350	25
Number of foot trail/pedestrian visits	1,420	750	270	400
Number of Auto Tour visits	6,810	6,500	310	n/a
Number of boat trail/launch visits	0	0	0	0
Total wildlife observation visits	8,230	7,250	580	400
Number of photography participants	490	400	50	40
Number of education participants involved in on- and off-site environmental education programs	1,765	1,700	55	10
Number of interpretation participants in on- and off-site talks/programs	120	75	45	0
Total other recreational participants	205	75	30	100
Number of volunteers	4	1	0	3

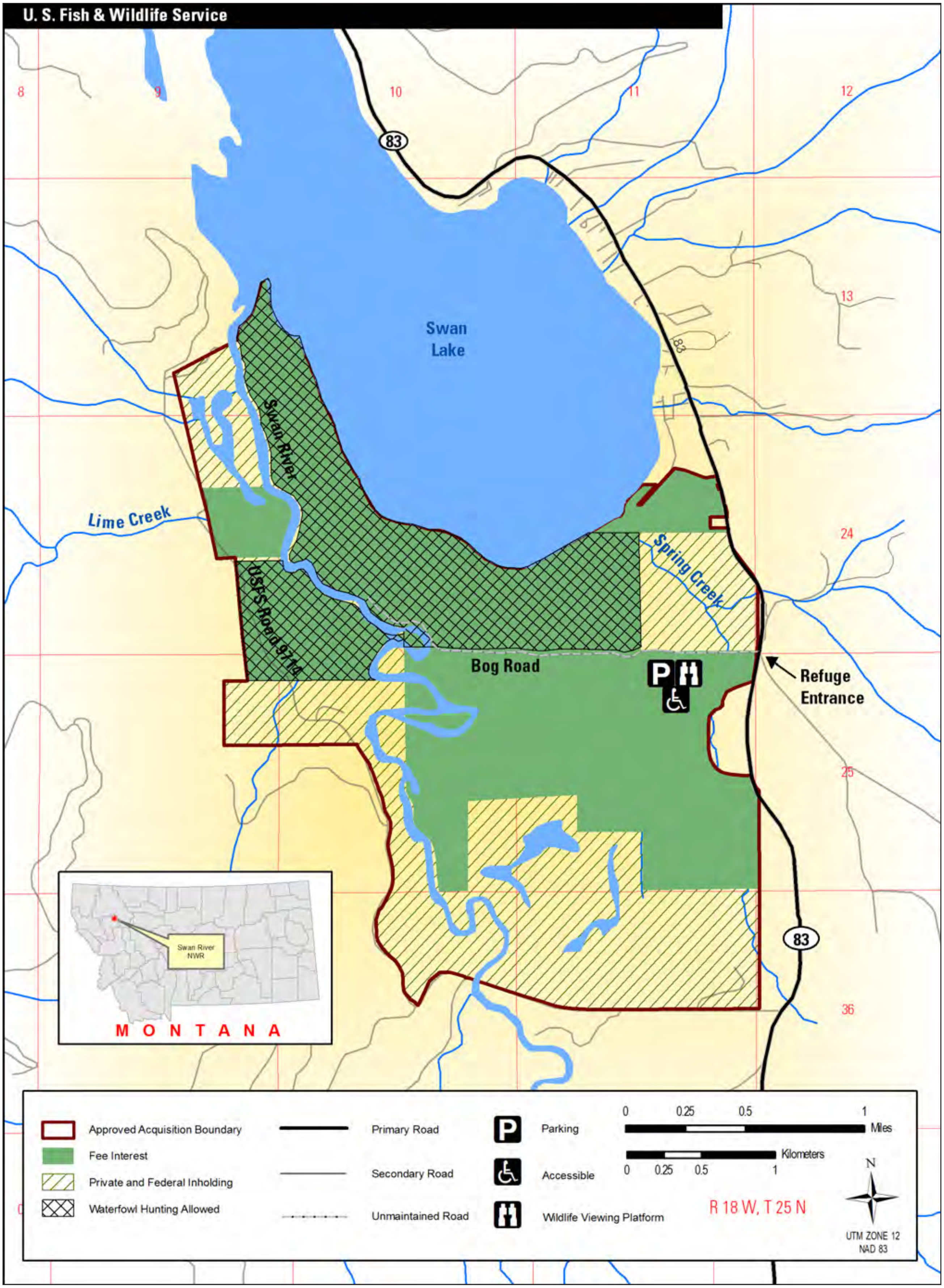


Figure 13. Map of public use at Swan River National Wildlife Refuge, Montana.

APPROPRIATENESS AND COMPATIBILITY

In general, national wildlife refuges are closed to all public use until specifically opened. Waterfowl production areas are inherently open to migratory gamebird hunting, upland gamebird hunting, big game hunting, fishing, and trapping and closed to all other uses unless specifically opened.

Existing and proposed uses of national wildlife refuges where the Service has jurisdiction over the use need to be screened for appropriateness before compatibility. For a use on a refuge to be found appropriate, it must meet one of the following criteria: (1) be a priority public use; (2) be described in a refuge management plan approved after October 9, 1997; (3) is take of fish and wildlife under State regulations; and (4) be found appropriate as specified in 603 FW 1 Sec 1.11. Uses that are not appropriate are to be denied without determining compatibility.

One such use deemed not appropriate came up during public scoping. A commercial outfitter requested to conduct guided hunting on the Swan River Refuge. A formal evaluation was conducted using the criteria noted above; and guided waterfowl hunting was found to be "Not Appropriate" on the Swan River Refuge for the following reasons. To be permitted on a National Wildlife Refuge, an economic use must contribute to "the achievement of the national wildlife refuge purposes or the National Wildlife Refuge System mission" (50 CFR 29.1). Guided waterfowl hunting would not contribute to the purpose of the Swan River Refuge, which is "for use as an inviolate sanctuary… for migratory birds". Additionally, this use was found to be "not appropriate" because it would not further enhance public understanding or be beneficial to the refuge's natural or cultural resources. The current hunting program on the refuge provides relatively easy access to a quality recreational hunting experience, and the refuge complex has not received any public comments or requests from hunters indicating the need for a guided hunt. There is also concern that competition from a commercial operation for the "best" hunting locations could impair the potential for nonguided hunters to experience a quality hunt.

Uses that are found appropriate must still have a compatibility determination. A compatible use is a use that will not materially interfere with or detract from the fulfillment of the Refuge System mission or the purposes of the refuge. A compatibility determination is written documentation by the refuge manager of a proposed or existing use of a refuge to decide if it is or is not compatible with the purpose the refuge was established. Refuge management activities are not subject to compatibility, unless that activity produces a commodity (for example, haying, grazing, timber harvest, and trapping.).

A use that is found compatible does not necessarily mean it is approved. For administration reasons, the refuge manager may deny a compatible use. This process includes a public comment period and concurrence is required from the refuges regional chief. Lastly, the compatibility policy has no administrative mechanism to appeal a compatibility determination.

All existing and proposed uses will go through this screening process. These policies make sure that each approved use will be conducted in accordance with the legal mandates and policies for which each refuge was established, and that each use complies with station budget and staff levels.

Economic uses are only allowed on national wildlife refuges as described in 50 CFR 29.1 in accordance with 16 U.S.C. 715s. The use must contribute to the achievement of the national wildlife refuge purposes or the National Wildlife Refuge System mission. Specific uses must be compatible and can only be authorized with the proper permit. 50CFR 29.1 states, "Economic use in this section includes but is not limited to grazing livestock, or engaging in operations that facilitate approved programs on national wildlife refuges."

HUNTING

Hunting is one of the six priority recreational uses identified in the Improvement Act. All recreational activities are secondary to the primary purpose for which the refuge unit was established and must be compatible. In FY 2011, hunting accounted for 1,847 recreational visits to the refuge complex, which is 14 percent of the total visitor use. The highest hunting use occurs on the district.

In addition to the site-specific regulations mentioned below, all State hunting regulations apply to Service lands in the refuge complex. Shotgun hunters may only possess and use nontoxic shot on fee title lands within the refuge complex, and vehicle travel and parking is restricted to roads, pullouts, and parking areas.

Benton Lake Wetland Management District

All waterfowl production areas in the district, except the Sands and H2–O WPAs, are open to migratory gamebird hunting, upland gamebird hunting, big game hunting, fishing, and trapping in accordance with Montana State law. The Sands and H2-O WPAs were donated to the Service with deed restrictions that prohibit hunting. Travel on the waterfowl production areas is by foot or nonmotorized boats. No camping, overnight parking, or fires are permitted on waterfowl production areas. The one exception is Arod Lakes WPA which is cooperatively managed with MFWP. State provided facilities include a boat ramp that allows motorized boats, a small, designated camping area and limited motorized vehicle access for ice fishing three months of the year.

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

Hunting is popular throughout the project areas. Hunting for a variety of wildlife includes waterfowl, upland gamebirds, elk, moose, deer, black bear, bighorn sheep, mountain lion, and furbearers. Public access to conservation easement lands is under the control of the landowner.

Swan River National Wildlife Refuge

On the refuge, approximately 100 annual hunter visits occur. The area of the refuge north of Bog Road is open for waterfowl hunting and closed for all other species. Big game and upland game hunting is not authorized on the refuge. Guided hunting opportunities are not authorized on the refuge.

FISHING

National wildlife refuges may be opened to sportfishing only after a determination is made that this activity is compatible with the purposes for which the refuge was established. In addition, the sportfishing program must be consistent with principles of sound fishery management and otherwise be in the public interest. Lands acquired as waterfowl production areas are open to sportfishing subject to the provisions of State laws and regulations. Fishing or entry on all or any part of individual areas may be temporarily suspended by posting on occasions of unusual or critical conditions of, or because of situations affecting, land, water, vegetation or fish and wildlife populations. In FY 2011, fishing accounted for 425 recreational visits to the refuge complex, which is 3 percent of the total visitor use for the refuge complex.

Benton Lake National Wildlife Refuge

The refuge offers no fishing opportunities due to a lack of sport fish on the refuge. The Pumphouse Unit is open for walk-in access to Muddy Creek, which provides trout-fishing opportunities. More information about fishing may be found in chapter 7.

Benton Lake Wetland Management District

The Arod Lakes and Blackfoot WPAs are open to fishing. Arod Lakes WPA, where yellow perch and northern pike are plentiful, receives the bulk of fishing visits in the refuge complex.

Blackfoot Valley, Rocky Mountain Front and Swan Valley Conservation Areas

Public access to conservation easement lands is under the control of the landowner and subject to State stream access laws.

Swan River National Wildlife Refuge

The refuge is open to fishing in accordance with State regulations with a closure from March 1 until July 15 to protect nesting migratory birds.

TRAPPING

Benton Lake Wetland Management District

With the exception of Sands and H2-O WPAs, recreational trapping is permitted on waterfowl production areas in accordance with State regulations.

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

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

Swan River National Wildlife Refuge

Recreational trapping is prohibited on the refuge. Trapping by special use permit occurs for wildlife and infrastructure management purposes only.

WILDLIFE OBSERVATION AND PHOTOGRAPHY

Wildlife observation and photography are popular wildlife-dependent recreational activities at the refuge complex. A variety of habitats and many species of wildlife throughout the refuge complex provides many observation and photography opportunities year-round. In FY 2011, wildlife observation and photography accounted for 8,230 and 490 recreational visits, respectively, which is 62 percent and 4 percent of the total visitor use to the refuge complex. The Benton Lake Refuge received most of the visitation.

To protect nesting birds and other wildlife, pets are required to be leashed and remain on designated roads and trails, except during the hunting season in the hunt area. Vehicles (both motorized and nonmotorized) must stay on designated roads. Off-road vehicle travel is strictly prohibited due to negative impacts to biological resources and disturbance to wildlife.

Commercial filmmakers and still photographers must acquire a special use permit to work on Service lands. The permit specifies regulations and conditions that the permittee must follow to protect the wildlife and habitats they have come to capture on film and to prevent unreasonable disruption of other visitors enjoyment of the refuge complex. Commercial filming and photography on Service lands must also show a means (1) to generate the public's appreciation and understanding of the refuge's wildlife and their habitats and the value and mission of the Refuge System, or (2) to facilitate the outreach and education goals of the refuge complex.

Benton Lake National Wildlife Refuge

The refuge offers the Prairie Marsh Wildlife Drive, a 9-mile self-guided auto tour route, as well as a Visitor Center, informational kiosk, a boardwalk trail with spotting scope, and a photography blind that is available on a first-come, first-served basis. More wildlife observation and photography opportunities are provided by a blind that is available by reservation in April and May for viewing the courting rituals of sharp-tailed grouse. The refuge also permits visitors to use their own temporary photography blinds along Prairie Marsh Wildlife Drive. Most visitors view wildlife from the auto tour route. More information about wildlife observation and photography may be found in chapter 7.

Benton Lake Wetland Management District

Wildlife observation and photography is prohibited unless authorized on waterfowl production areas by special use permit or through compatibility determination. Currently, the waterfowl production areas are open to wildlife photography and observation. Parking areas provide easy access.

Waterfowl production areas are open to foot traffic, including hiking, snowshoeing, and cross country skiing. Bicycle use is permitted only on roads open to vehicular traffic. Equestrian use is prohibited. Impacts to biological resources, such as introduction of invasive species and disturbance to wildlife during periods of nesting and migration, are a continuing concern.

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

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

Swan River National Wildlife Refuge

Bog Road provides 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 also provide opportunity for wildlife observation and photography and are popular destination point while traveling through the Swan Valley.

Foot traffic, including hiking, cross country skiing and snowshoeing is currently permitted north of Bog Road from July 16 through the end of February; however, access to Swan River NWR in winter months is difficult. Bog Road is not supported and typically is covered with several feet of snow. Parking is very limited on the refuge; therefore access is primarily from Swan Lake. The number of visitors using the refuge for cross country skiing or snowshoeing are very low; likely less than ten visitors per year.

USFWS

Rocky Mountain Front Conservation Area.

Equestrian and bicycle use are prohibited on Swan River NWR to limit impacts to biological resources, such as the introduction of invasive species and disturbance to wildlife during periods of nesting and migration.

Boating is permitted on the Swan River in accordance with State regulations. Many visitors to the refuge use canoes or kayaks to travel up the river enjoying the sights and sounds of the refuge. Use of motor boats is controlled by the State "no wake" regulation which has reduced the impacts to the river shoreline. The use of boats on the Swan River is primarily done in the summer months of July and August. Outside of that period visitor use on the river is sporadic.

"No-wake" is a State regulation that was adopted to curb motor boaters, and personal water craft users from running at top speed up the Swan River. The regulation is followed by most visitors and has increased use of the river by canoeists and kayakers. The "no-wake" regulation has reduced signs of erosion along the riverbanks, which would help native bull trout. The creation of a Federal no-wake regulation would take staff time and would not provide added benefits above the current situation.

ENVIRONMENTAL EDUCATION AND INTERPRETATION

Opportunities for environmental education and interpretation are abundant within the refuge complex. In FY 2011, for programs on and off of the refuge complex, environmental education accounted for 1,765 visits and interpretation accounted for 120 recreational visits, which is 13 percent and 1 percent, respectively, of the total visitor use. In addition, 525 participants attended 10 special events on and off the refuge complex.

Benton Lake Wetland Management District

Waterfowl production areas are open for environmental education and interpretation if they are found to be compatible. All waterfowl production areas in the district have the potential to be part of a structured environmental education and interpretation program. Currently, no such program exists due to the lack of environmental education staff in the refuge complex. Occasional environmental education events are held at the H2–O WPA in Powell County. These usually involve wetland education themes with grade school children from around the Blackfoot Valley.

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

Public access to conservation easement lands is under the control of the landowner and no active interpretive or educational programming is occurring on easement lands.

Swan River National Wildlife Refuge

Currently, no formal environmental education or interpretation program exists at the refuge due to a lack of environmental education staff. The kiosk panels at the refuge, which are regulatory and informational, have been revised. Concrete work that provided a parking area, trail, and observation deck, all, of which, are accessible to people with disabilities, was completed in 2009. and construction of a new kiosk was completed in 2011. Interpretive panels on the viewing platform discuss biology of the marsh. There is currently very limited potential for staff led environmental education at the refuge due to the difficult access conditions on Bog Road and the lack of parking space. Bog Road provides access to the interior of the refuge. It is a one-lane gravel road that can become impassable in high water conditions or wet weather.

4.7 Operations

Service operations consist of the staff, facilities, equipment, and supplies needed to administer resource management and public use programs throughout the refuge complex, which is located across a 12-county area covering more than 2,700 square miles. Within this area, the Service is responsible for the protection of 163,304 acres of lands and waters.

STAFF

Currently, the refuge complex staff is comprised of 9.5 permanent full-time employees (table 10). Since 1998, the refuge complex has lost three positions—one full-time law enforcement position, one permanent biological science technician and a permanent maintenance worker. The current staff level remains well below the minimum prescribed in the June 2008 Final Report—Staffing Model for Field Stations (USFWS 2008e), which recommended ¬adding 8 staff members, including a general schedule (GS)–13 refuge manager, GS–12 wildlife refuge specialist, GS–9 park ranger (visitor services specialist), GS–9 park ranger (law enforcement), GS–12 wildlife biologist, wage grade (WG)–8 maintenance worker, and GS–6 biological science technician (0.5 full-time equivalent employee).

Table 10. Staff funded in fiscal year 2011 at the Benton Lake National Wildlife Refuge Complex, Montana.

Official Title	Working Title	Series/Grade	FTE	Assignment	Stationed At
Permanent Staff					
Wildlife Refuge Manager	Complex Manager	GS-0485-14	1.0	Refuge Complex	Benton Lake NWR
Wildlife Refuge Manager	Deputy Refuge Manager	GS-0485-12	1.0	Refuge Complex	Benton Lake NWR
Wildlife Biologist	Refuge Biologist	GS-0486-12	1.0		Benton Lake NWR
Supv. Wildlife Refuge Specialist	Wetland District Manager	GS-0485-12	1.0	District - all	Benton Lake NWR
Wildlife Refuge Specialist	Wildlife Refuge Specialist	GS-0485-11	0.5	District - Blackfoot	H2-O WPA
Wildlife Refuge Specialist	Wildlife Refuge Specialist	GS-0485-09	1.0	District - RMF	Benton Lake NWR
Maintenance Worker	Maintenance Worker	WG-4749-08	1.0	Benton Lake NWR	Benton Lake NWR
Assistant Fire Management Officer	AFMO	GS-0401-09	1.0	Western Fire District	Benton Lake NWR
Administrative Officer	Budget Specialist	GS-0341-11	1.0	Refuge Complex	Benton Lake NWR
Budget Analyst	Regional PCS/ Travel Coord.	GS-0560-09	1.0	Refuge Complex	Benton Lake NWR
Temporary, Term, and Seasonal Staff (as money allows)					
Biological Science Tech (Term)	Biological Science Tech (Term)	GS-0404-06	0.8	Benton Lake NWR	Benton Lake NWR
Biological Science Tech (Temp)	Biological Science Tech (Temp)	GS-0404-06	0.5	Benton Lake NWR	Benton Lake NWR
Administrative Office Assistant	Generalist	GS-0303-04	0.5	Refuge Complex	Benton Lake NWR

FACILITIES

Facilities are used to support habitat and wildlife management programs and wildlife-dependent public use activities. Facilities and real property assets are generally well supported throughout the refuge complex. The condition of real property assets affects the efficiency of staff to manage biological and visitor resources. The refuge complex has one full-time maintenance worker to support buildings, fences, and roads.

Poorly functioning facilities and infrastructure (for example, pump house, water delivery ditches, levees, and water control structures) can affect wetland, grassland, and forest management activities throughout the refuge complex. Water delivery, storage, and release are fundamental for accomplishing some management objectives. Poorly functioning levees, water control structures, pump house, and delivery ditches would significantly reduce effectiveness of management. Interior and exterior fencing and boundary signing within the refuge complex are in need of further maintenance, which reduces efficiency and effectiveness of grassland and wetland management and resource protection.

The condition of real property assets affects the efficiency of staff to manage visitor services. Visitors to the refuge complex expect facilities and real property assets such as offices, comfort stations, roadways, boardwalks, and kiosks to be in good condition, accessible, and contain correct information. Accessible facilities exist, but may not be strategically located to meet the needs of the users.

VISITOR AND EMPLOYEE SAFETY AND RESOURCE PROTECTION

Up until the end of FY 2011, the Benton Lake Refuge has had at least one dual-function law enforcement-commissioned officer position. A full-time law enforcement officer is critical to protect fish and wildlife resources along with staff and visitor safety. Within the last 4 years, the refuge complex has had a permanent full-time law enforcement position and up to two collateral duty positions. Currently, only one collateral duty officer exists throughout the refuge complex.

Past violations on fee-title lands have primarily been hunting violations. Problems of vandalism, trespass issues, dumping, and general littering exist, but violators are not often apprehended by law enforcement. Seasonal closures are implemented throughout the refuge complex to protect sensitive wildlife resources. Minimizing disturbance to nesting migratory birds is of particular concern. Law enforcement officers on the refuge complex are also responsible for monitoring and enforcing easement contracts, which is a critical aspect of protecting wetland and grassland habitats.

The current management routinely emphasizes safe work habits, use of personal protective equipment, and job hazard analyses in all work situations, including ones that seem relatively free of potential hazards. In FY 2009, the Regional Safety Office conducted an inspection at Benton Lake Refuge headquarters and compound that resulted in the correction of a small number of minor unsafe situations (for example, handrails need to connect to walls). In 2009, there was only one employee on-the-job injury. Overall employee and visitor safety is at acceptable levels.

4.8 Partnerships

The primary objectives of partnerships for conservation between the Service, private partners, nongovernmental organizations and others are to:

- support biological diversity related to wildlife values,
- link together existing protected areas,
- preserve existing wildlife corridors, and
- protect large, intact, functioning ecosystems,
- while supporting the rural character and agricultural lifestyle of western Montana.

The Partners for Fish and Wildlife Program continues to develop strong partnerships with private landowners along the Rocky Mountain Front and within the Blackfoot and Swan Valleys through the implementation of habitat restoration and management projects on private lands. Strong partnerships have also developed with a variety of agencies and organizations jointly involved to accomplish similar objectives through restoration and protection projects such as Trout Unlimited, TNC, The Conservation Fund, Ducks Unlimited, Natural Resource Conservation Service, MFWP, and the Montana Department of Natural Resources and Conservation.

Habitat restoration efforts currently focus on invasive weed treatment, wetlands, streams, native grasslands, and riparian areas. Typical projects include wetland restoration, riparian corridor enhancement (revegetation), instream restoration, invasive weed treatment programs, and the development of grazing systems to rejuvenate native grasslands.

The Blackfoot River watershed has a history of pioneering innovative land management strategies to support working landscapes and the fish and wildlife that depend on them. Recognizing the strong tie between land and livelihood, private landowners have played a key role in conservation projects for more than three decades. One of the earliest efforts involved developing Montana's enabling legislation for conservation easements, with the first conservation easement in Montana signed in the Blackfoot Valley in 1976.

The mission of the Blackfoot Challenge, a private nonprofit organization, is to coordinate efforts that conserve and enhance the natural resources and rural way of life in the Blackfoot Valley for present and future generations developed out of this rich tradition. Their contributions are cornerstone for the successes within the valley. In 2006, the Blackfoot Challenge won the Innovations in American Government Award sponsored by the Ash Institute for Democratic Governance and Innovation at Harvard University's Kennedy School of Government.

Innovative partnerships continue to develop within northwest Montana. As part of the Blackfoot Community Project, for example, partners developed the 41,000-acre Blackfoot Community Conservation Area that involves community forest ownership of 5,609 acres and cooperative ecosystem management across public and private lands. As a multiple-use demonstration area, this project shows innovative access, land stewardship, and restoration practices through management by a 15-member community-based council.

TNC has been a leading influence on the acquisition of conservation easements along the Rocky Mountain Front, protecting more than 79,000 acres at a cost of $15.8 million over the past 30 years. In the past 5 years, TNC has provided $2.1 million in private money to the Service's easement program within the project area. In addition, this partnership recently expanded to include the Conservation Fund and Richard King Mellon Foundation, both of whom have committed an added $15 million dollars in private money to buy conservation easements along the Rocky Mountain Front.

In addition there are several grant programs administered by the Division of Ecological Services, available to tribes, States, and individual private landowners, for projects that help federally listed, proposed, or candidate species along the Rocky Mountain Front Conservation Area, Blackfoot Valley Conservation Area and Swan Valley Conservation Area.

4.9 Socioeconomic Environment

Most of the complex is open to public use including the compatible, wildlife-dependent uses of hunting, fishing, wildlife observation, photography, environmental education and interpretation. These recreational opportunities attract outside visitors and bring in dollars to the community. Associated visitor activity—such as spending on food, gasoline, and overnight lodging in the area—provides local businesses with supplemental income and increases the local tax base. Management decisions for the refuge complex about public use, expansion of services, and habitat improvement may either increase or decrease visitation to the refuge complex and, thus, affect the amount of visitor spending in the local economy.

As part of the CCP process, the Service had a contractor prepare a socioeconomic study for the complex (USGS, PASA 2011), which is the basis for the following sections described below: population and employment, public use of the refuge complex, and baseline economic activity.

REGIONAL ECONOMIC SETTING

For the purposes of an economic impact analysis, a region (and its economy) is typically defined as all counties within a 30-60 mile radius of the impact area. Only spending that takes place within this regional area is included as stimulating changes in economic activity. The size of the region influences both the amount of spending captured and the multiplier effects. Most of the economic activity related to the refuge complex is located within a twelve-county region in northwestern Montana: Cascade, Chouteau, Glacier, Hill, Lake, Lewis and Clark, Liberty, Missoula, Pondera, Powell, Teton, and Toole Counties. These counties compose the local economic region for this analysis. The complex headquarters is located at the Benton Lake Refuge, 12 miles north of Great Falls.

During the last century, ranching, farming, mining, oil and natural gas development, and the railroad have been important factors in the social and economic history of the area. More recently, outdoor recreation and tourism have been increasingly important contributors to the local economies. The next sections describe the socioeconomic characteristics and trends in the twelve-county region.

Population and Density

Table 11 summarizes the population characteristics of Montana and the twelve counties in the complex's local economic region. In 2009, the U.S. Census Bureau estimated the total population for the twelve counties to be 342,587 residents, or 35.1 percent of Montana's total population. Three counties (Cascade, Lewis and Clark, and Missoula) accounted for 252,743 residents, or 74 percent of the residents in the twelve-county region. Missoula County was the most heavily populated with 108,623 residents, while Liberty County was the least populated with 1,748 residents (U.S. Census Bureau 2011a). Three counties had populations greater than 60,000 and six had populations less than 8,000. Montana's population experienced an in-migration of residents from 2000-2009, growing by nearly 8 percent (U.S. Census Bureau 2011a). Counties with larger populations grew more quickly than lesser populated counties. Cascade, Glacier, Hill, Lake, Lewis and Clark, and Missoula counties recorded population gains over the past decade while Chouteau, Liberty, Pondera, Powell, Toole, and Teton counties recorded population losses (U.S. Census Bureau 2011a). Missoula County experienced the largest gain (13 percent) while Liberty County experienced the largest loss (19 percent) (U.S. Census Bureau 2011a).

To better understand the demographic profiles of these counties, it is useful to examine their population densities and compare these to the same figures for the major communities in the region. Generally, counties with larger populations tend to be more densely populated. Missoula County, the most populated county in the complex, has a population density of 42 persons per square mile. Cascade, Lake, and Lewis and Clark Counties (all heavily populated) follow similar patterns. Liberty County, the least populated county in the twelve-county region, has a population density of only 1 person per square mile. Chouteau, Pondera, Powell, Teton and Toole Counties (all sparsely populated) follow similar patterns. The 2010 census reports the population of the city of Missoula to be 66,788, which represents over 60 percent of the population of Missoula County. Similarly, the city of Great Falls has approximately 72 percent of Cascade County's population (U.S. Census Bureau 2011a). The higher local densities in these large communities show that rural areas outside of these communities may be more sparsely populated than shown in table 11.

Population projections may help to show the expected economic conditions and demand for recreation surrounding the complex in the future. Montana's population was projected to increase 24 percent from 2009 levels by 2030, with a steady increase of approximately 11 percent each decade. The twelve-county region is also predicted to grow, with the population in the region expected to increase by 18 percent from 2009 levels by 2030 (NPA Data Services, Inc. 2011). Toole County, the second smallest county in the region, and Cascade County, the second largest, are predicted to lose the highest proportion of residents (-8.37 percent and -7.69 percent, respectively) while Lake County, currently the fourth largest county in the complex, is predicted to gain the largest proportion of residents (47 percent) (NPA Data Services, Inc. 2011).

Communities near the Refuge Complex

The following narrative describes the communities near each of the units.

BENTON LAKE NATIONAL WILDLIFE REFUGE

Benton Lake Refuge is primarily located in north-central Cascade County, with portions located in Chouteau and Teton Counties. Visitors travel to Benton Lake Refuge for wildlife observation, photography, waterfowl and upland game hunting. Great Falls, located about 12 miles to the south, is the closest city to the refuge. Despite a history of boom-and-bust mining cycles, Great Falls is a well-planned city. By the late 1800s, connections to the railroad allowed for a growing number of businesses and a vibrant agricultural sector in the city. Throughout the 1900s, the city experienced steady growth due to the diversity of the local economy. By 1939, when Malmstrom Air Force Base was established in Great Falls, the city had several well-developed sectors in the local economy, including manufacturing, agriculture, military, and retail (Big Sky Fishing 2011). Currently, Great Falls is a growing tourist destination as it provides access to a wide variety of outdoor recreation opportunities. Visitors come to the city for its rich Western history and impressive parks and open spaces (Great Falls Visitor Information Center 2011). In addition to these attractions, Great Falls is one of the many gateways to Glacier, Yellowstone and Grand Teton National Parks, as well as Showdown, Teton Pass, and Great Divide ski resorts (Great Falls Visitor Information Center 2011).

Table 11. Regional population estimates and characteristics for Montana, 2000-2030.

	Resident Population in 2009	*Persons per Square Mile*	*Percent Population Change 2000-2009*	*Projected % Population Change 2009-2030*
Montana	974,989	7	7.9%	24%
Cascade	82,178	30	2.5%	-8%
Chouteau	5,167	1	-13.5%	-3%
Glacier	13,550	5	2.7%	7%
Hill	16,632	6	0.02%	-7%
Lake	28,605	19	7.5%	47%
Lewis and Clark	61,942	18	10.9%	38%
Liberty	1,748	1	-18.8%	-2%
Missoula	108,623	42	13.0%	30%
Pondera	5,814	4	-8.8%	-4%
Powell	7,089	3	-1.2%	15%
Teton	6,088	3	-5.4%	-2%
Toole	5,151	3	-2.1%	-8%

Source: U.S. Census Bureau (2011a) and NPA Data Services, Inc. (2011)

BENTON LAKE WETLAND MANAGEMENT DISTRICT

The district is the largest in the country, covering ten counties. The Service has acquired 22 waterfowl production areas within the district, most of which lie in north-central Montana's Glacier and Toole Counties. More than 7,000 acres of wetland easements and 4,294 acres of grassland easements in northern Montana have been purchased for waterfowl production. Although these easements are spread throughout the district, the town of Shelby is near to a cluster of wetland easements. Shelby is a small town that is dependent upon agriculture and tourism. The agricultural industry accounts for 10 percent of the 3,525 jobs in Toole County (Bureau of Economic Analysis 2011). Wildlife living on the conservation easements and waterfowl production areas also attract visitors to the area. Opportunities for viewing wildlife are abundant, and hunting, trapping, and fishing are available in many of the waterfowl production area areas.

BLACKFOOT VALLEY CONSERVATION AREA

The Blackfoot Valley Conservation Area is located in north Powell County and lies just south of the town of Ovando, which was home to only 81 residents in 2010 (U.S. Census Bureau 2011b). This sleepy town is located along highway 200 between Helena and Missoula. Historically, it has played several significant roles including, for example, a thoroughfare for the Blackfoot Indian Tribe, a camp for the Lewis and Clark party, a forerunner in the establishment of a United States Post Office system in Montana, and a regional hub for cattle and sheep ranching in late 19th century (Ovando, Montana 2011). The Blackfoot River Valley is a 1.5-million acre watershed that is the central focus of the Blackfoot Community Project, a partnership with The Nature Conservancy, the Blackfoot Challenge, seven local communities and private landowners (Blackfoot Challenge 2005).

The Blackfoot Valley CA encompasses an 824,024-acre ecosystem that includes portions of Missoula, Powell, and Lewis and Clark counties. To date, a total of 43,991 acres of wetland, grassland, and conservation easements have been obtained within the project area. Parts of these counties make up the Blackfoot River watershed in western Montana and include the Ovando Valley and Helmville Valley. The watershed is bordered to the east by the Continental Divide, to the south by the Garnet Mountains, to the north by the Bob Marshall and Lincoln-Scapegoat wilderness areas, and to the west by the Rattlesnake wilderness area. The center of the project area lies about 55 miles east of Missoula. The Blackfoot Valley CA is part of a conservation strategy to protect one if the last undeveloped, low elevation river valley ecosystems in western Montana. The area compliments other components of a broad partnership known as the "Blackfoot Challenge". These efforts include the Service's Partners for Fish and Wildlife Program working with private landowners to restore and enhance habitat on private lands and coordinated management activities on public lands throughout the entire Blackfoot Valley.

ROCKY MOUNTAIN FRONT CONSERVATION AREA

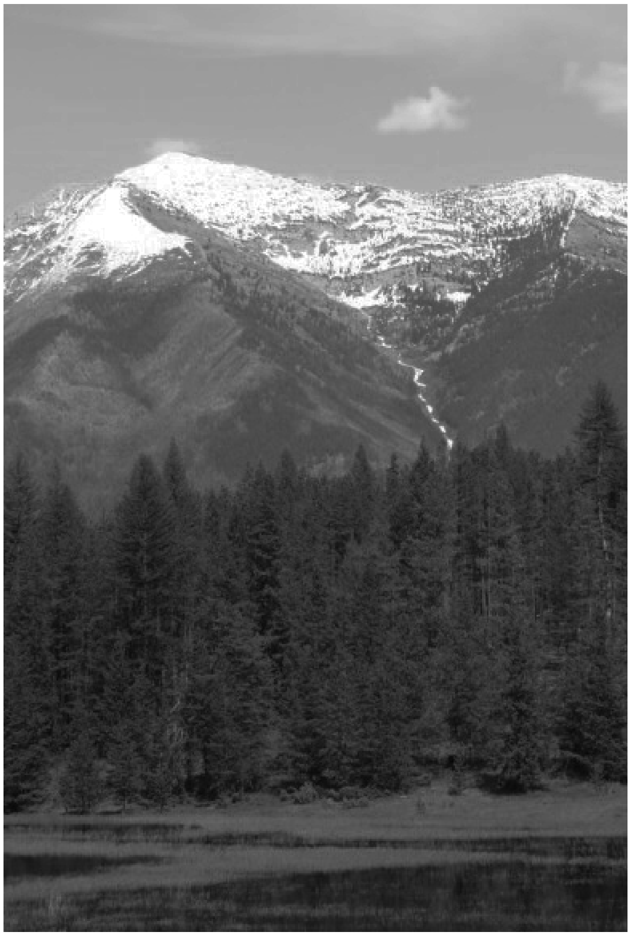
The Rocky Mountain Front CA stretches from Pondera County, south through Teton County, and into Lewis and Clark County. The town of Choteau is located near the center of the conservation area in Teton County, 53 miles northwest of Great Falls. In 2010, Choteau, the county seat of Teton County, was home to 1,684. Located on regional trucking routes as well as Burlington Northern Railroad routes, the city serves as an important commercial hub (U.S. Census Bureau 2011b; Choteau Chamber of Commerce date unknown). The town is also a "home base" from which tourists and recreationists enjoy the Rocky Mountain Front, located just 20 miles to the east. This area, which is known for its many wide-open spaces and pristine wildlife habitats, allows visitors to enjoy the "…culture and traditions [that] are steeped in the fertile soil and in the wheat, barley and livestock" (Choteau Chamber of Commerce date unknown). Tourists also enjoy the Old Trail Museum, which takes visitors back to prehistoric times. Hiking through the mountains, viewing wildlife and fishing the streams and lakes are some of the major recreational highlights of the area surrounding the Rocky Mountain Front Conservation Area (Teton County History 2011). More than 80,000 acres of conservation easements have been acquired to date.

SWAN RIVER REFUGE

Swan River NWR covers 1,569 acres in northern Lake County. Visitors are attracted to the refuge for opportunities to fish, hunt waterfowl, and view wildlife. The refuge is near the city of Kalispell, which is the 7th largest city in Montana and the Flathead County seat. Colorado College recently named Kalispell the "most diverse, balanced economy in the Rocky Mountain West" in its State of the Rockies report (Kalispell Chamber of Commerce 2011). Kalispell has a small-business oriented economy that is growing fast due to train traffic and increasing interest in outdoor recreation. The city provides easy access to the Canadian border as well as public lands, which makes up 94 percent of the county's total land area (Kalispell Chamber of Commerce 2011).

SWAN VALLEY CONSERVATION AREA

Swan Valley CA, which is part of the Interior Columbia River Basin, is located in Lake and northern


USFWS

Swan Valley Conservation Area.

Missoula Counties on the western side of the twelve-county region. The establishment of the Swan Valley CA authorized the purchase of up to 10,000 acres of conservation easements and up to 1,000 acres of fee title land next to the Swan River NWR. The conservation area lies about 30 miles southeast of Kalispell, near the small town of Seeley Lake, which was home to 1,436 residents in 2000 and relies on tourist traffic to and from Yellowstone and Glacier National Parks to sustain its local economy.

Gender, Age and Racial Composition

In the 2009 Census estimate, Montana had about an equal proportion of males (49.9 percent) and females (50.1 percent). This is also true of most of the counties in the complex; the largest disparity, however, is in Powell County, where 61.4 percent of the population is male (U.S. Census Bureau 2011a).

Median ages of the twelve counties ranged between 31 years (Glacier County) and 48.8 years (Liberty County). Only four of the twelve counties reported median ages below the state median (39.0 years). In general, the age distribution of the twelve-county region mimics the distribution of the state as a whole (U.S. Census Bureau 2011a). Counties with higher populations tend to follow the state pattern more closely, and there is more variation in the median age in counties with considerably lower populations.

In 2009, Montana's population was mostly Caucasian (90.3 percent of all residents). American Indian/Alaska Natives had the second largest representation with 6.5 percent of residents. Generally, this distribution is also representative of the racial demographics in the twelve-county region (U.S. Census Bureau 2011a). The demographics of the region, however, do differ slightly from statewide trends in the following ways:

- The regional Caucasian population represents 2.7-percent less of the total population than indicated by statewide demographics.

- The regional American Indian/Alaska Native population represents 2.0-percent more of the total population than indicated by statewide demographics.

The latter of these differences between statewide and regional racial demographics is due in large part to the American Indian/Alaska Native population of Glacier County, which represents the highest proportion of American Indian/Alaska Natives (60.9 percent) in both the region and the state. All counties surrounding the complex are within two percentage points of the state proportion of residents of Hispanic or Latino origin (U.S. Census Bureau 2011a).

ECONOMIC CONDITIONS AND TRENDS

This section discusses conditions and trends in unemployment and social welfare. Many of the counties responded to the recent recession with below-average increases in unemployment, oftentimes reporting unemployment figures lower than the state and national rates. In contrast, many of the counties reported poverty figures much higher than the state and national averages (U.S. Census Bureau 2011a; Bureau of Labor Statistics, 2011). This section also discusses income and employment by industry.

Unemployment and Poverty

Table 12 summarizes unemployment rates, poverty levels, and household incomes. From 2007-2010, many of the counties in the complex proved to have job markets that were less impacted by the recent recession than the rest of the country. The largest increase in nationwide unemployment occurred between 2008 and 2009, during which time unemployment increased by 3.5 percent (U.S. Census Bureau 2011a). In contrast, the average increase in unemployment for the twelve-county region during the same period was 0.9 percent. Glacier County had the smallest change in the unemployment rate from 2008-2009, with unemployment increasing by only 0.4 percent (U.S. Census Bureau 2011a).

In 2009, most of the counties in the region reported median household incomes below the national median ($50,221). The exception is Lewis and Clark County ($52,317), which had the highest median household income in the 12-county region. Lewis and Clark was the only other county in the region to report a figure greater than the state median ($42,222). After Lewis and Clark County, Hill ($40,778), Cascade ($40,434), and Missoula ($40,130) Counties were the only other counties to report a median household income greater than $40,000. Glacier County ($29,941) reported the lowest median income in the region (U.S. Census Bureau 2011a).

Poverty levels in the region tended to be higher than the state (15.0 percent) and national (14.3 percent) averages in 2009. Glacier, Lake, and Powell Counties reported the highest poverty rates among individuals, with 30.5 percent, 20.9 percent, and 20.3 percent, respectively. Lewis and Clark, Cascade, and Teton Counties reported the lowest poverty rates among individuals, with 10.1 percent, 15.1 percent, and 15.3 percent, respectively (U.S. Census Bureau 2011a).

In 2010, all of the counties in the 12-county region had median household incomes below the national median ($51,425), and many of the counties had median incomes below the State median ($43,089). The largest median household income, $50,245, was reported in Lewis and Clark County. The lowest median household income, $32,790, was reported in Pondera County (U.S. Census Bureau 2011a). Only Hill ($44,833), Flathead ($45,258), and Lewis and Clark ($50,245) Counties reported median household incomes above the State median.

Although unemployment seemed to show a rather strong economy, poverty levels in the 12-county region tended to be higher than the State (14.7 percent) and national (13.5 percent) averages. Glacier, Pondera, Liberty, and Lake Counties reported the highest poverty rates among individuals, with 24, 23.6, 22.8, and 21.3 percent, respectively. Lewis and Clark, Flathead, Powell, and Teton Counties reported the lowest poverty rates among individuals, with 10.4, 11.6, 12.8, and 13 percent, respectively (U.S. Census Bureau 2011a).

Table 12. Unemployment, Poverty and Household Income in the Counties Surrounding the Benton Lake National Wildlife Refuge Complex, Montana.

	Median Household Income 2009	*Unemployment Rate 2010*	*Net Change in Unemployment Rate 2007-1010*	*Percent of Persons Below Poverty 2009*
United States	$50,221	9.6%	5.0%	14.3%
Montana	$42,222	7.2%	3.9%	15.0%
Cascade	$40,434	6.1%	2.8%	15.1%
Chouteau	$37,945	4.4%	1.5%	18.1%
Glacier	$29,941	10.1%	2.2%	30.5%
Hill	$40,778	5.6%	1.7%	19.1%
Lake	$35,888	10.1%	5.0%	20.9%
Lewis and Clark	$52,317	5.5%	2.7%	10.1%
Liberty	$36,106	5.0%	2.2%	18.3%
Missoula	$40,130	7.3%	4.1%	16.9%
Pondera	$34,813	6.6%	2.9%	19.1%
Powell	$35,848	8.9%	3.9%	20.3%
Teton	$36,834	5.9%	3.0%	15.3%
Toole	$37,238	4.7%	2.4%	16.5%

Source: (U.S. Census Bureau 2011a,b).

Employment and Income by Industry

Table 13 summarizes employment by industry for the entire region. In 2009, about half of the regional employment (49%) fell into four main sectors, which are as follows (Bureau of Labor Statistics 2011):

- public administration
- educational, health, and social services
- retail trade
- arts, entertainment, recreation, accommodation, and food services

The Census data show that there is a tradeoff between population levels and employment in certain sectors. Namely, counties in the region with smaller populations tend to have both high employment in the agriculture and mining sectors and low employment in the retail trade industry. The opposite is true of regional counties with relative large populations. For example, Liberty County, the least populous of the 12-county region, reported that the agriculture industry alone accounted for 23 percent of its total employment in 2009, while retail trade accounted for 9 percent. In contrast, Missoula County, the most populous county, reported that the retail trade industry accounted for 13 percent of its total employment in the same year, while agriculture and mining accounted for only 1 percent of total employment (Bureau of Labor Statistics 2011).

Liberty County had the highest dependence on farm earnings, which accounted for more than 45 percent of its total earnings for 2009. Chouteau, Pondera, and Teton Counties also showed a high dependence on their farming industries, which accounted for 29 percent, 21 percent and 20 percent of total county earnings, respectively (Bureau of Economic Analysis 2011). These counties have an average population of around 4,700 residents, and an average population density of 2.3 persons per square mile (U.S. Census Bureau 2011a).

Key Activities that Affect the Local Economy

The ability of the complex to affect local economic activity and desired economic conditions is related to Service land use decisions and associated land uses. Recreation and tourism are the prominent resource-based industries with ties to the complex.

TOURISM AND OUTDOOR RECREATION IN MONTANA

Montana residents and visitors to the state take part in a variety of outdoor recreation activities. According to the 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, approximately 950,000 residents and nonresidents took part in wildlife-associated activities in Montana (FWS and U.S. Department of Commerce 2008a). Of all participants,

Table 13. Employment by industry for the 12-county region surrounding Benton Lake National Wildlife Refuge Complex, Montana.

Total employment (jobs) = 221,513

Industry	*Employment by Industry for the 12-county region (%)*
Educational, health and social services	13
Retail trade	12
Arts, entertainment, recreation, accommodation and food services	10
Construction	6
Public administration	14
Professional, scientific, management, admin, and waste services	9
Manufacturing	2
Finance, insurance, real estate, and rental and leasing	8
Ag, forestry, fish and hunting, and mining	5
Other services (except public administration)	6
Transportation and warehousing	2
Wholesale trade	2
Information Services	2

Source: U.S. Census Bureau (2011a)

31 percent took part in fishing for a total of 2.9 million fishing days, 21 percent took part in hunting for a total of 2.1 million hunting days, and 79 percent took part in wildlife-watching for a total of 3.1 million activity days. Montana residents had the highest per capita hunting participation in the country at 20 percent, and fishing participation was also high at 23 percent. Most of all anglers (59 percent) and hunters (74 percent) in Montana were state residents, while most of away-from-home wildlife watching participants in Montana were nonresidents (67 percent). The in-state spending associated with these activities totaled $1.1 billion in 2006, with $585 million spent on trip-related expenditures, $472 million on equipment purchases, and $72 million on licenses (FWS and U.S. Department of Commerce 2008a).

HUNTING AND FISHING

Much of the Service's fee-owned land in the refuge complex is open to hunting. In 2006, the number of people that reported participating in fishing, hunting, or both as a primary form of recreation in Montana totaled 378,000 (FWS and U.S. Department of Commerce 2008a). The spending associated with fishing and hunting in Montana totaled $753 million; of which 55 percent ($417 million) was spent on equipment, 38 percent ($283 million) was spent on trip related expenditures, and 7 percent ($53 million) was spent on other expenses such as magazines, membership dues, and land leasing (FWS and U.S. Department of Commerce 2008a). Waterfowl hunting is a popular recreation activity in the area surrounding the refuge complex. Although popular, the number of waterfowl hunters have declined in recent years. In 2001, there were 23,675 waterfowl stamps sold to in-state residents. Fewer stamps were sold in 2005 (17,474) and fewer still in 2010 (16,428) (MFWP 2011). During the same period, upland game hunting, comprised of turkey and bird hunting, has seen an increase from 44,000 licenses in 2001 to 52,000 in 2010. In 2006, migratory bird hunting comprised only 8 percent of all hunters in Montana (MFWP 2011).

WILDLIFE VIEWING

Wildlife viewing opportunities are abundant throughout the State of Montana. Wildlife viewing can include the activities of observing, identifying, or photographing wildlife. In 2006, the number of people that reported participating in wildlife viewing as a primary form of recreation totaled 755,000 in Montana (FWS and U.S. Department of Commerce 2008a). The spending associated with wildlife viewing in Montana totaled $376 million; of which 80 percent ($303 million) was spent on trip related expenditures, 15 percent ($55 million) was spent on equipment, and 5 percent ($19 million) was spent on other expenses such as magazines, membership dues, and land leasing (FWS and U.S. Department of Commerce 2008a). According to a USFWS report on the national and state economic impacts of wildlife watching, spending by resident and nonresident wildlife watchers in Montana in 2006 generated economic impacts of $376 million in retail sales, $213 million in wages, 9,772 jobs, and $50 million in state and local sales tax revenue, totaling $639 million in total economic effects (FWS 2008b).

Land Use and Ownership Changes Surrounding Refuge Complex Lands

Divided by the Rocky Mountains, the twelve-county area surrounding the refuge complex contains a diverse variety of land uses and covers. Lake, Missoula, and Powell Counties lie to the west of the Continental Divide, and Cascade, Chouteau, Glacier, Hill, Lewis and Clark, Liberty, Pondera, Teton, and Toole lie to the east. The western region is largely forested and includes some of the best water, wildlife and working forests in the country (TNC 2011). Land cover in the western counties is comprised of 58 percent forestland, 19.7 percent grassland, 9.3 percent shrubland, 7.0 percent mixed cropland, 0.3 percent urban, and 3.3 percent other lands and water. Refuge complex units lying to the west of the divide include Swan River NWR, the Blackfoot Valley Conservation Area, and the Swan Valley Conservation Area. The eastern region is more arid and is largely comprised of planted grasslands and native prairie. The area also includes croplands, primarily located in the northeastern counties of Chouteau, Hill, Liberty, Pondera, Teton, and Toole. Land cover in the eastern counties is comprised of 9.9 percent forestland, 74.8 percent grassland, 6.6 percent shrubland, 6.2 percent mixed cropland, 0.1 percent urban, and 0.8 percent other lands and water (Headwaters Economics 2011). Refuge complex units lying to the east of the divide include Benton Lake Refuge, the district, and the Rocky Mountain Front CA.

Land ownership within the twelve-county area is comprised of 63.5 percent private ownership, 20.7 percent Federal ownership, 6.9 percent State ownership, and 7.6 percent tribal ownership (Headwaters Economics 2011). Of the federally owned land, 77 percent is owned by the USDA Forest Service , 9 percent by the National Park Service, 10 percent by the BLM, and 4 percent by other Federal agencies including the U.S. Fish and Wildlife Service (Headwaters Economics 2011).

CHANGES IN LAND USE

The lands and waters of the refuge complex are unique landscapes with high conservation values.

Some of the largest tracts of pristine wildlife habitat remaining in the U.S. are located within the Rocky Mountain Front, Blackfoot Valley, and Swan Valley Conservation Areas. These areas include large expanses of intact habitat and historic wildlife corridors that help federal trust species such as grizzly bear, gray wolf, wolverine, pine martin, and Canada lynx as well as migratory bird species, fish species, and rare plant species. The conservation areas in the complex are primarily comprised of a mix of public lands and large tracts of privately owned ranchlands and forestlands. Private ranchlands and forestlands provide dual benefits by supplying wildlife habitat on working landscapes. These valuable landscapes are threatened by residential development. In 2000, the American Farmland Trust identified 5.1 million acres of prime ranchlands in Montana as being vulnerable to low-density residential development by the year 2020, with ranchlands located in high mountain valleys and mixed grassland areas surrounding the Rocky Mountains at highest risk of conversion. Within the Rocky Mountain Region (which includes 263 counties in Idaho, Montana, Wyoming, Utah, Colorado, Arizona, and New Mexico) Lewis and Clark and Missoula Counties ranked in the top ten counties for acres of strategic ranchland at risk (American Farmland Trust 2000).

Development risk for ranchlands is largely driven by population growth and housing demand. Northwestern Montana has seen a boom in population and residential development in recent years. Within the twelve-county area, Missoula County has seen the fastest growth in population, with an increase of 12.95 percent between 2000 and 2009. Lewis and Clark and Lake Counties have also seen a large increase in population, with increases of 10.85 percent and 7.45 percent, respectively during the same time period (U.S. Census Bureau 2011a). In addition to increases in population, second homes have become very popular in the state. As of 2011, there were more than 38,000 vacation homes in Montana, up 59 percent from those reported in the 2000 Census (Great Falls Tribune, 2011). Increases in population and second homes have led to increases in residential development in the region. Within the twelve-county area, acres of private land developed for residential use increased by 29.9 percent from 1980 to 2000. As of 2000, residential development accounted for 2.8 percent of private lands in the twelve-county area, up from 2.1 percent in 1980 (Headwaters Economics 2011). Among the twelve counties, residential development accounted for the largest percent of private acreage in Lake and Missoula Counties. Between 1980 and 2000, residential development in Lake County increased by 101.1 percent from 9.2 percent to 18.4 percent; and residential development in Missoula County increased by 10.1 percent from 11.4 percent to 12.5 percent (Headwaters Economics 2011).

Residential development is not the only threat to wildlife in the region. The conversion of grasslands and wetlands to croplands can degrade water quality and diminish valuable habitat. Wetlands cover a relatively small area of Montana, but they have high ecological value as stopovers and breeding grounds for migratory birds and waterfowl. Montana wetlands are at risk of cropland conversion, with about 27 percent of the wetlands present before 1800 converted to other land uses, primarily cropland (Dahl 1990). In addition to the filling, leveling, and draining of wetlands, conversion of grassland to cropland has threatened upland habitat next to wetlands. Upland habitats provide nesting cover for migratory birds and for waterfowl and their broods. The complex's wetland management districts play a key role in protecting Montana's wetland and grassland resources.

Conservation Reserve Program (CRP) lands also affect wildlife habitat and water quality near the complex. The CRP program pays landowners to take highly erodible croplands out of production and plant them to native grasses. CRP grasslands reduce erosion and help keep contaminates, sediments, and nutrients out of streams and lakes (USDA FSA 2008). CRP lands also help wildlife and have been found to increase nest abundance and population growth for waterfowl and migratory birds (Ryan et al. 1998). As of 2011, CRP lands in Montana comprised more than 2.8 million acres or about 3 percent of the Montana land base (USDA FSA 2011). The USDA Farm Service Agency enters into 10 or 15 year CRP contracts with farmers, and more than 59 percent of these contracts are scheduled to expire in the next three years; 497,194 acres will expire in 2011, 694,004 acres will expire in 2012, and 365,537 acres will expire in 2013 (USDA FSA 2011). Depending on market conditions, commodity prices, and farm policy, these expirations could result in a large conversion of grasslands to croplands (Smith, Montana Outdoors); however, it is not likely that all of the expiring contracts will be converted (Roberts and Lybowski 2007).

CONSERVATION EASEMENTS

The Service has identified conservation easements as a key strategy for conserving important wildlife habitat in Northwestern Montana. Conservation easements leave land in private ownership, protecting private property rights, while providing the Service with a cost-effective conservation strategy that enables the conservation of large blocks of habitat. Within the Rocky Mountain Front, Blackfoot Valley, and Swan Valley conservation areas, the Service proposes to conserve a total of 408,500 acres of wildlife habitat through the acquisition of conservation easements from willing sellers. To date, the Service has protected 76,847 acres in Lewis and Clark, Pondera, and Teton counties through conservation easements within the Rocky Mountain Front Conservation Area, and 43,991 acres in Lewis and Clark and Powell counties through wetland, grassland, and conservation easements within the Blackfoot Valley Conservation Area. The Service has protected an added 11,392 acres in wetland and grassland easements in the district.

A conservation easement is a voluntary legal agreement entered into between a landowner and a conservation entity. Conservation easements are binding in perpetuity; the landowner reserves the right to sell or bequeath the property, but the easement and its associated restrictions remain with the property in perpetuity. Under a conservation easement, a landowner supports ownership of their property, but transfers some of their ownership rights to the conservation entity. Landowners have a set of rights associated with their land. For example, landowners have the right to run cattle, grow crops, harvest trees, build structures, and subdivide and sell portions of their land. Under a conservation easement, the landowner transfers several of these rights to a conservation entity. The most common right transferred is the right to develop or subdivide the land. Some conservation easements include more land use restrictions. The terms of a conservation easement must be mutually agreed-upon by the landowner and the easement holder. There are three primary types of conservation easements offered in the refuge complex: perpetual wetland easements, perpetual grassland easements, and perpetual conservation easements. Perpetual wetland easements protect privately owned wetlands from being drained, filled, or leveled; perpetual grassland easements protect privately-owned rangeland and hay-land from conversion to cropland. Perpetual conservation easements include the wetland and grassland restrictions and also protect land from being subdivided for residential development. For all refuge complex easements, landowners support the right to allow or disallow public access to their land. Hunting on many private lands is available for a fee through outfitters and guides. Although conservation easements do prohibit game farms, refuge complex easements do not preclude commercial hunting on private lands. Private landowners can also grant permission for hunters to hunt on their land at no cost. The State of Montana facilitates private land hunting through their Block Management program, which helps landowners manage hunting activities and provides the public with free hunting access to private land (Personal conversation with Neal Whitney, MFWP, on June 14, 2011.).

SOCIAL AND ECONOMIC IMPACTS OF CONSERVATION EASEMENTS

Conservation easements are public goods that generate many benefits for local residents, communities, and governments. Unlike goods derived from natural resources that are traded in a market, many of the benefits from conservation, such as ecosystem services and intrinsic worth, can be difficult to monetarily quantify. Conservation easements can protect values associated with biodiversity and wildlife abundance, support aesthetic beauty, and protect social and culturally significant features of landscapes and livelihoods (Holdren and Ehrlich 1974, Ehrlich and Ehrlich 1992, Daily 1997, MEA 2005). Ecosystem services, such as water purification, oxygen production, pollination, and waste breakdown, are also supported for local residents through conservation easements (MEA 2005). A primary public benefit of U.S. Fish and Wildlife Service conservation easements is enhanced and preserved wildlife habitat. As development stressors increase over time, many key off-refuge habitat areas may become less available due to conversion to nonwildlife habitat uses. Habitat preservation has been shown to stabilize and increase wildlife populations, especially for migratory bird species (Reynolds et al. 2001). Conservation easements on private lands strengthen the resiliency of species habitat and provide opportunities for wildlife movement and adaptation for years to come. Although the general public may not be able to explicitly use or access land that is protected by conservation easements, these lands do help residents through increased biodiversity, recreational quality, and hunting opportunities on publicly accessible wildlife refuges and on some private lands (Rissman et al. 2007). In addition to preserving wildlife habitat and ecosystem services, conservation easements can protect the traditional and historic way of life that is associated with the working landscape; land with historic commercial use, such as ranching, forestry, and farming, is often compatible with or beneficial to wildlife refuge objectives (Jordan et al. 2007, Rissman et al. 2007). Conservation easements can also provide financial benefits for landowners that can enable them to preserve the natural and historic value of their farm, ranch, and open space lands, and to pass this legacy on to their children and grandchildren.

The Service proposes to buy conservation easements from willing sellers at fair market value. The fair market value of a conservation easement is decided through an appraisal process. An appraiser estimates how much the land would sell for unencumbered by the conservation easement (the before value) and how much the land would sell for with the conservation easement in place (the after value). The value of the conservation easement is equal to the before value minus the after value, or the difference in the fair market value of the property with and without the easement. Landowners may also choose to donate conservation easements to the Service. The donation of a conservation easement may qualify as a tax-deductible charitable donation, which may result in federal income tax benefits. The sale of a conservation easement for less than its fair market value (called a bargain sale) may also qualify for tax deductions. Landowners may be able to claim a charitable income tax donation equal to the difference between the fair market value and the bargain sale price of their easement. Income from the sale of a conservation easement may be taxable. Please note that the Fish and Wildlife Service does not give tax advice. Landowners considering entering into a conservation agreement with the Service should consult a tax advisor or attorney for advice on how a conservation easement would affect their taxes and estate.

Conservation easements affect the value of the encumbered property, and may affect the value of neighboring properties. A conservation easement will reduce the fair market value of an estate, because the easement permanently removes some of the estate's development potential. The reduction in value depends on the potential development value of the land and the level of restriction agreed-upon in the easement. In general, an easement on land located in an area with high development pressure will have a greater effect on the value of the land than an easement on land located in an area with low development pressure; and an easement that is more restrictive will have a greater effect on the value of the land than an easement that is less restrictive. Changing the status of a parcel of land from developable pastureland to privately owned conservation land can increase the residential value of adjacent properties that are in proximity to permanently preserved open spaces (Irwin 2002). Evidence suggests that increases in residential property values as a result of open space proximity is most significantly due to the preclusion of development and not necessarily the type of open space preserved. In other words, preserved farm and ranchland could increase residential property values in a similar way that preserved forestland could (Irwin 2002).

The conservation easements acquired by the refuge complex are expected to have minimal impacts to local government revenue. Local governments collect revenue through intergovernmental

USFWS

Boardwalk at Benton Lake National Wildlife Refuge.

transfers, property taxes, sales taxes, personal income taxes, and other charges such as permitting. Property taxes constitute the largest source of local governments' own revenue (Urban Institute and Brookings Instutution 2008), and are expected to remain unchanged. Property taxes are assessed based on the value of property. For most types of properties, county assessors use fair market value to determine property tax liabilities; however, agricultural and forest land is often assessed differently. In many states, the assessed value of agricultural land and forestland is decided based on the productive value of the land rather than on the fair market value of the property. The fair market value of land is the amount that a property is estimated to sell for. This value includes both the productive value of the land and any speculative value associated with the possibility of developing the land. Conservation easements reduce the fair market value of property by removing the speculative value associated with possible development; however, conservation easements generally do not affect the productive value of agricultural land or forestland. In Montana, agricultural lands and forestlands are valued on the basis of land productivity, and are not influenced by the pressures of urban influences or land speculation (Montana Department of Revenue 2011). Most of the properties that enter into conservation easement agreements with the Service are classified as agricultural land or forestland, thus there will be little to no impact to the current property tax base for the twelve-county area. Local government revenue associated with personal income is also expected to remain relatively constant within the twelve-county area. The proposed easements would affect the location and distribution of development, but are not expected to change the rate or density of human population growth. Redistribution of population growth could affect the distribution of personal income related revenues across the counties, but is expected to have little effect on total revenues within the twelve-county area. Land protection through conservation easements could result in a reduction in future expenditures for local governments and municipalities. New residential developments require local governments to provide services such as fire protection, police services and schools, and to construct new infrastructure such as roads, parks, and water and electrical delivery systems. A 2009 study to assess the effect of the Montana Legacy Project on net government revenues in Lake and Mineral Counties found that the costs of residential development of Legacy Project lands outweighed expected new revenues (Headwaters Economics 2011a, 2011b). The effect of conservation easements on local government revenue is complex and speculative, but evidence suggests that the effects of the refuge complex conservation easement programs on net revenues will be marginal.

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.

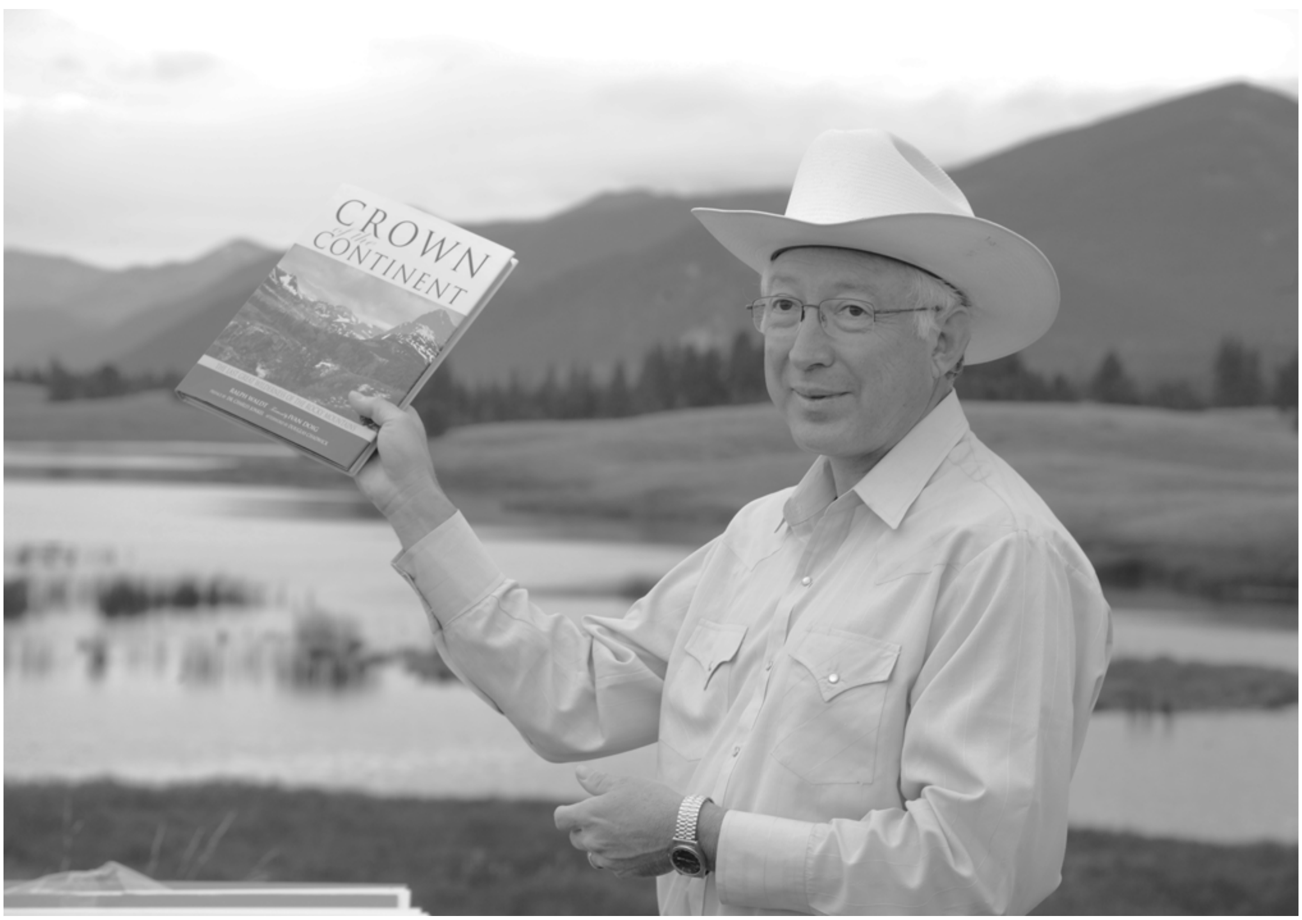
Grasslands: Tame —Alternative C

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 maintenance 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. Fredrickson).

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 resources 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-

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 personnel. 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

USFWS

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.

CHAPTER 6—Management Direction

Mitch Werner

Swan Valley Conservation Area.

This chapter contains the specific objectives and strategies that would be used to carry out the Service's proposed action (alternative C), which is the draft CCP for the Benton Lake National Wildlife Refuge Complex in northwestern Montana. The Service recommends this as the alternative that could best achieve the refuge complex's purposes, vision, and goals while helping to fulfill the Refuge System mission.

The proposed action (alternative C) would apply to all units of the refuge complex. If the Regional Director selects alternative C as the preferred alternative, the objectives and strategies presented in this chapter would become the final plan to be carried out over the next 15 years. In addition, the stepdown management plans listed in table 29 (refer to section 6.3 below) would provide implementation details for specific refuge programs. Alternative C would be augmented by specific objectives and strategies for the Benton Lake Refuge, which are fully described in chapter 7 under alternative C1.

The focus of the draft CCP, as described in alternative C, acknowledges the importance of naturally functioning ecological communities in the refuge complex. Management efforts would be focused on restoring and supporting the natural dynamics of the ecosystems of the northern Great Plains and Rocky Mountains and providing associated visitor services.

Appendix E contains the required compatibility determinations (draft) for public uses and management actions associated with this draft CCP. In addition, appendix F describes the fire management program for the refuge complex.

6.1 Proposed Goals, Objectives, and Strategies

This section discusses goals, objectives, and strategies that serve as the steps needed to achieve the CCP vision. While a goal is a broad statement, an objective is a concise statement that describes what is to be achieved, the extent of the achievement, who is responsible, and when and where the objective should be achieved—all to address the goal. The strategies are the actions needed to achieve each objective. Unless otherwise stated, the refuge complex staff would carry out the actions in the objectives and strategies. The rationale for each objective provides context such as background information, assumptions, and technical details.

A major objective of this CCP is to establish partnerships with landowners, volunteers, private organizations, and county, State, and Federal natural resource agencies. This has been woven into the objectives and strategies that follow across all goals. In particular, landowners would be informed of opportunities to take part in compensated habitat protection programs (such as conservation easements). Opportunities exist to enhance or establish new partnerships with nonprofit organizations, sporting clubs, community organizations, and educational institutes.

Another process that would be applied across all goals is adaptive resource management (ARM) to help in inventory, monitoring and research. The Service proposed that the uncertainty surrounding habitat management could be dealt with most efficiently within this paradigm (figure 14) (Holling 1978, Kendall 2001, Lancia et al. 1996, Walters and Holling 1990). This approach provides a framework within which objective decisions can be made and the uncertainty surrounding those decisions reduced. Briefly, the key components of an ARM plan follow:

- Clearly defined management goals and objectives.
- A set of management actions with associated uncertainty as to their outcome.
- A suite of priority models representing various alternative working hypotheses describing the response of species or communities of interest.
- Monitoring and assessment of the response of target organisms.

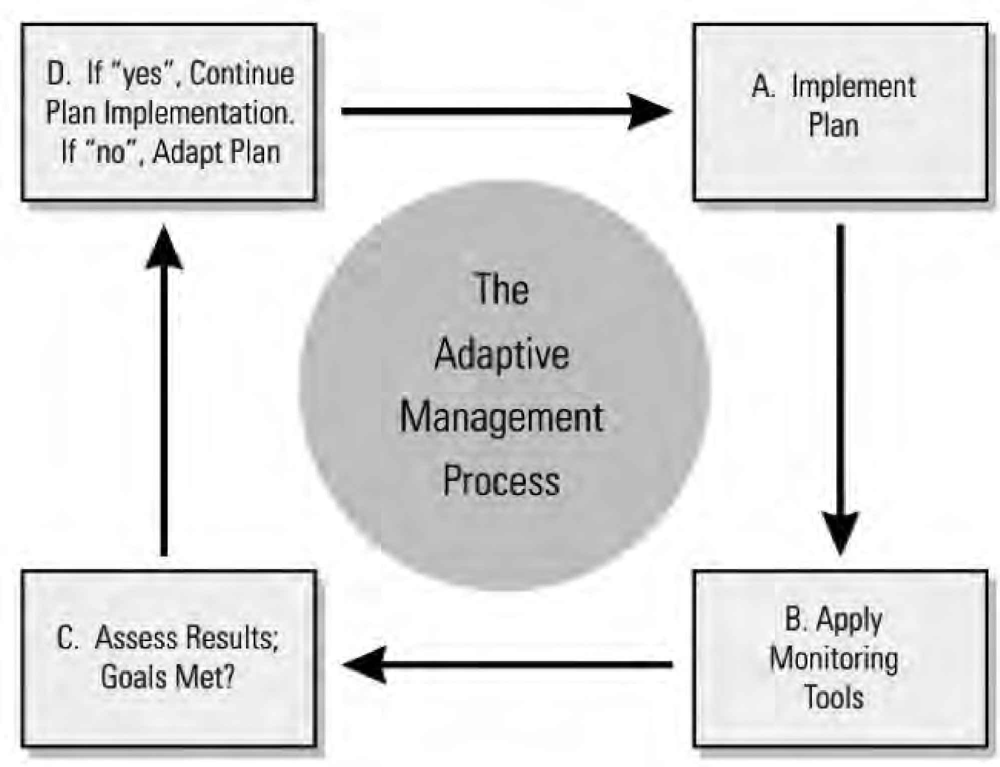

Figure 14. The adaptive resource management process..

- Use of monitoring and assessment information to direct future decisionmaking through choosing a best model.

The first three components (goals, actions, and models) are largely defined before initiation of an ARM plan, while the latter two (monitoring and directed decisionmaking) constitute an iterative process, whereby each year the predictive ability of models are tested against what was observed during monitoring. This may result in a new best model, greater support for the existing best model, or new models constructed from emerging hypotheses. In this way, management can evolve as more information is gained and uncertainty is reduced.

The development of ARM plans for habitat management, for example, would allow the refuge complex to learn by doing, while supporting a focus on management objectives. Knowledge gained from assessing management actions is considered as integral to the process as the management actions themselves. This emphasis on gaining knowledge about the refuge complex creates a situation whereby the refuge complex can refine its habitat management in a feedback between management and assessment. Reducing the uncertainty of habitat management via ARM plans would greatly help the refuge complex in development of long-term habitat management plans.

Landscape Conservation Goal

Actively pursue and continue to foster relationships within the Service, other agencies, organizations, and private partners to protect, preserve, manage, and restore the functionality of the diverse ecosystems within the working landscape of the refuge complex.

Background Information

The refuge complex is located in an area that is designated as a high priority for landscape conservation and linkage protection by many conservation partners including MFWP, National Fish and Wildlife Foundation, TNC, The Conservation Fund, Ducks Unlimited, Trout Unlimited, Pheasants Forever, American Wildlands, Yellowstone to Yukon Conservation Initiative and the Blackfoot Challenge. Many of these organizations are involved in transboundary conservation, protecting and connecting habitat in the United States and Canada. Strong partnerships have already been developed to meet the challenges of climate change and wildlife.

Climate Change Objective 1

Carry out at least five management actions in the next 10 years that improve resiliency of wildlife and habitats to adapt to the effects of climate change.

Strategies

- Address climate change stressors through preservation of large blocks of functional land that have natural processes, which maximizes resiliency.

- Work cooperatively with partners to improve condition of landscape to increase resiliency and seek more opportunities to work with partners to address climate change issues including restoration projects on Service-interest lands.

- Vigorously take part in all aspects of the Great Northern LCC and the Plains and Prairie Potholes LCC.

- Conduct baseline monitoring of habitat conditions to measure effects of climate change.

- Watch and analyze management actions to figure out the effect of climate change, including actively participating and cooperating in data acquisition through the national inventory and monitoring program.

- Support existing weather station and river gauges throughout complex, and install more stations and gauges to check climate change.

- Partner with USGS and others to obtain information on climate change and its applicability to management of the complex.

- Restore native grasses and perennial plants in grassland habitats throughout the refuge complex (see grasslands objectives).

- Actively support USDA NRCS conservation programs, such as CRP, in refuge complex watersheds.

Rationale. Climate change is contributing to the loss, degradation, and fragmentation of current habitats and would likely create unique new habitats as species redistribute themselves across the landscape. In addition, climate change is interacting with nonclimate stressors—such as land use change, wildfire, urban and suburban development, and agriculture—to fragment habitats at ever-increasing rates. Protecting and restoring contiguous blocks of habitat, and using linkages and corridors to enhance connectivity between habitat blocks, would likely facilitate the movement of fish and wildlife species responding to climate change.

The refuge complex is located in two LCCs—the Great Northern and the Plains and Prairie Potholes. These LCCs are a conservation alliance of science and management with other bureaus in the DOI, other Federal agencies, the State natural and wildlife resource offices, Canadian Provinces of British Columbia and Alberta, and academic and other nongovernmental organizations. LCC products may include resource assessments, climate model applications to proper scale, vulnerability assessments, inventory and monitoring protocols, and conservation plans and designs. Many of these products will be developed collaboratively with DOI Climate Science Centers and other science providers (for example, USGS Science Centers, USDA Forest Service Research Stations, and universities). In the face of accelerating climate change and other twenty-first-century conservation challenges, LCCs will continually seek out new scientific information, assess the effectiveness of conservation actions and make necessary adjustments as new information becomes available. With active and vigorous participation by complex staff, this recurring feedback process would help staff address uncertainties on the landscape and transform new knowledge into more effective conservation plans and actions on the ground.

To understand the effect of climate change on refuge complex habitats and resources, baseline inventories and longer term monitoring of key indicators need to be developed. Temperature, precipitation and runoff are likely to be sensitive to climate change and by expanding these monitoring stations within the refuge complex, staff would have a better understanding of how global changes are translating to local effects. Developing baseline information and monitoring for habitat indicators would also be critical for understanding how climate change is affecting these resources as well as giving direction to future management. Collaborating with others such as the USGS, LCCs, and the Service's Inventory and Monitoring Program would strengthen this effort by bringing more technical expertise, scientific credibility and a connection to climate changes outside of the refuge complex.

Managing complex lands in a healthy vigorous state dominated by native species can increase carbon sequestration. CO2 from the atmosphere is taken up by plants and stored as carbon in biomass (for example, tree trunks, leaves and roots) or stored as organic carbon in soils. Plants and soil have extraordinary capacity to remove and store atmospheric carbon, thus diminishing greenhouse gases. Recent work by the USGS and Ducks Unlimited has shown that restoration of previously farmed wetlands results in rapid replenishment of soil organic carbon (Gleason et al. 2005).

CRP is among the most important land use strategies for sequestering stored organic carbon and, in addition, contributes significantly to controlling soil erosion losses, restoring soil quality, providing wildlife habitat, and protecting air and water quality (Rice and Owensby 2001). The CRP program also illustrates the potential to sequester carbon in soil by converting cropland to grass cover. Gebhart et al. (1994) reported for the Great Plains that 21 percent of carbon lost by decades of intensive tillage was recovered within 5 years under CRP, with carbon sequestration rates of 4,357–5,990 pounds per acre each year.

Restoration to native grasses is more expensive to establish, but has a higher carbon storing potential, than exotic grass mixtures. Further, it was found that in natural ecosystems of perennial plants, annual biomass production belowground generally exceeds that aboveground. Root mass was greater at grazed sites in two-thirds of the studies, and when production was viewed at the whole plant level, grazing had no effect on plant production (Milchunas and Lauenroth 1993).

Climate Change Objective 2

To decrease greenhouse gases in the atmosphere that lead to accelerated climate change, aggressively sequester carbon and use best management practices to meet stewardship responsibilities; manage lands, facilities, travel, vehicles, and vessels; and become carbon-neutral by 2020.

Strategies

- Throughout the complex, conduct an energy audit on all buildings and continue to carry out energy saving strategies.

- Designate a staff member to carry out and share energy saving strategies that staff can use to reduce energy consumption on the refuge complex.

- Reduce energy use in buildings by implementing energy efficient projects—upgrade insulation, heating systems, windows and doors.

- Expand the photovoltaic system at the complex headquarters.

- Employ energy saving practices such as, unplug office equipment when not in use, buy energy star products, recycle, buy recycled products, install high-efficiency lighting, unplug chargers when not in use, lower thermostats, set water heaters to 120–130 °F, enable the "sleep mode" feature on computers, configure computers to "hibernate" automatically after 30 minutes of inactivity, and shut down computers at the end of the day.

- Incorporate "green" building principals and construction practices in construction projects. New buildings and additions should be designed to maximize efficiency and should be equipped with the most energy efficient heating and cooling systems, and appliances.

- Use renewable energy sources for infrastructure—wind power, solar power, and geothermal energy technologies.

- Replace current vehicles with energy efficient models, and consider alternative fuel vehicles when possible.

- Reduce fuel consumption in existing vehicles by implementing conservation strategies (such as, check tires to make sure that there is proper inflation, change oil as directed by the manufacturer, and by checking air filters monthly and changing when needed).

- Reduce travel by using teleconferencing, Webinars, and WebEx.

- Manage habitats to maximize carbon sequestration.

Rationale. This objective is identified in the Service's climate change strategy. Methods for accomplishing carbon neutrality include reducing the carbon footprint of the refuge complex and increasing carbon sequestration on refuge complex lands. The refuge complex is continuing to expand. As more infrastructure is added, it should be evaluated for energy efficiency and upgraded to reduce energy consumption.

The Service's land management activities for wildlife have an associated carbon footprint. To achieve carbon neutrality, the Service must assess and reduce this footprint to the greatest extent possible, while still achieving the Service's mission. The Service should consider how to reduce emissions while achieving the Service's highest land management priorities, a process that involves evaluating green energy alternatives, considering trade-offs, and making difficult choices.

Refuge managers have a variety of management tools to help them support healthy, vigorous grasslands. The condition of habitat and the tools selected to achieve habitat goals affect sequestration of carbon. For example, the amount of soil organic carbon is greater under a grazing regime than under a haying regime. This is a result of a greater amount of carbon being returned to the pasture as excreta and greater stubble remaining with grazing (Schnabel 2001).

Restoration of eroded and degraded soils provides a large potential to sequester soil organic carbon. DNC that has been planted on some of the waterfowl production areas is often similar in composition and structure to CRP, which has been found to increase sequestration of soil organic carbon.

Preserving Intact Landscapes Objective 1

Over the next 15 years, protect 170,000 acres of wildlife habitat (grassland, wetland, riparian, sagebrush-steppe and forest) that support intact, functional landscapes, protect high-priority habitat and linkage zones for Service trust species, increase resiliency for climate change and other stressors and support working landscapes within refuge complex conservation areas.

Strategies

- Work with other Service programs such as realty and the Partners for Fish and Wildlife to engage and meet with interested landowners, to set priorities, and to buy conservation easements.

- Regularly meet with county commissioners, State and Federal agencies, nongovernmental conservation organizations and other participating partners to provide updates and coordination on conservation easement purchases and program progress.

- Pursue money to buy easements in established conservation areas from congressional appropriations, private donations, partnerships with nongovernmental organizations and securing other non-Federal money sources.

- Host informational tours to share examples of successful conservation collaboration between the Service and partners.

- Fully carry out the Service's SHC initiative, which would refine and update priorities within conservation area boundaries for buying conservation easements.

- Develop, take part in, and collaborate on monitoring that informs landscape protection, SHC and ARM, such as the Annual Breeding Waterfowl Surveys in the PPPLCC's Prairie Pothole Region in Montana and at the Swan Valley CA.

- Establish a complex representative to regularly engage with the Great Northern LCC and the Plains and Prairie Potholes LCC.

- Evaluate and explore new areas and partnership opportunities within the refuge complex to establish conservation areas and increase the opportunities for landowners to take part in conservation easement programs.

- Hire 1.5 FTE wildlife refuge specialists to support land acquisition and work with the realty program.

- Hire 0.5 and 1.0 FTE wildlife refuge specialists to manage conservation easement programs in Swan Valley and Blackfoot Valley CAs.

Rationale. Within the refuge complex, the Rocky Mountain Front, the Blackfoot Valley and the Swan Valley have been identified as priority areas where protecting intact, functional landscapes would have significant benefits for Service trust species including grizzly bears, bull trout, trumpeter swans, lynx, waterfowl and other priority migratory birds. Conservation areas have been established in each of these landscapes that enable the Service to work with willing landowners to buy perpetual conservation easements.

The Service has had a successful history of buying conservation easements and protecting intact, functional landscapes in the Blackfoot Valley since 1994 and the Rocky Mountain Front since 2005. One key to this success is building partnerships internally and externally. Within the Service, having Service staff from the refuge complex, the Partners for Fish and Wildlife Program and the realty program engaged in each landscape has been a formula for success. In the newly established Swan Valley CA and any future conservation areas, this level of partnership and commitment is likely to be necessary to be successful. In addition, 1.5 FTE are necessary to

USFWS

A wetland in the Rocky Mountain Front Conservation Area.

establish a full-time position in the Blackfoot Valley and Swan Valley CAs for the successful implementation of conservation easement objectives.

Based on the history of money and staff availability for buying easements within the refuge complex, a total of 170,000 acres over the next 15 years is considered a reasonable objective. This would include 120,000 acres for the Rocky Mountain Front CA, 45,000 acres for the Blackfoot Valley CA and 5,000 acres for the Swan Valley CA over the life of the plan. These acre estimates are based on several variables within each CA: acquisition averages over the last five years, high variability in annual money sources such as LWCF, average parcel size, land values, and the availability of willing sellers. Historically, the number of landowners interested in easements exceeded the available money. Decisions among conservation areas would be made through consensus based on biological values, willing sellers, money source and opportunity.

Priorities within projects have been identified in land protection plans published by the Service in 2011 for each conservation area (USFWS 2011f). These priorities would need to continue to be evaluated and revised using SHC. SHC is a way of thinking and doing business that requires the Service to set biological goals for priority species populations, helps the Service make strategic decisions about conservation efforts, and encourages the Service to constantly reassess and improve its actions. These are critical steps in dealing with a range of landscape-scale resource threats such as development, invasive species, and water scarcity—all magnified by accelerating climate change. SHC incorporates five key principles in an ongoing process that changes and evolves. These include biological planning (setting targets), conservation design (developing a plan to meet the goals), conservation delivery (implementing the plan), monitoring and adaptive management (measuring success and improving results) and research (increasing understanding). LCCs are fundamental units of planning and science capacity to help the Service and its partners carry out SHC. Having a staff member engaged with the LCCs would improve the refuge complex's efforts to carry out SHC.

In addition to established conservation areas, the Service has the authority to buy wetland and grassland easements throughout most of the refuge complex through the Federal Duck Stamp Program. Federal Duck Stamp funding targets important migratory bird habitat. To use this money strategically (SHC), the Service is currently working on updating models of wetland use by breeding waterfowl in the PPPLCC's Prairie Pothole Region in Montana. These priorities would be consistent with priorities in the eastern part of the greater area, based on similar models that target unprotected wetlands with more than 25 breeding duck pairs per square mile and are at high risk of degradation. In addition, the Intermountain West Joint Venture is developing similar models of wetland use by breeding waterfowl in the Swan Valley to refine wetland protection priorities in this landscape.

Preserving Intact Landscapes Objective 2

Protect Service interests throughout the refuge complex by annually coordinating, monitoring, and collaborating with entities engaged in activities such as industrial or commercial development and agricultural land conversion.

Strategies

- Actively engage in planning efforts by industrial and commercial interests where it influences complex interests by providing relevant Service data and input during the development and siting phases, reviewing and responding to planning documents—such as an EA or environmental impact statement (EIS)—and where proper, participating in postimplementation monitoring.

- Attend training on the regulations, effects, and mitigation techniques for industrial, commercial, and agricultural developments that affect resources.

- Proactively collaborate with partners and LCCs in landscape-wide regional threat assessments.

Rationale. In addition to those activities that directly harm the natural resources located on fee title and easement lands, the Service is concerned with any potential effect on other parts of the refuge complex. Certain activities, such as development and land conversion, have the potential to have far-reaching and cumulative effects on resources throughout the refuge complex.

Habitat Goal

Actively conserve, restore, and manage upland and wetland habitats across the northern prairies and intermountain valleys of the refuge complex, through management strategies that perpetuate the integrity of ecological communities.

Grasslands Objective 1

Within the first 5 years of the plan, complete rangeland assessments on fee-title native grassland tracts greater than 80 acres in size (10 tracts totaling 12,420 acres).

Strategies

- Evaluate existing native plant communities in comparison to the historical climax plant community (HCPC) described in the corresponding NRCS Ecological Site Descriptions.
- Summarize the degree to which current vegetation indicates a decline in integrity of native vegetation in a report. Use these results to rank grasslands for future management action.
- Hire one seasonal technician [for 2 seasons] to conduct native grassland assessments.

Rationale. Interpreting Indicators of Rangeland Health Technical Reference 1734–6 Version 4 (Pellant et al. 2005), is recognized by range professionals as the basis for inventory and assessment of rangeland health. This publication was a collaborative effort between the BLM, NRCS, the Agricultural Research Service and the USGS's Forest and Rangeland Ecosystem Science Center. The publication promotes the concept of rangeland heath as an alternative to range condition and assessing rangelands through ecological status concepts. These principles combined with NRCS Ecological Site Descriptions, provide the best available science for assessing the refuge complex's prairie tracts.

Native grassland tracts greater than 80 acres in size were found to be a reasonable break point for conducting rangeland assessments within the refuge complex. Remaining native grassland tracts in the refuge complex are made up of smaller fragmented areas (<80 acres) typically represented by rocky hill tops, wetland edges and fence line corners making them difficult to manage separately from their tame grass dominated surrounding.

Ten tracts were identified for rangeland assessments: Benton Lake Refuge and nine waterfowl production areas—Blackfoot, Ehli, Furnell, H2–O, Jarina, Kingsbury Lake, Kleinschmidt Lake, Sands, and Savik.

Grasslands Objective 2

Within 15 years, manage 10 high-priority, fee-title, native grassland tracts to support plant communities at greater than 80 percent of their HCPC or within their ecological site-specific reference state.

Strategies

- Manage grasslands using fire, grazing, rest, and if necessary, haying cycles. Timing and combinations of treatments may be altered to support native plant communities or trend toward restoration of their HCPCs. Attention will be given to diversity of vegetative structure within each management unit.
- Priority would be given to invasive species management within native grasslands using IPM and EDRR.
- Watch species composition and vegetative trends to evaluate the success of current management regimes.
- Identify and check key wildlife species as added indicators of grassland health and management success.
- Hire one seasonal biological technician for native grassland management throughout the refuge complex.

Rationale. Grasslands within the refuge complex were formed as the result of climatic conditions, geological parent materials, fire, biotic factors, and the influences of natural herbivory (USDA–NRCS–MT. 2005) The HCPCs for each of these unique combinations can be described by evaluating relict areas, and other areas protected from excessive disturbance. Within the refuge complex, the HCPCs are generally dominated by cool-season grasses, with a minor component of warm-season grasses, native forbs, native shrubs and an absence of nonnatives.

Traditional theories of plant succession leading to a single HCPC, however, are inadequate for understanding the refuge complex succession of plant communities in grasslands (Briske et al. 2005). Grasslands are more aptly described using state-and-transition vegetation dynamics in a nonlinear framework. A "state" is an alternative, persistent vegetation community that is not simply reversible in the linear successional framework. States are seral stages, while pathways between states are "transitions." Transitions are triggered by climatic events such as wildland fire or by management such as grazing, farming, and prescribed fire. The HCPCs, and their associated states and transitions, have been described by NRCS for most of the grassland types on the refuge complex (USDA–NCRS–MT. 2005).

Historically, HCPCs transitioned to other seral states due to drought, grazing, precipitation and fire regimes. These transitions did not compromise the long-term resiliency or health of the grasslands. In addition, these different states were preferred by different wildlife species providing a variety of grassland habitats and resources over time. Departure from this historical range of variation can occur under continued adverse effects such as colonization and recruitment of noxious weeds, improper management actions, extended drought and changes in the natural fire regime. The HCPC species are gradually outcompeted by lower successional species. This shift in species composition disrupts ecological processes, impairs the biotic integrity of the site and restricts the system's ability to recover to higher seral states. Thus, the site loses much of its resiliency (USDA–NRCS–MT. 2005).

Therefore, the objective is to manage grasslands within the refuge complex so that they do not cross a threshold where resiliency is lost and the system is no longer able to recover to higher seral stages, yet still allowing for departures from the HCPC that are part of the historical states and transitions of that grassland type. NRCS grassland descriptions do not specifically state 80 percent as a threshold; however, this seems to be a reasonable starting point and as management and evaluation progresses this can be reevaluated. Although research consistently shows that precipitation is the principle factor altering productivity on ecological sites in the northern Great Plains (Heitschmidt et al. 2005), rotational management prescriptions for grazing, fire and rest emulate historical transitions, contribute to HCPC resiliency and provide a diversity of habitats that appeals to a wide variety of grassland-dependent species.

Across the fee-title grasslands, nonnative, invasive species are one of the largest threats to supporting HCPC resiliency and function. Preventing the introduction of invasive species is the first line of defense against invasions. However, even the best prevention efforts would not stop all invasive species introductions. EDRR efforts increase the likelihood that invasions would be addressed successfully while populations are still localized and population levels are not beyond that which can be contained and eradicated (NISC 2003). Once populations are widely established, all that might be possible is the partial mitigation of negative effects. In addition, the costs associated with EDRR efforts are typically far less than those of long-term invasive species management programs.

Grasslands Objective 3

Within 15 years of the approved plan, convert 800 acres of tame grass stands, on five high-priority fee-title tracts, to native-dominant perennial herbaceous cover including several species of native forbs.

Strategies

- Identify cooperators and negotiate farming agreements and budget seeding and chemical costs for planned planting years.

- Use cooperative farming agreements for 2–4 years to prepare the seedbed before planting native species.

- Hire 0.5 FTE maintenance worker to convert tame grass stands to native cover and check results.

Rationale. Replanting tame grass to native grasslands, with subsequent treatments of prescribed fire and grazing management, would emulate historical processes and gradually recover soil mycorrhizae, invertebrate diversity and symbiotic relationships. Once native grass species are reestablished, soil erosion potential should be negligible, with permanent plant cover breaking the cropping cycle required to support tame grass. Carbon sequestration and nutrient cycling would be significantly greater in the more floristically diverse community expected with native plantings.

Tame grass stands that were hayed are more likely to be burned or grazed once they are replanted to native prairie. These types of management should replenish and improve the nutrient cycles rather than mining the soil nutrients through rotational haying systems.

Priority for planting native species is given to tracts with tame grass stands that have become decadent or overrun with undesirable introduced cool-season grasses, especially fields that are next to or within high-priority prairie tracts and compatible with grazing and fire treatments. Factors taken into consideration to assure reasonable success of establishment and long-term management include, (1) surrounding adjacent vegetation and (2) availability and suitability of management tools (prescribed grazing and fire). Tame grass tracts where the surrounding adjacent landscapes are dominated by agricultural crops and tame grass stands were identified as a lower priority for native planting. In these areas, resource costs associated with protecting native plantings from invasion of cool-season exotic grasses and noxious weed infestations are prohibitive.

There are approximately five priority tracts within the refuge complex (Benton Lake Refuge, Big Sag, H2–O, Kingsbury Lake, and Sands WPAs) that have about 1,651 acres of tame grass that could be planted to native grass species using the criteria described above. Planting native grass species requires higher input costs ($156 per acre), traditionally takes longer (3–4 years) and is more difficult to establish than tame grass ($106 per acre and 1–2 years to establish). Given the higher input costs and difficulty in establishment, planting approximately 50 percent, or 800 acres, of the priority tame grass stands to native species is considered reasonable over the next 15 years. Monitoring these plantings would be important to assess the success and to identify improvements in techniques and efficiencies that could reduce costs over time.

Grasslands Objective 4

Over the life of the plan, support 1,905 acres of low-priority, fee-title, tame grass and DNC in good to fair condition based on species composition (25-percent legume, 75-percent wheatgrass mix), vigor (seedhead production greater than 25 percent) and litter accumulation of less than 6 inches in the duff layer.

Strategies

- Manage 1,055 acres of DNC (currently in good to fair condition) using cooperative rotational systems (primarily haying).
- Replant 850 acres of DNC (currently in poor condition and not suitable for native plantings) back to DNC using cooperative faming agreements for 2 to 4 years to prepare the seedbed before replanting DNC.
- Treat invasive species within tame grasslands using IPM and EDRR.
- Identify cooperators, negotiate farming agreements, and budget seed and chemical costs for planned planting years.
- Hire 0.5 maintenance worker to support DNC grassland management.

Rationale. Tame grass stands established for wildlife cover should ideally be comprised of 75-percent grasses and 25-percent alfalfa (Duebbert et al. 1981). Grasses planted with legumes are taller and the overall stand productivity is higher. Taller, dense vegetation, in turn, has been related to higher waterfowl nest densities and success (Higgins and Barker 1982, Arnold et al. 2007).

Tame grass stands that have been successfully established on good sites can be expected to provide desirable vegetative structure for at least the first 6 growing seasons and to keep the composition for at least the first 10 growing seasons, and probably longer for most stands (Higgins and Barker 1982, Devries and Armstrong 2011). Decreasing vigor can be identified by deviations from the optimal 75:25 percent mix, as well as reduced vigor measured by seedhead production. In drier parts of the PPPLCC's Prairie Pothole Region, such as the refuge complex, an approximate guideline of less than 25-percent seedhead production is recommended (personal communication, Ducks Unlimited). Declining stand quality often also coincides with a buildup of litter (Duebbert at al 1981, Higgins and Barker 1982, Devries and Armstrong 2011). The threshold of 6 inches is based on staff observations and experience managing tame grass stands within the refuge complex. Because tame grass stands are generally a lower priority than native grasslands on the refuge complex, indicators have been chosen that can be rapidly assessed with informal monitoring.

Management of low-priority fee-title tame grass and DNC within the refuge complex was divided into two categories, (1) Maintenance of 1,055 acres of DNC in good to fair condition and (2) replanting 850 acres of DNC currently in poor condition. These figures do not include the 1,651 acres of degraded tame grass stands identified and grouped as high-priority areas for native grass plantings.

The 1,055 acres of DNC in good to fair condition may be managed primarily using rotational haying systems to sustain longevity, species composition, vigor and reduce litter accumulation. Rotations provide a diversity of structural habitats within the management units, which appeals to a wide variety of grassland-dependent species. Occasional prescribed grazing or fire may be implemented within specific tract rotations.

The 850 acres of tame grass currently in poor condition should be prioritized for cooperative farming and planting back to DNC. As tame grass stands continue to degrade over time into poor habitat conditions the initial resources to address these habitat needs grows substantially.

Regardless of tame grass condition, treating invasive species infestations in these units would still be a priority. Emphasis would be given to species that have been identified by the State of Montana as noxious. EDRR efforts increase the likelihood that invasions would be addressed successfully while populations are still localized and population levels are not beyond that which can be contained and eradicated (NISC 2003). Once populations are widely established, all that might be possible is the partial mitigation of negative effects.

Grasslands Objective 5

Within 15 years, begin removal of 25 miles of tree shrub plantings, starting with high-priority large native prairie tracts.

Strategies

- Remove up to 19 miles of nonnative tree plantings on the Benton Lake Refuge. Removal efforts would start with 3.5 miles of interior tree plantings that cause fragmentation of otherwise contiguous grassland blocks.

- Remove remaining nonnative tree plantings on waterfowl production areas in the wetland management district as a second priority.

- Use forestry cutters for tree removal. Apply herbicide treatment for two growing seasons following tree removal.

- Evaluate areas for grass seeding after trees have been successfully removed.

Rationale. The refuge complex has approximately 25 miles of nonnative tree plantings. Most of these plantings occur on the Benton Lake Refuge. The 19 mile figure represents nonnative tree plantings in or next to native prairie grasslands. Nonnative tree plantings contribute to fragmentation, depredation and parasitism, which negatively affect grassland-dependent migratory birds (Bakker 2003). Some of these species include species of concern, such as marbled godwits and chestnut-collared longspurs.

Tree plantings on waterfowl production areas within the district are a lower priority because they are exclusively in tame grass stands and do not fragment native prairie.

Forestry cutters are available within the region and maybe reserved for specific projects. The tree removal may be accomplished using existing Service staff in the fall and winter months, which would result in cost savings. Based on past operations, it takes approximately 8 hours to remove 1 mile of tree planting.

Wetlands and Riparian Areas Objective 1

Over the next 15 years, manage and protect water quality for wetlands and riparian habitats on fee-title lands within the refuge complex such that there is minimal hazard to wildlife from contaminants.

Note: Minimal hazard is defined as conditions where "hazardous constituents may be elevated in one or more ecosystem components, but no imminent toxic threat is identified" (Lemly 1995, USDI 1998). The exact numerical value would vary with the contaminant and the constituent (such as water or soil).

Strategies

- Develop a baseline assessment of water quality in relation to high-priority contaminants on fee-title wetlands and riparian areas.

- For wetlands and riparian areas already within the minimum hazard thresholds, check conditions every 5 years thereafter or as water conditions allow.

- For wetlands and riparian areas above the minimum hazard threshold, conduct proper onsite remediation to reduce contaminants.

- For complex wetlands and riparian areas above the minimum hazard threshold, work with neighboring landowners, watershed groups, nongovernmental organizations and other government agencies to reduce offsite contributions to contaminants whenever possible.

Rationale. There are hundreds of substances known to affect wetlands and waterbodies; however, there are nine that are common in the western United States and of particular concern. These include salinity, dichlorodiphenyltrichloroethane (DDT) and the trace elements arsenic, boron, copper, mercury, molybdenum, selenium and zinc (USDI 1998). In addition, lead can be a concern when birds feed in hunted areas and ingest lead pellets.

For waterbodies on fee-title land managed by the Service, any contaminant at levels shown to cause reproductive impairment in wildlife are unacceptable. Information is available on the biological effects of these contaminants that can be used to define what level, and in what constituent (such as water, soil, or wildlife), is right for defining the minimum threshold (for example, USDI 1998, Montana Department of Environmental Quality, and EPA) for a given waterbody.

Selenium is a serious problem on the Benton Lake Refuge. The refuge has a history of moderate to high hazard levels (Nimick et al. 1996, Zhang and Moore 1997, refuge unpublished data 2006). Selenium at these levels is sufficient to affect reproduction in sensitive species such as waterfowl. See chapter 7 for more details on addressing this objective for selenium on Benton Lake Refuge.

In 1995, a survey of contaminants from 10 sites within the district was conducted to find out if trace elements were accumulating in either sediment or the aquatic food chain of wetlands (Gilbert et al. 1995). Elevated levels of lead, boron, and selenium were detected in several locations. The concentrations did not appear to pose an immediate threat to wildlife resources but continued monitoring was recommended. Other fee-title wetlands within the refuge complex that have not been tested before should have at least an initial baseline survey completed, especially those with potential sources of contaminants in the surrounding landscape.

For some fee-title wetlands, streams and rivers on the refuge complex contaminants may be coming from offsite sources that are not directly under Service management. In these situations, partnerships with neighboring landowners, watershed groups and other government agencies may be necessary.

Wetlands and Riparian Areas Objective 2

Where possible, over the next 15 years, restore the natural hydrologic processes (wet–dry cycles) for the site-specific hydrogeomorphic condition of wetlands and riparian areas within the refuge complex.

Strategies

- Check water inputs on fee-title lands as necessary to protect water rights.

- Conduct a hydrogeomorphic assessment of the Swan River Refuge and evaluate other fee-title areas, which could greatly benefit from this type of intensive assessment.

Rationale. Each wetland and riparian system lies within a specific hydrogeomorphic context, which is based on the underlying geology, soils, topography, elevation, hydrology, plant and animal communities and physical anthropogenic features of the surrounding landscape. While hydrology is widely considered by wetland experts to the most significant of these factors for driving wetland health and function, it cannot be considered outside of the hydrogeomorphic context.

Throughout the refuge complex, most of the wetlands on fee-title lands have not been altered and any changes to the original hydrogeomorphic condition are due to the surrounding landscape. However, for some of the wetlands and riparian areas within the refuge complex the hydrology has been altered. Most of the alterations to these waterbodies have been done with the intention of maximizing use by migratory birds, in particular waterfowl. While these alterations may initially increase use by waterfowl, these conditions may either be difficult to sustain or may result in unintended negative consequences to the health and sustainability of the wetland or riparian systems. For example, repeated or deep flooding may result in lower wetland productivity such as decreased food sources (seeds, invertebrates) for waterbirds, changes in vegetation including favoring nonnative, aggressive species, reducing flows or increasing temperatures that are detrimental to species such as native trout in streams or rivers used as water sources, and causing or exacerbating contamination of waterbodies (Murkin et al. 1997, Zhang and Moore 1997, Heitmeyer et al. 2009).

To understand the extent to which alterations are affecting wetland health and integrity, a process known as the HGM methodology can be applied. An HGM study assembles known information about the hydrogeomorphic features of a waterbody before alteration, develops an understanding of what the alterations have been and their effect, and then describes possible management actions for improving the health and sustainability of the wetland or riparian area. By continuing to check and support water rights, both natural and supplemental, the refuge complex has the greatest flexibility of possible management actions for improving the health of wetlands or riparian areas once the hydrogeomorphic context is understood.

Several areas within the refuge complex have been identified as high priority for restoring hydrology and wetland function because of documented negative effects, feasibility of restoration, or connection to ongoing mitigation efforts. These include the Benton Lake and Swan River Refuges. A complete hydrogeomorphic assessment has been completed for the Benton Lake Refuge. For a detailed description of restoration at Benton Lake Refuge, see chapter 7. Whether or not other fee-title lands could benefit from an HGM analysis would also be evaluated.

Wetlands and Riparian Areas Objective 3

Where it is not currently feasible to restore full hydrologic function within the refuge complex, annually manage wetlands and riparian areas to emulate the natural hydrologic processes (wet–dry cycles), as for the site-specific hydrogeomorphic condition.

Strategies

- At H2–O WPA, natural flow and runoff would be captured, and Blackfoot River flows would be occasionally diverted from April to September to prolong the spring, summer, and fall hydroperiod. If less than historical amounts of water are used, residual right may be leased to the State.

- At Blackfoot WPA, management of natural wetland basins would emulate natural processes. The drying cycle would be emulated in all wetland basins including mitigation wetland basins. Mitigation wetland basins may be held at lower water levels to emulate natural flows and runoff.

Rationale. Some wetland and riparian areas within the refuge complex have been altered, but the ability to restore the hydrologic function is limited by legal obligations, such as wetlands created under mitigation agreements, limited by constraints in the surrounding landscape beyond the Service's management controls or lack of money.. In these cases, the Service would manage these areas by emulating the natural flooding and drying cycles.

Wetlands and Riparian Areas Objective 4

Within 5 years, complete condition assessments on fee-title wetlands and riparian areas throughout the refuge complex.

Strategies

- Evaluate existing wetlands and riparian areas with Level 1 Assessments designed by the MNHP.
- Summarize the degree to which current vegetation indicates a decline in integrity of native vegetation and value to wetland-dependent wildlife in a report. Use these results to rank wetlands for future management action.
- Hire one seasonal technician for two seasons to conduct wetland assessments.

Rationale. Wetlands and riparian systems are very dynamic. Flooding and drying cycles have a significant effect on the plant and animal communities that may be present at any given point in time. Because of this variability, vegetation is often the preferred indicator of wetland condition because at least some plants are usually present in a wetland basin making it possible to do surveys in wet and dry years. Many guides have been developed to account for the range of variability for wetland vegetation and what it indicates for wetland condition, including several specifically for Montana (MNHP 2010, Hansen et al. 1996, NatureServe 2010). The MNHP, in particular, has developed a rapid assessment that can be tailored to the needs of the user. Using these guides that describe the full range of natural variability for a particular wetland type or site, in addition to current vegetation, the Service would assess the degree to which the integrity of the native wetland vegetation community has been compromised.

Wetlands and Riparian Areas Objective 5

Within 15 years, begin or continue management of fee-title wetland vegetation so that refuge complex-wide at least 80 percent of wetlands are in good vegetative condition as defined by the MNHP Wetland Condition Assessment method.

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Kingsbury Waterfowl Production Area.

Strategies

- Manage wetland vegetation by using grazing, haying, or fire to emulate historical disturbances when natural flooding and drying cycles allow.

- Reduce competition and cover of nonnative vegetation by using discing, prescribed fire, grazing, haying or herbicides.

- Where proper and feasible, native plantings and seeding may be used to restore native vegetation.

- Priority would be given to invasive species management within wetlands using IPM and EDRR.

- Use natural flooding and drying cycle to favor native vegetation and reduce nonnative vegetation where applicable.

- Check vegetation to find out if wetland vegetation is improving or declining.

- Identify and check key wildlife species as added indicators of wetland health and management success.

Rationale. Vegetation is a common indicator of wetland health (Fennessy et al. 2007). Many methods have been developed to try to capture this, but the methods of DeKeyser et al. (2003, 2009), Hargiss et al. (2008), and the MNHP (2010) have been developed on similar wetland basins and capture the range of variation within the refuge complex. The method is also flexible, allowing for rapid assessments in areas where change is expected to be minimal or the Service's ability to affect the wetland with management is minimal, but can be scaled up to a more intensive method where active restoration, changes in management or significant effects from the surrounding landscape would be expected.

Objectively determining the breakpoints, or thresholds, for condition classes, such as defining what is a "good" wetland is difficult. The MNHP is currently working on a wetland reference network in Montana that would help clarify this definition. Until this is finished, the Service would use the vegetation metrics identified by the MNHP and strive to have wetlands in the top condition classes for each metric. At a minimum, the Service would conduct the rapid assessment and strive for at least 80-percent cover by native plants, less than 5-percent noxious weeds, less than 25-percent other nonnative or highly tolerant native species, moderate litter accumulation that does not prevent plant recruitment, no single dominant plant type across entire wetland, and for wetlands with naturally occurring woody vegetation all age classes of native woody vegetation are present and less than 50 percent of available second year and older stems are browsed. For wetlands with active restoration or management, the more intensive assessment can be implemented that collects more details on the diversity of native plant species, their Coefficient of Conservatism and overall Floristic Quality Index (Northern Great Plains Floristic Quality Assessment Panel 2001; Montana Natural Heritage Program unpublished data) Reference conditions and cutoff values of "good" may be reassessed after the initial evaluation.

Forests and Woodlands Objective 1

In collaboration with the BLM's Marcum Mountain Resource Management Projects (Environmental Assessment DOI–BLM–MT–B010–2009–0013–EA), the Service would develop site-specific prescriptions to reduce average conifer canopy coverage by 50–75 percent through emulation of a mixed severity fire in natural patterns, consistent with Douglas-fir habitat types within Fire Groups 4 and 6 (Fischer, 1987).

Strategies

- Treat 260 acres of warm Douglas-fir forest habitat on the Blackfoot WPA using timber harvest, mastication, and prescribed fire, or a combination of these treatments.

- Restore historical wildlife habitat attributes, such as snags, large down logs, and quantity and quality of forage and browse species, while keeping open, large-tree (more than 18 inches diameter at breast height) habitat with edge sinuosity and feathered density transitions.

- Support visual resources within the various forest types.

- Increase the landscape's resilience to future wildfire events, root disease and mountain pine beetle outbreaks by supporting and increasing (depending on location), the widely adapted seral species present (such as ponderosa pine and quaking aspen).

- Reduce invasive weed species within these forest types.

Rationale. Harvest, mastication, and prescribed fire treatments would be designed to decrease conifer encroachment into open parks and meadows, increase aspen groves by decreasing conifer encroachment and stocking density to more historical levels, decrease ladder fuel on ponderosa pine-dominant sites, and reduce any remaining hazardous fuel.

Treatment activities are intended to support and restore forest and rangeland health by improving vegetation distribution (spatial and temporal) and species composition and structure to resemble the historical range of natural variability.

The quaking aspen and shrub–grass parks have tended to decrease in extent and habitat quality because of long-term fire suppression, conifer competition, timber management activities, browse damage by wild ungulates and livestock, and past livestock management practices.

Some proposed vegetation treatment units are located within sight of Highway 200. Treatments in these units would be implemented in such a way as to not dominate the visual landscape.

- Fire Group Four: Warm, dry Douglas-fir habitat types. Under natural conditions, these sites support fire supported ponderosa pine stands. In the absence of fire, Douglas-fir regenerates beneath the pine and eventually dominates the overstory.

- Fire Group Six: Moist Douglas-fir habitat types. Douglas-fir often dominates all stages of succession on these sites, even when subjected to periodic fire.

Forests and Woodlands Objective 2

Within 2 years of plan approval, find out if forestland treatments are needed on the remainder of the refuge complex. If needed, develop management plans with site specific prescriptions.

Strategies

- Use natural fire regimes according to "Fire Ecology of Western Montana Forest Habitat Types" (Fischer, 1987) to support the health and vigor of forested resources. Natural fire regimes would be emulated with prescribed fire, which may require some thinning or fuel reduction before prescribed fire.

Rationale. In general, complex forest lands are in good condition and do not need extensive management at this time. Since forest comprise only 3 percent of refuge complex lands and are naturally self-sustaining for decades, complex resources have been directed to other habitats. All complex forest lands are surrounded by vast acres of forest managed by the USDA Forest Service, Montana Department of State lands and Plum Creek Timberlands. Timber management of these mid-elevation forests is primarily for sustainable harvest and multiple uses. Managing refuge lands for mature forests would complement adjacent forest types.

Sagebrush–Steppe Objective

Support 2,500 acres of healthy, vigorous sagebrush-steppe habitats dominated (more than 50-percent cover) by mid-height, native cool-season grasses. Support at least 13-percent mountain big sagebrush cover with an average canopy height less than 5 feet. Support Ponderosa pine, Douglas-fir and Rocky Mountain Juniper at less-than–5-percent cover. Annually, these conditions should be supported on at least 50 percent of grassland and steppe habitats as nesting cover for upland nesting waterfowl and sagebrush-obligate species.

Strategies

- When conditions are conducive, prescribed fire may be applied to the native sagebrush uplands emulating the historical mean fire interval for big sagebrush communities in southwestern Montana, which is estimated to be 25 years (Lesica et al. 2005).

- If prescribed fire is not fully successful in reducing the woody vegetation cover to less than 5 percent, mechanical removal of trees may be needed to meet objective.

- Units of sagebrush–steppe would be grazed at a high intensity (50–60 percent removal of standing cover), with a heavy stocking rate, for a short duration, as needed to reduce litter and increase vigor of the grassland understory.

- Priority would be given to invasive species management within sagebrush-steppe using IPM and EDRR.

- Check species composition and vegetative trends to evaluate the success of current management regimes.

Rationale. Native sagebrush-steppe is an imperiled ecosystem, with as much as 60 percent of the sagebrush communities in North America considered to be significantly altered or degraded (Knick et al. 2003). There is a priority to protect this vital habitat type through conservation easements and work with private landowners through the Partners for Fish and Wildlife Program to improve management on these lands. The Service also wants to manage its fee-title sagebrush-steppe to best complement the native species that rely on this habitat type.

Woody species such as Ponderosa pine and Rocky Mountain juniper are encroaching into the native sagebrush uplands and significant ecological changes are occurring. This invasion is taking place because fire has been excluded from the valley floor and it will continue until fire is reentered into the natural equation or until mechanical and chemical techniques are used (Miller and Rose 1999, Miller et al. 2001). Historical mean fire intervals for big sage communities were estimated at 25 years for southwestern Montana (Lesica et al. 2005).

Prescribed fire can be logistically and socially difficult to complete. When certain situations present themselves, such as landowner interest, partner availability, and the ability to safely complete burns, prescribed fire would be considered to meet various habitat objectives. However, no more than 50 percent of the native uplands in a single unit would be burned during the breeding season each year. If prescribed fire is not fully successful in reducing the woody vegetation cover to less than 5 percent, mechanical removal of trees may be needed to meet the objective.

The understory of the sagebrush-steppe is typically dominated by rough fescue, ranging in canopy cover from 10 percent to as much as 70 to 80 percent on the least disturbed, most mesic sites. Other important understory (more than 75 percent) grasses are Idaho fescue, prairie Junegrass, and bluebunch wheatgrass (Cooper 2004). Rough fescue plants appear to be well adapted to periodic burning; however, succession to a near-climax state takes more than 20 years following heavy grazing, and complete recovery following light grazing can take up to 14 years (Tirmenstein 2000). Conversely, Idaho fescue can increase with grazing and can become dominant when rough fescue is overgrazed. If prescribed fire is not possible on sagebrush-steppe habitats, litter may build up and decrease the vigor of the understory grasses. In such cases, limited grazing may be helpful, but no more than 25 percent of the total native upland acreage would be grazed in any one year. Grazing prescriptions would need to be carefully monitored to avoid adverse effects.

Plants such as spotted knapweed, yellow toadflax, common tansy, and Canada thistle have the genetic propensity to invade native vegetation and become a dominant element of the landscape, often with only minimal disturbance or through natural disturbance events. These species degrade wildlife habitat, increase soil erosion, diminish water quality, degrade native grasslands, and require the expenditure of significant resources in attempts to control their spread. None of these species are native to Montana, and most of the natural agents (insects and diseases) that keep these species under control in their native areas of Europe of Asia are not present in Montana and there is no other natural agent to prevent the unchecked spread of these species across the State.

On the Service's fee-title lands, the local refuge manager and the Invasive Species Strike Team have mapped infestations and are actively managing these infestations through biocontrol, chemical control and monitoring. Integrated weed management strategies include herbicides, biocontrol, revegetation, multispecies grazing, hand pulling, plowing, mowing, prevention, and EDRR.

High-priority species such as the Brewer's sparrow, and loggerhead shrike build nests aboveground in shrubs or rely specifically on shrubs for cover. Brewer's sparrows, in particular, have experienced significant declines in the last 10–20 years and are good habitat indicator species because they appear to be sensitive to habitat changes at multiple scales (Knick et al. 2003). Brewer's sparrow is strongly associated with sagebrush, preferring sites with more than 13-percent sagebrush cover with an average canopy height less than 5 feet and more than 25 percent of cover in native, climax species (Bock and Bock 1987, Rotenberry et al. 1999).

Wildife Goal

Support diverse and sustainable continental, regional, and local populations of migratory birds, native fish, species of concern, and other indigenous wildlife of the northern prairies and intermountain valleys of northern Montana.

Species of Concern Objective

Over the next 15 years, develop protocols to protect and enhance federally listed endangered, threatened, or candidate species on refuge fee-title lands for the continued health and viability of populations of species of concern and reduce any possible negative effects from management actions on other State and Federal species of concern.

Strategies

- Biologists would develop protocols to evaluate the effects of new or changed management actions on species of concern.
- Biologists would develop a monitoring protocol to establish abundance, population trends and habitat associations of high-priority species of concern.

- Partner with conservation organizations, MFWP, Plum Creek Timber Company, and private organizations to help with inventory and monitoring.

- Coordinate with the MNHP to survey the Swan River Refuge yearly for water howellia.

- Survey suitable habitat on waterfowl production areas in the Blackfoot Valley for Spalding's catchfly.

- Continue to help Blackfoot Trumpeter Swan reintroduction by coordinating cygnet releases, release sites, and monitoring until seven breeding pairs are established or until evaluation by the working group under the guidance of the Blackfoot Trumpeter Swan Program Implementation and Evaluation Plan suggests that the project should be terminated.

- Consider reintroduction of trumpeter swans within the Swan Valley Conservation Area.

- Evaluate and potentially begin grizzly bear conflict reduction measures, as implemented in the Blackfoot River Conservation Area, in communities within the Rocky Mountain Front and Swan Valley Conservation Areas. Grizzly bear conflict reduction measures would only be implemented in concert with Montana Fish, Wildlife and Parks and with support from local communities.

- Evaluate the effects of public use on species of concern and carry out seasonal public-use restrictions in areas where species of concern occur within 5 years of plan approval.

Rationale. The ESA requires Federal agencies to carry out conservation (recovery) programs for listed species and to make sure that agency actions are not likely to jeopardize the continued existence of listed species or adversely change or destroy their critical habitat. Section 7(a) of the act requires Federal agencies to evaluate their actions with respect to any species that is listed as endangered or threatened and with respect to its critical habitat, if any is being designated.

Conservation planners often develop a list of species of concern specific to their goals and objectives. The refuge complex has decided to use the MNHP's list of species of concern because they are specific to areas managed by the refuge complex, and the criteria used to make up their list was based on population size, area of occupancy in Montana, short- and long-term trends, threats, inherent vulnerability, and specificity to environment. Species designated as State species of concern by the MNHP that may occur within the refuge complex are located in appendix D. Refuge biologists would look at the MNHP list, compare it to other programs' lists, and evaluate population trends and habitat needs to establish a hierarchy of species to consider in management decisions for the complex. Any management action that would result in long-term or substantial changes to habitat (including changes from historical management techniques) would be reviewed by refuge staff for effects on species of concern before implementation. In addition, staff would conduct pre- and post-monitoring of selected species in conjunction with habitat management efforts including restoration, and regeneration efforts. Supporting an up-to-date list of species of concern, providing feedback on refuge complex occurrences to MNHP, and monitoring the effects of management actions would help support the conservation of species of concern on the refuge complex.


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Badger.

Habitat management practices are derived from a managers past experience, knowledge collected over years of hands-on fieldwork, research trials, and communication with colleagues. However, habitat management is a complex science and results can be site specific and change through time. It is necessary to check the effect of management actions on priority species to make sure these actions are having the desired wildlife species response. Management techniques can be altered if the desired results are not met. This is the basis of adaptive resource management.

Specific actions to help species of concern that have already been implemented on the refuge complex include the following: (1) collaboration with the MNHP to check for water howellia on the Swan River Refuge; (2) reintroduction of trumpeter swans to the Blackfoot Valley; and (3) baseline monitoring of colonial-nesting waterbird species of concern.

Spalding's catchfly is a federally listed threatened species that is easy to miss in traditional surveys and monitoring. Waterfowl production areas in the Blackfoot Valley contain habitats (rough fescue-dominated grasslands and fescue–sage grasslands) that support Spalding's catchfly in other locations. Although vegetation surveys have been conducted on these waterfowl production areas, intensive surveys for Spalding's catchfly also need to be conducted.

Water howellia is restricted in Montana to depressional wetlands in the Swan Valley, typically occupying small basins where the water level recedes partially or completely by the fall. Water howellia is located on land owned by TNC next to the Swan River Refuge. Similar habitat is found on the Swan River Refuge. Surveys need to be conducted in suitable habitat yearly because water howellia production is highly dynamic depending on yearly climatic conditions.

The Northern Continental Divide Ecosystem (NCDE) grizzly bear population is increasing at an annual rate of 3 percent and the overall population is estimated at approximately 900 bears (Servheen 2011). There were 232 mortalities documented between 2000 and 2010 with 49 percent of those deaths occurring on private lands. Research shows that these mortalities are a direct result of human/grizzly bear conflicts (Servheen 2011). Successful, cooperative, conservation delivery activities that have been implemented in the Blackfoot Valley Conservation Area to reduce human/grizzly bear conflicts include removal of dead livestock carcasses, protecting spring calving areas and installing power fencing around apiaries (USFWS 2011f). Initiating similar cooperative efforts in the Rocky Mountain Front and Swan Valley Conservation Areas could result in further reductions in human/grizzly bear conflicts for the NDCE grizzly bear population.

Disturbance caused by recreational pursuits may elicit behavioral or physiological responses in wildlife. Behavior responses are seen when individuals are displaced from prime foraging habitats. This may result in decreased body condition going into winter, which has been linked to lower reproductive performance and even death. Other forms of behavior responses include flight and interference with foraging. Physiological responses are less obvious and harder to measure. They include adrenalin-induced increases in heart rate, blood flow to skeletal muscle, increased body temperature and elevated blood sugar (Gabrielsen and Smith 1995). All of which exert an energy cost to the animal reducing vigor.

Because they are listed under the ESA and have been the subjects of considerable research, evidence of such effects is more readily available for grizzly bears than many other species of concern (Claar et al. 1999). Recreational activities can affect, directly or indirectly, the survival of grizzly bears. Grizzly bears can be directly taken in the defense of human life. Indirectly, recreationists can displace bears off quality habitat onto less desirable habitat. This may result in reduced reproduction by displaced bears, higher mortality rates due to food stress or lower security, and smaller bear populations due to reduced carrying capacity of remaining habitat (Serveen et


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Grizzly bear spotted in Blackfoot Valley Conservation Area.

al. 2001). Another example includes nesting trumpeter swans that have been shown to be sensitive to human disturbance during the nesting season. Birdwatching, photography, research, and other activities in or near nesting areas may cause nest failure or cygnet loss by disturbing adults (Mitchell 1994). In Yellowstone National Park, human intrusion was the most significant known cause of egg failure in trumpeter nests (Banko 1960). By reviewing and summarizing known effects from disturbance on species of concern within the refuge complex, staff would be better able to manage and reduce the possible negative effects.

Migratory Birds Objective

Through the life of the plan, the refuge complex would annually review national and regional migratory bird population trends and then address monitoring and management strategies as needed.

Strategies

- Increase communication and coordination with Division of Migratory Bird Management within the Service to identify species of conservation concern.

- Once a species of conservation concern is identified, seek Division of Migratory Bird Management input to provide potential management and research direction and opportunities for helping with long-term sustainability.

- Use adaptive management, such as implementation of seasonal closures on fee-title lands to protect nesting birds, limited predator removal, nest success monitoring and artificial nesting structure implementation to support habitat augmentation efforts for species of conservation concern, and cooperate with research efforts done by partner agencies.

- Annually take part in population level or landscape-level monitoring of migratory birds such as the North American Breeding Bird Survey, Annual Midwinter Waterfowl Survey, Prairie Pothole Breeding Waterfowl Survey (Four-square Mile Survey), Mourning Dove Survey, and preseason waterfowl banding for the refuge complex.

Rationale. Due to an ever-increasing habitat loss, migratory birds have become dependent on land managers for habitat creation, maintenance and health (Vickery et al. 2000). Landscape-level habitat and species management is the impetus as natural resource management moves into the future (USFWS 2009e). Contributions to this landscape-level effort done by the refuge complex would include continuation of the annual reviews for national and regional migratory bird trends through the following efforts:

- Partners in Flight
- U.S. Shorebird Conservation Plan
- North American Bird Conservation Initiative
- U.S. Conservation Joint Ventures Bird Habitat Joint Ventures—Prairie Habitat Joint Venture (Canada) and Prairie Pothole Joint Venture (United States)

Consultations with the Division of Migratory Bird Management within the Service would identify potentially imperiled species. When species are identified as being a species of conservation concern, management actions could be modified accordingly to support migratory bird objectives.

All participation in population and landscape-level studies requires an 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 preseason waterfowl banding. 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.

Wildlife Disease Objective

Annually review national and regional disease trends and carry out monitoring and management strategies as needed.

Strategies

- Annually review and update the 2006 Disease Contingency Plan as needed.
- Conduct regular surveillance for key wildlife diseases such as highly pathogenic, botulism, chronic wasting disease, and West Nile virus.
- Consult with the regional Wildlife Health Program to carry on or adopt new monitoring protocols.
- Support a supply of protective equipment for emergency cleanup and specimen collection operations.

Rationale. Because refuges are a concentration spot for migratory birds and other wildlife, there is greater potential for disease outbreaks and mortality events. A Disease Contingency Plan specific to the Benton Lake Refuge was developed in 2006 and contains protocols for disease monitoring and management. Working with other State and Federal agencies will be important in identifying present and future wildlife disease concerns.

Cultural Resources Goal

Identify and evaluate the cultural resources of the refuge complex and protect those that are determined to be significant.

Cultural Resources Objective

Protect and preserve cultural resources throughout the refuge complex through coordination with the Region 6 Cultural Resources Branch, who help refuge staff with meeting the requirements of Section 106 of the National Historic Preservation Act and other cultural resources-related legislation.

Strategies

- Inform the R6 cultural resources staff of refuge complex projects early in project planning with the Cultural Resources Review Form.

- Known, but not documented, cultural resources will be documented by the cultural resources staff to figure out the proper long-term management.

- Documented National Register eligible, or potentially eligible, resources and undocumented cultural resources, regardless if they have been evaluated for the National Register, will be protected from alteration or neglect.

- Conduct further investigation into the eligibility of two sites on the H2-O WPA for the National Register of Historic Places.

Rationale. The refuge complex has several documented cultural resources; however, much of its property has not been inventoried for these resources. Archaeological and historic sites are important to the Service and the public and compliance with cultural resources-related legislation would serve to protect these resources. Federal laws and policies mandate the identification and evaluation of archaeological and historic sites on Federal lands. Specifically, Section 106 of the National Historic Preservation Act requires all Federal agencies to consider cultural resources before project implementation and specifies the process required to meet this goal. Under the National Historic Preservation Act cultural resources are treated as eligible for the National Register until they have been evaluated.

About 470 acres of archaeological survey has been conducted at the H2-O WPA (Schwab 1994). Four prehistoric lithic scatters and two historic sites were found. The two historic sites (McCormick ditch 24PW623 and McCormick farmstead 24PW618) were found to be potentially eligible for the National Register of Historic Places and need further investigation if work is proposed near them. The McCormick farmstead was found to be not eligible by the contractor, but the Montana State Historic Preservation Office did not concur. The unresolved National Register eligibility of this site is an on-going issue for the complex.

Visitor Services Goal

Provide opportunities for visitors of all abilities to enjoy wildlife-dependent recreation on Service-owned lands and increase knowledge and appreciation for the refuge complex's ecological communities and the mission of the National Wildlife Refuge System.

Hunting Objective

Throughout the life of the plan, provide a variety of hunting opportunities for approximately 1500 visits per year, that support sustainable resources and provide participants with an opportunity to appreciate the natural environment on the district and Swan River Refuge.

Note: Specific hunting objectives and strategies related to the Benton Lake Refuge are presented in chapter 7.

Strategies

- Provide a variety of hunting opportunities across the refuge complex as shown in table 26.

- On the district, (excluding Sands WPA and H2—O WPA), evaluate the potential for implementing a hunting season for State-defined predators and nongame species from August 15 through March 1.

- Work with partners to develop programs to introduce young people to safe, effective, and ethical hunting techniques and methods.

- Coordinate with State and other interested groups to host a Hunter Education class at the refuge complex Headquarters, which would include a mentored gamebird hunt.

- Encourage landowners of conservation easements to take part in the State block management program to increase hunter access.

Table 26. Hunting opportunity throughout the Benton Lake National Wildlife Refuge Complex, Montana.

Animal group	*Benton Lake Refuge†*	*The District**	*Swan River Refuge*
Big game	No	Yes (mule deer, white-tailed deer, pronghorn, elk, moose, bighorn sheep, mountain goat, mountain lion, and black bear)	No
Upland gamebird	Yes (pheasant, gray partridge, and sharp-tailed grouse)	Yes (pheasant, gray partridge, sharp-tailed grouse, spruce grouse, ruffed grouse, Franklin's grouse, and turkey)	No
Migratory gamebird	Yes (ducks, geese, swans, and coots)	Yes (ducks, geese, swans, coots, common snipe, mourning dove, and sandhill crane)	Yes (ducks, geese, swans, and coots)
Predator	No	No**	No
Furbearer	No	No**	No
Nongame wildlife	No	No**	No

**Excludes Sands WPA and H2–O WPA, which were donated with condition of being a nonhunting unit.*
†Refuge hunting seasons vary from State regulations, see refuge specific regulations
***Trapping in accordance with State regulations is permitted on the district (with the exception of Sands and H2-O WPAs)*

Rationale. Hunting is one of the six priority recreational uses identified in the Improvement Act. All recreational activities are secondary to the primary purpose for which the refuge unit was established and must be compatible. Hunting provides traditional recreational activities throughout the refuge complex and local areas with no definable adverse effects on the biological integrity or habitat sustainability of the refuge complex resources as defined in the act. Hunting cannot conflict with the purpose of the refuge complex units. Service policy states that no more than 40 percent of a national wildlife refuge may be open to migratory bird hunting. This restriction makes sure that habitat without disturbance is available for migrating birds, including waterfowl.

In FY 2011, an estimated 1,847 visits for hunting occurred on the refuge complex representing 14 percent of recreational visits to the refuge complex. A variety of hunting opportunity exists throughout the refuge complex. Population goals for harvest are set by MFWP and flyway councils. All waterfowl production areas (except the Sands and H2–O WPAs, which were donated to the Service with the caveat of remaining nonhunting areas) are open to migratory bird, upland gamebird, and big game hunting in accordance with all State seasons. Refuges of the refuge complex are more restrictive such as the Benton Lake and Swan River Refuges, which offer bird hunting only.

Hunting predators and nongame wildlife is currently prohibited on the refuge complex; however on the district (excluding Sands and H2—O WPAs) the potential for implementing a hunting season for State-defined predators and nongame species will be evaluated. Montana defines predators as coyotes, weasels, striped skunks, and civet cats (spotted skunks). Nongame species are defined as badgers, raccoons, red foxes, hares, rabbits, ground squirrels, marmots, tree squirrels, porcupines, and prairie dogs. Restricting a predator and nongame hunting season to August 15 through March 1 would provide increased recreational opportunities to hunters while minimizing disturbance to migratory birds.

Fishing Objective

Continue to offer opportunities for fishing at the Swan River Refuge and waterfowl production areas within the refuge complex while supporting sustainable resources.

Strategies

- Swan River Refuge would continue to be closed to fishing via walk-in access from March 1 until July 15 to reduce disturbance to nesting migratory birds. Walk-in access for fishing opportunities on the river through the refuge would continue from July 16 until the end of February.

- On Swan River Refuge, navigable waters are open to fishing by boat year-round. Boating access points are available on Swan Lake.

- Walk-in access would continue year-round on the Arod Lakes WPA with vehicle access to Middle and Round Lakes permitted from January 2 to April 1.

- Minnow seining would continue to be prohibited throughout the refuge complex.


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Cutthroat trout.

Rationale. As one of the six priority recreational uses identified in the Improvement Act, fishing provides traditional recreational activities on refuges and waterfowl production areas in the refuge complex with no definable adverse effects on biological resources. Throughout the refuge complex, fishing is authorized within designated timeframes and locations; however, a limited number of areas in the refuge complex support recreational fisheries.

Waterfowl production areas open to fishing include Arod Lakes and Blackfoot. In FY 2011, 425 fishing visits were reported for the refuge complex. Arod Lakes WPA, where yellow perch and northern pike are plentiful, receives the bulk of fishing pressure in the refuge complex.

Wildlife Observation and Photography Objective

Throughout the life of the plan, continue to provide visitors of all abilities with opportunities to observe and photograph a variety of wildlife species.

Strategies

- Make sure the public is aware of wildlife observation and photography opportunities throughout the refuge complex and identify open observation areas to the public through signage, publications, and maps.
- Support and improve infrastructure associated with wildlife observation and photography across the refuge complex.
- Expand wildlife observation and photography opportunities by providing added infrastructure. Support seasonal closures (table 27) in some areas to protect sensitive wildlife values.
- Allow limited commercial photography through special use permit decided on a case-by-case basis.
- Install a spotting scope to enhancing viewing opportunities at the Swan River Refuge information kiosk and observation platform.
- Continue to provide year-round wildlife observation and photography opportunities on waterfowl production areas throughout the district.
- Evaluate the potential for adding more walking trails throughout the refuge complex such as Bog Road on the Swan River Refuge.
- Collaborate with nongovernmental organizations to conduct birding tours and other opportunities to the public for wildlife observation.
- Hire a park ranger position (0.50 FTE, or one person assigned half time to the refuge complex, half time to Benton Lake Refuge exclusively) to help provide more wildlife observation and photography opportunities along with guided interpretive tours.

Table 27. Seasonal closures at the Benton Lake National Wildlife Refuge Complex, Montana.

Activity type	*Benton Lake Refuge*	*The District*	*Swan River Refuge*
General	See chapter 7, section 7.18	Arod Lakes WPA Road to Middle and Round Lakes Closed to motorized vehicles April 1 through the end of upland game season (approximately January 2)	Entire refuge closed to all public access March 1–July 15 except wildlife observation platform, kiosk and Bog Road. South of Bog Road closed year-round
Hiking	Permitted on roads that are open to motorized vehicles and designated trails	Permitted on roads that are open to motorized vehicles.	Permitted on Bog Road year-round.
Skiing and snowshoeing	Permitted refuge-wide from the close of upland gamebird season (approximately January 1) through the end of February	Permitted as weather allows	Restricted to designated roads and trails.
Equestrian use	Permitted on roads that are open to motorized vehicles	Prohibited	Prohibited
Bicycling	Permitted on roads that are open to motorized vehicles and designated trails	Permitted on roads that are open to motorized vehicles	Permitted on Bog Road year-round.
Boating	Nonmotorized boats are permitted in the hunting area during hunting season only	According to State regulations	According to State regulations (no-wake zone)

Rationale. Wildlife observation and photography are among the six wildlife-dependent recreational activities listed in the Improvement Act. As such, they are considered priority public uses; although, all recreational activities are secondary to the primary purpose for which each refuge unit was established and must be compatible. Wildlife observation and photography provide recreational activities 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 act. In 2011, wildlife observation and photography accounted for 8,230 and 490 annual visits, respectively, to the refuge complex. A park ranger position would allow focus on the untapped resources within the refuge complex such as Great Falls, which could dramatically increase wildlife observation and photography visitation.

The opportunity to view and photograph a variety of species in their native habitats can be an exciting and rewarding experience. These encounters would enrich visitors' personal lives while garnering support for conserving the unique qualities and natural resources of the refuge complex for future generations.

Environmental Education and Interpretation Objective 1

During the life of the plan, enhance public knowledge and understanding of the restoration efforts and the progress being made. Expand environmental education programs for adults and children on and off the refuge complex, focusing on the wetland habitat and native prairie habitats and the natural, cultural, and historical resources of the refuge complex. Programs and activities would promote awareness of and advocacy for refuge resources and management activities for the more than 19,500 visitors and students annually.

Strategies

- Hire permanent 0.5 FTE park ranger to focus on environmental education, community outreach, public use, information dissemination, maintenance of public use infrastructure, programming and special events for the refuge complex.

- Develop more education kits specific to refuge programs and resources including field exploration kits (for example, backpacks with field equipment), a lending library and field activity pages.

- Develop a series of environmental outreach programs with specific themes as they relate to the particular complex unit, such as riparian restoration program for the Blackfoot Valley Conservation Area.

- Annually take part in at least two community events (such as the Environthon) where the opportunity is available to educate the public about the refuge complex, its resources and the management activities.

- Provide onsite programs for school groups on the refuge complex.

- Conduct visits to local schools within the refuge complex to present information on the history, purposes, natural resources, management and the restoration project.

- Host events for the International Migratory Bird Day, National Wildlife Refuge Week, and National Trails Day.

- Pursue opportunities to expose middle school, high school, and college students to the field of natural resource management through job shadowing, internships, and other activities.

- Develop programs for introducing young people to the enjoyment of the outdoors and instilling ethical, safe, and effective skills for observation, identification, and photography of wildlife.

- Work with schools and teachers within the refuge complex to develop programs that support their curriculum objectives and facilitate a workshop for local teachers.

- Pursue grants and other money sources to support environmental education programs.

- Explore the possibility of a partnership with community colleges and universities to expand educational opportunity, volunteer activities, and internships.

- Use social networking tools to reach a greater part of the public including supporting and updating an accurate complex Web site, creating a Facebook page and Twitter account.

- Work with other organizations to place refuge information and directional maps at locations with high public traffic.

- Develop a refuge specific traveling display that can be used for programs and events.

- Develop and install interpretive panels for the facilities throughout the refuge complex.

- Engage partners and challenge cost-share opportunities to develop a short refuge complex film accessible from the refuge complex Web site and used during outreach and educational activities.

Rationale. Environmental education and interpretation are two of the six priority public-use activities listed in the Improvement Act. All recreational activities are secondary to the primary purpose in which the refuge was established, and must be compatible. These uses (hunting, fishing, wildlife observation, wildlife photography, interpretation, and environmental education) receive special recognition by the Service and are accommodated when compatible with the original purpose of the refuge unit. Environmental education within the Refuge System incorporates onsite, offsite, and distance-learning materials, activities, programs, and products that address the audience's course of study, refuge purposes, physical attributes, ecosystem dynamics, conservation strategies, and the Refuge System mission.

Environmental education is a process designed to teach citizens and visitors, children and adults, the history and importance of conservation and scientific knowledge about the Nation's natural resources. Through this process, the Service can help develop a citizenry that has awareness, knowledge, attitudes, skills, motivation, and commitment to work cooperatively toward the conservation of environmental resources. The refuge complex has been conducting minimal environmental education and interpretation activities due to limited staff. In FY 2011, the refuge complex staff reached 1,765 participants during on and offsite environmental education programs. Most of which, approximately 850, are third graders in the Great Falls Public School System who visit the Benton Lake Refuge as part of their education curriculum. In addition, refuge complex-wide, 525 participants attended 10 special events and 120 participants attended interpretation programs on- and offsite.

Environmental Education and Interpretation Objective 2

During the life of the plan, increase environmental and interpretive programs within the Blackfoot Valley and Swan Valley CAs.

Strategies

- Use refuge wildlife specialist (1 FTE) at Upsata Lake to explore and help refuge park ranger with outreach and education opportunities within the district, Blackfoot Valley CA, Swan Valley CA, and the Swan River Refuge.

- Use the facilities at Upsata Lake for environmental education and interpretive programs.

- Establish a cooperative program with the University of Montana at Missoula.

- Offer environmental education programs for youth groups, schools and the public within the Missoula area and Swan Valley CA.

Rationale. More potential exists in the Blackfoot Valley and Swan Valley CAs to expand the Service's educational and interpretive efforts. Upsata Lake WPA, which is proposed for acquisition, offers an opportunity for more onsite environmental education and interpretive experiences with its proximity to Missoula and the University of Montana.

Administration Goal

Provide facilities, strategically allocate staff, and effectively use and develop funding sources, partnerships, and volunteer opportunities to maintain the long-term integrity of habitats and wildlife resources of the refuge complex.

Staff and Funding Objective

Throughout the life of the plan, strive to fill positions identified in the CCP as critical to accomplishing goals and objectives (table 28).

Current staff within the refuge complex consists of 9.5 permanent FTEs, and approximately 3 seasonal FTEs. Table 28 shows the current staff and proposed added staff required to fully carry out the CCP. Due to the area of responsibility and added complexities of this plan all grade levels for current staff would be evaluated. If all positions were funded, the refuge complex staff would be able to carry out all aspects of this CCP, providing the greatest long-term help to wildlife, habitat, and ecosystems while improving facilities and providing visitor services. Projects that have adequate money and staff would receive priority for accomplishment. Staff and money are requested for the 15-year life of this CCP.

Strategies

- Conduct site visits and prepare briefing packages for Service and other Federal officials (for example, congressional staff) to showcase complex achievements and potential acquisition growth.
- Use local media throughout the refuge complex to promote habitat improvements, outreach activities, and other accomplishments.
- Continue to cultivate good working relationships with the refuge complex's neighbors, other State and Federal agencies, nongovernmental organizations and other user groups to promote grassroot support and advocacy for refuge complex initiatives.
- Cooperate with organizations like TNC and the Conservation Fund to leverage resources for conservation easement programs.
- Continue to accurately document money and staff needs through memos and reports.
- Prove to neighbors, partners, and local communities the potential benefits of increased money and staff in the refuge complex.
- Establish a Friends group to help support and advocate for the refuge complex.
- Coordinate and take part in multi-agency youth and volunteer programs and initiatives.
- Refine and increase participation in the refuge complex volunteer program.

Table 28. Current and proposed staff at Benton Lake National Wildlife Refuge Complex, Montana.

Refuge Complex Unit	*Current Positions (FTE)*	*Proposed Added Positions*
Benton Lake and Swan River Refuges' headquarters	5.5	1 FTE full-time law enforcement officer, 1 FTE refuge complex park ranger, 1 FTE supervisory biologist refuge complex, 0.5 FTE generalist
Benton Lake Refuge	2	0.8 career-seasonal biological technician, 0.8 seasonal biological technician
Swan River Refuge	0	Supported by wildlife refuge specialist assigned to Swan Valley CA
The District	1	1.0 maintenance worker
Blackfoot Valley CA	0.5	0.5 FTE wildlife refuge specialist
Rocky Mountain Front CA	1	0
Swan Valley CA	0	1 FTE wildlife refuge specialist

Rationale. Increases in the size and complexity of lands within the refuge complex require added staff and money. Several new or expanded easement initiatives (Blackfoot Valley, Rocky Mountain Front, and Swan Valley Conservation Areas) would need more staff for monitoring and administration of easements as well as more money to acquire easements.

Current staff and budget levels are not sufficient to complete required administrative functions. 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 cost of living adjustments. 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, a significant increase in LWCF appropriations for the Rocky Mountain Front Conservation Area has occurred in recent years. This money is highly variable and directly affects the refuge complex's ability to preserve intact landscapes.

To accomplish the goals and objectives identified in this plan, the refuge complex staff would need to maximize opportunities for in-kind help, both fiscal and human resources, in addition to experiencing increases in base (operations money) 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. Creative work force planning, partnerships, and using supplemental money opportunities are mechanisms to successfully carry out recommendations. Other options are to use maintenance action teams, contracting, seasonal and temporary hires, volunteers, and youth initiatives.

Facilities and Infrastructure Objective

Strive to support facilities and real property in good to excellent condition and meet Service standards and Refuge System goals.

Strategies

- Update the Refuge Lands Geographic Information System (RLGIS) database and assess condition assessment of existing infrastructure. Complete a rotational assessment every 5 years throughout the refuge complex.
- Support and improve facilities at Upsata Lake WPA, which is proposed for acquisition.
- Remove any assets that are no longer contributing to the mission and goals of the refuge complex.
- Use annual maintenance money for maintenance of real property assets.
- Use grazing cooperators for routine fence maintenance and pursue opportunities to use cooperators and volunteers for sign installation and replacement.
- Set priorities for replacement of water control structures based on age, availability of money and management needs and condition assessments.
- Set priorities for road maintenance based on available money and public use.
- Provide adequate facilities for employees and equipment.
- Improve and support existing accessible infrastructure and establish new facilities as needed.
- Increase staff by 1.0 FTEs to address seasonal maintenance needs on the district.
- Replace faded logos on entrance signs and anywhere else they appear.
- Repair or replace damaged or faded boundary and informational signs, as needed, to meet Service sign standards.
- Continue to develop and install entrance signs on all waterfowl production areas.
- Develop a trapping plan for Swan River NWR. Trapping would occur by special use permit for wildlife and infrastructure management purposes only.

Rationale. Visitor services infrastructure including information kiosks, entrance, directional and boundary signing, trails, roads (public use and staff use only), water control structures, fences, dikes and buildings need routine annual and long-term maintenance to support resources in good to excellent condition.

Due to the extensive maintenance backlog in the Service and the lack of maintenance staff in the refuge complex (there is currently one full-time maintenance worker for the entire complex), infrastructure throughout the refuge complex varies from poor to excellent condition. Roads and dikes need gravel. In some areas, significant repair due to muskrat burrowing is needed. Some water control structures are failing due to advanced age and some sections of boundary fence no longer function effectively due to broken posts and wire. Signs are missing, unreadable and, in many cases, have been shot by vandals.

Recently, energy conservation modifications have been made at several facilities. There are more facilities in the refuge complex that need insulation, windows and roofs, and in some cases, siding.

Accessible facilities (such as restrooms and entrance ramps) exist primarily in refuge office buildings. Limited accessible facilities in the field include the Benton Lake boardwalk and hunt blind, and the Swan River observation platform and kiosk.

Visitor and Employee Safety and Resource Protection Goal

Provide for the safety, security, and protection of visitors, employees, natural and cultural resources, and facilities throughout the refuge complex.

Visitor and Employee Safety Objective 1

Keep employee accidents and injuries (as reportable to the Office of Workers Compensation Program) below the regional average of 6.2 hours of lost time a year.

Strategies

- Provide employees with proper personal protective equipment.
- Make sure all required safety and operator training is completed before engaging in tasks or work situations. Make sure other training, such as cardiopulmonary resuscitation (CPR) and first aid, is available to employees as needed or requested.
- Make sure employees review job hazard analyses before engaging in at-risk tasks.
- Practice sound risk management "the state in which risks are acceptable."
- Continue safety talks at weekly staff meetings.

Rationale

Injuries in the Service account for 21.1 days of lost time in FY 2010, second quarter (DOI 2010). Minimizing the potential for accidents and injuries is cost efficient, provides better job satisfaction for employees, and is the right way to conduct business. The Service requires job hazard analysis write-ups before all at-risk tasks, such as operating an all-terrain vehicle or pounding fence posts. A library of job hazard analyses is available on the Regional Safety Office Web site.

Visitor and Employee Safety Objective 2

Over the life of the plan, strive to support the refuge complex as 100-percent visitor accident-free.

Strategies

- Educate and inform visitors of their responsibilities while visiting national wildlife refuges and the ways to mitigate potential dangers and hazards.
- Use directional and informative signage, visitor information kiosks, and posted warnings to help reduce preventable accidents and mishaps.
- Close roads deemed unsafe for travel due to weather conditions or poor visibility.
- Law enforcement officers will help with protecting visitors and report serious incidents to the proper authorities (per guidance found in 054 FW 1).

Rationale. Visiting a national wildlife refuge can be inherently dangerous. Snake bites, stinging and biting insects and their associated diseases, extreme hot and cold temperatures, wind, lightning, standing or turbulent water, uneven terrain, and steep edges can potentially turn a pleasant day out into a life-altering experience. The Service's role is to help identify these dangers, inform the public about them, and mitigate these dangers to the greatest extent possible.

Visitor and Employee Safety Objective 3

In the first 5 years, improve communication systems within the refuge complex.

Strategies

- During weekly program manager's meeting, share key safety issues between the multiple programs of the refuge complex.

- Provide staff with the best available communication tools (cell phones, satellite phones, radios) and upgrade them regularly.

- Routinely update the refuge complex's Web site to provide current conditions, information, safety hazards, and sightings of interest.

- Continue to coordinate with USDA Forest Service in the usage of their radio system including repeaters.

Rationale. Historically, vast areas of the refuge complex have been in communication dead zones, a situation that is complicated by the topography of the landscape. As cell and satellite usage increases, coverage has improved; however many areas of the refuge complex continue to experience no service. Radios provide an essential means of communicating out in the field and to a base station; however, getting the proper authorizations to buy and program the best devices for the Service's needs has proven problematic over the last decade. A Memorandum of Understanding is in place with the Lewis and Clark National Forest office in Great Falls. Use of USDA Forest Service frequencies and repeaters has to some extent decreased the problem of communication dead zones, however, more efforts are needed.

Resource Protection Objective 1

Strive to support 100-percent compliance with easement contracts.

Strategies

- Follow the guidelines contained in the refuge easement manuals for enforcement procedures, conduct annual surveillance flights to detect or prevent potential easement violations and promptly follow up with needed enforcement actions.

- Make sure that there is conservation easement compliance by conducting annual meetings with individual landowners to review and discuss potential activities on their land as related to easement administration.

- Annually send letters and meet with new landowners to inform them of existing easements on their property, including associated easement provisions.

- Annually review Farmers Home Administration easements to make sure that all easement provisions are enforced.

- Review and update easement administrative manuals as needed.

Rationale. Monitoring and enforcing easement contracts is a critical aspect of protecting wetland and grassland habitats. Efforts to protect the habitat resources on easements would also be focused on preventative law enforcement. Proactively contacting landowners and operators may serve to remind them of easement provisions and hopefully prevent future violations.

Resource Protection Objective 2

Over the life of the plan, strive to limit illegal activity to at, or below, levels to be figured out within 5 years of plan approval.

Strategies

- Conduct regular law enforcement patrol of refuges and waterfowl production areas to make sure that there is compliance with regulations.

- Continue to foster good relationships with other local, State and Federal law enforcement agencies.

- Make sure that there is adequate law enforcement coverage during peak activity by working cooperatively with officers from other refuges.

- Edit hunting regulations and general activities brochures to improve clarity and understanding of refuge specific regulations.

- Support proper signage to reduce visitor confusion and improve clarity of boundaries and restricted areas.

- Make sure that refuge regulation pamphlets are available for the public visiting outside of normal office hours.

- Develop baseline data using known current violations and set a measurable goal to reduce future violations.

- Hire a (1.0 FTE) full-time law enforcement officer assigned to the refuge complex and support at least one dual-function law enforcement officer (1.0 FTE) on the district.

- At the Swan River Refuge, close Bog Road (a county-owned road) to motorized vehicles west of the kiosk parking lot.

- Carry out seasonal closures throughout the refuge complex to protect sensitive wildlife values.

Rationale. Resources to be protected throughout the refuge complex include natural (wildlife and habitat) resources, cultural resources, facilities, and other government property. Law enforcement efforts would be focused on preventative enforcement. It is expected that initially, the number of documented violations would increase due to increased law enforcement presence. As visitors become more aware of refuge complex regulations or have contact with law enforcement officers, the number of violations should decrease.

There is currently one dual-function Refuge Officer at the refuge complex. This officer spends between 25 and 50 percent of their duty hours conducting law enforcement activities including regular patrols and investigations to make sure that there is resource protection. The Montana–Wyoming Zone Officer, is stationed at the Benton Lake Refuge, and may provide more law enforcement support as time allows. Staff would continue to provide visitor, employee and resource protection at current levels even though LE presence has diminished from three dual-function law enforcement officers in 2004 to one dual-function officer in 2011.

Past violations on fee title lands, enforced with Violation Notices, have primarily been hunting violations. Problems of vandalism, trespass issues, dumping, and general littering exist, but violators are often not apprehended by law enforcement.

At this time, there is insufficient data to determine a measurable goal for reducing violations on fee title lands. It is expected that as law enforcement effort increases, the amount of documented incidents should increase because as officers spend more time and effort in the field, they become more aware of incidents and issue more violation notices. In time, the initial increase in the number of documented incidents should level off and decline as the local community and visiting public becomes more aware and compliant with regulations.

On the Swan River Refuge, Bog Road was once believed to be a county road; this four-wheel drive road has a history of being used for motorized recreation. The Service's recent investigation into this issue revealed that this is not a county road, and work is progressing toward extinguishing the right-of-way reserved by the former landowner before purchase as a National Wildlife Refuge. On conclusion of this issue, the road will be gated to prevent unauthorized vehicle travel and may be opened as an interpretive trail.

Seasonal closures (table 27) would be implemented throughout the refuge complex to protect sensitive wildlife resources. Minimizing disturbance to nesting migratory birds is of particular concern.

Jeff Van Tine

Deep Creek.

6.2 Stepdown Management Plans

The CCP is intended as a broad umbrella plan that provides general concepts and specific wildlife, habitat, visitor services, and partnership objectives over the next 15 years. The purpose of the stepdown management plans is to provide detail to managers and employees for implementing specific actions and strategies authorized by the CCP. Table 29 presents the plans needed for the refuge complex by unit, their status, and the next revision date.

Table 29. Stepdown management plans for Benton Lake National Wildlife Refuge Complex, Montana.

Plan	*Completed Plan, Year Approved*	*New or Revised Plan, Completion Year*
Habitat Management Plan		
Inventory and Monitoring Plan		
Integrated Pest Management Plan		
Fire Management Plan		
Visitor Services Plan		
Law Enforcement Plan		

6.3 Plan Amendment and Revision

This CCP will be reviewed annually to decide if it needs revision. A revision will occur when significant information becomes available, such as a change in ecological conditions. The final CCP will be augmented by detailed stepdown management plans to address the completion of specific strategies in support of the CCP goals and objectives. Revisions to the CCP and the stepdown management plans will be subject to public review and NEPA compliance. At a minimum, this plan will be evaluated every 5 years and revised after 15 years.

CHAPTER 7–Analysis of Management Alternatives for the Benton Lake National Wildlife Refuge

Neal Mischler

Pronghorn on the grasslands of the refuge complex.

During the planning process, it became evident that the issues surrounding the management of the Benton Lake Refuge, and the wetland basin in particular, were of serious concern within the refuge complex. The Service and the public have identified declining wetland health and selenium contamination, and its effect on wildlife and management on the refuge, as the most critical issues needing to be addressed in this CCP.

Because of the complexity of the analysis for Benton Lake Refuge, all aspects of NEPA evaluation unique to the refuge are presented together in this chapter and described in detail. When completed, the management direction for the refuge complex, described in chapters 1–6, and the management direction for the Benton Lake Refuge, described in this chapter, 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.

7.1 The Planning Process

One of the most important issues identified for the refuge complex during the planning process, by both the public and the planning team, was the declining condition of the Benton Lake Refuge wetlands. Refuge staff had concerns that long-term selenium contamination problems in the wetland were increasing and potentially becoming critical. In addition, staff had observed expansions of nonnative wetland vegetation and declining open water habitat important to waterfowl. Overall use by wetland dependent birds had also appeared to have declined from historic numbers. The public, particularly migratory gamebird hunters, also commented on the lack of open water and difficulty accessing wetlands with deep layers of sedimentation.

To better understand what was causing this declining condition, the Service met with consultants from Greenbrier Wetland Service on April 28 and July 29, 2009, to develop a hydro-geomorphic assessment of Benton Lake. The scientists from Greenbrier Wetland Services are recognized experts in the field of wetland ecology. They worked with Service staff to understand what changes had occurred in the Benton Lake wetlands over time and how this might relate to the observed declines in bird use, increases in invasive species and increasing selenium contamination (Heitmeyer et al. 2009). In addition, USGS developed a water budget model based on more than 30 years of data (Nimick et al. 2011) and a selenium model based on research conducted by USGS and the University of Montana (Knapton et al. 1988, Nimick et al. 1996, Zhang and Moore 1997) on the refuge. These models, coupled with the wetland assessment, were used to develop and analyze the management alternatives and to select one as the proposed action for the refuge.

After initially identifying the proposed action at a planning meeting in February 2010, refuge staff began another scoping effort to share the results with the public. Refuge staff focused on groups and individuals who had expressed interest or concern about Benton Lake during the first scoping effort. Refuge staff organized and led presentations to local interest groups (Russell County Sportsmen's Association, Upper Missouri Breaks Audubon, Sun River Watershed Group), MFWP, congressional representatives and the public. Many people attended the meetings and provided comments that the Service recorded.

At the request of local stakeholders including Ducks Unlimited, National Wildlife Federation, Russell County Sportsmen's Association, local and State Audubon organizations, and MFWP, a workshop was held in Great Falls, Montana, June 9, 2011, to explore options related to water management, selenium contamination, and public use at the refuge. Many good ideas were generated at the workshop including recognition that achieving refuge objectives for selenium and wetland habitat would require dealing with inputs from the highly altered Lake Creek watershed, as well as refuge water management.

As a result of these scoping efforts, the planning team decided that more alternatives were needed for Benton Lake than the three that had been developed earlier for the complex-wide planning effort.

7.2 Establishment, Acquisition, and Management History

The refuge (figure 15) was established by Executive order of President Herbert Hoover in 1929. It is located on the northern Great Plains, 50 miles east of the Rocky Mountains and 12 miles north of Great Falls, Montana. The original area of the refuge was 12,235 acres, of which about 3,000 was flooded wetland in 1928 (Great Falls Tribune 1929a). Originally owned and managed by the Bureau of Reclamation as part of the Sun River Reclamation Project, Benton Lake subsequently became part of the National Wildlife Refuge System. Impetus for establishing the refuge came mostly from local sportsmen and women, especially waterfowl hunters, in the mid-1920s when about 8,000 acres of U.S. Government-controlled land near Benton Lake was proposed to be opened for settlement. Sportsmen and women supported the establishment of the refuge even though this designation "will mark the end of hunting on the lake, which for years has been the favorite duck shooting grounds of Great Falls sportsmen" (Great Falls Tribune 1929a).Figure 15. Map of the pump station, easement, and travel route of water from Muddy Creek to the Benton Lake National Wildlife Refuge, Montana.

The refuge was unstaffed, with infrequent visits from refuge managers stationed at the National Bison Range until 1961, when local support from the Cascade County Wildlife Association prompted a major effort to increase the water supply and management capabilities of the refuge. A pump station, pipeline, and water control structures were constructed from 1958–1962 to bring irrigation return water from Muddy Creek, about 15 miles to the west, to the refuge. The acquisition of the pumping station near Power, Montana, brought the refuge to its current 12,459.88 acres (12,383 fee-title acres and 76.88 acres of right-of-way easement). A complete acquisition history can be found in table 2 (see chapter 2, section 2.1).

In 1962, the first water was pumped from Muddy Creek and managed by the new, permanent staff on the refuge. The historic Benton Lake bed was divided into six wetland management units (Unit 4 was later subdivided into three subunits) by dikes, ditches and water control structures to facilitate management of water.

In addition to construction of dikes, ditches, water control structures and pumps, many other topographic alterations have occurred on the Benton Lake Refuge since the early 1960s. These alterations include roads, parking lots and building complexes, excavations and mounds within wetland units for nesting islands, sedimentation and filling of some wetland depressions, construction of drainage ditches within units and deposition of hard material (for example, riprap, rock, concrete, and gravel) into wetlands (USFWS 1961–99). Most of the nesting islands were built in the 1980s; however, the islands in Unit 4b were later removed when they attracted large gull colonies that preyed on waterfowl nests.

Water management at the refuge, since the Muddy Creek pumping system was developed, has typically sought to consistently flood some wetland units each year to provide breeding and migration habitat for waterfowl. Since 1962, water typically has been pumped from late August through October to provide water for fall migrating waterfowl and to store water in units for the next spring. In many years, water is also pumped from mid-April to mid-June to raise water levels for waterfowl reproduction. From 1962 through the late 1980s, some water was also pumped during the summer to support water levels; however, in the last 20-plus years the pumps generally have not been used during summer and Units 3–6 are mostly dry from mid-July until pumping resumes in August. This gradual change in water management was the result of discovering that deep season-long flooding did not stimulate desirable wetland vegetation and was often associated with botulism in Units 3–6. Largely because botulism has never been a significant problem in Units 1 and 2, these units have traditionally been managed for more permanent water. Water is held in these units throughout the summer to provide brood rearing habitat for waterfowl (USFWS 1961–99).

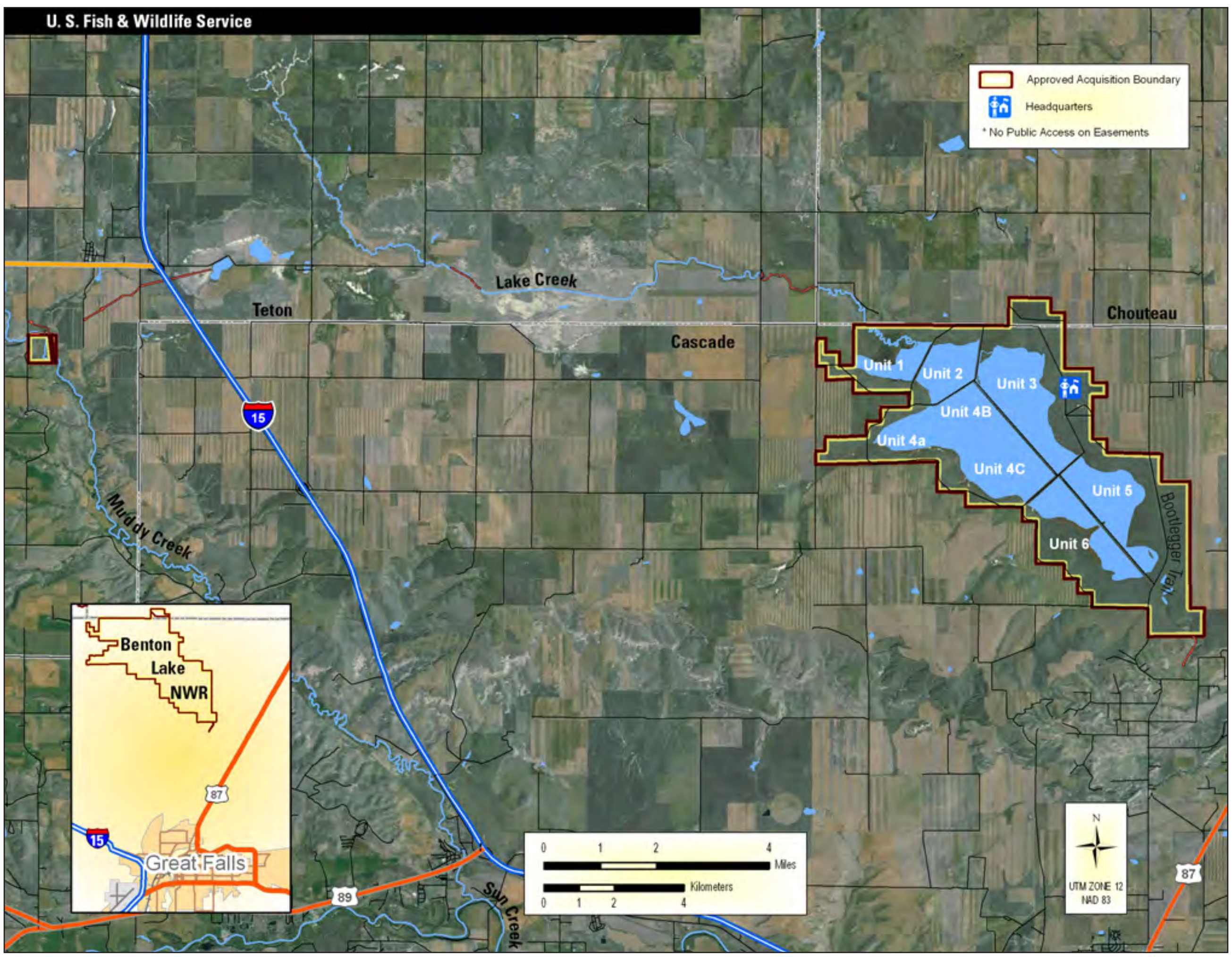

Figure 15. Map of the pump station, easement, and travel route of water from Muddy Creek to the Benton Lake National Wildlife Refuge, Montana.

In the uplands, management of the early 1960s included breaking more than 600 acres of native prairie for agricultural production, planting many shelterbelts, and a reduction in haying and grazing activities that had dominated the refuge's first 30 years. During the 1970s, the agricultural lands were gradually converted to DNC, grazing was ended, and waterfowl production was the primary emphasis of the refuge.

7.3 Purpose, Goals and Planning Issues

Chapter 2, section 2.2 details the purpose for which Benton Lake Refuge was established.

The Service developed a set of goals for the refuge complex, which can be found in chapter 2, section 2.4. All of these apply to the Benton Lake Refuge.

Comments collected from scoping meetings and correspondence were used in the development of a final list of issues for the refuge. The following issues are unique to the refuge and are the reason this chapter was developed.

Adjacent Landowners and Land Uses

When private landowners keep their fields in grass through the CRP, this helps prevent the accumulation of salinity and selenium in seepage areas. This help may be lost if large areas currently in the (CRP) are converted to crops. It has been suggested by Refuge staff, members of the public, and interest groups that staff should consider working more with private landowners, particularly surrounding the refuge, to build partnerships that improve water quality and reduce saline seeps.

This planning issue involves several planning elements and carries through all alternatives in chapter 7 under the preserving intact landscapes and grasslands planning element heading.

Loss of Ecological Processes

Natural fluctuations in water levels (seasonal flooding and drying)—integral to a healthy functioning and self-sustaining wetland system—have been lost at the refuge. The most striking manifestations of the loss of fluctuating water levels and flooding intervals include: the domination of nonnative species such as Garrison creeping foxtail, the spread of monotypic stands of native and nonnative species that depend on stable water conditions (for example, cattail, alkali bulrush), lack of sediment solidification, increasing loss of open-water habitat, and the diversity of plant and wildlife species that result from dynamic water levels. However, there is uncertainty around whether or not dry periods need to be as long as occurred naturally or historically to restore and support wetland ecological health.

The functionality and productivity of wetlands are also related to the way water moves across the wetland and floods the basin. This water movement has been severely disrupted at the refuge. Instead of shallow 'sheet flow' from Lake Creek across the wetland basin, the water is diverted into a distribution canal and flows first into deep ditches along the dikes, rather than spreading quickly across the basin, resulting in negative effects on sedimentation, selenium distribution, microtopography, vegetation, and invertebrate and seed availability for wildlife.

This planning issue involves several planning elements and carries through all alternatives in chapter 7 under the grasslands and wetlands and riparian areas planning element headings.

Declining Wetland Ecological Health

An absence of historical dry periods at the refuge that sustain wetland health is a concern. The altered source, depth, timing and duration of flooding affects contaminant and sediment loading and distribution, as well as nutrient cycling. It appears that these changes are likely altering the type, distribution and biomass production of vegetation and invertebrates, which provide resources (for example, food, breeding habitat) required for wildlife to meet their life cycle needs.

In the years following the initial pump house construction and subsequent flooding of Benton Lake, the wetland basin was very productive with tens of thousands of waterfowl, shorebirds and other waterbirds using the refuge. In recent years, refuge staff and the public have noticed significant declines in the number of waterbirds. Current estimates of waterfowl during migration peak at 10,000–30,000 birds, as compared to 50,000–100,000 noted in the early years of refuge water management. Despite designation as a Western Hemisphere Shorebird Reserve Network Site, refuge staff rarely see peak numbers of more than 500 shorebirds using the refuge.

This planning issue involves several planning elements and carries through all alternatives in chapter

7 under the water resources and wetlands and riparian areas planning element headings.

Water Quantity, Delivery, and Cost

Water management, at the Benton Lake Refuge is a key issue for the refuge complex. The refuge's impoundments are intensively managed with supplemental water transported across substantial distances at great financial cost. In recent years, the delivery and management of this water has cost as much as $135,000 annually. As costs for electricity continue to rise, pumping costs have risen as well. This has required the reallocation of money that could be used for land management to accommodate the increasing pumping costs.

How best to use the water budget to maximize wetland health and migratory bird productivity needs to be addressed. How the refuge's water rights in Muddy Creek may be affected by changes in water management also needs to be defined.

This planning issue involves several planning elements and carries through all alternatives in chapter 7 under the wetlands and riparian areas and water resources planning element headings.

Water Quality and Selenium Contamination

Major issues that have affected the management of the refuge in the last 20 years include increasing accumulation of contaminants (selenium) in the wetland, dense stands of monotypic vegetation that have increasingly become dominated by nonnative species, pumping costs for electricity and declining bird use. Refuge records suggest that the large numbers of migrating and breeding waterfowl that used the refuge in the 1970s and 1980s have declined over the last 20 years. Current estimates of waterfowl during migration peak at 10,000–30,000 birds, as

USFWS

Seep at Benton Lake National Wildlife Refuge.

compared to 50,000–100,000 noted in the early years of refuge water management.

Selenium concentrations in the water, sediment and biota of portions of the Benton Lake Refuge are currently at levels that can affect reproduction of species that are particularly sensitive to selenium, such as waterfowl species. These levels have been increasing over the last 50 years and if they continue to increase, selenium could reach levels that cause reproductive failure in waterfowl and other waterbirds in in some parts of the refuge in as little as 10 years.

The Sun River Watershed Group has been working to improve water quality in Muddy Creek, in particular reducing sediment loading into the Sun River. This group would like the refuge to continue withdrawing water, either through the pump house or a siphon (if built), to help reduce flows in Muddy Creek.

Some interest groups identified the need for the refuge to continue to pump or siphon water from Greenfields Irrigation District to dilute concentrations of contaminants (salinity and selenium) entering the refuge. The Service received several comments suggesting that the refuge needs to address selenium inputs from the Lake Creek watershed by working with landowners and other partner organizations and consider establishing a conservation easement program that includes the refuge, Muddy Creek, and Lake Creek watersheds. It was also suggested that working in the watershed should be a higher priority, and would be more effective, for improving water quality on the refuge than changes to management.

There may be more impairments to water quality from sediments, pesticides, and nutrient loading on the refuge that have not been studied.

This planning issue involves several planning elements and carries through all alternatives in chapter 7 under the preserving intact landscapes and water resources planning element headings.

Invasive Plants, Nonnative Plants, and Noxious Weeds

Nonnative grasses, forbs, and woody species are of concern because they diminish the quality and suitability of habitat and reduce its potential to support many native wildlife species. If nonnative species are particularly invasive they can spread easily, replace native habitat, reduce diversity, and cause great expenditure of financial and human resources. Nonnative grasses such as crested wheatgrass, Garrison creeping foxtail, Kentucky bluegrass, Japanese brome and cheatgrass are concerns on refuge lands. Several fields on the refuge are planted with nonnative grasses, which should be evaluated for replanting to native species to provide optimal habitat conditions for wildlife.

Shelterbelts of planted, nonnative trees and shrubs occur on the refuge where woody vegetation did not naturally occur. Shelterbelts were originally planted to increase wildlife diversity, but current research suggests that they increase predation and negatively affect imperiled grassland birds. Whether or not these shelterbelts should be removed or supported needs to be evaluated.

This planning issue involves several planning elements and carries through all alternatives in chapter 7 under the grasslands and wetland and riparian areas planning element headings.

Wildlife Management

Protecting habitat and managing for a wide variety of migratory birds is a priority for the refuge complex. Waterfowl and other waterbirds, grassland songbirds, and riparian area-dependent birds are some of the highest priority groups. Grassland birds, in particular, have experienced the most severe declines of any group of birds across the U.S. Managing the refuge to help these species is a concern.

The public is also concerned about waterbirds such as white-faced ibis, black-crowned night-herons, and Franklin's gulls that use the refuge and depend on relatively deep, permanent water.

There is concern that the refuge wetlands should be flooded every year to provide wetland habitat for wildlife that compensates for other wetland habitat that has been drained or altered in Montana.

Botulism has been a problem in some of the refuge units in the past. Flooding Units 3–6 during late summer in hot, dry years has historically led to botulism outbreaks killing thousands of birds. Botulism needs to be considered in future management scenarios.

This planning issue involves several planning elements and carries through all alternatives in chapter 7 under the preserving intact landscapes and visitor services planning element headings.

Hunting

Hunters have expressed concern that the quality of waterfowl hunting at the refuge has declined significantly over the last several years. Excessive vegetation, limited open water, and low-water levels were mentioned specifically. Several comments suggested that significant management actions would be needed to improve conditions. Opening other parts of the refuge normally closed to hunting, while management actions were implemented on the current hunt units, was also suggested.

Comments were also received that the access for hunters with disabilities needs to be improved.

This planning issue involves several planning elements and carries through all alternatives in chapter 7 under the visitor services and visitor and employee safety planning element headings.

Wildlife Observation

The public enjoys viewing wildlife on the refuges and waterfowl production areas within the refuge complex. The Benton Lake Refuge in particular, because of its close location to the city of Great Falls, is especially valued by birdwatchers. The public has requested the expansion of opportunity to observe sharp-tailed grouse on their dancing leks, a very popular activity. Expanding birdwatching opportunities for a wide diversity of birds should be evaluated.

This planning issue involves several planning elements and carries through all alternatives in chapter 7 under the visitor services and visitor and employee safety planning element headings.

Comments Received from the Public and Found to be Outside the Scope of the Plan

Many issues were identified through scoping, including public meetings, letters, emails, and other written correspondence from the public. The following comments from the public, however, were reviewed by the Service and found to be outside of the scope of the plan because they conflict with existing policy; the Service's, or the Refuge System's, mission and purpose; the best available science; or with other information:

- The focus of the refuge should be for ducks, not other species. The highest and best use should dictate management and give residents access for several hunting and recreational pursuits.

This comment suggests refuge management actions that are not congruent with the purpose of the refuge. The refuge was established as "a refuge and breeding ground for birds" (Executive Order No. 5228, November 21, 1929). One species group is not considered more important than another. The Improvement Act requires that "each refuge shall be managed to fulfill the mission of the Refuge System, as well as the specific purpose for which that refuge was established" (section 4 (a)(1)(3)(A)). There is a strong and singular wildlife conservation mission for the Refuge System and, when found to be compatible, wildlife-dependent recreational uses are legitimate and proper uses but secondary to the primary purpose for which the refuge was established.

- Federal Duck Stamps purchased the refuge so it has to be managed for ducks and migratory bird funds and Pittman–Robertson Funds spent on the refuge clearly show a long-term dedication on the part of the public to sound wetland management to help waterfowl and other wetland species.

This comment suggests that the refuge was bought by Federal Duck Stamp revenue, but it was not. The refuge lands were reserved during homesteading. The lands were subsequently transferred from the Bureau of Reclamation to the Service as a refuge and breeding ground for birds by Executive order. There was no hunting allowed of any species at that time. No Federal Duck Stamp or Pittman–Robertson monies were used to construct the levees and water control structures. All alternatives presented in the document reflect sound wetland management to help waterfowl and other wetland species.

- If a long dry period is implemented, when the basin is wet again, the birds will not be able to find the refuge because management has broken the birds' tradition.

This comment suggests that water-dependent birds have not adapted to long-term flooding and drying cycles. Although some species of waterfowl tend to return to the same breeding area used the year before (such as homing), most species of waterfowl exhibit some degree of flexibility in settling patterns in response to local wetland conditions (Johnson and Grier 1988). Examples of this occur regularly on the waterfowl production areas within the wetland management district where basins under natural hydrological regimes are flooded following a relatively long dry cycle with significant associated bird use.

- There are no visible deformities yet, so why is the Service proposing such radical solutions now?

This comment suggests that the Service knowingly not address accumulating selenium, which would be in direct opposition of the Improvement Act, the mission of the Refuge System, and the purpose of the refuge. When selenium contamination reaches levels where visible deformities can readily be observed, the refuge is likely to be so highly contaminated that extreme measures such as capping portions of the refuge, as occurred at the Kesterson NWR in California in the 1980s, will be necessary. At lower levels, selenium causes impairments that prevent eggs from hatching, which is not easily observed without careful monitoring. However, at these levels there are more options available to managers to reduce selenium levels. The Improvement Act directs that "the Secretary shall ensure that the biological integrity, diversity, and environmental health of the Refuge System are supported for the benefit of present and future generations of Americans" (section 4 (4) (B)).

- The refuge should just treat the selenium problem, for example by scraping out or removing the contaminated sediment, to solve the wetland health issues.

This comment suggests that the Service take an approach in addressing wetland health issues that treats a symptom (selenium) of the problem, not the problem, itself. Chapter 7 analyzes management alternatives and impacts that focus on the underlying changes to wetland ecological processes, such as alterations to the flooding and drying cycle, that result in symptoms such as selenium contamination. By taking this approach, the Service expects that selenium contamination will be reduced, and overall wetland health will be improved, so that the refuge can be managed in a way that provides long-term solutions that help migratory birds and other wildlife.

- It has been suggested that botulism should not be given strong consideration in developing a management scheme.

This comment suggests that the Service purposefully carry out management strategies that have proven in the past to cause significant wildlife mortalities. Several units on the refuge have a history of botulism outbreaks and botulism is known for recurring outbreaks in earlier disease locations. Refuge staff recognize that wildlife mortalities, from a variety of causes, are natural and to be expected. However, the purpose of the refuge as a breeding ground for birds indicates that the Service should strive to manage so that the refuge is not a population sink.

- If the refuge does not pump water it will result in the abandonment of the refuge and management.

This comment suggests that management actions such as prescribed fire, grazing, treating invasives, ARM, and providing for public uses would not continue to occur. However, such management actions are currently considered under all alternatives.

- Members of the public suggested that under certain alternatives the participation of the Great Falls Public School Third Graders at the refuge would be discontinued.

All alternatives under consideration would continue to provide opportunities for the third graders who visit the refuge. Discussions with school staff identified no concerns. The teachers stated that they would adjust their curriculum to the future conditions of the refuge.

- Over the last three decades conservation partners have invested close to $750,000 in water management infrastructure that affects 655 acres on the refuge. Removal or modification of this infrastructure would mean a loss of this investment.

The Service recognizes and appreciates the past efforts of the refuge's partners in supporting the development of infrastructure on the refuge. These efforts were based on the best available wildlife management expertise and science at the time. Just as this infrastructure was built with the intention of helping wildlife, it may be that removing some or all of it is now of greater help to wildlife. The Service is committed to an ARM approach, and when new information becomes available, the Service must stay flexible to adjust management accordingly.

- The Service received a comment that removal of the basin infrastructure is a "criminal act."

This comment suggests that there is legal standing for this position, but that is not the case. The refuge operated without any infrastructure from its establishment in 1929 to 1960 and was considered to be fulfilling the purpose for which it was established. Modification to infrastructure is analyzed under a variety of the alternatives presented in the document.

- The refuge should be turned over to the State so that hunting would have higher priority in management.

This comment suggests a change of management, but the Service does not consider divestiture unless a unit no longer meets the purposes for which it was established. The refuge provides significant natural resource benefit and continues to meet the purpose as a refuge and breeding ground for birds. Furthermore, reserving and protecting wetland health is a concern regardless of ownership.

- Some hunters asked the Service to consider purchasing public access rights from landowners of conservation easements or purchase fee title instead, so that the public may have the opportunity to access more lands for hunting.

This comment suggests fee title acquisition, but this does not meet the Service's regional priorities (which is easement acquisition); and it is not as cost effective for protecting landscape level habitats that protect a broad array of trust species. Landowners interested in entering into perpetual conservation easement contracts have a suite of Federal, State and nongovernmental organization contracts to choose from. The easement contracts differ in which individual property rights are encumbered depending on the specific agencies' mission. Landowners who are interested in easement programs that will provide public access to their land are referred to the State. Purchasing this right is more closely aligned with MTFWP's mission and money. In addition, the State offers public access incentive programs (Block Management Program) available to private landowners regardless of whether or not their properties are encumbered by Service easements. These are short-term (1- 3 year) agreements that landowners may consider for financial or ethical reasons.

Prioritizing the easement program on protection of wildlife habitat enables the Service to protect more acres and deliver conservation on a landscape scale. One of the main reasons why most landowners are attracted to the Service's conservation easement program is that the Service allows the landowner to support control over public access. Changing this policy would likely reduce landowner interest. In addition, purchasing public access rights is estimated to add 25 to 30 percent to the cost of the easement which would mean fewer acres could be protected with annual money allocations. Lastly, the increased challenges of administering the provisions of public access on easements would likely detract from the ability of staff to protect more habitat acres.

Fee title acquisition, such as new waterfowl production areas, has considerable limitations. These lands would first have to qualify under the purchasing constraints of the Migratory Bird Program by supporting enough wetlands on a tract of land to sustain a minimum of 25 pairs of breeding ducks per square mile. There has to be an adequate amount of Migratory Bird Funds available in Montana for acquisition (current money levels would only secure approximately 600 acres per year). Private landowners would have to be willing to sell these specific tracts of land. Fee title acquisitions would cost at least 70 percent more per acre than conservation easements, because the purchase price would be full appraised market value. In addition, the Service would incur all operation and maintenance costs for these new fee title tracts. Fee title acquisition decreases the county tax base and is generally unpopular within local communities.

- A conservation area (like those on the Rocky Mountain Front, Blackfoot Valley and Swan Valley) should be established for the area surrounding Benton Lake Refuge (for example, Lake Creek watershed).

This comment suggests establishing a conservation area, but the Service currently has tools that can be used by refuge staff to protect land and work with private landowners in the area around Benton Lake without needing to establishing a conservation area. The refuge complex staff have analyzed the issue of working with partners to improve water quality in the area surrounding the refuge. The Service's successful model for conservation easements is to partner with landowners to support their current land management (typically ranching) to create a win-win for landowners and wildlife. Conservation easements in the Lake Creek watershed would require landowners to change their current land management which would likely reduce the success of this approach. Also, the significantly modified landscape does not rank as highly for benefits to trust resources as more intact landscapes within the State.

7.4 Development of Alternatives

The Service assessed the planning issues identified in section 7.2, the existing biological conditions described in section 7.10, and external relationships affecting the refuge complex. This information contributed to the development of alternatives; as a result, each alternative presents different approaches for meeting long-term goals. Each alternative was also evaluated according to how well it would advance the vision and goals of the refuge complex and the mission of the Refuge System, along with how well it would address the planning issues.

The following alternatives are specific to Benton Lake Refuge and do not apply to the rest of the refuge complex.

- alternative A1–no action

- alternative B1
- alternative B2
- alternative C1–proposed action
- alternative C2

However, alternatives A1 through C2 are extensions of alternatives A, B, and C that would apply to the entire refuge complex, as shown in table 30:

Table 30. Each Benton Lake National Wildlife Refuge Complex-level alternative is linked to one or more alternatives for Benton Lake National Wildlife Refuge, Montana.

Refuge Complex Alternative	A	B	C
Benton Lake Refuge Alternative	A1	B1, B2	C1, C2

Planning elements and their accompanying planning issues from section 7.2 are as follows:

- Grasslands: Loss of Ecological Processes, Invasive Plants, Nonnative Plants and Noxious Weeds
- Wetlands and Riparian Areas: Loss of Ecological Processes, Declining Wetland Ecological Health, Water Quantity, Delivery and Cost; Invasive Plants, Nonnative Plants and Noxious Weeds; Loss of Ecological Processes
- Water Resources: Declining Wetland Ecological Health; Water Quantity, Delivery and Cost
- Visitor Services: Wildlife Management, Hunting, Wildlife Observation
- Staff and Funding
- Resource Protection

The planning team decided that further examination of the forests and woodlands planning element in chapters 3 and 5 was not needed for Benton Lake Refuge.

Elements Common to All Alternatives

Regardless of the alternative selected, refuge management will strive to achieve key objectives that show wetland health and sustainability are improving wildlife. For elements common to all alternatives, see section 3.2. Those elements that are common only to alternatives A1 through C2 include:

- reducing selenium contamination to levels where it does not impact reproduction in wildlife, particularly waterbirds. This is evaluated by measuring selenium at multiple trophic levels (for example, water, sediment, invertebrates and eggs).
- supporting wetland vegetation to consist of at least 80 percent native species.
- avoiding the creation of a sink for wildlife populations. This objective applies especially to alternatives B1 and B2 where the possibility of artificially flooding the lower units during summer could lead to increased botulism mortality over natural conditions.

Actions Same as the Refuge Complex

Management actions and environmental consequences for the climate change, preserving intact landscapes, species of concern, migratory birds and visitor and employee safety planning elements in chapters 3 and 5 apply equally to alternatives A1 through C2 in chapter 7 as they do to alternatives A through C.

7.5 Alternative A1 (Current Management–No Action)

Alternative A1 is the no-action alternative, which represents the current management of the refuge. This alternative might not meet all the CCP goals. It is provided as a basis for comparison with the other alternatives. It also fulfills the requirement in

Two key objectives for wetland health for all alternatives:

- Reduce selenium so it does not impair reproduction in wildlife (for example,<2ug/g in sediment)
- Wetland vegetation should be at least 80% native species

NEPA that a no-action alternative be addressed in the analysis process.

Management activity being conducted by the Service would remain the same. The Service would not develop any new management, restoration, or education programs at the refuge complex. Budget and staff levels would remain the same with little change in overall trends. Programs would follow the same direction, emphasis and intensity as they do at present.

Current management on the refuge would continue and would focus, primarily, on the individual wetland units. Most staff time and efforts would be directed toward providing migration and breeding habitat every year for wetland-dependent wildlife, primarily waterfowl. Annual flooding would be supported by pumping water from Muddy Creek to supplement natural run-off. Water management within the 8 wetland units on the refuge would be similar each year so that units are flooded at approximately the same time and depths consistently. This alternative would provide an opportunity for waterfowl hunting every fall. Managing grasslands and other wildlife-dependent public uses (wildlife observation and photography, environmental education and interpretation, and upland game-bird hunting) on the refuge are a secondary focus.

Grasslands

Protection of native grasslands through easement programs would continue to be a high priority throughout the refuge complex. Within authorized conservation areas, easements would be regularly used to protect native grasslands. Easements would be aggressively monitored and proactively enforced.

Native grasslands would be managed to sustain grassland health, composition and native plant diversity. This would be done by emulating historical disturbance regimes such as fire, treatment of invasive species using IPM and EDRR, and proper periods of rest. Grazing would not be used as a tool to manage grasslands on the refuge.

Management of tame grass on the refuge would strive to support health and longevity of stands with periodic disturbance with fire or haying.

Nonnative tree plantings in grasslands (shelterbelts) are present, but would not be actively managed. Most of the nonnative tree plantings on the refuge complex occur on the Benton Lake Refuge.

Wetlands and Riparian Areas

Pumping is used to supplement the refuge's natural runoff and artificially flood wetland habitat. The refuge would continue to pump an average of 4,000 acre-feet per year, although this may decline over time if electricity costs increase. The water would be pumped from Muddy Creek primarily in the fall and occasionally in early summer. Most wetland units would be flooded to some extent every year. The distribution, depth and timing of flooding would be similar each year. The lower units (Units 3–6) would be managed to dry out during July and August to reduce the likelihood of botulism and waterfowl mortality. Units 1 and 2 would be flooded year-round to provide brood habitat. (A detailed description of current water management can be found in section 7.10).


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

Water Resources

Annually about 4,000 acre-feet of water (of a 14,600-acre-foot water right) would continue to be pumped from Muddy Creek and runoff from the Lake Creek drainage is captured within the wetland basin.

Visitor Services

The overarching goal of the public use program would continue to be to enhance wildlife-dependent recreation opportunities and access to quality visitor experiences while managing units to conserve fish, wildlife, plants, and their habitats. Recreational uses should continue to help visitors focus on wildlife and other natural resources, and provide an opportunity to make visitors aware of resource issues, management plans, and how the unit contributes to the Refuge System and Service mission. National wildlife refuges are encouraged to provide wildlife-dependent recreation where feasible and compatible with the purpose of the refuge.

Hunting

Hunting of waterfowl (duck, goose, swan (by permit only), and coot) and upland gamebirds (pheasant, sharp-tailed grouse, and gray partridge) would continue in designated areas of the refuge on approximately 4,600 acres of upland and wetland habitat. Big game hunting would continue to be prohibited. Hunting rabbits or any other wildlife species, including furbearers would continue to be prohibited.

Hunting on the refuge begins with the opening of the State waterfowl season and runs through November 30. Benton Lake Refuge is open for the youth waterfowl season, which typically occurs the weekend before the opening of the general waterfowl season. Hunting is on a first-come, first served basis. One disabled accessible hunting blind is available in Unit 5 through special use permit.

Wildlife Observation and Photography

The Prairie Marsh Wildlife Drive would provide year-round wildlife-viewing and photography opportunities via auto, bicycle, equestrian, or foot-traffic, including hiking, snowshoeing, or cross-country skiing.

Lower Marsh Road would continue to be available to vehicles, foot-traffic, bicycling, and equestrian use for wildlife-viewing and photography opportunities from July 15 until the opening day of waterfowl hunting season. Rough road conditions prevent the use of RVs, vehicles towing trailers, and large vehicles.

Facilities providing more opportunities for wildlife observation and photography include the Unit 1 photographic blind and the Prairie Marsh Boardwalk with spotting scope and interpretive panels. More year-round opportunities for wildlife observation and photography by means of temporary blinds on Prairie Marsh Wildlife Drive would continue to be available. Blinds in other selected areas may be authorized as well through special use permit.

Cross-country skiing and snowshoeing for wildlife-viewing and photography would continue to be permitted refuge-wide from December 15 until the end of February. Equestrian and bicycle use would be limited to roads open to motorized vehicles.

The Sharp-Tailed Grouse Blind would continue to be available to refuge visitors by reservation on weekends during April and May. The grouse blind provides a highly sought-after opportunity to observe and photograph the courting rituals of sharp-tailed grouse.

Environmental Education and Interpretation

The refuge would continue to offer joint-sponsored outdoor education courses with the MFWP, including Youth Waterfowl Safety Clinic and the Becoming an Outdoor Woman series. Partnership with the Great Falls Public School would continue to provide the opportunity for all third graders in the Great Falls Public School system to come to the refuge and learn about natural resources. This highly popular activity includes more than 850 students annually. Refuge staff would provide information about the refuge and education specialists from the GFPS perform onsite activities and learning modules. Geocaching would continue to be prohibited; however virtual geocaching would be authorized if requested.

Refuge staff would continue to take part in the annual Montana Envirothon in Lewistown, Montana. The event attracts student teams from all across Montana while they compete for the opportunity to represent Montana and compete at the National Envirothon Competition. Refuge staff help students learn about fish and wildlife resources and their associated habitat. More than 200 students and teachers take part in the annual event. As time allows, the refuge would also continue to collaborate with other school groups to provide tours, teach science, and work together on monitoring projects.

Refuge staff would continue to take part in the STEM Expo hosted in Great Falls, Montana. This exposition hopes to develop into an annual event promoting math and science within the community. The event would offer staff the opportunity to reach more than 550 children, teachers, and parents. Benton Lake Refuge participation in the future was identified as a beneficial educational outreach activity.

Staff and Funding

The refuge complex headquarters is located on the Benton Lake Refuge. Service operations would continue to consist of the staff, facilities, equipment, and supplies needed to administer resource management and public use programs throughout the refuge complex, which is located across a 12-county area covering more than 2,700 square miles. Within this area, the Service would be responsible for the protection of 163,304 acres of lands and waters.

Staff

The refuge has seen a reduction in staff since 2000. Currently, the refuge complex staff is comprised of 9.5 permanent full-time employees (table 12 in chapter 4, section 4.7). Staff assigned to the Benton Lake Refuge would continue to include: a part of the wildlife refuge manager, the deputy wildlife refuge manager, an administrative officer, and a wildlife refuge biologist, maintenance worker, term-seasonal biological technician, and part-time generalist. The wetland district manager would continue to often help with refuge support.

Since 1998, the refuge complex has lost three positions—one full-time law enforcement position, one permanent biological science technician and a permanent maintenance worker. The complex has gained a wildlife refuge specialist assigned to the Rocky Mountain Front CA and Assistant Fire Management Officer assigned to the complex. The current staff level remains well below the minimum prescribed in the "June 2008 Final Report—Staffing Model for Field Stations" (USFWS 2008e), which recommended ¬8 more staff including a GS–13 refuge manager, GS–12 wildlife refuge specialist, GS–9 park ranger (visitor services specialist), GS–9 park ranger (law enforcement), GS–12 wildlife biologist, WG–8 maintenance worker, and GS–6 biological science technician (0.5 full-time equivalent employee).

Resource Protection

Same as refuge complex alternative A.

7.6 Alternative B1

Benton Lake Refuge wetland impoundments would be intensely managed to improve health over current conditions, yet provide for wetland-dependent wildlife habitat and recreation (waterfowl hunting) every year at consistent levels. Efforts would be made to improve wetland health and sustainability for individual wetland units through short-term drying rotations, prescriptive management treatments and working in the Lake Creek and Muddy Creek watersheds. Drying rotations may be extended if necessary to achieve wetland health objectives. Managing grasslands and other wildlife-dependent public uses (wildlife observation and photography, environmental education and interpretation, and upland game-bird hunting) would be a secondary focus.

Grasslands

Protection of native grasslands through easement programs would continue to be a high priority throughout the refuge complex. Within authorized conservation areas, easements would be regularly used to protect native grasslands. Easements would be aggressively monitored and proactively enforced.

Native grasslands would be managed to sustain grassland health, composition and native plant diversity. This would be done by emulating historical disturbance regimes such as fire, treatment of invasive species using IPM and EDRR, and proper periods of rest. Grazing would not be used as a tool to manage grasslands on the refuge.

Management of tame grass on the refuge would strive to support health and longevity of stands with periodic disturbance with fire or haying.

Nonnative tree plantings in grasslands (shelterbelts) are present, but would not be actively managed. Most of the nonnative tree plantings on the refuge complex occur on the Benton Lake Refuge.

Wetlands and Riparian Areas

Initially, similar amounts of water would be pumped from Muddy Creek as in alternative A1 (4,000 acre-feet per year) to extend the natural flooding cycle in the spring, summer, and fall, and to provide consistent wetland habitat every year on the refuge. However, short-term dry periods (7+ years in Units 1 and 2 and 3-5+ years in Units 3-6) would be rotated among units to volatilize selenium to change it into a vapor that would reduce its level in the wetland reduce invasive vegetation and improve wetland health. If necessary, more dry time may be implemented in individual units until wetland objectives are met. Added treatments of increased prescribed fire, discing vegetation, spraying invasive plants and reseeding would be used if needed. Flooding the lower units during summer will continue to be avoided to prevent botulism outbreaks unless it becomes necessary to dry Units 1 and 2 simultaneously for selenium control. In this case, one of the lower units may be flooded through summer to provide brood habitat. The flooding and drying rotation, water control structures and other management tools would continually be assessed and modified through an adaptive management process. This could include building more infrastructure such as a diversion channel around Units 1 and 2, expanding dry cycles, and adding management treatments.

Water Resources

Same as alternative A1, except the total acre-feet pumped would depend on progress toward wetland objectives.

Visitor Services

Hunting

Same as alternative A1, except the area open for waterfowl hunting could change from year to year based on the flooding and drying rotation of the units. More upland gamebird habitat might be available if particular units within the hunt area are in their drying cycle.

Wildlife Observation and Photography

Same as alternative A1, except there may be modifications to the opening and availability of Lower Marsh Road depending on the sequence of implementing the dry cycle in various units, which could affect access by bicycle or foot. These modifications would be implemented if unacceptable disturbance is occurring that needs to be reduced or if management actions need adjusting.

Foot-traffic, including hiking, snowshoeing, and cross-country skiing, would be permitted only on designated trails; roads open to motorized vehicles; and in the refuge hunt area during the refuge hunting season.

The auto tour route may be adjusted to accommodate adjustments to water management units and changes in hunt area and water availability.

May establish mobile photo blinds through special use permit.

Environmental Education and Interpretation

Management actions would be the same as alternative A1, plus greater emphasis would occur with interpretive panels and maps to explain (1) the purpose and importance of emulating natural processes for the health and vitality of ecological system and (2) changes to public use regulations and access areas to accommodate rotating closed area due to changes in wetland and water management.

Staff and Funding

Significant increase in staff and money for the intense management actions and monitoring would be necessary. Increases in permanent staff to accomplish this alternative include: a 1.0 FTE supervisory biologist, a term 0.8 FTE biological technician, and 1.0 FTE maintenance worker. The supervisory biologist will be assigned to work throughout the complex and on Benton Lake Refuge to direct restoration and monitoring efforts and supervise the permanent wildlife biologist and term and temporary biological technicians. A large proportion (80 percent) of their work load is expected to be focused on the refuge. To accomplish monitoring responsibilities and to make sure that objectives are be-

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A spotting scope is on hand for educational use and for wildlife observation at the visitor center at Benton Lake National Wildlife Refuge.

ing met is expected to also require two seasonal 0.8 FTE biological technicians. In addition, a full time law enforcement officer, assigned to the complex, is expected to spend a part (25 percent) of his/her time patrolling and protecting natural resources and helping visitors on the refuge.

Water level management (operations and maintenance) efforts are expected to be same as alternative A1. Pumping (electricity) expenses are expected to be similar to alternative A1.

Monitoring efforts would be implemented to assess results to make sure that the objectives for selenium, vegetation, and wetland health are being met. This is especially important to establish baseline information and to decide if more drying is needed. A significant increase in expense is expected over alternative A1.

Prescriptive habitat treatment (discing, mowing, herbicide treatment, etc.) would be implemented in individual units. Significant increase in expense to accomplish this will occur above alternative A1.

This alternative includes the possible construction of a diversion channel that could divert water to and from Units 1 and 2, which would increase water management flexibility.

Resource Protection

Same as refuge complex alternative B, plus more law enforcement and administrative help needed to make sure that boundaries are properly signed and literature is available to support possible shifts in hunting areas. Efforts would focus on preventative law enforcement.

7.7 Alternative B2

Benton Lake Refuge wetland units would be intensely managed to improve health over current conditions, yet provide for wetland-dependent wildlife habitat and recreation more often than would occur naturally. Efforts would be made to improve wetland health and sustainability through an initial, basin-wide dry period to “reset” the system, prescriptive management treatments and work in the Lake Creek and Muddy Creek watersheds. When wetland health has improved sufficiently, pumping may be incrementally reintroduced and reevaluated annually. Managing grasslands and other wildlife-dependent public uses (wildlife observation and photography, environmental education and interpretation, and upland game-bird hunting) on the refuge would occur as resources allow, primarily during the initial, basin-wide dry period.

Grasslands

Same as refuge complex alternative B. In addition, up to 3.5 miles of nonnative tree plantings in grasslands (shelterbelts) would be removed. Shelterbelts that have the greatest negative effect on grasslands would be the highest priority for removal. Degraded tame grass stands (up to 207 acres) would be planted back to native grass species where proper and feasible.

Formal monitoring of grasslands would be focused on native prairie with an emphasis on linking management actions to grassland condition (adaptive management). Restoration of habitats (native grass planting and tree removal) would be formally monitored to evaluate success. Monitoring of tame grasslands would be minimal and informal.

Wetlands and Riparian Areas

The refuge would be managed to improve wetland health and sustainability through an initial, basin-wide drying period (8 plus years) to “reset” the system. During the initial dry period, pumping will cease and all units will only receive natural run-off. When conditions allow, more intensive management (prescribed fire, discing, and herbicide application) will occur. All wetland infrastructure (dikes, ditches, water control structures), the pumphouse, equipment, and conduit between the pump station and the refuge would remain in place.

When wetland health has improved sufficiently and objectives have been achieved, pumping may be incrementally reintroduced. The objectives for wetland management are the same as those described under alternative B1. If pumping is reintroduced, short-term dry cycles on a unit-by-unit basis and more management techniques, similar to those described in alternative B1, will continue to be part of the long-term management of the wetland. The decision to flood or dry each unit would be an annual decision based on an adaptive resource management approach. Wetland cycles, health, and wildlife response would be tracked with intensive monitoring to provide feedback on management success.

Water Resources

Pumping water would not occur during the initial dry period. Once wetland objectives are achieved, pumping could resume. Natural runoff would still be captured from the Lake Creek watershed every year.

Visitor Services

Hunting

During the initial dry period, management actions would be similar to alternative C1. During these years, there would be no waterfowl hunting opportunities on Benton Lake since there would be no, or very limited, water in the fall.

During years with adequate water (runoff or pumped), the area open for waterfowl hunting could change from year to year based on the flooding and drying rotation of the units.

The upland gamebird season would be expanded to the end of the State season.

Wildlife Observation and Photography

During the initial drying period, same as alternative A1, except foot-traffic, including hiking, snowshoeing, and cross-country skiing, would be permitted only on designated trails; roads open to motorized vehicles; and in the refuge hunt area during the refuge hunting season. Same as alternative B1 during any pumping or high run-off years.

Environmental Education and Interpretation

Management actions would be the same as alternative B1, plus interpretive panels and maps would also explain the need to reset the natural processes in the wetlands with an initial dry period.

Staff and Funding

Staff needed to carry out this alternative same as alternative B1, except a slight reduction (10 percent) in the part of time the supervisory biologist would spend dedicated to the refuge is expected to occur.

Water level management (operations and maintenance) efforts are expected to be significantly reduced from alternatives A1 and B1. A significant cost saving during the extended drying period would be the reduction in pumping (electricity) and water management (operations and maintenance) expenses.

If pumping resumes, infrastructure and facilities to support water management of the refuge would need annual maintenance similar to the alternatives A1 and B1. Monitoring efforts are expected to be similar to alternative B1. Monitoring efforts would include assessing results to make sure that the objectives for selenium, vegetation, and wetland health are being met. This is especially important if pumping is resumed. Efforts to establish baseline information and monitoring changes from the extended dry period are expected to be enhanced over alternatives A1 and B1.

During the dry phase, active prescriptive habitat treatment (discing, mowing, herbicide treatment, etc.) is expected to be intense and similar to alternative B1, but instead of being applied to a single unit at a time, the treatments could be applied basin-wide.

The diversion channel is not expected to be needed.

Resource Protection

Same as refuge complex alternative B, plus more law enforcement and administrative help needed to make sure that boundaries are properly signed and literature is available to support possible shifts in hunting areas. Efforts would focus on preventative law enforcement.

7.8 Alternative C1 (Proposed Action)

Benton Lake Refuge management would focus on the refuge as a whole, with emphasis on restoring the health and long-term sustainability of the wetland basin, to support a wide diversity of migratory birds and a variety of wildlife-dependent recreation. This would be accomplished by reintroducing the full extent and variability of the natural wet-dry cycles, prescriptive management treatments and working in the Lake Creek watershed. The wetland basin would receive only natural run-off and wetland basin infrastructure (for example, ditches, dikes, and water control structures) could be modified or removed only if necessary to achieve wetland health objectives. The pumphouse and all water rights would be supported. As the wetland basin is restored and becomes self-sustaining, more resources would be directed toward managing and restoring upland grasslands, providing other wildlife-dependent public uses (wildlife observation and photography, environmental education and interpretation, and upland game-bird hunting), and providing support for conservation easement acquisition in the complex.

Grasslands

Same as refuge complex alternative C, plus up to 19 miles of nonnative tree plantings in grasslands (shelterbelts) would be removed. Shelterbelts that have the greatest negative effect on grasslands would be the highest priority for removal. Up to 728 acres of tame grass stands would be planted back to native grass species.

Formal monitoring of grasslands would be focused on native prairie with an emphasis on adaptive management. Restoration of habitats (native grass planting and tree removal) would be formally monitored to evaluate success. Monitoring of tame grasslands would be minimal and informal.

Wetlands and Riparian Areas

Same as A1, except all units on the refuge would be subject to natural hydrologic regimes. Limited pumping may occur (estimated once every 8 years) to support water rights to Muddy Creek or for specific restoration purposes only (for example, flooding out nonnative vegetation). To facilitate this, the pump house, underground pipeline (4 miles), and several structures on Lake Creek will be supported. Units 1 and 2 would be restored to wet meadow wetlands, with water entering the refuge through the old Lake Creek channel and natural diffuse runoff. Infrastructure on the refuge could be modified or removed incrementally if monitoring results show that is necessary to achieve refuge objectives. Staff will work with our partners in the Lake Creek watershed to carry out conservation actions that improve water quality and wetland health on the refuge.

Formal monitoring of wetlands would focus on wetland health and sustainability through adaptive management. Monitoring would track long-term trends in wetland cycles, health and wildlife use. For restoration efforts, monitoring would be especially important to decide if systems are recovering.

Water Resources

Only natural runoff would be captured on a regular basis protecting Lake Creek water rights. To preserve the Muddy Creek water rights, occasional pumping may occur (estimated once every 8 years).

Visitor Services

Hunting

During years with limited precipitation and runoff, there would be no waterfowl hunting opportunities on the refuge since there would be no, or very limited, water in the fall. These dry years would provide increased upland gamebird habitat for hunting. The upland gamebird hunting season would be extended to the end of the State season (same as alternative B2).

During years with adequate water, a decision would be made on an annual basis about the location of open and closed areas. These designated areas may be rotated depending on water and vegetative conditions.

Wildlife Observation and Photography

Same as alternative A1, except foot-traffic, including hiking, snowshoeing, and cross-country skiing, would be permitted only on designated trails; roads open to motorized vehicles; and in the refuge hunt area during the refuge hunting season. If modification or removal of water management infrastructure occurs, parts of the existing auto tour route could be changed. Efforts would be made to reestablish the auto tour route in another location. If interior roads are removed for habitat management purposes, more hiking trails that access the interior of the refuge may be established to facilitate wildlife

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The Canada goose is a frequent visitor to Benton Lake National Wildlife Refuge.

observation and photography. Any new opportunities would be implemented in a way that reduces disturbance to wildlife.

Environmental Education and Interpretation

Same as refuge complex alternative C regarding implementation of expanded environmental education and interpretation program. In addition, at the Benton Lake Refuge, greater emphasis would occur with environmental education, outreach, interpretive panels and maps to explain (1) the purpose and importance of conserving, managing, and restoring healthy functioning ecosystems, (2) the importance of natural hydroperiods in wetlands, and (3) changes to public use regulations and access areas to accommodate changes in wetland and water management. Environmental education curriculum may be adapted to reflect changes in habitat from restoration efforts.

Staff and Funding

Staff

Staff increases expected to be needed to carry out this alternative include: a part (50 percent) of the 1.0 FTE park ranger assigned to the complex, a part (25 percent) of the 1.0 FTE law enforcement officer assigned to the complex, a part (70 percent) of the 1.0 FTE supervisory biologist assigned to the complex, and 0.8 FTE biological technician. From alternative B2, this is a reduction of two, 0.8 FTE biological technicians, and 1.0 maintenance worker and an increase of a part (50 percent) of the 1.0 FTE park ranger assigned to the complex.

Money and resources are expected to be reallocated throughout the refuge complex to deal directly with constraints to manage for self-sustaining systems. Areas requiring extra effort will have resources reallocated toward restoring ecological processes and removing constraints. Water level management (operations and maintenance) efforts are expected to be significantly reduced from alternatives A1, B1, and B2. A significant cost saving would be the reduction in pumping (electricity) and the associated water management (operations and maintenance) expenses. Limited pumping is expected to only be used to support the refuge's water rights or as a prescriptive habitat management effort.

Monitoring efforts are expected to be slightly reduced from alternatives B1 and B2. Monitoring efforts would include assessing results to make sure that the objectives for selenium, vegetation, and wetland health are being met while applying an adaptive resource approach to infrastructure modification or removal. Infrastructure will be incrementally assessed and only removed to achieve wetland objectives.

Prescriptive habitat treatment (discing, mowing, herbicide treatment, etc.) is expected to be less intensive than alternatives B1 and B2, and applied basin-wide relatively simultaneously.

Restoration and rehabilitation of altered habitats and ecosystems are expected to require more staff, equipment, and money. Activities expected include wetland basin restoration, shelterbelt restoration, and tame grass conversion.

Resource Protection

Same as refuge complex alternative C.

7.9 Alternative C2

Benton Lake Refuge management would focus on the refuge as a whole, with particular emphasis on restoring the long-term sustainability of the wetland basin, to support a wide diversity of migratory birds and wildlife-dependent recreation. This would be accomplished by reintroducing the full extent and variability of the natural wet-dry cycle, removal of the water management infrastructure (for example, ditches, dikes, and water control structures), prescriptive management treatments, working in the Lake Creek watershed and decommissioning of the pump house. As the wetland basin is restored and becomes self-sustaining, more resources would be directed toward managing and restoring upland grasslands, providing other wildlife-dependent public uses (wildlife observation and photography, environmental education and interpretation, and upland game-bird hunting), and providing support for conservation easement acquisition in the complex.

Grasslands

Same as refuge complex alternative C, plus up to 19 miles of nonnative tree plantings in grasslands (shelterbelts) would be removed. Shelterbelts that have the greatest negative effect on grasslands would be the highest priority for removal. Up to 728 acres of tame grass stands would be planted back to native grass species.

Formal monitoring of grasslands would be focused on native prairie with an emphasis on adaptive management. Restoration of habitats (native grass planting and tree removal) would be formally monitored to evaluate success. Monitoring of tame grasslands would be minimal and informal.

Wetlands and Riparian Areas

Full restoration of the Benton Lake basin would begin immediately, although the process would likely take several years to complete. All units on the refuge would be subject to natural hydrologic regimes. Pumping would cease and the pumphouse, equipment, and conduit between the pump station and the refuge would be removed or reclaimed. Infrastructure within the wetland basin (ditches, dikes, water control structures) would be modified or removed. Units 1 and 2 would be restored to wet meadow wetlands, with water entering the refuge through the old Lake Creek channel and natural diffuse runoff.

Formal monitoring of wetlands would focus on wetland health and sustainability through adaptive management. Monitoring would track long-term trends in wetland cycles, health and wildlife use. For restoration efforts, monitoring would be especially important to decide if systems are recovering.

Visitor Services

Hunting

During years with limited precipitation and runoff, there would be no waterfowl hunting opportunities on the refuge since there would be no, or very limited, water in the fall. These dry years would provide increased upland gamebird habitat for hunting. The upland gamebird hunting season would be extended to the end of the State season (same as alternative B2).

During years with adequate water, a decision would be made on an annual basis about the location of open and closed areas. These designated areas may be rotated depending on water and vegetative conditions.

Wildlife Observation and Photography

Same as C1 plus, more wildlife observation and photography opportunities would be established.

Environmental Education and Interpretation

Same as refuge complex alternative C regarding implementation of expanded environmental education and interpretation program. In addition, at the Benton Lake Refuge, greater emphasis would occur with environmental education, outreach, interpretive panels and maps to explain (1) the purpose and importance of conserving, managing, and restoring healthy functioning ecosystems, (2) the importance of natural hydroperiods in wetlands, and (3) changes to public use regulations and access areas to accommodate changes in wetland and water management. Environmental education curriculum may be adapted to reflect changes in habitat from restoration efforts.

Staff and Funding

Staff

Same as alternative C1, except one less 0.8 biological technician would be required, and the timeline for restoration is quickened and higher costs are expected to occur immediately. Full restoration is associated with this alternative and includes the highest restoration costs.

Resource Protection

Same as refuge complex alternative C.

7.10 Alternatives Considered but Eliminated

The following options were eliminated from further analysis as described below.

Siphon

The possibility of augmenting the current pumphouse with a siphon has been discussed and evaluated by refuge staff and partners since 1992. The purpose of the siphon was to alleviate the high electricity costs associated with pumping water with the current pumphouse and facilities on the refuge. Other benefits that were originally identified included the ability to supply water during the winter and spring, the potential for the refuge to fully exercise its 14,600-acre-foot water right for Muddy Creek, and conservation of electricity. Given the recent concerns about selenium accumulation, the siphon was also proposed as a way to bring higher quality water to the refuge. However, given the high cost of building a siphon ($5 million), insufficient flows to replace pumping needs, and uncertain improvements in water quality, pursuing this alternative is not beneficial to the refuge at this time.

In 1992, the refuge requested that the Bureau of Reclamation complete an appraisal to use a siphon system to supply water from the Sun River Irrigation Project. The final report, "Appraisal Design Report for Water Supply Study, Benton Lake National Wildlife Refuge," dated October 3,1992, outlined plans for completion of the project and estimated associated costs under a range of options. The Bureau of Reclamation report found the siphon system to be technically feasible using an existing irrigation return water canal (Muddy Creek Tributary #3) near the existing pump station. No design obstacles were noted. Easements would need to be acquired from four landowners to complete the project.

In 2006, the Bureau of Reclamation completed a 30-percent Conceptual Design of the siphon project. The siphon would tie into the existing pipeline just downstream of the pump station. The siphon would consist of two reinforced concrete structures, approximately 2 miles of 36-inch diameter pipe, a 12-foot-long steel flume over Muddy Creek, and a 36-inch in-line valve and a valve house. A small intermittent tributary of Muddy Creek would also have to be relocated for approximately 300 feet. The siphon would deliver water to the refuge using gravity flow and the capacity of the system is 20 cfs based on the pipe diameter. The most current estimate (2006) by the Bureau of Reclamation for the cost of the siphon project is $5 million dollars .

In 2007 and 2008, waterflows in the Upper Muddy Creek Tributary #3, where the siphon intake would be located, were measured by Montana State University. Water flowed in this tributary from May through October and flows during the irrigation season varied from 0 to 23 cfs. The estimate for the total volume of water flowing through the tributary was 2,186 acre-feet in 2007 and 2,759 acre-feet in 2008 (personal communication, Alan Rollo).

Currently, the refuge pumps approximately 4,000 acre-feet per year in dry years. At the time the siphon was originally proposed, the refuge was pumping 6,000–8,000 acre-feet per year. The 2007–8 flow data show that the amount of water from the siphon would not be enough to entirely replace current pumping. Furthermore, to capture the full 2,186–2,759 acre-feet, water would need to be siphoned during the entire irrigation season. Siphoning during summer months would be challenging because there would be high losses to evaporation, increased risk of wildlife mortalities from botulism, and further alteration to the natural hydrologic cycle that is likely to have a negative effect on nutrient cycling, vegetation, invertebrates, and wetland health. The quality of the water, specifically the selenium levels, at the proposed siphon inlet are not well understood. The siphon would take water from the Greenfields Bench. As of 2010, Montana Department of Agriculture water monitoring reported 202 detections of 30 different pesticide compounds from 22 samples across the Greenfields Bench. For the most part, concentrations were low and none of the detections exceeded or approached human health or aquatic life benchmarks. Nitrate concentrations were elevated, but below the drinking water standard. In addition, the siphoned water still has to flow through Lake Creek where it would pick up more selenium before reaching the refuge.

Only Pumping in Spring

Based on the results of the hydro-geomorphic assessment of the refuge (Heitmeyer et al. 2009), pumping in the spring, instead of the fall, would more closely emulate the annual historical flooding cycles. Refuge staff modeled a rotational system drying out one unit at a time for 3 years with a spring pumping scenario (500 acre-feet in May and 1,500 acre-feet in June). These months and water volumes were chosen based on availability of water from Greenfields Irrigation District, evaporation rates, and costs. The scenario was run through a water model developed by USGS for the refuge (Nimick et al. 2011). This early modeling exercise showed a couple of key results. In a dry cycle, only pumping in May–June meant that the wetland water was (1) too late to attract as many spring migrants as fall flooding, (2) capable of flooding nests of early nesting bird species, (3) providing water on the refuge during July–August, which increased botulism risk and (4) comprised of surface water that usually evaporated before fall negating any opportunity for annual waterfowl hunting. Pumping earlier in the year may be possible, but without return flows in Muddy Creek from irrigation, only one pump can be used to pump a small amount of water. In dry years, this small volume is likely to be lost to ground saturation and evaporation, making this choice less effective and more costly (per acre-foot) than late spring or fall pumping. Based on this analysis, an alternative with only spring pumping was eliminated from further consideration.

Restore Units 1 and 2 and Pump Water to Lower Units

Early during the planning process, staff considered a rotational management scenario for drying out the lower units for 3 years as well as restoring the original Lake Creek channel and Units 1 and 2 to wet meadows based on the HGM assessment. This report found that Units 1 and 2 historically were an alluvial fan meant to be the highest and driest part of the wetland basin, and instead have been converted to the deepest, wettest part of the wetland basin. These are also the units with the highest selenium levels and restoring this part of the basin to temporarily flooded wetlands, rather than semipermanent wetlands, would reduce selenium levels.

The Service modeled a rotational system drying one of the lower units at a time for 3 years with Units 1 and 2 restored to temporarily flooded wetlands. In this scenario, the only brood habitat on the refuge would be whichever lower units were in their wet cycle. If the lower units have standing water in July and August, they have an increased risk for botulism based on past history, particularly in hot summers. If the lower units were flooded less deeply so that they dry out in July–August (as is current practice to prevent botulism), there would be no brood habitat. This means that refuge would be attracting birds to the refuge by fall pumping, which creates attractive water in the spring for migrants, and knowingly managing the refuge so it dries out before the birds could successfully raise a brood. Although it is possible that wetland birds could be attracted to spring water at Benton Lake that dries out during the summer under natural conditions, this would not happen every year as proposed under this alternative. Therefore, supporting Units 1 and 2 as potential brood habitat was considered preferable for any scenario with pumped water (see alternatives B1 and B2) and this alternative was eliminated from further consideration.

Minimal Pumping in the Fall Primarily for Recreation

A small amount of water could be pumped in the fall for hunting. The amount of water would be managed so that it evaporates by freeze-up or early the next spring. One benefit of this scenario is that there would be fall hunting and fall migration habitat every year on the refuge, although it would be less than currently is available. There would be less water pumped onto the refuge, so the negative effects from pumping would be reduced. However, this alternative would focus on recreation without addressing issues of wetland health. In addition, this scenario would not be very cost effective, because of the electricity demand charge for pumping lower volumes of water results in significantly higher costs per acre.

7.11 Affected Environment

The summary of the affected environment in chapter 4 includes Benton Lake Refuge. However, aspects that specifically affect the management alternatives at the refuge are discussed in detail in this section. In addition, the hydrogeomorphic assessment for the refuge (Heitmeyer et al. 2009) can be provided on request.

Climate

The climate of the Benton Lake Refuge is semiarid continental, which is characterized by cold, dry winters and warm, dry summers. Subzero weather normally occurs several times during a winter, but the duration of cold spells typically lasts only several days to a week after which it can be abruptly terminated by strong southwesterly Chinook winds. The dynamic Chinook winds often prohibit large accumulations of snow over winter and reduce large spring runoffs because snow melts in smaller increments throughout winter and is mostly absorbed into the ground.

During the period of record at Great Falls, the average annual precipitation is 14.98 inches. Yearly precipitation extremes have ranged from 25.24 inches in 1975 to 6.68 inches in 1904.

Long-term temperature and precipitation data show dynamic patterns of recurring peaks and lows on a 10- to 20-year cycle (NOAA 2009), depicted in figure 16. Regional precipitation decreased and temperatures rose from the late 1910s to the late 1930s. A steady rise in precipitation and declining temperatures occurred from the early 1940s to the mid-1950s followed by another decline in precipitation and local runoff in the 1960s. Precipitation rose again during the late 1970s and early 1990s, and remained about average during the 1980s and late 1990s to early 2000s. Currently, the region appears to be heading back into a wet cycle, with 2010 being the wettest year since 1993 (NOAA 2011a).

Climate Change

Although temperature increases over the next several decades appear inevitable, the resulting effect on precipitation, moisture and wetland hydroperiods is highly uncertain. Some modeling has suggested that there could be shifts of highly favorable water and cover conditions for waterfowl breeding if precipitation does not increase along with temperatures (Johnson et al. 2005, Johnson et al. 2010). However, other researchers have found that precipitation

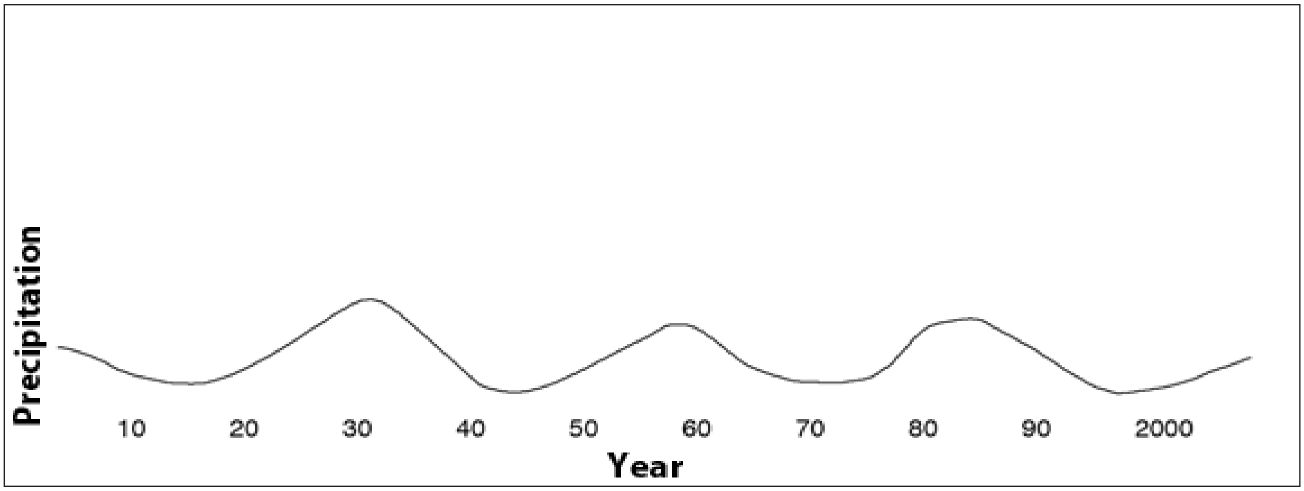


Figure 16. Model of long-term dynamics of water levels in Benton Lake, Montana. Source: USFWS and NOAA 2008.

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).

Geology

Detailed geologic mapping has been completed for the Benton Lake area (Maughan 1961, Lemke 1977, Maughan and Lemke 1991). The Benton Lake basin is characterized by gently dipping sedimentary bedrock formed during the Cretaceous period (145–65 million years ago) overlain in many places by deposits from glaciers and streams from the last ice ages (Maughan 1961). The ancient sedimentary bedrock that lies beneath the Benton Lake basin is important because of the effect it has on water quality today as a source of selenium. Bedrock in most of the Benton Lake basin is seleniferous marine shale of the Cretaceous Colorado Group, often referred to as Colorado Shale (Maughan 1961).

During the last Pleistocene ice sheet, Glacial Lake Great Falls covered low-lying parts of the Benton Lake region. Glacial lake deposits near Benton Lake are primarily clay and silty clay and are up to 100 feet thick (Lemke 1977). Glacial drift associated with the last ice sheet was deposited northeast of Benton Lake and east of Priest Butte Lakes and formed the closed Benton Lake basin.

Most geomorphic surfaces on the current Benton Lake bed are deposits from Glacial Lake Great Falls. A second surface of local stream and sheetwash deposits cover a small area along the Lake Creek drainage on the north, and a small tributary drain on the southwestern side of Benton Lake. These deposits were formed by overbank deposition and scouring of sediments along the drainages that entered Benton Lake and resemble small natural levees and alluvial and colluvial fans that are 2–8 feet higher in elevation than the adjacent Benton Lake bed. These elevated geomorphic surfaces have been converted from the highest and driest part of the basin to the deepest and wettest units on the refuge (Units 1 and 2).

Within Benton Lake proper, elevation gradients are relatively subtle ranging from about 3,614 feet amsl in the lowest depressions in the middle of the historical lakebed to about 3,622 feet amsl on the edge of the lake that defines its full-pool water level (figure 17). A detailed elevation map of the south part of Benton Lake prepared in the early 2000s indicates several deeper depressions historically were present in the lakebed, and likely reflected glacial scouring when the basin was created. Uplands terraces on the refuge range from about 3,622–3,850 feet amsl.

Soils

Surface soils at the refuge are predominantly clays and silty clays (Vertisols) deposited in the lake-system environments of glacial Lake Great Falls and Benton Lake. The Benton Lake bed and surrounding lower elevation areas are mostly plastic clays and exceed 100 feet deep under parts of Benton Lake. These are Pendroy, Thebo Vanda and Marvan clays (NRCS 2011c). In the area where Lake Creek enters Benton Lake, soils are mostly silt and sand with minor clay and gravel present in soil stratigraphy.

Thickness of these soils range from 10 to 40 feet where they become intermixed with underlying lake-system-type deposits. Higher elevation terrace-type soils along the western and southern edges of Benton Lake are mostly 10–30 feet thick silty clay loam types overlying reddish-brown, poorly sorted sand and gravel dominantly of subangular to slabby sandstone and subrounded quartzite, shale, granite, and argillite (Maughan and Lemke 1991). Some of these surfaces have interesting, stratified soils indicating various depositions from historical marine environments, Glacial Lake Great Falls, and underlying Colorado Shale (Condon 2000).

Water Resources

Benton Lake lies within a closed basin (figure 18). For the first 30 years of the refuge history, the refuge was not staffed and the hydrological regime in Benton Lake mirrored seasonal and long-term regional precipitation patterns (Nimick 1997, Heitemeyer et al. 2009). During this time, Lake Creek provided much of the water input to Benton Lake while runoff from local drainages surrounding the lake and onsite precipitation provide the remainder. Since 1961, the refuge also receives water inputs via water pumped from Muddy Creek in the adjacent watershed.

Lake Creek is an intermittent, ephemeral, stream with greatest flows during spring and early summer following snowmelt and increased spring rains (Nimick 1997). Water is assumed lost from the wetlands solely by evaporation, which averages about 40–41 inches per year Soil Conservation Service 1970). Nimick and others (1996) concluded that little water is lost from Benton Lake to ground

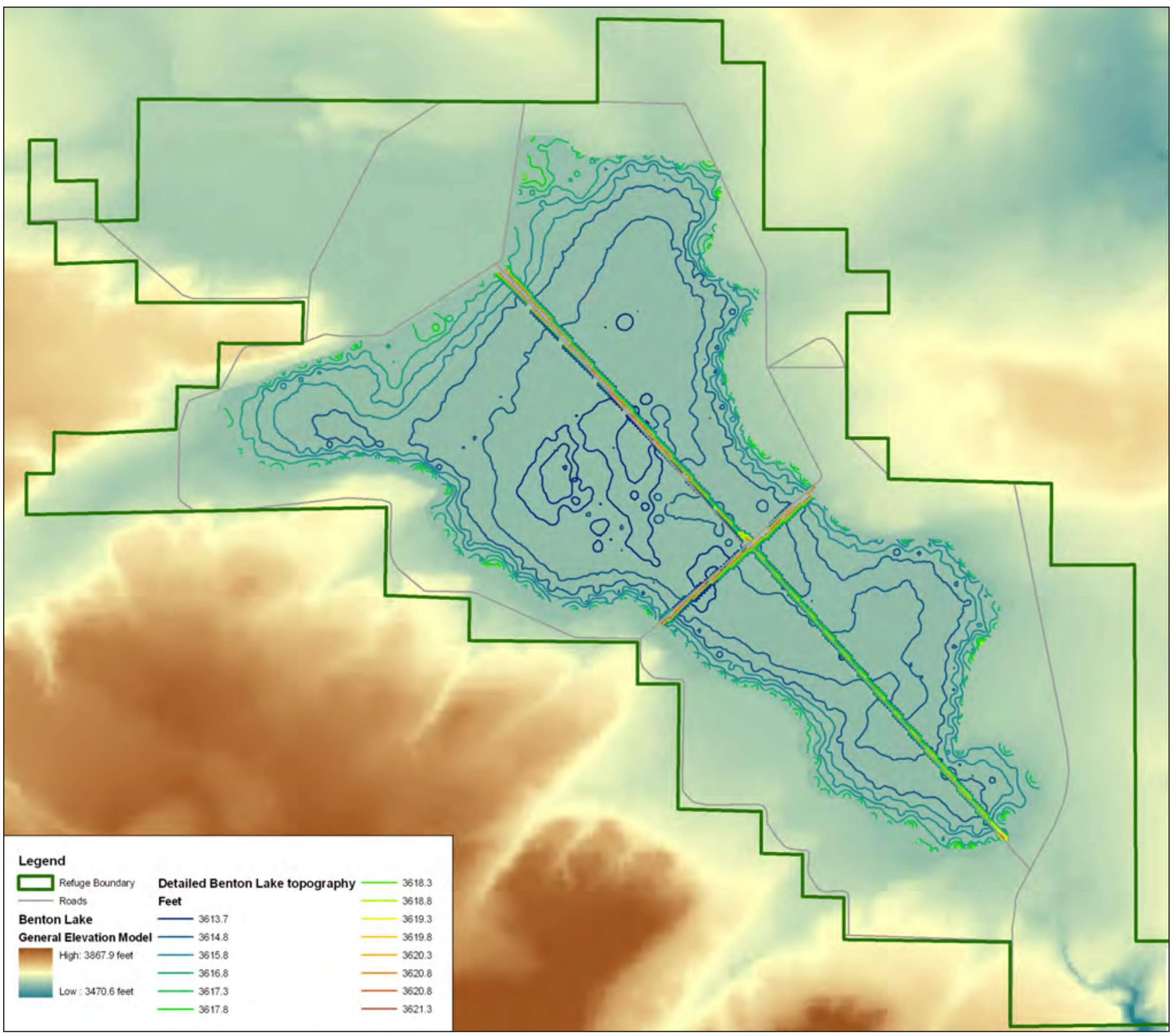


Figure 17. Map of the topography of the Benton Lake National Wildlife Refuge, Montana.

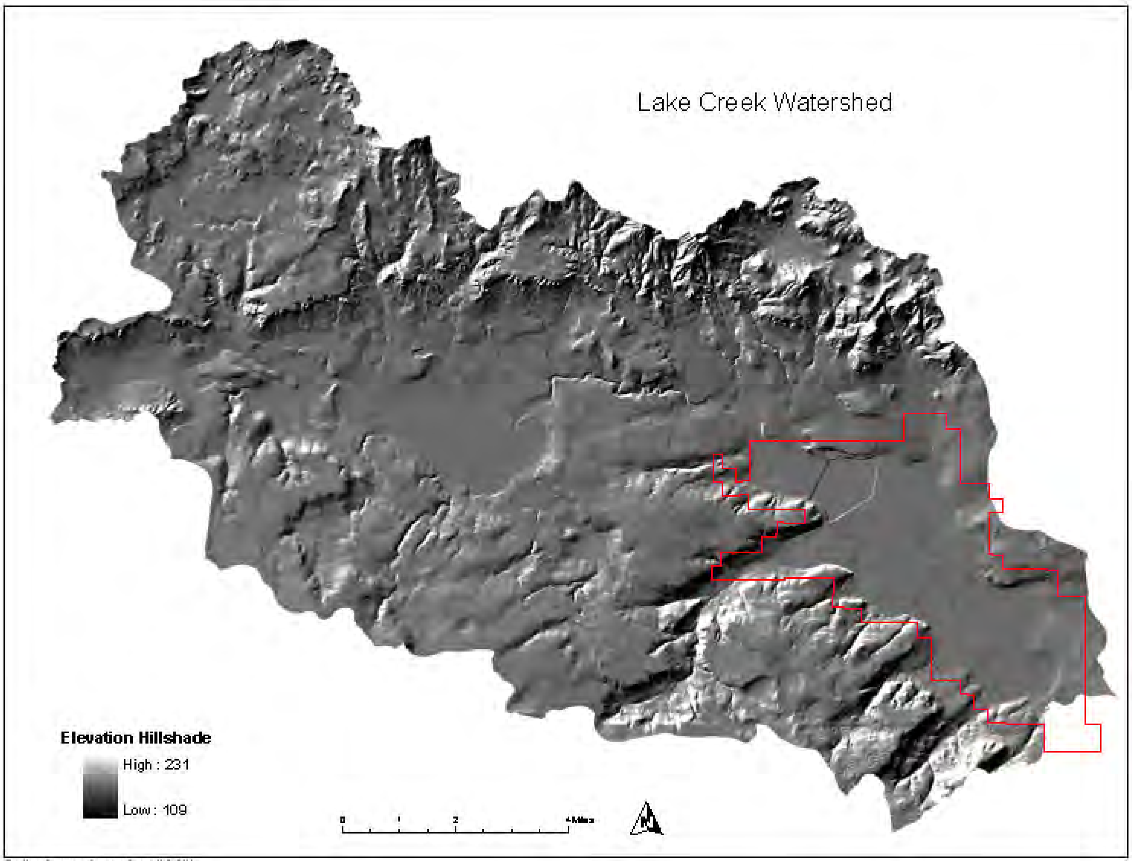


Figure 18. Map of the Lake Creek watershed, Montana.

water because of the relatively impermeable glacial-lake sediment that underlies the wetlands.

Inputs from natural runoff and precipitation are highly dynamic and have a strong seasonal pattern. These inputs are highest in spring and early summer, followed by gradual declines during summer and fall. The wetland units typically are completely ice covered from mid-to-late November through mid-to-late March. Major spring snowmelt events during March and April are infrequent, but can create several thousand acre-feet of runoff when the weather first warms. The highest rainfall months are May and June, which produce smaller runoff events, typically a few hundred acre-feet. Total annual natural runoff has varied from 0–19,200 acre-feet since 1970 (table 31).

Table 31. Annual amounts of pumped water, natural runoff, and selenium entering Benton Lake, 1970–2010.

Year	*Pumped water (acre-feet)*	*Runoff (acre-feet)*	*Estimated pumped selenium (pounds)*	*Estimated natural selenium (pounds)*	*Total estimated selenium (pounds)*
1970	3,670	3,000	50	122	172
1971	6,371	0	87	0	87
1972	9,079	990	123	40	164
1973	6,643	0	90	0	90
1974	5,897	334	80	14	94
1975	0	13,933	0	568	568
1976	2,978	400	40	16	57
1977	4,167	0	57	0	57
1978	0	19,200	0	783	783
1979	68	12,100	1	493	494
1980	2,000	1,100	27	45	72

Table 31. Annual amounts of pumped water, natural runoff, and selenium entering Benton Lake, 1970–2010.

Year	*Pumped water (acre-feet)*	*Runoff (acre-feet)*	*Estimated pumped selenium (pounds)*	*Estimated natural selenium (pounds)*	*Total estimated selenium (pounds)*
1981	3,650	500	50	20	70
1982	3,037	4,132	41	168	210
1983	2,822	1,763	38	72	110
1984	4,790	1,947	65	79	144
1985	6,380	1,157	87	47	134
1986	3,376	4,759	46	194	240
1987	7,987	350	109	14	123
1988	7,517	208	102	8	111
1989	212	9,710	3	396	399
1990	4,797	1,056	65	43	108
1991	8,028	943	109	38	148
1992	7,276	21	99	1	100
1993	1,932	3,049	26	124	151
1994	5,800	227	79	9	88
1995	5,555	344	76	14	90
1996	3,969	846	54	34	88
1997	4,430	2,245	60	92	152
1998	5,693	622	77	25	103
1999	5,033	122	68	5	73
2000	5,385	54	73	2	75
2001	5,082	51	69	2	71
2002	3,975	610	54	25	79
2003	3,868	4	53	0	53
2004	3,985	73	54	3	57
2005	2,730	422	37	17	54
2006	3,951	827	54	34	87
2007	3,542	486	48	20	68
2008	4,204	673	57	27	85
2009	4,866	1,730	66	71	137
2010	3,069	3,433	42	140	182
Mean	4,337	2,264	59	92	151
Median	4,167	673	57	27	94
Total	177,814	92,833	2,417	3,785	6,202

Source: unpublished records on file at Benton Lake Refuge; Nimick et al. 1996.

In 1957, money was secured to construct pumping and water delivery structures from Muddy Creek to the refuge with support from members of the Cascade County Wildlife Association. A pump station (figure 15) and pipeline were constructed from 1958–62 to bring irrigation return flows in Muddy Creek from the central and northeast parts of the Greenfields Bench to the refuge. The first water pumped to Benton Lake from Muddy Creek occurred in 1962. Water from the Muddy Creek pump station is moved about 5 miles through an underground pipeline over a low-drainage divide and then is discharged into the natural Lake Creek channel where it flows for about 12 miles to its mouth in Benton Lake. Pumping from Muddy Creek has corresponded to times of irrigation return flow in the Greenfields Irrigation system and is generally from May until mid-October. The Benton Lake Refuge has rights for up to 14,600 acre-feet of water from Muddy Creek each year depending on adequate flows in the creek (Palawski and Martin 1991). Water from Muddy Creek is free, but the refuge must pay electrical costs for the three pumps (two 350-horsepower and one 250-horsepower).

Natural runoff in the intermittent Lake Creek typically occurs from March through June and averages about 0.1 cfs except during periods of snowmelt and heavy precipitation. During July and August, Lake Creek normally is dry except when summer thunderstorms cause brief periods of flow. Without pumped water, Lake Creek would also be dry in September and October most years. In contrast to natural runoff and instream flows in Lake Creek, streamflow during periods of pumping generally ranges from 30–42 cfs when the three Muddy Creek pumps are run simultaneously. The full capacity of the three pumps is used only when streamflow in Muddy Creek is augmented sufficiently by irrigation drainage within the Greenfields Irrigation Division.

Water Management

Managing water at the refuge is complex because of the unpredictability of the timing and volume of inflows from natural runoff and the inability to drain most units. In addition, the flooding and drying must be managed individually for each unit to achieve refuge objectives. The amount of water pumped is decided annually and is governed, in part, by natural runoff received that year, the timing and amount of flows in Muddy Creek due to management by Greenfields Irrigation District and availability of money in the refuge budget for electricity to run the pumps. The greatest theoretical pump capacity is 41.5 cubic feet per second, or 82.3 acre-feet per day. Typically, sufficient water is available in Muddy Creek for pumping between May 1 and October 31. Pumping may be possible earlier in the season after ice has melted; however, lower flows significantly increase the cost per acre-foot and consequently may reduce the total volume of water that can be pumped with a given year's pumping budget.

Historically, the volume of water pumped to Benton Lake was calculated from the hours of pump operation, the rated capacities of the three pumps, and monthly changes in unit water levels. Since 1991, the volume of pumped water also has been measured at the Lake Creek gauging station and reported in annual water-use reports. Added diffuse runoff flowing from ungauged parts of the Benton Lake basin continued to be estimated from changes in unit water levels.

The amount of natural runoff into Benton Lake and water pumped from Muddy Creek has varied substantially since the pump station was developed. For example, natural runoff has varied from 0 (1971, 1973, 1977) to 19,200 (1978) acre-feet and pumped water has ranged from 0 acre-feet during the very wet years of 1975 and 1978 to 8,028 acre-feet in 1991. Because of this wide range of variability, simple long-term averages can be misleading. For example, during a relatively wet period, mean annual natural runoff into Benton Lake was 3,361 acre-feet during 1970–93, while pumped water averaged 4,278 acre-feet. During a dry period from 1994 to 2007, an average of only 495 acre-feet of natural runoff entered Benton Lake from the Lake Creek watershed, while an average of 4,500 acre-feet of water was pumped from Muddy Creek.

Water management is constrained by the current infrastructure capabilities. Smaller amounts of natural runoff flow from the surrounding drainages into Units 3, 4a and 6, but most natural runoff, and all pumped water, enters the refuge via Lake Creek into Unit 1 (figure 15). From there, water flows into Unit 2. From Unit 2, water can be directed to Units 4a, 4b, and the interunit canal. Water that is directed to the interunit canal flows via gravity to the south end where it can be directed into Units 3, 4c, 5, and 6. A water control structure allows water to flow from Unit 4c to Unit 4b. Currently, there is not functional infrastructure to dry out the lower units (Units 3–6) by any means other than evaporation. An interunit pump has been used in the past on the refuge, but equipment failures, unexpected precipitation, and the topography of the wetland units prevented full dewatering.

Water management has typically sought to flood some wetland units predictably, and consistently, each year to provide breeding and migration habitat for waterbirds (Annual Narratives, 1961–99) (figure 19). This water management has varied among years and has significantly altered natural hydrological regimes, both seasonally and long term, in Benton Lake proper. Except in years of exceptional natural runoff, water has been pumped into Benton Lake in late-August through October since 1962 to provide water for fall migrant waterfowl and to store water in units for the next spring. If necessary, water from Muddy Creek is also pumped into Benton Lake from mid-April to mid-June to raise water levels in the units for waterbird reproduction (Nimick 1997, USFWS 1961–99). From 1962 through the late 1980s, some water was pumped to the refuge during the summer in most years to support water levels in the management units; however, in the last 20-plus years, the pumps generally have not been run during summer, and water levels in units have receded from evapotranspiration.

Units 1 and 2 traditionally have been managed for more permanent water regimes and water storage. Water levels in the deepest parts of these units are more than 3 feet deep in some areas. Water from Lake Creek enters these units first and, with current water control infrastructure, year-round storage of water is considered most efficient in these units. In addition, these units have not experienced large botulism die-offs during the summer, and therefore can provide brood-rearing habitat for waterbirds (see wildlife disease section).

Depending on annual water availability and management objectives, some or all of Units 3–6 have been flooded seasonally or for longer periods. From 1962 to the mid-1980s, water was typically moved into these units in spring and held at higher, more completely flooded, levels through the summer to provide nesting and brood rearing habitat for waterfowl and other waterbirds. For example, Unit 3 was managed for year-round inundation from 1964 to 1975 (USFWS 1961–99). In the last 20-plus years, water moved into these units in spring has not been supplemented with summer pumping and water levels have gradually receded until fall pumping begins. This gradual change in water management represented an evolution in learning that deep, season-long flooding was not meeting refuge objectives, especially in the lower units (Units 3–6) and that shallower, seasonal flooding encouraged more desirable emergent wetland vegetation and helped reduce the incidence and severity of botulism outbreaks (USFWS 1961–99) (see wildlife disease section).

Selenium and Water Quality

In 1983, incidents of mortality, physical abnormalities, and reproductive failures in waterfowl were discovered by the Service at the Kesterson National Wildlife Refuge in the western San Joaquin Valley, California, where irrigation return flows had been impounded to form wetlands. Selenium was detected in high concentrations in the irrigation water used to flood impoundments. Subsequently, the severity

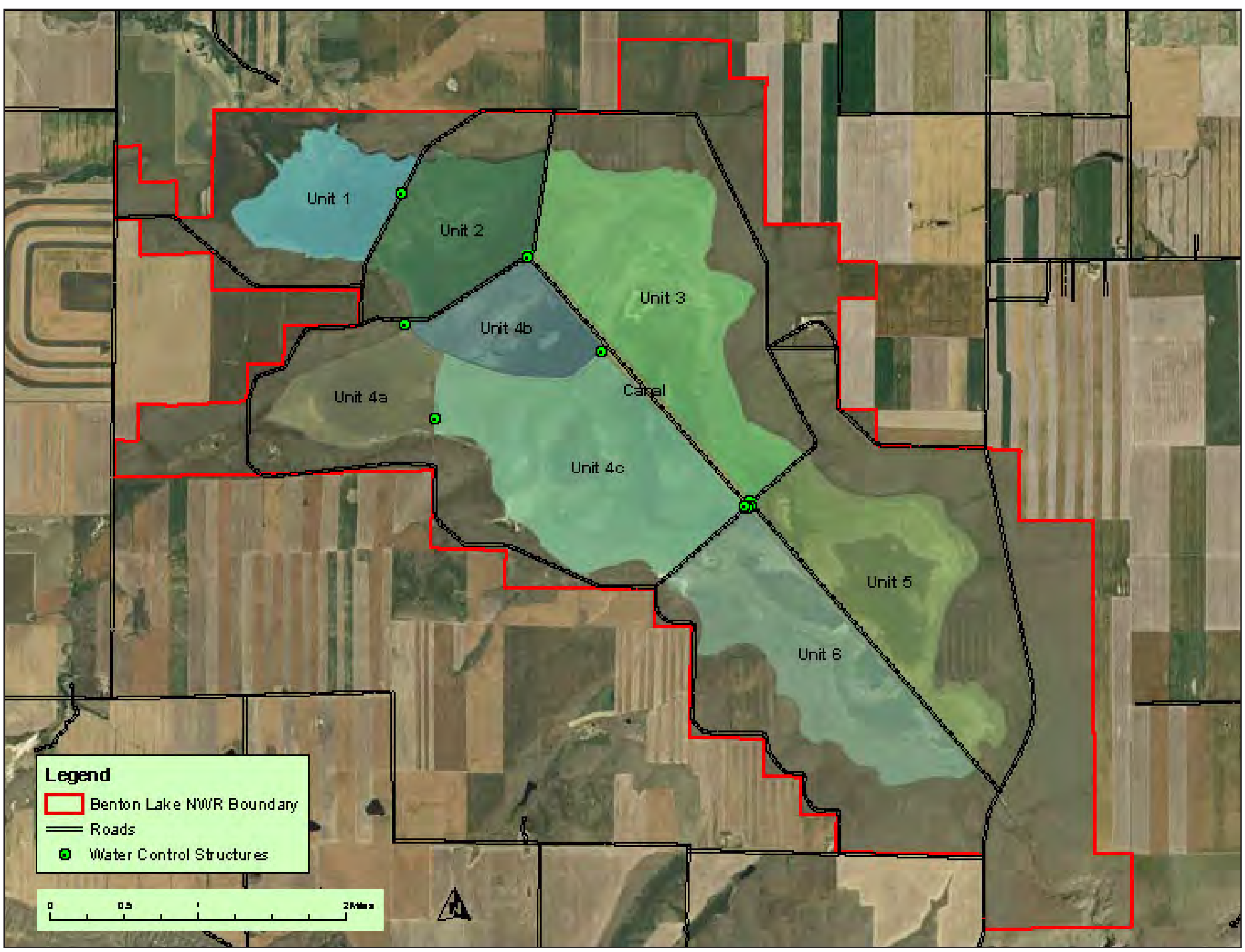


Figure 19. Water management pools on the Benton Lake National Wildlife Refuge, Montana.

of the situation required the Kesterson Refuge to "cap" (fill in) the wetland.

During this period, potentially toxic trace elements and pesticide residues were detected in other areas in Western States that receive irrigation return flows (Nimick et al. 1996). Because of similar geologic and hydrologic characteristics in many irrigated areas of the Western United States, there was concern that potentially toxic conditions related to selenium or other contaminants in return flows might not be limited to the Kesterson area. To address this concern, the DOI began the National Irrigation Water Quality Program in 1985 to evaluate whether irrigation-related problems existed at other irrigation projects the Department constructs or manages including national wildlife refuges or other wetland areas.

The Sun River area of west-central Montana was selected in 1986 for a DOI reconnaissance study. The study found that most sampling sites within the Greenfields and Fort Shaw Divisions of the Sun River Irrigation Project had constituent concentrations that were below established criteria for the protection of humans, fish and wildlife (Knapton et al. 1988). However, several sites within Freezeout Lake Wildlife Management Area and the Benton Lake Refuge had selenium concentrations in water, bottom sediment, and biota that were associated with biological risk and moderately to considerably higher than regional background values or reference concentrations.

Selenium (Se) is a semimetallic trace element that is an essential nutrient for animals. However, there is a very narrow margin between nutritionally optimal and potentially toxic dietary exposure for vertebrates. Based on the known margins of safety between normal and toxic dietary exposures, selenium is more poisonous than either arsenic or mercury (DOI 1998). Relatively small increases in the dietary exposure of animals is potentially harmful. A general rule of thumb for selenium is that thresholds for adverse effects in vertebrate animals begin at concentrations less than ten times above normal, although immunotoxic effects have been documented at concentrations less than 5 times above normal levels. Reproduction in vertebrates is particularly sensitive to selenium toxicity, especially in egg-laying vertebrates such as birds (DOI 1998). Birds are also vulnerable because selenium bioaccumulates through the food chain (Lemly 1995, 2002).

The underlying geology, land use changes in the landscape surrounding the refuge, and alterations to natural hydrology (water source, timing, and duration of flooding) have all contributed to the increased selenium levels on the refuge (Lemly and Smith 1987, Lambing et al. 1994, Nimick et al. 1996). Bedrock in most of the Benton Lake basin is seleniferous marine shale of the Cretaceous Colorado Group, often referred to as Colorado Shale (Maughan 1961). Selenium in these formations is highly mobile and biologically available in arid regions with alkaline soils, as is the case in much of north-central Montana.

The crop–fallow method of wheat farming that surrounds the refuge is the primary contributor to saline seep development in the watershed. Seeps are formed during fallow periods when precipitation exceeds the storage capacity of the soil. The excess water percolates through salt-laden soil layers dissolving salts and eventually forming a saline water table above a deeper, impermeable layer, such as shale. The saline water then moves horizontally downslope until it discharges at the surface, where it evaporates and concentrates salts, including selenite (Se4+) and selenate (Se+6), in the immediate area (Brown et al. 1982). Runoff that flows through these areas in the Lake Creek watershed washes selenium and other concentrated salts into Benton Lake at the bottom of the watershed, where it accumulates (figure 20).

Construction of the multiple units and introduction of Muddy Creek water via pumping has also increased total selenium accumulation on the refuge (Zhang and Moore 1997, Heitmeyer et al. 2009). Before 1961, Benton Lake was one large wetland and no water was pumped into the basin. In most years, pooled water from spring runoff was lost to evaporation during the following summer. Selenium concentration pre-1961 sediment collected in cores from the Unit 3 inlet area was approximately 0.2–0.3 micrograms per gram (µg/g). This low concentration of selenium in older sediment suggests that equilibrium concentrations were very low before construction of the unit system.

After the unit system was constructed in 1961, and Muddy Creek water was pumped into the refuge, inputs of selenium increased and outputs decreased. The total pounds of selenium that enter the refuge annually in pumped water and natural runoff is highly variable among years (table 31). From 1970–2010, the total selenium load from natural run-off was approximately 3,785 lbs. Pumping from Muddy Creek imported an added 2,417 lbs. to the refuge.

Although selenium is transported to the refuge in the surface and ground water that flows to the refuge, almost all of the selenium that enters the refuge accumulates in wetland sediment. Selenium is not evenly distributed among or within the units, but rather accumulates more rapidly near the locations of primary selenium inputs and more permanently flooded units (Zhang and Moore 1997). In general, selenium concentrations in sediments are highest where Lake Creek enters Unit 1 and 2 and in Unit 4c near a large seep. The remaining units in the refuge receive less selenium inputs, because they are further from the mouth of Lake Creek (Knapton et al. 1988, Nimick et al. 1996, Zhang and Moore 1997).

The natural dry cycle, which is important for removing selenium from the system, also has been significantly reduced since pumping began. Selenium is removed from the refuge primarily by transferring directly to the air from water or sediment (volatilization). The rate of selenium volatilization depends on the form of selenium, microbial activity, and various environmental conditions, but is much higher from exposed sediment than open water (Zhang and Moore 1997). Selenium now enters the refuge in Unit 1, which is rarely dried, and consequently average selenium concentrations in sediment are 2.7 µg/g, with some values above the toxic threshold of 4 µg/g.

Selenium Toxicity at Benton Lake

The toxic threat to wildlife from selenium is based on the degree of contamination present and the extent of exposure. The method used in this CCP to assess selenium contamination and the toxic threat to aquatic systems is a simple, scientifically credible process developed by A. Dennis Lemly (1995,2002). The Lemly protocol incorporates key parameters such as concentration, exposure and abiotic and biotic cycling. By using this protocol, refuge staff can develop an overall hazard value that can be compared across sites and over time. This hazard assessment focuses on bioaccumulation and its ultimate impact on reproductive impairment in aquatic birds.

The protocol defines five hazard levels:

- High: a toxic threat sufficient to cause complete or nearly complete reproductive failure in sensitive species of aquatic birds (for example, ducks and stilts).

- Moderate: a toxic threat of sufficient magnitude to substantially impair, but not remove reproductive success; some species will be severely affected while others will be relatively unaffected.

- Low: a toxic threat that could marginally affect the reproductive success of some sensitive species, but leave most species unaffected.

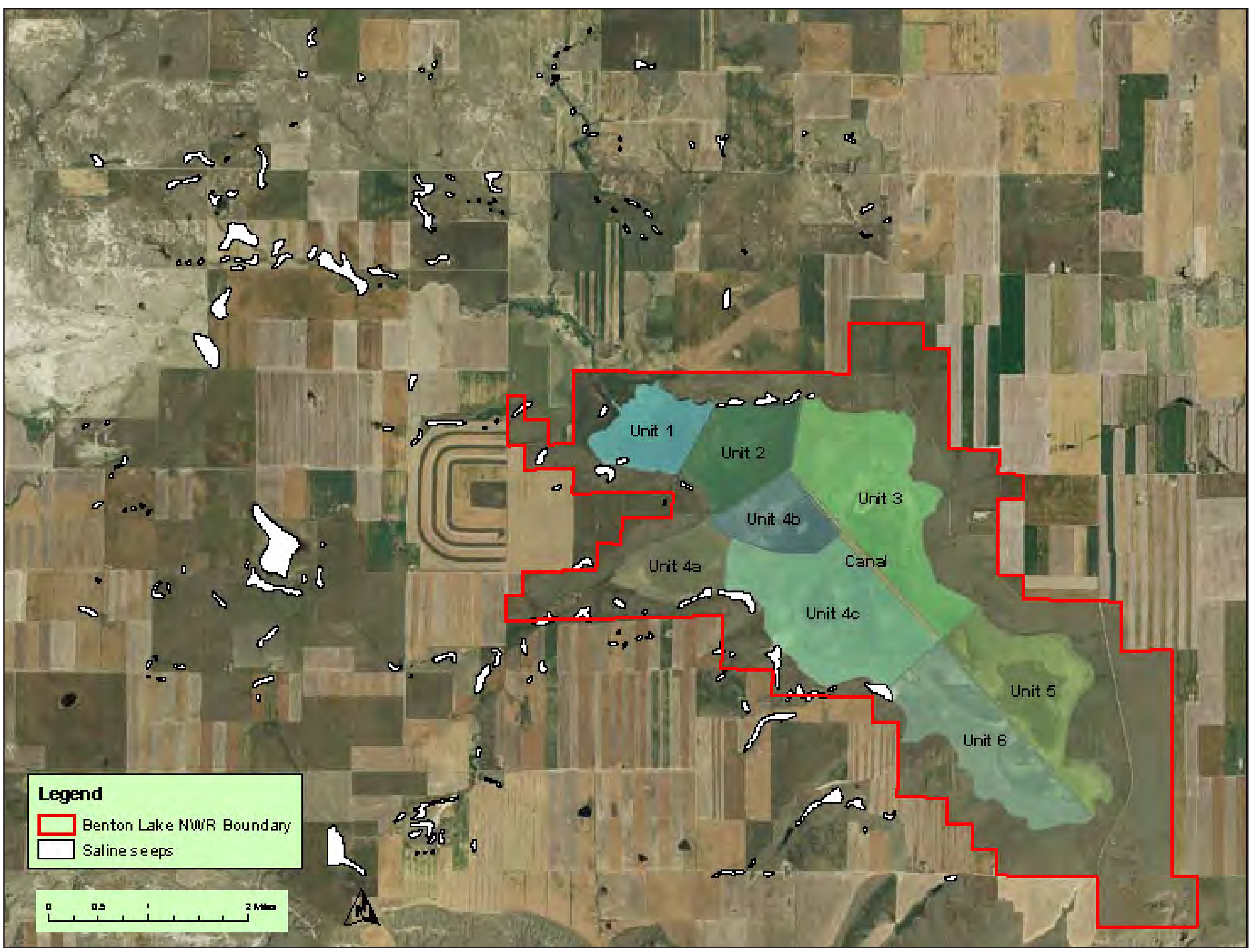


Figure 20. Map of saline seeps in the Benton Lake region, Montana.

- Minimal: no imminent toxic threat is identified, but concentrations of selenium are slightly elevated in one or more ecosystem components (water, sediment, benthic invertebrates, birds).

- None: no toxic threat is identified and selenium concentration are not elevated in any ecosystem component.

To conduct a hazard assessment, samples must be collected from multiple ecosystem components. This includes water, sediment, invertebrates and aquatic bird eggs. Selenium hazard has been defined independently for each component. These values are based on extensive studies, in a wide range of habitats and environmental conditions (table 32).

Table 32. Lemly Hazard Assessment score by component.

Hazard	*Score*	*Water (ug/l)*	*Sediments (ug/g)*	*Macroinvertebrates (ug/g)*	*Aquatic bird eggs (ug/g)*
None	1	<1	<1	<2	<3
Minimal	2	1-2	1-2	2-3	3-5
Low	3	2-3	2-3	3-4	5-12
Moderate	4	3-5	3-4	4-5	12-20
High	5	>5	>4	>5	>20

The "scores" for the sample with the highest selenium concentration in each component is then combined to get an overall hazard rating:

- No hazard = 4
- Minimal hazard = 5-7
- Low Hazard = 8-10
- Moderate Hazard = 11-14
- High hazard = 15-20

The method is not simply additive, but considers multiple routes of exposure and synergistic effects. Across all of the alternatives for Benton Lake Refuge, the service has designated "minimal" hazard as the objective for future management.

The highest concentrations of selenium that can occur in various ecosystem components for which no toxic threat is associated has been described by Lemly (1995, 2002). For water this is less than 2 µg/l, sediment less than 2 µg/g, macroinvertebrates less than 3 µg/g, and aquatic bird eggs less than 5 µg/g. Many samples from several years have found selenium concentrations higher than these thresholds for each of these ecosystem components at the refuge (Nimick et al. 1996, 2006–8, Henny et al. 2000) (figure 21). These values can be combined to create an overall hazard assessment for a given area, such as individual units on the refuge (Lemly 1995, 2002).

In 2006, water, sediment, invertebrates, and wetland-dependent bird eggs were sampled from Unit 1, 3, 5 and the seep in Unit 4c to get an updated hazard assessment for the refuge (table 33). These units were chosen to capture the high and low ends of selenium contamination in the wetland. Samples were taken within units at a subset of the same sampling sites used in earlier studies (Zhang and Moore 1997). In cases where multiple samples were taken in a unit, such as sediment and eggs, the highest selenium value was used to be the most conservative (not likely to underestimate) in assessing the threat. In Unit 1, where natural runoff and pumped water enter the refuge via Lake Creek, there was a high hazard level. Selenium concentrations were low in the water and eared grebe egg, but high in the sediment and invertebrate samples. The results of the Lemly assessment at the seep next to Unit 4c showed that this area also has a high overall hazard. Selenium concentrations were high in water and sediments, but the gadwall egg sampled from this area had a very low selenium level. The other two units, 3 and 5, had low overall hazard levels, respectively, reflecting the distance of these units from the selenium inputs and the benefit of seasonal drying (Zhang and Moore 1997).

The highly hazardous conditions found at the seep next to Unit 4c were not surprising given that seeps are primary sources of selenium contamination in the Lake Creek watershed and on the refuge (Nimick et al. 1996, Nimick 1997). A hazard rating of high means an "imminent, persistent toxic threat sufficient to cause complete reproductive failure in most species of fish and aquatic birds" (Lemly 1995, 2002). The selenium concentration in the water in 2006 (33.8 µg/g) was within the wide range of concentrations (10–500 µg/L) found during earlier studies (Knapton et al. 1988, Nimick 1997). Selenium concentrations in the sediment and invertebrates were similar to earlier samples (Knapton et al. 1988, Lambing et al. 1994, Zhang and Moore 1997). Interestingly, the gadwall egg sampled from this area had such low selenium concentration that Lemly considers it no threat. This suggests that even though

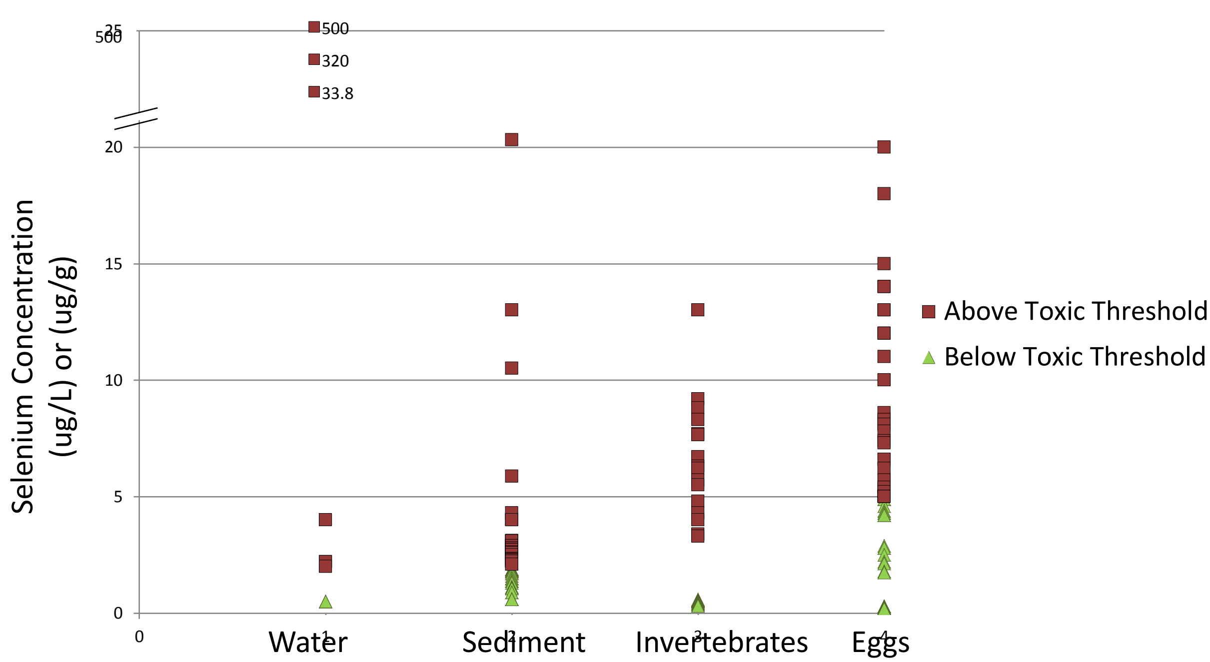
Table 33. Lemly Hazard Assessment Results for four sites at the Benton Lake National Wildlife Refuge. Contamination hazard levels are assigned to each of four trophic levels sampled at each site between May 15 and July 15, 2006. The overall hazard level is figured out by combining the individual hazard assessments according to Lemly (1995,2002).

Trophic level	*Unit 1*	*Unit 4c seep**	*Unit 3*	*Unit 5*
Water (micrograms/liter (µg/L))	2.2	33.8	0.56	2.2
Hazard	Low	High	None	Low
Sediment (micrograms/ grams dry weight (µg/gDW))	4	20.3	0.32	1.09
Hazard	High	High	None	Minimal
Invertebrates (µg/gDW)	7.65	4.01	2.14	1.75
Hazard	High	Moderate	Minimal	None
Bird species, egg (µg/gDW)	Eared grebe 8.71	Gadwall 1.86	Teal 3.19	American Avocet 5.32
Hazard	Low	None	Minimal	Low
Overall hazard	High	High	Minimal	Low

*sampled at seep only

there are acutely hazardous conditions in the immediate area of the seep, birds probably spend a very small percentage of their time in the seep area and the hazards are mitigated by their feeding primarily in other units, such as in Units 3 and 5, which are nearby and have lower levels of selenium. In 2006, most of Unit 4c that is next to the seep had been dry for several years, which would limit mixing between the seep and the wetland unit and reduce the influence of the seep on avian reproduction.

The high hazard level in Unit 1 is of greater concern. Unit 1 is a large wetland that can exceed 750



(n=183 samples total). (Knapton et al 1988, Nimick et al 1996, Zhang and Moore 1997, Refuge Files 2006-2008).

Figure 21. Graph showing the range of selenium concentrations from water, sediment, invertebrates, and egg samples across Benton Lake National Wildlife Refuge, 1986–2008.

acres at full-pool levels. The high threat level was primarily due to selenium concentrations in the sediment and invertebrates, while all other trophic levels had low concentrations. In particular, selenium concentrations in eared grebe eggs were low, which is the trophic level of greatest concern for managers. Because of this, it is tempting to downplay the overall high hazard level except that the Lemly protocol is based on the understanding that the toxic effects of selenium are interactive and best characterized by considering all of the trophic levels simultaneously.

Selenium Modeling

A model of selenium cycling (Zhang and Moore 1997) was developed for the refuge to understand the dynamics of selenium accumulation on the refuge and predict outcomes for various management scenarios. The main selenium reservoirs on the refuge are the sediment and water. Sediment is considered highly hazardous when average concentrations for a unit exceed 4 µg/g (Skorupa and Ohlendorf 1991, Lemly 1995, 2002). With the assumption that the input and output of selenium to the refuge was similar to the long-term average, and starting with selenium levels measured in 1994, the original model runs predicted that Units 1 and 2 would exceed this hazard threshold in 9 years (2004) and 17 years (2012), respectively. Due to the annual drying of the lower units, Units 3, 5 and 6 would never cross the toxic threshold. Unit 4, because of adjacent saline seeps, was predicted to cross the threshold in 67 years despite annual drying.

In 2006, mean selenium levels measured in sediment samples from Unit 1 (2.3±0.3 µg/g) had not yet reached the toxic threshold of 4 µg/g. To be sure this discrepancy was not due to sampling error, in 2008 the sediment in Unit 1 was resampled to target the upper 0.8 inch, which is the most sensitive to selenium accumulation, increase the 2006 sample size, and to capture all of the same locations sampled in 1994. The actual 2008 mean value was 2.7±0.2 µg/g, which was still below the 5.4µg/g predicted for 2008 in the original model.

The model was reevaluated to find the cause of the discrepancy. The original model runs assumed selenium inputs in the future would be similar to the long-term average up to that point (1970-1993); however, 1994–2007 was a dry period and natural runoff was only 14 percent of this long-term average (495 acre-feet versus 3,615 acre-feet). When the model was run again with all of the same starting data from 1994, but with only 14 percent of the selenium inputs, the predicted values for 2008 were closer to those actually measured in the field (model =3.5 µg/g, 2008 field samples = 2.7 ± 0.2 µg/g).

These results suggest that the model is strongly influenced by inputs but somewhat overestimates the rate of accumulation of selenium. When natural runoff and selenium inputs increase during the next wet cycle, which appears to have begun in 2009, selenium accumulation is expected to increase again. Units 1 and 2 may have a few more years than the 9 and 17 years originally predicted by the model before they become highly toxic. However, it may actually be fewer years, because the mean selenium concentration in the upper 0.8 inch of sediment of Unit 1 was 60-percent higher in 2008 than the original model values in 1994 (Zhang and Moore 1997). Regardless, if there is no change in management, the toxic threshold is still likely to be crossed in these units soon enough to be of serious concern.

Selenium Remediation Efforts

An action plan, “Calming Troubled Waters,” was written in 1991 by refuge staff to address the selenium issue at the refuge. The goal of the plan was to “maintain or reduce levels of trace elements such as selenium at levels which pose no threat to species using Benton Lake” (USFWS 1991). This plan focused primarily on the watershed and the negative effect on water quality caused by the agricultural practices in the surrounding landscape. The primary strategy at that time was to clean up the refuge by cleaning up the watershed. The plan was estimated to take 5–10 years and cost $4.5 million dollars ($7.1 million in today’s dollars). The Service was successful in using a CRP incentive program to enlist five landowners in CRP contracts. In addition, the refuge collaborated with the Lake Creek Improvement Association and the Lake Creek Partnership to obtain Federal grants to improve water quality in the watershed. Seeps and recharge areas were mapped in the watershed and 27 producers signed 5-year contracts to try alternative cropping practices. The report shows that production from these crops went “as well as to be expected.” The refuge also worked with one neighbor to keep a field in a key seep recharge area in alfalfa for 5 years. Monitoring indicated that this continuous cover was effective in reducing ground water levels, which helps to dry up seeps. While these efforts resulted in short-term successes, the program ended when money for a full-time contaminants specialist and annual payments to landowners to keep their fields in cover crops was no longer available. Supporting continuous cover in the watershed in key areas, to reclaim seeps and improve water quality, requires sufficient incentives for landowners to choose this practice over current crop–fallow systems for small grains. “Calming Troubled Waters” did not consider any reduction in pumping water as a way to manage selenium levels on the refuge.

Other selenium removal approaches have been considered elsewhere. The three types of remediation commonly pursued are containment, removal, and treatment (Higashi et al. 2005). Containment has been difficult to achieve in many cases and where open-water systems are used, they are still a source of contamination to waterbirds drawn to the containment areas. Removal of selenium has been difficult, because of typically low starting concentrations and chemical similarity to sulfur, which can be present in as much as million-fold higher concentrations. One treatment choice, algal-bacterial reduction of selenate was developed to the point of large-scale trials. It removed approximately 80 percent of the selenium in water, but was found to increase concentrations of selenium in invertebrates 2–4 times. Biovolatilization is another remediation approach that takes advantage of natural biogeochemical processes, but is problematic because it draws selenium into the biota and consequently up the food chain. For example, vascular plants volatilize a relatively small amount of selenium while sequestering selenium in bio-available food web materials such as the shoots and roots. Although the shoot could be harvested and disposed of, the selenium is mostly contained in the belowground parts of the plants, which are not practical for harvesting or likely to be consumed in a prescribed fire (Higashi et al. 2005). Removal of selenium using organic materials such as rice straw has been successful in laboratory trials (Zhang and Frankenberger 2003). However, this technique has not been tested in the field to decide if it is a practical solution.

Key selenium concepts:

The underlying geology, land use changes in the surrounding watershed, increased selenium inputs from pumped water and decreased wetland drying have contributed to selenium accumulation on the refuge.

Selenium accumulates in the food chain and concentrations in the water, sediment, invertebrates and wildlife must all be considered when assessing the threat to reproduction

Selenium is not evenly distributed across the refuge. It is highest near input locations (currently Unit 1) where it accumulates in sediment. Selenium levels in Unit1 are currently high enough to impair reproduction in sensitive species.

The primary ways to reduce selenium accumulation are by exposing wetland sediment to air (such as drying) and reducing inputs by improving water quality or reductions in pumping.

Refuge specific models of selenium cycling show that highly hazardous levels of selenium could be reached in Units 1 and 2 in the next two decades.

Other Water Quality Concerns

While monitoring selenium accumulation levels has been a priority at the refuge, other water chemistry variables also have been studied (Knapton et al. 1988, Nimick 1997). A USGS study analyzed the water chemistry at the refuge, with an emphasis on dissolved solids (Nimick 1997). From 1974–95, specific-conductance values for the refuge varied substantially from year to year and over multiyear periods. However, no significant trend of increasing specific conductance was clear in the long-term record. The study concluded that accumulation of dissolved solids in the refuge appeared to be negligible. Benton Lake Refuge management that dried Units 3–6 at least 1 month per year appeared to be effective in managing salts (Nimick 1997).

Initial water quality testing during the DOI Reconnaissance Study did not find elevated levels of nutrients such as nitrogen and phosphorous (Knapton et al. 1988). However, due to the intense agriculture in both the Muddy Creek and Lake Creek watersheds, levels of these nutrients, as well as sedimentation, may be problems that have been overlooked in recent years. More studies, including an updated baseline, would be needed to assess these issues.

Water Rights

Benton Lake Refuge has two primary water rights. One is for 14,600 acre-feet of surface water from Muddy Creek (41K 188174 00) with a priority date of April 28, 1958. The other is for the natural flow in the Lake Creek drainage, including the unnamed tributaries to Benton Lake, where the drainage enters the refuge in the amount of natural flow remaining after the satisfaction of the following rights:

- all rights recognized under State law with a priority date before the effective date of the Compact

- any rights for stock watering ponds with a priority date after the effective date of the Compact and a maximum capacity of the impoundment or pit of less than 15 acre-feet and an appropriation of less than 30 acre-feet per year from a source other than a perennial flowing stream

- any right to appropriate ground water with a priority date after the effective date of the Compact by means of a well or developed spring with a maximum appropriation of 35 gallons per minute (gpm) or less that does not exceed a total appropriation of 10 acre-feet per year.

The refuge also has a ground water right to 2 acre-feet per year diverted at a maximum rate of 45 gpm from ground water beneath the Benton Lake Refuge.

The "Montana House bill 717–Bill to Ratify Water Rights Compact" (compact) is a water rights compact between the State of Montana and the Service signed July 17, 1997. The parties to this agreement recognize that the water rights described in the compact are junior to any tribal water rights with a priority date before the effective date of the compact, including aboriginal rights, if any, in the basins affected.

Biological Resources

The following narrative describes habitats and wildlife on the Benton Lake Refuge.

Grasslands

Benton Lake Refuge has approximately 5,724 acres of native and planted tame grasslands (figure 22). The native mixed-grass prairie is characterized by predominantly cool-season species on Benton Lake's clay soils. This ecological site developed under the northern Great Plains climatic conditions, geological parent materials, fire, biotic factors, and under the natural influence of herbivory. The cool-season species evolved to take advantage of the precipitation regime that peaks in late spring–early summer. Research consistently shows that precipitation is the principle factor altering productivity on ecological sites in the northern Great Plains (Heitschmidt et al. 2005).

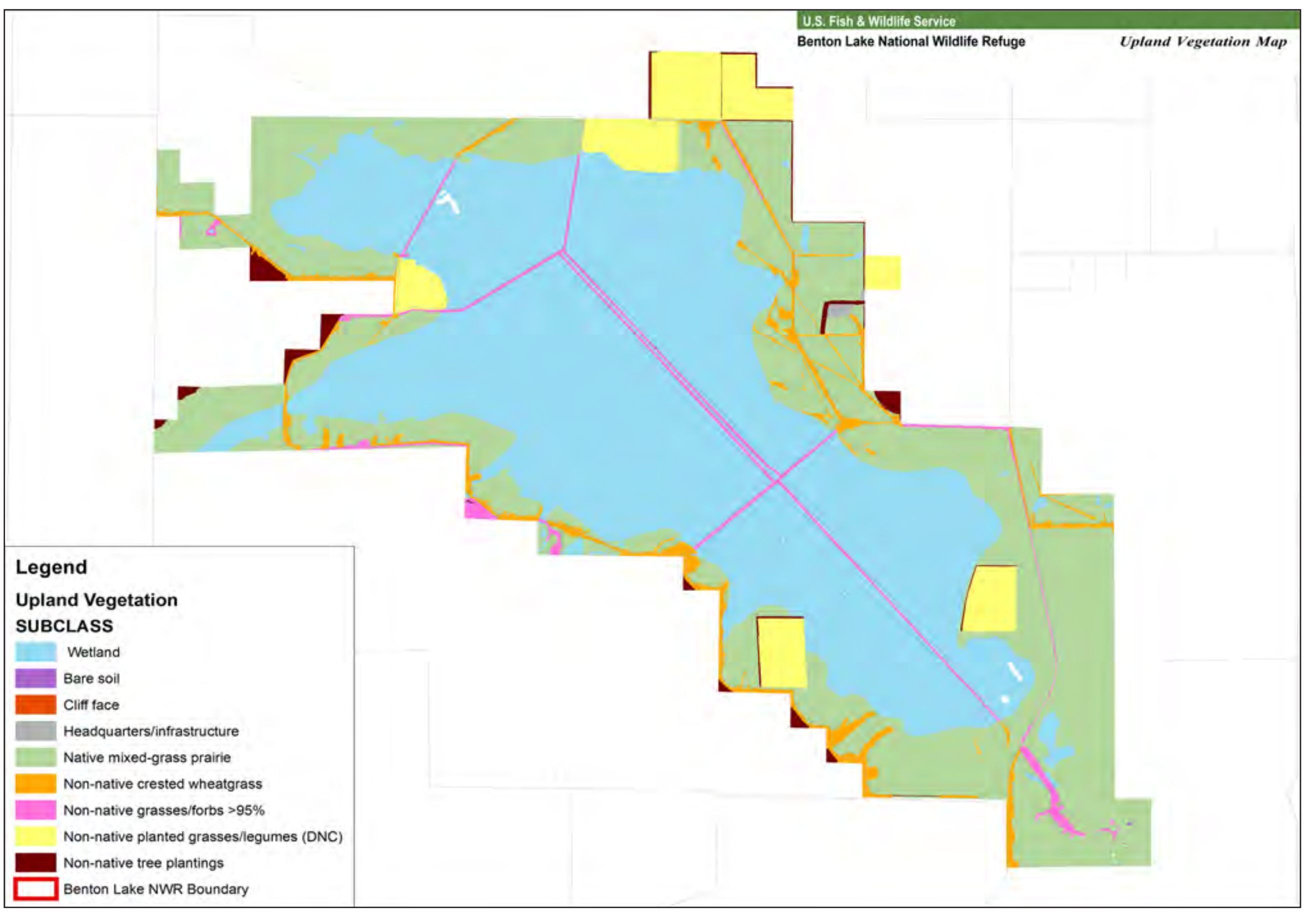


Figure 22. Map of upland vegetation at the Benton Lake National Wildlife Refuge, Montana.

The dominant plant community is represented by green needlegrass, western wheatgrass, thick-spike wheatgrass and bluebunch wheatgrass. Prairie Junegrass is the most common shortgrass. Other shortgrasses and sedges include plains reedgrass, threadleaf sedge, and needleleaf sedge. Bluebunch wheat grass is a dominant species on the clayey 10–14 inch precipitation zone site in the northern Glaciated Plains. Blue grama is the only common warm-season grass. Grasses represent about 80 percent of the total annual production in this community (NRCS 2005).

Dotted gayfeather, American vetch, white prairie clover, and purple prairie clover are forbs that commonly occur on the clayey sites. American vetch and the prairie clover are nitrogen-fixing species and valuable forage producing plants. Ground-plum milkvetch, scurfpea, and prairie thermopsis are lower successional forbs that have the ability to fix nitrogen. White milkwort, biscuitroot, wild onion, and western yarrow may be present as minor components of the plant community. Forbs represent about 15 percent of the total annual production (NRCS 2005). Silver sagebrush, Nuttall's saltbush, fringed sagewort, broom snakeweed, and prickly pear cactus also may represent minor shrub components. Overall, shrubs account for about 5 percent of the annual plant production (NRCS 2005).

There are approximately 728 acres of tame grasslands on the refuge. Some of the tame grasslands were inherited as former farm ground when the refuge was established; however, there were some areas of native prairie on the refuge that were broken and seeded to tame grass in the 1960s and early 1970s. The predominant herbaceous cool-season species used were varying combinations of intermediate wheatgrass, tall wheatgrass, slender wheatgrass, pubescent wheatgrass, western wheatgrass, and crested wheatgrass; the legumes were alfalfa and sweetclover. The basic seeding rates were comprised of 75-percent wheatgrass and 25-percent legumes. These species, commonly referred to as DNC, were chosen based on research that showed that they are highly attractive and beneficial to waterfowl (Duebbert 1969). DNC fields on the refuge range from excellent to poor conditions. Most stands are in some type of rotational management scheme to rejuvenate and extend the longevity of the planting.

In the recent past, planting shelterbelts was advocated in the Great Plains as a method of increasing species diversity (Schroeder 1986 and others), particularly bird diversity. A total of 19 miles of shelterbelts have been planted on the Benton Lake Refuge. Many of the shelterbelt trees and shrubs have died, which may be the result of recent drought conditions. A few shelterbelts are in moderate condition and most shelterbelts are in poor condition relative to their potential to increase bird diversity on the refuge. The most common tree and shrub species remaining in the shelterbelts are Russian olive and caragana. Attempts have not been made to irrigate or replant the shelterbelts.

Upland Invasive Species

The refuge is generally free from highly invasive, noxious weeds. Through EDRR, early colonizing plants of spotted knapweed and leafy spurge, in particular, have been eradicated every year and prevented from spreading. Canada thistle has been present for many years on the refuge. Thistle patches are found near many roads, dikes, wetland edges, and other disturbed areas. Some dense stands have been treated with success, but most areas go untreated.

In addition to the nonnative species described in the wetland section, several nonnative species are of concern for their impact in changing the native grassland habitat, even if they are not on the State's noxious weed list.

Crested Wheatgrass

Crested wheatgrass has been the most commonly planted exotic grass in western North America since the early 1900s. Invasion of this species into native rangeland can have a negative effect on plant and wildlife diversity (Reynolds and Trost 1981, Christian and Wilson 1999, Davis and Duncan 1999). Crested wheatgrass was used to landscape areas around the refuge headquarters area in the 1960s and to revegetate roadsides and other areas of disturbance. Since then, it has spread throughout the refuge to varying degrees and covers approximately 400 acres. The refuge has begun a pilot program to evaluate the most effective methods for controlling crested wheatgrass and restoring the native vegetation.

Russian Olive

This species is adaptable in semiarid and saline environments and has been promoted as a source of food and cover for some wildlife species (NRCS 2002), particularly ring-necked pheasant. With this in mind, refuge staff planted Russian olive trees on the refuge until the 1970s. Since that time, research has shown that Russian olive and other nonnative trees fragment native prairie by causing avoidance of these areas by some nesting grassland birds and increased predation of nests, adults, and juvenile grassland-dependent birds (Delisle and Savidge 1996, Gazda et al. 2002, Helzer 1996, Johnson and Temple 1990). Fortunately, at the refuge, Russian olive trees have not spread and are generally confined to shelterbelts where they were planted or single individuals scattered on the refuge.

Japanese Brome

This grass has been present in the refuge for many years with almost no attention given to treatment. Currently efforts are underway to map and estimate the extent and density of the infestation on the refuge. The degree to which this species affects wildlife use of native prairie is unknown.

Kentucky Bluegrass

This grass has been present in the refuge for many years with almost no attention given to treatment. Currently, efforts are underway to map and estimate the extent and density of the infestation. Recent efforts in the Dakotas has shown that many areas of native sod on fee title lands in the northern Great Plains have become heavily invaded with Kentucky bluegrass, which is associated with loss of floristic and avian diversity as well as negatively affected nutrient pools, energy flows, soil invertebrate and mycorrhizal relationships, and water cycles (Murphy and Grant 2005, Grant et al. 2009).

Cheatgrass

This grass has been present on the refuge for many years with almost no attention given to treating it. It is mostly restricted to the southeast part of the refuge east of the Bootlegger Trail. It is of concern because of its interaction with fire. Prescribed fire is the primary management tool at the refuge; however, cheatgrass can readily spread after burning (Zouhar 2003). Efforts to map the infestations and to develop a preburn treatment plan are in progress.

Other nonnative species that occur in low numbers or limited extent but could become an invasive problem include smooth brome, reed canarygrass, salsify, alfalfa, and yellow sweetclover.

Wetlands and Riparian Areas

This section describes the historical conditions of the refuge's wetland vegetation and current vegetation including invasive plants.

Historical Wetland Vegetation

The historical gradation of vegetation zones within the refuge from robust emergent in deeper depressions to grasslands on uplands has been altered over time. Most historical vegetation communities are still present on the refuge, but their distribution and extent have changed. Developments for water management and subsequent altered hydrology and water chemistry in units are responsible for most vegetative changes. Generally, communities have shifted to more extensive distribution of wetter and more alkaline-tolerant species. Increasing amounts of exotic and invasive species also now occur on the refuge (Heitmeyer et al. 2009).

Historical vegetation communities on the Benton Lake Refuge ranged from dense emergent wetland vegetation in the lowest elevation depressions to upland grassland on higher elevation terraces and benches next to the lakebed. This gradation of plant communities is typical of wetland basins in the northern Great Plains of Montana (Hansen et al. 1995). Plant species distribution reflected tolerance to timing, depth, and duration of annual flooding, salinity, and underlying soils and geomorphic surfaces. (table 34). The precise distribution of historical wet

Table 34. Hydrogeomorphic matrix* of historical distribution of habitat types on Benton Lake National Wildlife Refuge, Montana.

Habitat type	*Geomorphic surface* [a]	*Soil type*	*Flood frequency* [b]	*Elevation* [c]	*Estimated acres*
Robust emergent	Ql	clay	A–PM	<3614.5	73
Sedge–rush	Ql	clay	A–SP	3614.6–3615.7	1,728
Sedge–rush alkaline	Qac	clay	A–SP	3614.6–3615.7	53
Seasonal herbaceous	Ql	silt-clays	A–SE	3615.8–3616.3	1,040
Cordgrass–saltgrass	Qac	silt-clays	A–SE	3615.8–3616.3	143
Wet grassland	Ql	silty clay	1–SE	3616.4–3622	3,167
Wet grassland alkaline	Qac	silty clay	1–SE	3616.4–3622	1,216
Upland grassland	Qt and Kbb	silty clay	R	3622	4,802

**Relationships were figured out from land cover maps prepared by the General Land Office (1920),geomorphology maps (Maughan 1961), soils maps prepared by NRCS, hydrological data (unpublished NOAA and Benton Lake Refuge records on file at Benton Lake Refuge), various accounts by naturalists and settlers, and publications from the late 1800s and early 1900s.*

[a] *Ql =Quaternary lake, Qac =Quaternary alluvium and colluviums, Qt =Quaternary terrace, Kbb = Cretaceous Bootlegger.*

[b] *A–PM =annually flooded permanent, A–SP= annually flooded semipermanent, A–SE =annually flooded seasonal, 1–SE = irregularly flooded among years seasonal, R = rarely if ever flooded.*

[c] *Feet above mean sea level.*

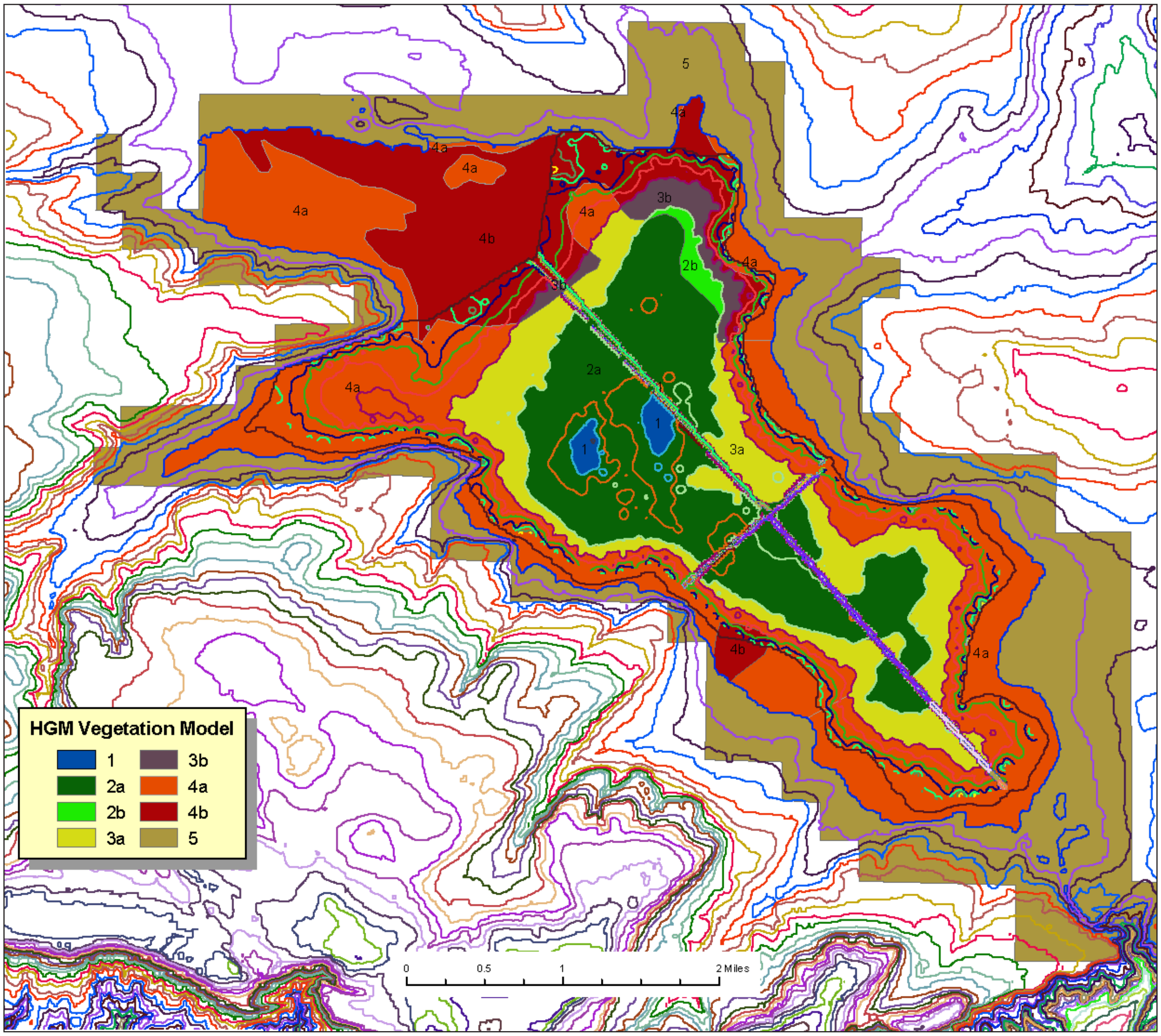


Figure 23. Map of potential historical vegetation communities on the Benton Lake National Wildlife Refuge, Montana. Vegetation community: 1=robust emergent, 2a=sedge–rush, 2b=alkaline sedge–rush, 3a=seasonal herbaceous, 3b=prairie cordgrass–saltgrass, 4a=wet grassland, 4b=alkaline wet grassland, 5=upland grassland.

land vegetation species groups in the refuge proper undoubtedly varied over time as surface water coverage and depth changed in the long-term wet to dry cycles (for example, van der Valk and Davis 1978, van der Valk 1989). The relative juxtaposition of historical plant communities occurred along a wetness continuum where specific groups expanded or contracted and moved either up or down elevation gradients as water levels rose and fell in Benton Lake basin over time. Furthermore, some communities with specific distribution associations, such as saltgrass that was associated with higher alkaline or saline conditions, also probably changed locations somewhat over time depending on the intensity and location of saline seeps as saline conditions in the lake became more or less concentrated or diluted during more extreme flooding versus drawdown phases of the long-term hydrologic cycle.

Recognizing the annual variation in flooding regimes and latent chronological and distribution response dynamics of wetland plant species to changing moisture conditions, an HGM matrix of potential vegetation communities related to geomorphologic, soil, elevation, and hydrology conditions historically present at Benton Lake was developed. The distribution of these HGM-predicted vegetation communities assumes average long-term flooding and drying periods of 10–20 years with peak highs and lows lasting about 5–6 years. This duration of peaks and lows is based primarily on historical aerial photographs of the refuge, especially the sequential basin photographs from 1950, 1951, 1954, 1956, and

1957. This HGM matrix was extrapolated to historical (such as before construction of levees and water control structures) basin conditions using the geographical information data sets on geomorphology, soils, and elevation (figure 23).

Using this HGM matrix (table 34) and potential historical vegetation map (figure 23), about 73 acres of the lowest elevations in the Benton Lake basin (less than 3,614.5 feet amsl) contained some surface water throughout most years and supported open-water aquatic plant communities surrounded by concentric bands of robust emergent vegetation including cattail and hardstem bulrush. Soils in these depressions were heavy clays and within the geomorphic surface formed by historical lake-system environments. Water in these depressions was fresh, with little salt concentration. Historical aerial photographs, surveys, and naturalist accounts from the Benton Lake region show that dense emergent vegetation was present in the deeper depressions at Benton Lake, at least during wet years of the long-term flooding cycle, but it is unclear which emergent species were present. It is likely that most emergent vegetation was hardstem bulrush, but some cattail probably was present also, based on similar wetland conditions in western Montana (Hansen et al. 1995) and the extensive presence of cattail within Benton Lake at present. The width of this emergent vegetation band varied depending on extent and duration of flooding and chronological position of the long-term hydrological cycle. Submergent aquatic plants such as pondweeds, naiads, coontail, widgeongrass, and milfoil were present in the deepest open areas and rich algal blooms occurred in these areas.

Semipermanently flooded sites that were slightly higher elevation (3,614.6–3,615.7 feet amsl) next to cattail and bulrush zones contained slightly less permanent water regimes and supported diverse sedge and rush species (figure 24). These sedge–rush communities covered about 1,728 acres and supported diverse herbaceous wetland plants including alkali bulrush, three-square rush, Nuttall's alkaligrass, beaked sedge, Nebraska sedge, and water smartweed. The sedge–rush community apparently

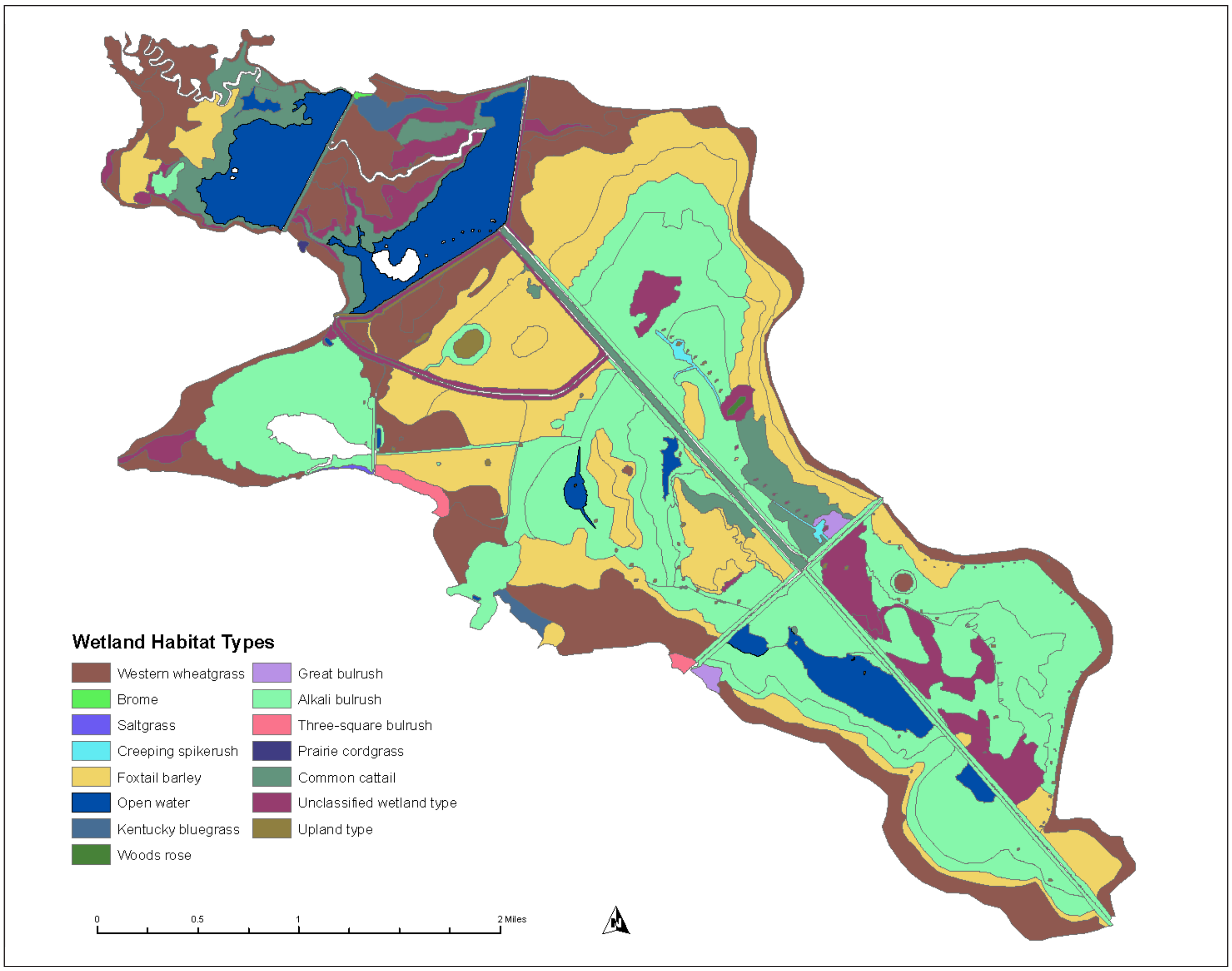


Figure 24. Vegetation communities on Benton Lake National Wildlife Refuge, Montana.

covered more area within the Benton Lake bed than other communities and historical accounts of the lake (for example, the General Land Office, 1920) comment on the wide bands and extensive coverage of sedges and rushes. This sedge–rush community may have expanded during wet periods to even higher elevation edges of Benton Lake and then contracted to lower elevations during extended dry periods. The periodic flooding and drying of these vegetation zones likely caused moderate alkaline soil conditions.

Seasonally flooded areas next to sedge–rush communities (3,615.8–3,616.3 feet amsl) contained diverse annual and perennial herbaceous plants and wet-prairie meadow grasses such as spikerush, lambsquarter, annual smartweeds, prairie cordgrass, and saltgrass. Prairie cordgrass apparently occurred in temporary and overflow areas along streams and the edges of marsh sites that had silty clay soils, less alkaline conditions, and where seasonal (usually spring) sheetflow of surface water occurred. Spikerush usually was in relatively narrow bands along yearly flooded stream and tributary sites and the margins of lake communities. In contrast, saltgrass was most common in more saline or alkali sites including areas where seeps flowed into Benton Lake and in some overflow areas next to Lake Creek.

The highest elevation edges of Benton Lake (3,616.4–3,622 feet amsl) typically had short duration seasonal flooding regimes and represented the transition zone from wetland to upland grassland plant communities (figure 24). Foxtail barley was present on the higher annually drawn down margins of the lake basin and in some ephemeral depressions. Foxtail barley gradually graded to western wheatgrass on terraces next to the lake. Eventually, these wetland-edge grass communities graded into upland grassland (elevations more than 3,622 feet amsl).

Current Wetland Vegetation and Invasive Plants

A survey of vegetation in Benton Lake Refuge units was conducted in 2001 and documented composition and distribution of plant communities (Thompson and Hansen 2002). At that time 91 plant species were documented in wetland units and the dominant vegetation communities (habitat types) were alkali bulrush (31.2 percent of total area within wetland units), western wheatgrass (18.1 percent), foxtail barley (17.4 percent), open water (9.6 percent), varied moist-soil annuals (8.8 percent), and cattail–hardstem bulrush (6.6 percent) (figure 24). The invasive creeping foxtail covered only 2.8 percent of the units in 2001. Creeping foxtail is an introduced rhizomatous perennial species. Its distribution has expanded through Benton Lake basin in recent years and generally occurs in bands or zones lying immediately above the zone occupied by cattail. The precise taxonomy of this creeping foxtail is unknown but may be the "Garrison" cultivar named and released by the NRCS Plant Materials Center in Bismarck, North Dakota in 1963 (NRCS 2007). The original collection of the Garrison cultivar was made in 1950 where plants were growing on the margins of prairie pothole wetland basins; it is especially adapted to cold-temperature regions next to wet areas such as the Benton Lake bed. Native species comprised 50, 100, 54, 58, and 58 percent, respectively, of tree, shrub, grass, forb, and total plants in wetland units in 2001.

Units 1 and 2, which have been managed for more permanent water regimes, contain large amounts of open water with extensive stands of cattail next to deeper open-water areas. Open-water areas contain abundant aquatic submergent vegetation, especially milfoil and pondweed. Creeping foxtail has spread into areas formerly dominated by foxtail barley at higher elevation edges of Units 1 and 2. Foxtail barley now occupies a relatively small amount of area of each unit. Western wheatgrass still occupies large areas on the highest upland edge of Units 1 and 2 but invasive Kentucky bluegrass, crested wheatgrass, and smooth brome are expanding in area. Some reed canarygrass also now is present in both units.

Unit 3 contains extensive, but declining areas of alkali bulrush in lower elevations and foxtail barley in higher sites. Creeping foxtail is gradually expanding coverage in the unit. In contrast, Canada thistle and field milk-thistle now occupy large areas of higher, drier edges of the unit. Former island areas also have small coverage by Woods' rose. Unit 3 now is managed for short duration seasonal flooding, but for more than 15 years (1964–78) it was managed for yearlong inundation (USFWS 1961–99).

Vegetation in Unit 4 varies among the three subunits and reflects permanency of water regimes and past excavations and construction of levees, nesting islands, and internal drainage ditches. Unit 4a has more natural vegetation communities than other subunits and is dominated by alkali bulrush. Subunit 4a has been allowed to flood and dry on more natural cycles, with deeper interior areas holding water for longer periods and supporting more alkali bulrush communities, compared to Units 4b and 4c. Foxtail barley and western wheatgrass remain dominant species on the edges of Unit 4a, but creeping foxtail has taken over most of the eastern part of the unit between the water control structure and the deeper interior.

Vegetation in Unit 4b is highly altered from historical condition. The historical geomorphology of the Unit 4b area was a higher alluvial depositional surface that historically flooded only for short periods during high-flow events of Lake Creek, mainly in spring, and it appears to have been dominated by prairie cordgrass, foxtail barley, wheatgrass, and possibly some saltgrass. Construction of the internal levee to subdivide Unit 4, construction of nesting islands, and excavations shifted this site to wetter regimes in the 1960s to 1980s. In more recent years Unit 4b has been managed for shorter duration flooding. Common species in Unit 4b are foxtail barley, common orache, lambsquarter, prickly lettuce, western wheatgrass, and the invasive crested wheatgrass. Little creeping foxtail is present in the subunit, which may be a result of the limited flooding this unit has received in the last 10–15 years.

Unit 4c is the largest subunit of Unit 4 and is becoming highly invaded by creeping foxtail. In 2001, the subunit kept a large amount of native foxtail barley, western wheatgrass, and alkali bulrush (Thompson and Hansen 2002), but each of these species is declining at present. Expansion of creeping foxtail may be increasing, because the site appears to have prolonged soil saturation, but not extensive surface flooding. Soil saturation may be discouraging less water tolerant native grasses and moist-soil-type species. It is uncertain if this saturation is being caused by leakage from the main water distribution canal or seasonal diversion of surface water into the unit.

Units 5 and 6 historically had several deeper depressions and these deeper sites remain dominated by alkali bulrush with some scattered cattail present. Similar to Unit 4c, creeping foxtail has spread across the areas with prolonged soil saturation in these units. Photos taken between 1996 and 2010 in Unit 6 show almost total replacement of alkali bulrush with creeping foxtail in transition zone between the inlet of the water control structures and the deeper depressions. The outer edges of these units that are flooded less frequently are now covered mainly by foxtail barley, lambsquarter, strawberry blight, rillscale, and western wheatgrass.

Wildlife

A rich diversity of wildlife species use the Benton Lake basin (appendix D). Aquatic invertebrates include a variety of Crustacea (such as *Daphnia* sp., *Gammarus* sp., and *Hyalella azteca*) and insects such as Corixid beetles, damselflies and dragonflies, Notonectid backswimmers, and Chironomids (Heitmeyer et al. 2009).

Several amphibian and reptile species also used Benton Lake including tiger salamanders, boreal chorus frogs, painted turtles, and common, western and plains garter snakes. There is one historical record of northern leopard frog on the refuge, but no recent occurrences. Uplands are used by western rattlesnakes and racers.

Fathead minnows are the only fish species occasionally present on the main refuge unit.

Mammal species diversity and abundance in the Benton Lake wetland basin is relatively low, except for many small rodents such as mice and voles. Several species of bats likely use wetlands as foraging areas, but no formal surveys have been conducted. Muskrat often create openings in wetland vegetation with den building, but shallow water that freezes completely every year may be limiting numbers. Additionally, many mammal species that mostly use the uplands, such as coyote, white-tailed deer, mule deer, and pronghorn, may also use dry parts of the wetlands to forage and breed. Very rare sightings of other mammals on the refuge include black bear, elk and moose.

The refuge provides migration and breeding habitat for a variety of birds. The Benton Lake Refuge has been designated as a Western Hemisphere Shorebird Reserve Network site and an Audubon Important Bird Area (IBA) (National Audubon Society 2012).

Grassland bird species are a priority for the refuge due to the conversion of native prairie in the surrounding areas and the overall trend of grassland bird species decline. During the past quarter-century, grassland birds have experienced steeper, more consistent, and more widespread population declines than any other avian guild in North America (Vickory et al. 2000). On Benton Lake Refuge priority grassland bird species include the ESA candidate species Sprague's pipit as well as ferruginous hawk, upland sandpiper, long-billed curlew, marbled godwit, burrowing owl, short-eared owl, grasshopper sparrow, and chestnut-collared longspur. Grassland bird point counts were conducted for 4 years (1994–7) consecutively at the refuge. One census reported that 820 individuals and 41 species of grassland birds were detected. Of these years studied there was a steady decline of the chestnut-collared longspurs, grasshopper sparrows, and horned larks.

Many wetland-dependent waterbirds breed at Benton Lake. The most common breeding species included eared grebe, mallard, northern pintail, gadwall, blue-winged teal, cinnamon teal, American wigeon, northern shoveler, redhead, lesser scaup, ruddy duck, Canada geese, American coot, American avocet, Wilson's phalaropes, marbled godwits, Franklin's gull, white-faced ibis, black-necked stilt, and black-crowned night-heron.

Of the relatively common wetland-dependent birds that breed on the refuge, 19 are considered species of concern (table 35). For some species, Benton Lake lies within the core of their breeding range.

Table 35. Migratory bird species of concern that breed at the Benton Lake National Wildlife Refuge, Montana.

Deeper, more permanent water	*Population estimate*	*Population status*	*Benton Lake relative to distribution*		*Benton Lake use relative to total population*
Black-crowned night-heron	not available	Stable	Disjunct		Occurrence at the refuge is <1% of the continental population.
Canvasback	600,000	Stable	Core		
Redhead	1,100,000	Increasing	Core		
Lesser scaup	4,200,000	Decreasing	Core		
Wilson's phalarope	1,500,000	?	Core		
Yellow-headed blackbird	23,000,000	Increasing	Core		
Shallower water	*Population estimate*	*Population status*	*Benton Lake relative to distribution*		
American bittern	not available	Decreasing?	Core		Occurrence at the refuge is <1% of the continental population.
Franklin's gull	1,000,000	Stable	Peripheral		
Mallard	8,400,000	Increasing	Core		
Gadwall	3,000,000	Increasing	Core		
Northern pintail	3,500,000	Decreasing	Core		
American wigeon	2,400,000	Stable	Core		
Blue-winged teal, cinnamon teal	6,300,000	Increasing	Core		
Green-winged teal	3,500,000	Increasing	Core		
American avocet	450,000	Stable	Core		
Black-necked stilt	175,000	Stable	Disjunct		
Willet	250,000	Stable	Core		
Marbled godwit	170,000	Stable	Core		
Long-billed curlew	164,000	Decreasing	Core		
Upland birds	*Population estimate*	*Population status*	*Benton Lake relative todistribution*	*Grass type*	
Ferruginous hawk	23,000	Decreasing?	Core	intermediate	Occurrence at the refuge is <0.05% of the continental population
Upland sandpiper	350,000	Decreasing	Core	intermediate	
Short-eared owl	2,400,000	Stable	Core	tall–dense	
Burrowing owl	2,000,000	Decreasing	Core	open–sparse	
Sprague's pipit	479,000	Decreasing	Core	intermediate	
Baird's sparrow	1,200,000	Decreasing	Core–Peripheral	intermediate	
Grasshopper sparrow	15,000,000	Decreasing	Core	intermediate–open	
McCown's longspur	1,100,000	Decreasing	Core	open–sparse	
Chestnut-collared longspur	5,600,000	Decreasing	Core	open–sparse	

Species = common or uncommon breeders at Benton Lake Refuge that have also been identified as a species of concern at a national or regional level.

Source: Service flyway data; Birds of North America Online; Partners in Flight Landbird Database; other Service publication data.

For others, such as Franklin's gulls, black necked stilts and black-crowned night-herons, the refuge is on the edge of their range or disjunct from the primary breeding habitat.

Planted, nonnative trees in shelterbelts provide habitat for at least 18 bird species that specialize in this type of habitat. Two of these species, loggerhead shrikes and Swainson's hawks, are species of concern and breeding has been documented in refuge shelterbelts.

Little quantitative data are available to determine changes in presence, abundance, and productivity of animal populations at the Benton Lake Refuge over time. Certain data show increasing numbers and production of waterbirds, especially dabbling ducks on the refuge in the late 1960s to late 1970s, when the refuge was initially flooded and units were managed for more prolonged water regimes (USFWS 1961–99). During this period annual duck production was reported to be high (several thousand ducklings) and included primarily northern shoveler, blue-winged teal, gadwall, cinnamon teal, northern pintail, and mallard. An increasing number of Canada geese also began using Benton Lake at this time and produced several hundred goslings in some years. Staff observations show that the number of breeding waterbirds have declined on Benton Lake in the last two decades. This may be due to the reduction in the amount of permanent and prolonged flooding of units in summer to manage botulism, below normal precipitation and runoff from 1998–2008, reduced productivity from the static hydroperiod created with annual pumping or may be an artifact of changes in staff and survey methods (USFWS 1961–99). Large numbers of migrant waterbirds also use Benton Lake during spring and fall migration. In recent years, up to 30,000 ducks, 400 tundra swans, and 2,000 Canada geese regularly use the lake and region each fall, with somewhat lower numbers in the spring.

Currently on the refuge, three predator-trapping locations using live-traps are supported from mid-April through July to reduce predation of nesting birds. Over the last 4 years, six predators (raccoons and skunks) were trapped. During the same period, eight nontarget animals were trapped and released.

Botulism

Avian botulism outbreaks, caused by the ingestion of a toxin produced by the bacterium *Clostridium botulinum*, have occurred at Benton Lake at least since the mid-1960s (USFWS 1961–99). Occurrence of botulism at Benton Lake before the 1960s is unknown (no records or monitoring data are available), but documentation of historic outbreaks in other large wetland basins in the western U.S. suggest it probably occurred at least in some years (for example, Wetmore 1915, Giltner and Couch 1930, Kalmbach 1930, Wobeser 1981).

Peak waterbird mortality caused by botulism at Benton Lake occurred in 1970–2 when more than 18,000 birds (17,127 ducks) died in 1970 and more than 10,000 birds died in 1971 and 1972 (USFWS 1970–99) (table 36). The years 1971 and 1972 were very dry years and water levels in units that had been managed for higher summer water levels to support duck broods (Units 3, 4c, and 5) receded quickly contributing to the die-off. In 1971, the Benton Lake Refuge was ranked highest in North America for known botulism losses (USFWS annual report, 1971). Waterbird mortality from botulism at the refuge declined during the remainder of the 1970s when water levels were high in the wetland basin, caused by increased precipitation and natural runoff from Lake Creek.

Table 36. Annual mortality of ducks caused by botulism at Benton Lake National Wildlife Refuge, Montana.

Year	*Number of ducks*
1970	17,127
1971	10,778
1972	10,081
1973	1,602
1974	884
1978	812
1979	1,148
1987	83
1988	597
1989	2,025
1990	509
1991	3,743
1997	88

Source: USFWS 1970–90; USFWS unpublished files.

Since the 1980s, botulism mortality at the refuge has been relatively low (less than 500) in most years except 1989 and 1991, when 2,025 and 3,743 ducks died, respectively. Generally, botulism outbreaks at the refuge have been greatest in Units 3, 4c, and 5 when they had greater amounts of flooding and rapid drawdown in late summer.

Over time, refuge managers have learned to allow Units 3–6 to dry during July, which has coincided with a significantly lower incidence of major botulism die-offs on the refuge. Units 1 and 2 can be kept full for brood water during July, as these units have not had a history of botulism. Concern for avoiding the conditions that created high botulism mortality (high water levels in lower units and hot, dry weather in summer) constrains water management options on the refuge.

Cultural Resources

The historical landscape in the Benton Lake basin contained vast expanses of grasslands, undulating topography, a few intermittent streams and forested riparian corridors, and scattered wetland basins, with Benton Lake being the largest. This area was inhabited by Native Americans for at least 10,000 years before European settlement. The Blackfeet, Cheyenne, and Crow tribes lived in the Plains region, but had mobile lifestyles and they apparently had relatively little influence on the Plains landscape, with the exception of occasionally setting fires. A few French trappers apparently visited areas along the nearby Missouri River in the mid-to-late 1700s, but the area was not explored until 1805 when members of the Lewis and Clark expedition viewed the Great Falls of the Missouri River and Black Eagle Falls. These Lewis and Clark explorers spent about 3 weeks in the area and recorded in their journals descriptions of the falls and surrounding area, which would eventually fuel interest in settlement. Expedition members returned to the area in 1806 and reported large numbers of bison, elk, deer, and pronghorn in the area along with grizzly bear and mountain lions. After 1807, trappers and fur traders became active in the region; the American Fur Company built Fort Benton on the Missouri River in 1847.

The United States received most of what is now Montana as part of the Louisiana Purchase in the early 1800s, and the northwestern part of the State was gained by treaty with Great Britain in 1846. In 1862, prospectors found gold in southwest Montana and many settlers moved to the State thereafter. The area around Benton Lake was not a source of gold, however, and only occasional trappers, hunters, and gold seekers occupied the area. Threats of Indian aggression also deterred European settlement in the region until the 1870s. Consequently, the physical and ecological nature of the Benton Lake basin remained essentially unchanged from its historical condition until about 1880, when settlers increasingly moved to the Missouri River Valley. Between 1880 and 1890 the population of Montana grew from about 39,000 to nearly 143,000. In 1884, Paris Gibson founded the city of Great Falls at the confluence of the Sun and Missouri Rivers and the city was incorporated in 1888 (Yuill and Yuill 1984). The Mullan Road, a common western pathway built in the early 1860s for pioneers and settlers traveling from Fort Benton by way of Coeur d' Alene to the Pacific northwest wound around the north end of Benton Lake (Cascade County Historical Society 1999). Interestingly, another early road near Benton Lake, running north of Great Falls from the current Highway 87 to Canada, was heavily used to carry bootlegged liquor to Great Falls and other towns further south during the Prohibition Era from 1920 to 1933. Named Bootlegger Trail, it crossed the old Mullan Road and homesteaders along the trail near Benton Lake augmented their income by allowing bootleggers to use their barns to layover during the daytime.

Beginning in the early 1900s, efforts to increase opportunity for small grain farming in the region began with the initiation of the Sun River Reclamation Project, later known as the Sun River Irrigation Project. This Sun River project was authorized by the Secretary of the Interior in 1906 and contains more than 100,000 acres of potentially irrigated land along the Sun River and its tributaries west of Benton Lake (Knapton et al. 1988). The Sun River project contains two major divisions, the Fort Shaw Irrigation Division that borders the Sun River contains about 10,000 acres and the Greenfields Irrigation Division, contains about 83,000 acres.

Construction of the Fort Shaw Division began in 1907, and the first water was delivered to division farmlands in 1909 (Knapton et al. 1988). Construction of facilities within the Greenfields Irrigation Division began in 1913 and the first water was delivered to area grain farmers in 1920. The main storage structure, Gibson Reservoir was constructed on the upper Sun River during 1922–9. Approximately 300 miles of canals and lateral distribution ditches distribute water across the Greenfields Bench.

The development of the Greenfields Irrigation Division dramatically changed the landscape within large parts of the district and influenced land use near the Benton Lake Refuge. During this time, native grassland was converted to irrigated cropland, mostly wheat and barley, and pasture–hayland. The advent of increased small grain production in the region and accompanying storage, transportation, and milling facilities encouraged grain production outside of the irrigation division also. Much of the native grassland was converted from native grassland to dryland cropland. The predominant crops grown in this area until the 1980s were wheat, barley, oats, and flax using crop–fallow rotations where alternating linear fields were either cropped or kept fallow (free of vegetation using tillage or chemical treatments) for 1–2 years. Since the mid-1980s, more than 60 percent of the cropland in the Greenfields Division has been contracted for growing malting barley, which has improved the financial sustainability of cropping lands in the area and has provided more than $20 million annual return.

Visitor Services

Visitors to the refuge enjoy a variety of wildlife-dependent, public use activities such as hunting, fishing, wildlife observation, photography, environmental education, and interpretation (figure 25). In general, national wildlife refuges are closed to all public use until specifically opened. Existing and proposed uses of national wildlife refuges, need to be evaluated for appropriateness and compatibility (See chapter 4, section 4.6 for a full description and definitions of these terms).

Hunting

Hunting on the refuge begins with the opening of the State waterfowl season and runs through November 30. Benton Lake Refuge is open for the youth waterfowl season, which typically occurs the weekend before the opening of the general waterfowl season. Hunting on Benton Lake is confined to Units 5, 6 and parts of Unit 4C. Ducks, geese, coots, swans (by permit), sharp-tailed grouse, gray partridge, and ring-necked pheasants can be hunted on the refuge. Hunting of all other species is prohibited. State seasons apply within the refuge framework. Hunting is on a first-come, first served basis. One disability accessible hunting blind is available in Unit 5 through special use permit.

Fishing

The refuge offers no fishing opportunities on the main part of the refuge due to a lack of sport fish. The Pump House Unit (147 acres) is open for walk-in access to Muddy Creek, which provides trout-fishing opportunities.

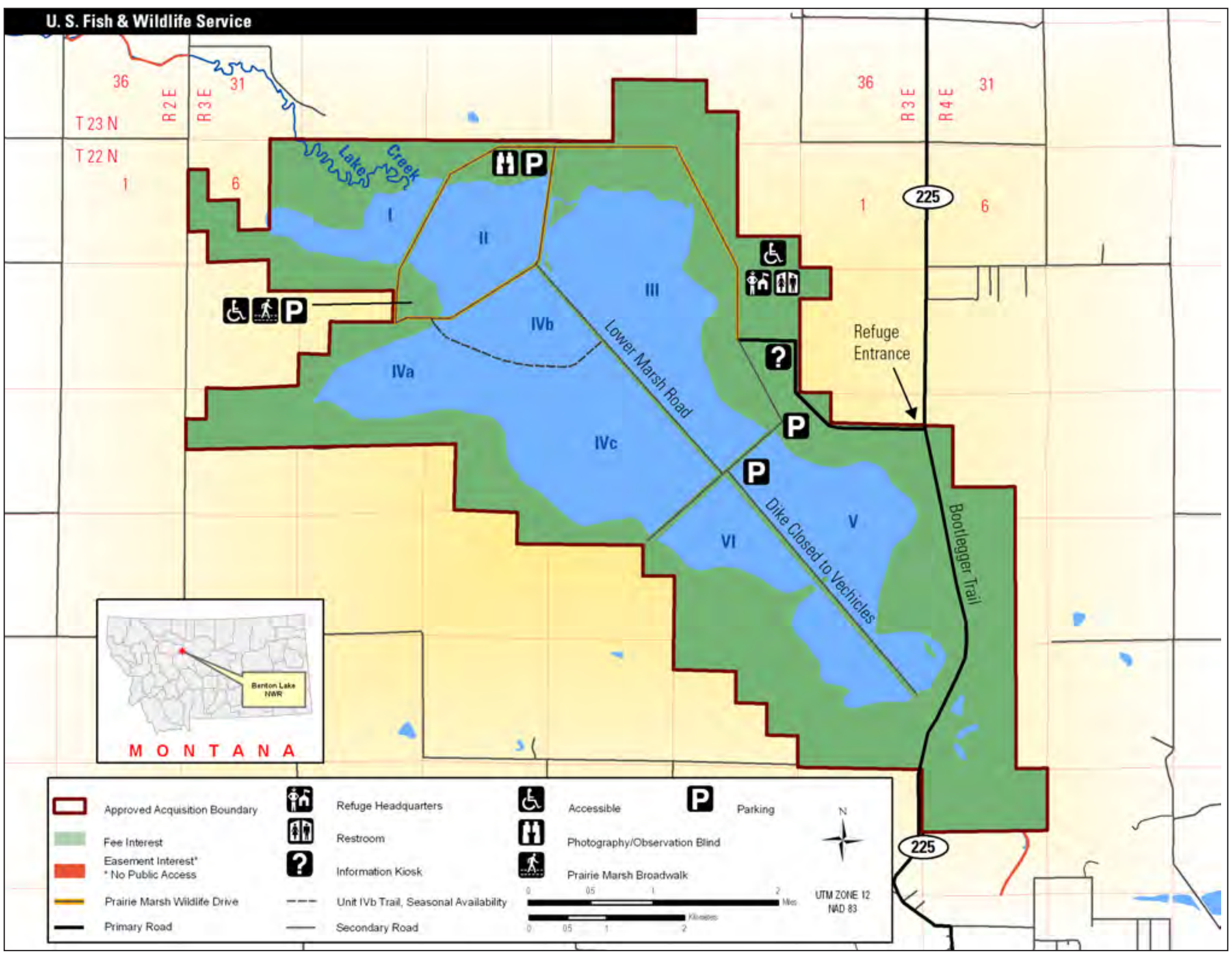


Figure 25. Public use at the Benton Lake National Wildlife Refuge, Montana.

Wildlife Observation and Photography

The most popular recreational activity on the refuge is wildlife observation and photography. The auto tour route, Prairie Marsh Boardwalk, Lower Marsh Road, and the sharp-tailed grouse blind are the most popular observation areas. In addition, a photography blind constructed in Unit 1 is available.

Environmental Education and Interpretation

The Benton Lake Refuge has the potential to provide an extraordinary environmental education and interpretation program. The refuge is located 12 miles from Great Falls, a city of 60,000 people, in north-central Montana. The population of Cascade County, where the refuge is located, is 82,000. The refuge staff has never included an environmental education position. Management staff has given occasional tours to school groups and nongovernmental organizations. The environmental science department of the GFPS brings all third graders (800–900 students) to the refuge each year in May and June for a basic introduction to prairie grasslands and wetlands. Refuge staff greet the buses and give a very brief overview of the Refuge System and provide refuge-specific information. Occasional youth hunting clinics are held at the refuge with help from MFWP staff. Becoming an Outdoor Woman workshops have also been held occasionally on the refuge. Refuge Staff also take part in the STEM Expo to help foster community-based participation by youth in the career fields of science and mathematics. The program includes both a community expo and mentoring program.

Interpretive panels have been updated and are displayed in the visitor kiosk located on the office entrance road. More panels are being developed for display on the Prairie Marsh Boardwalk.

Refuge Management Activities

The Service manipulates habitat through several management activities that are carried out under specific, prescribed conditions to meet the needs of wildlife. Water management on the refuge is described above. Prescribed fire has been used regularly on the refuge. Since 2004, the refuge has burned an average of 2,000 acres per year. In the recent past, cooperative farming and grazing have not been used on the refuge. Haying has been used to a limited extent on tame grass fields. For a complete description of these tools please see chapter 4.8.

Socioeconomic Environment

Benton Lake Refuge is located in north-central Cascade County. The refuge shares a partial border with Chouteau County, and lies near the border of Teton County. Visitors travel to the refuge for wildlife observation, photography, migratory and upland gamebird hunting. Great Falls, the closest city to the refuge, is about 12 miles south of the refuge. Unlike other cities with a history of boom and bust cycles of mining, Great Falls was a planned city. By the late 1800s, the city was connected to the railroad and had a growing number of businesses and agricultural production. Great Falls was never dominated by a single industry, which helped to continue its steady growth throughout the 1900s. With the arrival of Malmstrom Air Force Base in 1939 Great Falls boasted a diverse economy of manufacturing, agriculture, military and retail (Big Sky Fishing, 2011). Great Falls is a growing tourist destination as it provides access to a wide variety of outdoor recreation opportunities. Visitors come to Great Falls for its rich Western history and impressive parks and open spaces (Great Falls Visitor Information Center, 2011). Great Falls is one of the many gateways to Glacier, Yellowstone and Grand Teton National Parks, as well as Showdown, Teton Pass, and Great Divide ski resorts (Great Falls Visitor Information Center, 2011).

For a description of the socioeconomic setting in the 12-county area of the refuge complex, please see chapter 4.

Staff and Funding

The refuge complex headquarters is located on Benton Lake Refuge. Service operations consist of the staff, facilities, equipment, and supplies needed to administer resource management and public use programs throughout the refuge complex, which is located across a 12-county area covering more than 2,700 square miles. Within this area, the Service is responsible for the protection of 163,304 acres of lands and waters.

Staff

Currently, the refuge complex staff is comprised of 9.5 permanent full-time employees (table 10 in chapter 4, section 4.5). Of these, staff assigned to the management of Benton Lake Refuge include: a part of the wildlife refuge manager for the refuge complex, the deputy wildlife refuge manager, an administrative officer, part-time generalist, a term-seasonal biological technician and a complete FTE of wildlife refuge biologist and maintenance worker. The wetland district manager and wildlife refuge specialist (assigned to the Rocky Mountain Front) often help with refuge support as well. The refuge has seen a reduction in staff since 2000.

Since 1998, the refuge complex has lost three positions—one full-time law enforcement position, one permanent biological science technician and a permanent maintenance worker. The current staff level remains well below the minimum prescribed in the "June 2008 Final Report—Staffing Model for Field Stations" (USFWS 2008e), which recommended 8 more staff including a GS–13 refuge manager, GS–12 wildlife refuge specialist, GS–9 park ranger (visitor services specialist), GS–9 park ranger (law enforcement), GS–12 wildlife biologist, WG–8 maintenance worker, and GS–6 biological science technician (0.5 full-time equivalent employee).

Facilities and Infrastructure

Significant infrastructure exists on the refuge to primarily support water management activities. This includes 11.5 miles of dikes and ditches that divide the wetland basin into 8 units and 9 water control structures. In addition, the interunit canal (a 2.2 mile long and approximately 50 feet wide channel) delivers water to the lower units. The dikes also provide a roadway for the Prairie Marsh Drive Auto Tour Route and Lower Marsh Road Auto Tour Route. A pump house with 3 pumps and a water control structure that impounds flows of Muddy Creek also aides in water management.

The refuge office has been expanded to accommodate housing complex employees as well as other regional refuge programs. Recently constructed support infrastructure included a wind generator and photovoltaic system that provides electrical needs for the office building.

Visitor and Employee Safety and Resource Protection

A collateral duty officer (wildlife refuge specialist) is assigned to the district and conducts all law enforcement duties at Benton Lake Refuge.

7.12 Alternatives Analysis

Management actions are prescribed in the alternatives as a means for achieving the vision and goals for the refuge, 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 effects are evaluated at several levels including whether they 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

The five alternatives for the refuge are listed below. The effects of each of the five alternatives are described under the major resource topics described throughout this document.

In addition, table 53 in section 7.20 following the description of consequences summarizes the alternatives' actions and the associated consequences as described below.

Elements Common to All Alternatives

The following potential effects would be similar for each of the five 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 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.

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.

Cultural Resources

All of the alternatives would enhance cultural resources through protection of existing resources and extension of protection to newly discovered cultural resources.

There have been limited cultural resource surveys performed on the refuge, so more surveys would be required before any new construction or excavation to fully satisfy provisions of the Archeological Resources Protection Act and other applicable acts and policies related to historical and archaeological resources.

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

7.13 Consequences of Alternative A1 (Current Management –No Action)

Most staff time and efforts are directed toward providing migration and breeding habitat every year for wetland-dependent wildlife, primarily waterfowl. The opportunity for waterfowl hunting every fall is provided. Water management within the wetland units on the refuge is similar each year so that units are flooded at approximately the same time and depths consistently creating a dominance of semipermanent wetland habitat. This water regime favors species dependent upon semipermanent water sources such as wading birds and waterfowl. Management efforts strive to reduce the dynamic shifts and variability in hydro-periods which cause fluctuations in water levels. Risk of botulism is reduced due to seasonal drying of lower units. The effects from the extended dry cycles are cut. Selenium accumulation and toxicity hazard to wildlife will continue to increase. Wetland health continues to decline and issues pertaining to selenium contamination hazard, nonnative or single-species dominance of vegetation communities are not addressed. The ability to absorb perturbations in the system is likely compromised. Over the life of the plan, wildlife-dependent recreation is estimated at 5,625 hunting visits; 750 fishing visits; 114,750 wildlife observation and photography visits; and 26,625 visits for interpretive programming. Over the life of the plan, the total cost to carry out wetland basin management (operations and maintenance, pumping, monitoring, and prescriptive habitat treatment) is estimated to be $1,785,000. Staffing dedicated to refuge include: a part of the wildlife biologist, deputy complex wildlife refuge manager, maintenance worker, part-time generalist, and term biological technician with more support from the complex manager, wetland district manager, wildlife refuge specialist, assistant fire management officer, administrative officer, and budget analyst.

Grasslands

Native Grasslands

Protection of native grasslands through easement programs continues to be a high priority throughout the refuge complex. New and expanded project areas and more money sources provide the potential for protecting great expanses of native prairie. However, with annual additions to easement acres and contracts, supporting the current level of proactive easement enforcement and landowner contact would eventually be compromised. Preserving and managing native prairie landscapes reduces soil erosion, supports water quality, effectively sequesters carbon and increases resiliency and resistance to disturbances such as climate change (Bangsund et al. 2005).

Refuge management of native grasslands would continue extensively, but imprecisely, using a coarse, generic approach because of limited resources for staff, money and long-term monitoring. Native grassland health, composition and native plant diversity are managed using fire and rest cycles on the refuge. Noxious weeds would continue to be treated using IPM and EDRR and the low presence of these species would likely continue. Cool-season, exotic grasses such as Japanese brome, Kentucky bluegrass and crested wheatgrass, have invaded significant areas of the refuge. With current management and resource allocation, these infestations would likely continue to expand and further degrade the quality of the native prairie. The invasion by nonnative species can extend beyond the displacement of native species and the reduction of diversity and include the alteration of energy and nutrient flows within the prairie ecosystem (Christian and Wilson 1999). This could also affect reproductive success of grassland-nesting birds. For example, chestnut-collared longspurs, which are a common species of concern on the refuge, have been shown to have lower nest success, slower nestlings growth, and nestlings with smaller final mass in crested wheatgrass compared to native prairie (Lloyd and Martin 2005).

Tame Grasslands

Management of tame grass on the refuge strives to support the health and longevity of stands with periodic disturbance using fire or haying in a rotational system within specific management units. Tame grass on the refuge is typically taller and denser than native prairie, providing more structural diversity which meets habitat requirements for a wide variety of grassland-dependent species. However, 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).

Nonnative Tree Plantings

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).

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.

Nonnative tree plantings provide an unnatural change to the vegetative structure of the prairies. This allows some species to nest where they otherwise would not. The result is an increase in local species diversity, but with negative impacts to regional biological diversity.

Wetlands and Riparian Areas

Water Quantity and Timing

Units 1 and 2 would be flooded year-round. The lower units (Units 3–6) would be shallowly flooded all year except for July. A water budget model was developed with refuge staff and USGS to assess effects on changes in water management on the refuge (Nimick et al. 2011). This model is based on refuge water use records, precipitation, evaporation and runoff from 1970–2006. If the next 30 years were similar to the last 30 years, in a wet cycle, the refuge wetland basin would be greater than 50-percent full 4 years out of 15 and would never be less than 7-percent full. In a dry cycle, the refuge wetland basin would be 10-percent or less full most years, but never completely dry (Nimick et al. 2011).

Infrastructure

With current infrastructure, the ability to channel water to all units for management objectives is available. However, the system is constrained in that all water that enters from Lake Creek must pass through Units 1 and 2 before moving to the lower units. The lower units (Units 3–6) are difficult to dewater, which limits options for management, especially botulism. In the lower units, water first enters extensive 1- to 3-foot deep ditches before it spreads across the wetlands. This reduces sheet flow which decreases the quantity and quality of flooded acres within the wetland (see wetland productivity section).

Collectively, the dikes, roads and ditches have disrupted natural waterflow patterns into and through Benton Lake, affected wind- and water-related soil erosion and deposition patterns, and changed public access and disturbance of many areas on the refuge (Heitmeyer et al. 2009). For example, sheet flow that quickly moves across a wetland basin and shallowly floods the greatest area, which would warm quickly and make invertebrates, in particular, available to many birds, is delayed and altered by ditches that line each dike within the Benton Lake wetland. The dikes and ditches also create sediment traps altering the soil chemistry and microbial processes that support wetland function (Euliss et al. 2008). Holding water behind control structures changes the ecology of the wetlands. For example, mineral and organic nutrients that promotes a proliferation of plant life, especially algae, accumulate which then reduces the dissolved oxygen content and can cause the extinction of other organisms (Jarworski and Raphael 1978, Brix 1993). Impoundments favor anoxia and inhibit the release of nutrients that could contribute to pulses in primary production by slowing mineralization (Brix 1993, Wetzel 2001, Mitsch and Gosselink 2007). Scouring of sediment and transportation of mineralized nutrients are reduced due to impoundments (Euliss et al. 2008). Water control structures also affect salinity and selenium accumulation by trapping and concentrating contaminants, and in the case of selenium, potentially preventing adequate soil oxygenation to volatilize the contaminant (Seiler et al. 1999, Euliss and Mushet 2004, Nelson and Reiten 2006).

Water Quality

Extensive research on selenium contamination and loading has been conducted on Benton Lake Refuge (Lambing et al. 1994, Nimick et al. 1996, Nimick 1997, Zhang and Moore 1997, Henney et al. 2000). Because this alternative would continue current management, the average total load of selenium deposited on the refuge annually would be expected to be the same as has occurred over the last 30 years (151 pounds/ year, table 31). The total pounds of selenium that enter Benton Lake annually from pumped versus natural runoff would be highly variable among years depending on the relative amounts of water flowing to the lake from natural runoff in the Lake Creek watershed versus water pumped from Muddy Creek. On average, approximately 61 percent of the selenium comes from natural runoff and 39 percent from pumped water. Pumping increases the total selenium load to the refuge and prevents long-term dry cycles, which could remove selenium from the system.

A selenium cycling model, developed specifically for Benton Lake Refuge in 1997, predicted that Units 1 and 2 would become a toxic threat sufficient to cause complete, or nearly complete, reproductive failure in sensitive species of aquatic birds in 9 and 17 years, respectively (Zhang and Moore 1997, Lemly 1995, 2002). As of 2008, selenium levels in Unit 1 had not yet reached the toxic threshold. This appears to be because selenium inputs from natural runoff were 86-percent below the long-term average used in the original calculations. It is expected that when natural runoff, and associated selenium inputs, increase during the next wet cycle, which appears to have begun in 2009, units 1 and 2 may again have as little as 9–17 years, respectively, before they become highly toxic, under current management. It may even be fewer years, because the selenium in the upper 0.8 inch of sediment of Unit 1 was 60-percent higher in 2008 than the original model values in 1994 (Zhang and Moore 1997). If this occurred, drying out Unit 1 for more than 10 years would likely be necessary to try to remove selenium via volatilization (Zhang and Moore 1997). The new inlet wetland would likely be Unit 2, (due to infrastructure constraints), which if it continued to be flooded year-round for brood habitat, would likely cross the toxic threshold in 9 years. Due to the annual drying of the lower units, Units 3, 5, and 6 would never cross the toxic threshold. Unit 4, because of adjacent saline seeps, is predicted to cross the threshold in 67 years or less despite annual drying.

If both Units 1 and 2 accumulated selenium levels in the sediment more than 4 µg/g, there may be only two choices left to protect wildlife—destroy the wetland to limit access by wildlife (as was done at Kesterson National Wildlife Refuge) or remove selenium contaminated sediment from the wetland and start over, which is an extremely costly endeavor (Zhang and Moore 1997).

It is not currently known if phosphorous and other agrichemical nutrients are elevated in Benton Lake. Given the extensive conversion of native upland vegetation to farm production (wheat and barley) and farm practices such as crop and fallow farming in both the Muddy Creek and Lake Creek watersheds, it is a concern. Phosphorous and agrichemical nutrients further exacerbate and accelerate eutrophication (Craft and Richardson 1993a, b). Pumping would increase loads of these contaminants, but may also dilute concentrations.

Wetland Productivity

This alternative likely would continue to result in lower wetland productivity at potentially all levels of the food chain. Before 1961, Benton Lake experienced highly variable flooding and drying. After pumping began in 1962, refuge reports show that the wetland was very productive, as indicated by high waterfowl use. When a wetland refloods after a dry period, there is a pulse of nutrients that stimulates productivity in invertebrates, and some plants, which provides important food resources for waterfowl and other wetland-dependent wildlife (Magee 1995). Since this time, however, Benton Lake has experienced relatively stable water conditions with much less variability in flooding and drying. Stable water conditions negatively impact nutrient cycling in wetlands by creating anaerobic conditions and denitrification which can alter plant and invertebrate communities (Gosselink and Turner 1978, Magee 1995, Mitsch and Gosselink 2007, Malson et al. 2008, Euliss et al. 2008, Anteau 2012).

Variable flooding and drying conditions are key to sustaining complex interactions that create diversity and abundance in resources, such as invertebrates, that wetland-dependent wildlife require for migration and breeding (Schneider 1999, Murkin and Ross 1999, Anteau 2012). In general, greater diversity and abundance of invertebrates in wetlands supports a greater diversity of birds (Murkin and Ross 1999). When water conditions become more stable, optimal conditions for only a select suite of species are provided, plant and animal diversity is reduced and single species begin to dominate. However, the benefits for these species are likely to be short term and not sustainable if stable water conditions continue (Euliss et al. 2008, Anteau 2012). Although long-term, rigorous studies on invertebrates and other indicators of productivity have not been conducted at Benton Lake, the decreasing diversity of plant communities and waterfowl use observed by staff are likely to be primarily the result of stable water conditions.

The continuation of adding at least 4,000 acre-feet of pumped water into the refuge every year would increase erosion along Lake Creek and the load of sediment and contaminants being washed into the basin over and above the amount coming in with natural runoff, thus compounding the negative effects of these inputs. Given that this has already been occurring for 50 years, another 15 years is likely to be even more detrimental to productivity, as hydrology in the wetland has been stabilized for many years (Murkin et al. 1997, van der Valk and Davis 1978).

Wetland Vegetation

Flooding the units to approximately the same level, at the same time, every year would likely cause existing stands of monotypic vegetation, such as alkali bulrush, cattails and invasive Garrison creeping foxtail to continue to expand or become denser, especially in a dry cycle. This is because pumped water would be creating consistent water levels that favor the expansion of these species rather than allowing drier conditions where these species would be replaced by vegetation that is more competitive during drought. A wet cycle, with significant flooding, may create more open areas where current vegetation is drowned out (van der Valk 1981, Murkin et al. 1997, Frederick and Ogden 2001, Heitmeyer et al. 2009).

Water Resources

Water rights would be supported by continuing to use all water rights on an annual basis.

Visitor Services

A variety of visitor services opportunities exist. In FY 2011, approximately 10,000 visits occurred at the refuge. The most popular use continues to be wildlife observation (7,250 visits) followed with environmental education (1,700 participants), wildlife photography (400 visits), hunting (375 visits), interpretation (75 visits), and fishing (50 visits). Visits would be similar, with potential reductions, if habitat conditions continue to decline, which may affect usage of wildlife that attract refuge visitors. In addition, wet years with peak runoff, some uses would increase such as waterfowl hunting.

Limited law enforcement patrols are needed to manage this use at the present level; however, if use increases more demands for staff time are possible. There is a potential for conflict between user groups.

Hunting

A water budget model was developed with refuge staff and USGS to assess effects on changes in water management on the refuge (Nimick et al. 2011). This model is based on refuge water use records, precipitation, evaporation and runoff from 1970–2006. If the next 30 years are similar to the last 30 years, in a wet cycle, the refuge would be greater than 50-percent full 4 years out of 15 and would never be less than 7-percent full. In a dry cycle, the refuge would be 10-percent, or less, full most years, but never completely dry (Nimick et al. 2011). During the wet years, waterfowl hunting may increase significantly for 1 to 2 years. This has been documented in fall of 2011, in which hunter use nearly doubled during a peak runoff year. During the dry cycle, hunter numbers are expected to be similar to hunter usage

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Kingsbury Waterfowl Production Area. One of the many wetland habitats on the refuge complex.

recorded in past 10 years, which average approximately 300 visits annually. Over the past 15 years, waterfowl hunting peaks opening weekend with approximately 40 individual hunters. Weekends, until big game season opener, are about half the level of opening weekend with a peak of three to six hunting parties daily during the week. Just before freeze up, less than 6 hunting parties are generally using the refuge each day during the weekend. Over the life of the plan, the total waterfowl hunting visits are estimated to be 4,500 visits.

In addition to opportunity is a measure of quality of hunting experience. The quality of the hunt would continue to be marginal (as described by hunters at refuge open houses). Available open water would continue to decline over time with single species dominating such as alkali bulrush or invasive Garrison creeping foxtail. Extreme wet events such as that documented in 2011 would help set back the Garrison, but it may rapidly return. Solidification of sediment is not addressed, so it would still be a difficult hunting experience for hunters due to the muck buildup in refuge units including hunt units. A quality hunt experience also includes availability of waterfowl. If habitat is marginal, this reduces bird use and limits species availability for hunting, lowering the quality of the hunting experience.

Upland gamebird hunting is expected to remain relatively stable at 75 visits per year currently occurring, throughout the life of this plan totaling approximately 1,125 visits. No significant improvements would be expected in upland grasslands, so no increase in availability of birds for hunting is expected. Existing grasslands would continue to decline, which could affect bird numbers available to hunters.

Total hunting visits annually would be approximately 375 visits with an estimated total for the life of the plan at 5,625 visits.

Wildlife Observation and Photography

Primary focus of the wildlife observation and photography use is along the auto tour route, Boardwalk Prairie Marsh Trail, Lower Marsh Road, and grouse blind. No changes would occur at these facilities, except the possibility of another grouse blind being established due to repeated requests to enhance this opportunity since demand exceeds supply. This would result in a modest increase in visitor usage by approximately 100 visits per year.

Wildlife observation and photography account for 73 percent of overall annual visitation to the refuge. The number of visits are not expected to experience significant annual changes throughout the life of the plan; however, a slight decline from current usage is a possibility. Wildlife availability is not expected to change rapidly; however, not addressing serious management concerns such as selenium accumulation, lack of management of grassland habitat, and vegetative shifts resulting in single species dominance including invasive species would cause continued decline of wetland health and productivity. This, in turn, would result in steady reduced usage by wildlife. Visitors participating in wildlife observation and photography, which depend on the presence of wildlife, would be affected due to these declines. Although diversity of wildlife species (wetland and grassland-dependent species) is not expected to change, the number of individual species would continue to decline, which may affect observation numbers. If selenium levels result in toxic levels, significant declines in bird production would be expected, resulting in potential capping of the refuge and removal of observation opportunity and significant loss of species usage.

Current use is very limited on some roads that are already open to motor vehicles. Waterbirds may be slightly disrupted from this use. The time of year that these activities take place and the extremely limited level of use would cause very little negative effect on wildlife or habitat. Users may gain knowledge of the Refuge System and the refuge. There is a potential for conflict between user groups.

Environmental Education and Interpretation

We would expect no significant changes in the number of environmental education participants on the refuge, which is about 1,700 annually. Most of these participants would be Great Falls public schools third graders, STEM Expo participants, and the Montana Envirothon Event. These opportunities enhance the communities understanding of the Refuge System and mission of the Service, enhance environmental ethics, and develops advocacy of youth for natural resources.

Staff and Funding

Total costs for pumping ($960,000) and operations and maintenance ($825,000) through the life of the plan is estimated to cost $1,785,000.

Operations and maintenance for managing water requires staff to manage the water movement, record and produce annual water use reports. Support and run the pump house, and perform regular maintenance on the infrastructure associated with water management. The cost of operations and maintenance at the FY 2011 rates is expected to average $55,000 per year. For the life of the plan, operations and maintenance is estimated to cost $825,000. The price per acre-feet of pumped water varies significantly year to year. Based on the last 10 years, costs per-acre feet have ranged from $13.13 to $23.60. In addition to cost per-acre feet variable by year so is the amount of pumped water due to variations in natural runoff. In the past 10 years, the amount of pumped water has ranged from 2,849 to 5,082 acre-feet. The average acre-feet pumped per year and the cost per acre-feet used for costs estimates is $16 per acre-feet with an average pumped acre-feet of water of 4,000 acre-feet. Electricity expenses for pumping are estimated to cost $960,000 over 15 years. If energy prices go up, which is considered likely, either total cost would be higher, or less water could be pumped.

Under current management, inventory and monitoring is completed primarily by the wildlife biologist, seasonal biological technician, and through the help of the deputy refuge complex manager. Selenium sampling has occurred and water usage is documented.

No prescriptive habitat treatment is actively occurring within the wetland units.

Staff limitations under current management would remain and be stretched thinner with each added conservation easement in the three approved conservation areas. Easement contracts, evaluations, and preliminary acquisition work—inherently district manager's responsibilities—are supported by a temporally shared full-time position. Other easement programs (Farmers Home Administration, grassland, wetland) would continue to be administered but with little to no time to cultivate interest for acquisition.

Management of native prairie tracts would be ongoing but limited staff time does not allow site specific, quantitative monitoring of species composition and vegetative trends. This information is necessary to evaluate the success of current management regimes.

Farming and reseeding degraded tame grass stands have been considered but shortages of resources has prevented any concerted efforts. As tame grass stands continue to degrade over time into poor habitat conditions, the initial resources to address these habitat needs grows substantially.

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

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

Resource Protection

Currently, law enforcement patrols are limited to managing visitor services and resource protection.

7.14 Consequences of Alternative B1

Most staff time and efforts would be directed toward providing migration and breeding habitat every year for wetland-dependent wildlife, primarily waterfowl. A 50-percent reduction in the amount of brood habitat compared to alternative A1 is expected. Management within the wetland units includes short-term dry cycle and application of intensive prescriptive habitat treatment. Risk of botulism could be elevated over alternative A1 if summer flooding in lower units becomes necessary. Compared to alternative A1, selenium input into the wetland may be reduced and increase in removal of accumulated selenium may occur. Reduction in the toxic hazard to wildlife is expected, but less certain than the other alternatives. Short-term improvement in the health and sustainability of the wetland units is expected from reducing selenium contaminant levels, controlling nonnative vegetation, and stimulating productivity. The ability to absorb perturbations in the system is expected to improve over alternative A1, but is not self-sustainable. Over the life of the plan, wildlife-dependent recreation is estimated to be similar to alternative A1 for fishing visits; wildlife observation and photography visits; and interpretation and environmental education programming visits. Hunting visits are expected to increase 10-percent over alternative A1. Over the life of the plan, the total cost to carry out wetland basin management (operations and maintenance, pumping, monitoring, and prescriptive habitat treatment) is estimated to range from $2,641,000 to $2,829,000. Compared to alternative A1, an increase of a term biological technician, two seasonal biological technicians, and a maintenance worker dedicated to the refuge and a proportion of supervisory wildlife biologist, generalist, and law enforcement officer assigned to the complex are necessary to carry out this alternative.

Grasslands

Native Grasslands

Same as alternative A1, plus, with the increased effort to manage Benton Lake wetlands, there may be more declines in biological diversity, ecological integrity and environmental health of the refuge native grasslands.

Tame Grasslands

Same as alternative A1.

Nonnative Tree Plantings

Same as alternative A1.

Wetlands and Riparian Areas

Water Quantity and Timing

Either Unit 1 or 2 would be flooded year-round through the life of the plan to provide brood habitat. Each of the lower units would be dried out one at a time for at least 3 years. It is assumed that 3 years would be sufficient to get enough drying, but this may end up being longer (4–6+ years). Flooded units would still be allowed to dry during July. In a wet cycle, the refuge would be greater than 50-percent full 3 years out of 15 and would never be less than 5-percent full. In a dry cycle, the refuge would be 10 percent, or less, full most years, but never completely dry (Nimick et al. 2011). However, during a wet cycle, intended drying rotations may be delayed by high levels of natural runoff.

Infrastructure

Same as alternative A1.

Water Quality

Initially, Unit 1 would be dried out to reduce the selenium contamination in the sediments to less than 2 µg/g, a level where selenium may be slightly elevated in one or more ecosystem components, but no imminent toxic threat exists (Lemly 1995, 2002). Based on current selenium concentrations in the sediment of Unit 1, and a sediment volatilization rate estimated for Benton Lake (Zhang and Moore 1997), the Service estimates at least 8 years of drying to reduce selenium in Unit 1 to an average of less than 2 µg/g. During this time, natural runoff and pumped water would enter into Unit 2 (via the old Lake Creek channel in Unit 1), which would now accumulate selenium at a higher rate (Zhang Moore 1997). If using the old Lake Creek channel is not successful, a diversion channel may be constructed. If the next 15 years are dry, alternating every 2 years between Units 1 and 2, after the initial 8 years of drying, may keep selenium contamination at an acceptable level. Conversely, in a wet cycle, with increased natural runoff, the selenium levels in Unit 2 would rise more quickly during the drying of Unit 1, and it may not be possible to keep both units below the 2 µg/g threshold. However, if reductions in inputs could be achieved through work in the Lake Creek watershed described under Partnerships for Conservation, this concern could be reduced.

In Units 3-6 have lower starting concentrations of selenium than Units 1 and 2 in the sediment. Rotating short-term dry cycles (3+years), as well as annual drying in July, should keep these units below the toxic threshold.

The potential for improving any contamination from phosphorous, nitrogen and agrichemicals is unknown and would need monitoring.

Wetland Productivity

The overall effect on wetland productivity is uncertain in this alternative. The rotation of short-term dry cycles across units will increase the variability in flooding and drying that stimulates productivity (Frederickson and Reid 1995). However, the annual variation will not be the same as historic flooding and drying cycles. Productivity, for example in invertebrates, would likely be reduced because these species may not be adapted to these short term flooding and drying cycles (Magee et al. 1999). This alternative is not a self-sustaining system and would need significant management action intervention to stimulate diversity of plant and animal communities and improve productivity (Euliss et al. 2008).

Although a dry cycle would be implemented at the scale of an individual impoundment, the effects of long-term (10-20 year) wet and dry cycles at the scale of the entire refuge and the landscape would not be emulated with management. Long-term cycles at the refuge and landscape scale stimulate cycles of invertebrate communities, plant communities, and mammalian predators that create complex interactions that are not emulated by managing at the individual impoundment level. For example, some invertebrates are able to exploit newly flooded wetlands because they hold over in dry wetland sediments. This creates a window of opportunity to be very productive before other invertebrates, that must find the wetland by flying from distant wetlands, arrive and compete for resources. After an extended dry cycle, with few if any nearby flooded wetlands, this could take some time. In this alternative, this early window will not exist because newly flooded units will be immediately invaded from an adjacent flooded unit (Murkin and Ross 1999). Similarly, landscape-wide dry cycles that historically reduced communities of predators that prey on nesting birds will not occur under this alternative because Benton Lake will always have water somewhere that attracts prey for these predators (for example, Krapu et al. 2004).

Wetland Vegetation

Introducing at least a 3-year drying cycle rotation is expected to increase wetland vegetation diversity across the wetland basin. As units dry, monotypic stands of emergent vegetation, such as alkali bulrush, cattails and Garrison creeping foxtail, would die and give way to drier, terrestrial vegetation. How quickly this happens would likely depend on weather, the existing seedbank, any potential subirrigation from neighboring units and more management actions such as prescribed fire or discing. This may also create newly exposed mudflats that could provide opportunities for nonnatives such as Canada thistle to become established.

Once a unit is reflooded, it would transition from flooded grasses and annual forbs, to more open water as these plants die, to eventual reestablishment of alkali bulrush, cattails and possibly, Garrison creeping foxtail. During the flooding phase, these plants would likely continue to expand and reform dense, monotypic stands, as in alternative A1. In addition, in units that are not immediately dried, the emergent vegetation would continue to expand, as well as the nonnative Garrison creeping foxtail. A more aggressive drying rotation could be implemented by having more units in the dry cycle and fewer in the wet cycle. This would start reducing the emergent vegetation and reset the vegetation cycle (described above) on more of the refuge. Conversely, a wet cycle, with significant flooding, may create wetlands with large open areas where current vegetation is drowned out (van der Valk 1981, Murkin et al. 1997, Heitmeyer et al. 2009).

Water Resources

Same as alternative A1.

Visitor Services

A variety of visitor services opportunities would occur, with wildlife observation the dominant use. Overall visits for wildlife observation and hunting may increase slightly compared to alternative A1 due to improvement within individual units from management efforts to emulate natural processes such as drying. Some restrictions in the availability of use may occur due to rotation of units through variety of management prescriptions. The quality of visitor use experiences may improve as habitat quality improves based on the management prescriptions.

Hunting

Overall hunter numbers are expected to remain stable with slight increases (approximately 10 percent) possible, and the quality of the experience is expected to improve. The long-term trend at Benton Lake has been an overall decline in hunter numbers; however, the Service expects stable numbers with perhaps a modest increase from alternative A1.

A decrease in waterfowl hunters in individual units exposed to drying is expected. Units may be dry between 3 and 4 years eliminating waterfowl hunting opportunity during the treatment phase. This loss of opportunity is expected to be compensated by an increase in open water available to hunters in other units already receiving prescriptive management. Annually, waterfowl hunting visits are projected to be 330 visits per year, with approximately 4,950 waterfowl hunting visits expected over the life of the plan.

The short-term dry cycles are expected to improve habitat conditions of wetlands, which in turn, may improve the overall quality of hunting for waterfowl hunters over alternative A1. Available open-water habitat is expected to increase and improve over time. Over time, management actions are expected to reduce the Garrison creeping foxtail, alkali bulrush, and cattail stands. Solidification of the wetland sediments is expected to improve access for waterfowl hunters in the hunt units. Prescriptive habitat treatments are expected to improve habitat and in turn increase the availability of waterfowl, improving the hunting experience. These benefits are greatest in the years immediately following drying, prescriptive treatment, and flooding and would eventually diminish over time with subsequent stable water management.

The individual wetland unit would be the focus of restoration efforts. In addition, due to the rotational system some units would not receive treatment until toward the end of the 15-year planning process. In turn, these improvements in habitat that are linked to hunting experience may not occur immediately and be spread across the latter half of the planning process (years 8–15). Units experiencing treatment are expected to improve more rapidly. If habitat objectives are not met, more drying would be implemented throughout the units, which may reduce the availability of fall water for hunting waterfowl.

To administer a rotational system would require shifting the available hunting units. This could lead to confusion by hunters, especially if these changes occur on an annual basis. This may require hunters to annually refresh themselves on the rules and regulations associated with hunting on the refuge. This would take greater effort from refuge staff as well to clearly communicate the changes and expectations of refuge hunters through open houses and other outreach efforts. Although unlikely, the rotational system may contribute to access challenges for hunters based on closed area restrictions.

An increase in upland gamebird hunter visits due to the expansion of available habitat is expected. The annual upland hunting visits is estimated to be 83 visits and over the life of the plan 1,245 upland gamebird-hunting visits is expected.

Total estimated annual hunting visits for waterfowl and upland gamebird is 413 visits and 6,195 visits over the life of the plan. This is a 10-percent increase over alternative A1, which is the highest expected hunting visits of any of the alternatives.

Wildlife Observation and Photography

Same as alternative A1, plus the improvements in habitat would be expected to result in healthier wildlife populations than alternative A1, which would include greater diversity of species and more opportunity for wildlife observation and photography.

The auto tour route, and the opening of other interior roads (after July 15), may vary due to rotation and changes in the closed area. By changing water management within the units, waterbirds may become less habituated to traffic and therefore may be more disrupted with bicyclists or hikers passing by or stopping to observe. Visitors may have difficulty telling which roads are open and which are closed on a yearly basis. Maintenance of roads would cost more and would need to be conducted more frequently if use increases.

Environmental Education and Interpretation

Same as alternative A1, plus opportunities for wetland based interpretation and education would still exist although potentially in different locations. Under alternative A1, Unit 2 has been used by the GFPS as the location for the segment of the third grade visits that deals with wetlands. Under this alternative, Unit 2 may be dry. If this occurs, the onsite sampling location could easily be moved to another location within the wetland basin.

Staff and Funding

Expenses associated with pumping would be the same as alternative A1, plus this alternative would need increases in money and staff to support the intense prescriptive management and rotational dry cycle per unit. Staff increases to accomplish this alternative include: a large part of the supervisory biologist assigned to the complex to supervise biological activities associated with the refuge and help the deputy complex manager manage the water movement, record, and produce annual water use reports, support and run the pump station; 1.0 FTE biological technician and two 0.8-FTE seasonal biological technicians to watch selenium, botulism, vegetation, nest success, and bird use; and 1.0 FTE maintenance worker to help manage, support the pump house and infrastructure and conduct some of the prescriptive management treatments. In addition, the addition of full time law enforcement officer assigned to the complex would provide approximately 25 percent of their time helping with issues on the refuge.

Over the life of the plan, the total expenses for operations and maintenance, pumping, monitoring, and prescriptive habitat management are estimated to range from $2,641,000 to $2,829,000.

Operations and maintenance expenses are estimated to be similar to alternative A1 ($825,000 over the life of the plan).

Pumping expenses can vary due to how much natural runoff is received and how much pumping is necessary. Due to this variability estimates were calculated on whether a wet cycle is encountered or a dry cycle. Pumping could range between $991,000 to $1,048,000 over the life of the plan, a slight increase from alternative A1.

Ensuring that results toward meeting selenium, vegetation, and wetland health objectives are occurring, would require significant monitoring efforts

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Students from Centerville, Montana, identify birds at the visitor center at Benton Lake National Wildlife Refuge.

over alternative A1. Monitoring costs are estimated to be $45,000 per year totaling $675,000 over the life of the plan.

Prescriptive management (such as discing, grazing, prescribed fire, or mowing) will predominately be accomplished in-house through Maintenance Action Teams or staff. The costs are expected to vary based on seasonal conditions from $150,000-$281,000 over the life of the plan.

Redirecting permanent staff from other units within the refuge complex would be necessary to help meet the pumping, operations and maintenance, monitoring, and habitat treatment expenditures. If pumping costs continue to raise this would need an added proportion of staff time and discretionary money to cover the expenditure or reduction in the amount of pumped acre-feet of water.

Monitoring refuge-wide nest success as part of the predator-trapping effort would need a substantial increase in staff time compared to alternative A1. Past nest success monitoring conducted on the refuge required at least 3 staff people for 2 months. In addition, preplanning, data entry, analysis and summary would need another month of the biologist's time. Added cost for equipment would likely be less than $1,000 per year.

One-time costs associated with this alternative include diversion channel. The structure has been suggested as a possible enhancement of water movement by diverting water from Units 1 and 2. Costs for constructing the channel were estimated at $100,000 in 2005.

Resource Protection

Law enforcement patrols commitments would be increased to make sure users understand changes in visitor access necessary to accommodate efforts to improve habitat. Preventative law enforcement efforts such as signing, news releases, informational open houses and notice posting would be increased over alternative A1 to help reduce confusion and increase compliance of visitors to refuge rules and regulations.

7.15 Consequences of Alternative B2

Initial dry period and application of intensive prescriptive habitat treatment basin-wide is expected to improve the health and sustainability of the wetland basin and reduce selenium contaminant levels, control nonnative vegetation, and stimulate productivity. This alternative will provide will provide for a wide suite of migratory bird species (shorebirds, waterfowl, and grassland birds) over the life of the plan, and if pumping is resumed, migration and breeding habitat for wetland-dependent wildlife would occur more frequently than under a natural hydro-period. Compared to alternative B1, selenium input into the wetland is expected to be reduced at least 15-20 percent and removal of accumulated selenium will increase. A reduction in the toxic hazard to wildlife is expected. Short-term improvements in wetland health with long-term sustainability improved over alternatives A1 and B1, but it is not expected to be self-sustainable. Improvement in grassland habitats expected from conversion up to 207 acres of tame grass and removal up to 3.5 miles of shelterbelt habitat. The ability to absorb perturbations in the system is expected to improve over alternative B1 due to initial dry period, but is not self-sustainable once flooding resumes Over the life of the plan, wildlife-dependent recreation is estimated to be similar to alternative A1 for fishing visits; wildlife observation and photography visits; and interpretation and environmental education programming visits. Over the life of the plan, hunting visits are expected to decrease 15 percent over alternative A1. Over the life of the plan, the total cost to carry out wetland basin management (operations and maintenance, pumping, monitoring, and prescriptive habitat treatment) is estimated to range from $1,816,000 to $2,263,000. One-time implementation costs for grassland restoration are expected to total $36,000. Staffing to carry out the alternative are the same as alternative B1.

Grasslands

Native Grasslands

During the initial, basin-wide drying period, more complex resources would be available to protect and manage grasslands as described for alternative C1. If pumping is reintroduced, intensive management would resume and effects would be the same as alternative B1.

Tame Grasslands

During the initial, basin-wide drying period, up to 207 acres of degraded tame grass stands would be planted back to native grass species where proper and feasible. This would be followed with prescribed fire and grazing management to emulate historical processes and gradually recover soil mycorrhizae, invertebrate diversity and symbiotic relationships.

The associated nutrient cycles would be largely improved in comparison to mining the soil nutrients through rotational haying systems used to manage tame grass. Once native grass species are reestablished, soil erosion potential should be negligible, with permanent plant cover breaking the cropping cycle of tame grass. Carbon sequestration and nutrient cycling would be significantly greater in a more floristically diverse community.

Nonnative Tree Plantings

The strategic removal of 3.5 miles of nonnative tree plantings on the refuge would restore contiguous grassland habitat and reduce negative effects of fragmentation, predation and parasitism to grassland-dependent migratory birds (Bakker 2003). 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 65 and 750 acres of grassland habitat would become available or more desirable to grassland species by removing these trees (Bakker 2003). The highest priority plantings for removal are those that bisect large tracts of native prairie.

There may be a decrease in the diversity of migratory and resident bird species that depend on planted tree habitats. However, there would still be 15.5 miles of nonnative tree plantings on the refuge in addition to other nearby habitats, including the Missouri River riparian areas and neighboring agricultural tree plantings.

Wetlands and Riparian Areas

Water Quantity and Timing

The refuge would stop pumping for an initial period (approximately 8 years). During this time, all wetland units would only receive natural run-off. Once wetland objectives are met, pumping may be phased back in slowly with careful monitoring (with a rotational system similar to alternative B1). Long-term and recent weather patterns suggest the next 15 years are likely to be a wet cycle, so the success of this approach is highly uncertain. To be successful in this alternative, the period of not pumping will need to coincide with a natural dry cycle which may not occur during the initial years of this plan.

Infrastructure

Same as alternative A1.

Water Quality

As described in alternative B1, Unit 1 is estimated to take at least 8 years of drying to reduce selenium in the sediment to levels where flooding with pumped water could be reintroduced. Since both Units 1 and 2 will be drying simultaneously in this alternative, the selenium levels in both units will be decreasing during the initial drying period, which will make it easier to keep the units below toxic thresholds if pumping is reintroduced. The initial drying phase will also reduce selenium inputs over the life of the plan by 15-20 percent compared to alternative B1. The initial drying phase, with the associated reduction in resources needed to manage water, would also provide an opportunity to work more intensely in the Muddy Creek and Lake Creek watersheds to reduce selenium inputs. This may make pumping more sustainable if it is reintroduced and reduce some of the negative effects of altering the natural hydrology described for alternative B1.

Wetland Productivity

Following the initial, basin-wide drying period, the wetland productivity should improve as described for alternative C1. If pumping is reintroduced, intensive monitoring would be needed to support improvements and prevent or reduce negative effects of altering the natural hydrology described for alternatives A and B1.

Wetland Vegetation

During the initial, basin-wide drying period, a reduction in monotypic stands of emergent vegetation such as cattail and alkali bulrush would be expected. In addition, Garrison creeping foxtail may decline more rapidly than alternative B1 because there will not be the potential of subirrigation from adjacent flooded units and the seedbank will be decreasing across the whole basin. If pumping is reintroduced, intensive monitoring would be needed to support improvements and prevent or reduce negative effects of altering the natural hydrology described for alternatives A and B1.

Water Resources

Same as alternative C1. Water rights should be preserved as long as pumping occurs within an 8-year time period (USFWS Solicitor). However, if objectives are not met and more drying is necessary, this may risk the Muddy Creek rights if challenged by other users. No changes or risk of loss is expected for Lake Creek water rights for they would be exercised throughout the life of the plan by capturing natural run-off.

Visitor Services

A variety of wildlife-dependent recreational opportunities would be available. There would be an initial drying period until habitat objectives are met, with subsequent flooding on a regular basis as long as habitat objectives were supported. This would result in a mixture of effects on visitor services by reflecting a drying period similar to alternative C1 and a flooding regime similar to alternative B1.

Hunting

An increase in the number of waterfowl hunting visits is expected over alternatives C1 and C2 and a decrease from alternatives A1 and B1. The exact amount of time needed for drying is uncertain, and the exact number of years of pumping is not known. For these estimates, the Service assumed there would be nearly an even split between the number of years of pumping and drying. However, long-term hydrographs suggest we are currently in year 2 of a potential 5-year wet cycle, and it is likely that it would not be possible to begin a dry period for 3–5 years.

If pumping is reinstated, waterfowl hunting annually visits could be as much as alternative B1 with an average 330 visits per year. During nonpumping years, the projected average annual use of 120 visits per year should be similar to alternatives C1 and C2. If the Service assumes 8 years of dry and 7 years of pumping, the number of waterfowl-hunting visits over the life of the plan is estimated to be up to 3,375 visits.

The improvements in habitat condition are expected to improve waterfowl hunting experience similar to alternative B1; plus these improvements will be significant especially during the waterfowl hunting season following an extended dry period.

Improvements in the grasslands habitats may occur, but are not expected until the later years of the plan (years 10–15). Improvement to grasslands includes the planned conversion of 207 acres of tame grassland to native prairie and the removal of interiorly placed shelterbelts (3.5 miles). This may negatively affect some of the nonnative upland game species (pheasants and Hungarian partridges) and to a lesser extent native sharp-tailed grouse that are accustomed to using nonnative grasslands and shelterbelts for shelter and food. This reduction in usage of upland gamebirds may affect upland hunters.

During the dry period, more habitat would be available to hunt upland gamebirds. In addition, the upland gamebird hunting season will be expanded, which would provide more hunting opportunities. This is expected to result in an increase in upland gamebird visits. Upland gamebird-hunting visits have been estimated by averaging alternatives B1 and alternative C1, which totals 1,380 visits over the life of the plan. This exceeds upland game hunting visits for alternatives A1 and B1 and is less than alternatives C1 and C2.

Total hunting visits on a yearly basis is estimated to be 317 visits per year and 4,755 visits over the life of the plan. This is a 15-percent decrease from alternative A1.

Wildlife Observation and Photography

Same as alternative B1, plus during the reset dry period, the ability to observe certain water-dependent wildlife would be more variable. Water modeling suggests that there would be water on the refuge in March–May in 22 years out of 30. This means that there would continue to be an opportunity to see water-dependent wildlife most years, although in some years it may be limited to migrating, as opposed to breeding birds. Refuge staff are committed to continuing to provide wildlife observation opportunities and are interested in hearing ideas from the public on ways that the upland wildlife viewing could be expanded. While grassland birds can be more challenging to observe, they are a group of birds of high conservation concern due to their continental population declines, and the refuge would like to increase education and awareness of these species.

Environmental Education and Interpretation

Same as alternative A1, plus an emphasis on interpretation and education relating to the restoration efforts to meet habitat objectives and wetland health and productivity would begin.

Staff and Funding

Staff necessary to accomplish this alternative would be the same as alternative B1; however, slight shifts in proportion of staff time spent on the refuge versus other complex units are expected to change slightly. This includes reduction of time by supervisory biologist, wetland district manager, wildlife refuge specialist, and an increase in time by the complex's Assistant Fire Management Officer to conduct more prescribe fires.

Over the life of the plan, the total expenses for operations and maintenance, pumping, monitoring, and prescriptive habitat management are estimated to range from $1,816,000 to $2,263,000. This is less than alternative B1 and slightly higher than alternative A1. Operations and maintenance costs would vary from nonpumping years ($5,000 per year) to pumping years ($55,000 per year). Operations and maintenance costs for the life of the plan are estimated to total $425,000, which is less than alternatives A1 and B1. Pumping would not occur during the initial drying phase (8 plus years), but would resume if habitat objectives are met and supported. Pumping expenses are estimated to occur annually once the initial drying period resets the system. Pumping costs across the life of the plan are estimated to range from $434,000 to–$729,000, depending on how much natural runoff is received.

Monitoring would be a significant expense and is estimated to be the same as alternative B1. Intense monitoring during the initial drying period and annually, if pumping is resumed, would be necessary to make sure habitat objectives are being met. Monitoring expenses are estimated to total $45,000 per year and $675,000 for the life of the plan.

During the initial drying period, all units would be undergoing rapid prescriptive habitat treatment; this exceeds management expenditures compared to all other alternatives. It is expected to require not only in-house staffing to accomplish, but contracted help as well. This very intensive treatment is expected to set back the accumulated negative effects that the lack of drying has caused from the last 50 years of repetitive water level management. Management treatments are estimated to total $282,000 to$434,000 depending on the natural runoff.

Added one-time costs associated with this alternative include: shelterbelt restoration of 3.5 miles and up to 207 acres of tame grass conversion to native species. Forestry cutters are available within Region 6 and maybe reserved in advance for specific projects; such as shelterbelt restoration. The tree removal work could be accomplished by existing staff in the fall and winter months. Costs to remove 3.5 miles of planted trees would be approximately $1,000 and include: fuel, maintenance of the equipment (replacing teeth and fluids, repairing breakdowns, and herbicide treatment for two growing seasons, and grass reseeding. The conversion of up to 207 acres of tame grass is estimated to cost $35,000. This would be completed over multiple years. These projects are expected to be completed during the extended drying period.

Resource Protection

Same as for alternative B.

7.16 Consequences of Alternative C1 (Proposed Action)

The long-term sustainability of the whole refuge will be restored which will help a wide suite of migratory bird species (waterfowl, shorebirds, and grassland birds) over the life of the plan. Compared to alternative A1, selenium input into the wetland is expected to be reduced at least 40 percent and removal of accumulated selenium will be maximized. A reduction in the toxic hazard to wildlife is expected. Restoring the full extent of the dry cycle improves the wetland health with long-term sustainability over alternatives A1, B1, and B2, and is expected to be self-sustainable. Improvement in grassland habitats expected from conversion up to 728 acres of tame grass and removal up to 19 miles of shelterbelt habitat. The ability of wetlands and grasslands to absorb perturbations in the system is expected to greatly improve over alternatives A1, B1 and B2 since resistance and resiliency is strengthened from the restoration of natural processes. Over the life of the plan, wildlife-dependent recreation is estimated to be similar to alternative A1 for fishing visits with an increase of 25 percent for wildlife observation and photography visits and interpretation and environmental education programming visits. Over the life of the plan, hunting visits are expected to decrease 41 percent over alternative A1. Over the life of the plan, the total cost to carry out wetland basin management (operations and maintenance, pumping, monitoring, and prescriptive habitat treatment) is estimated to range from $809,000 to $941,000. One-time implementation costs for grassland restoration are expected to total $118,500. Restoration of the wetland basin could range from $0 to $4,000,000 if complete removal of water management infrastructure is necessary. Compared to alternative A1, an increase of a term biological technician and seasonal biological technician dedicated to the refuge and a proportion of supervisory wildlife biologist, generalist, law enforcement officer, and park ranger assigned to the complex are necessary to carry out this alternative.

Grasslands

Same as alternative B2 during the initial drying phase, plus more resources would be available to manage and improve the quality of native prairie in the uplands. In addition, more acres of tame grass (up to 728) are likely to be replanted to native prairie and the associated benefits, as described under alternative B2, realized on more acres.

Approximately half of the refuge is native, mixed-grass prairie. While some areas have been invaded by nonnative grasses such as crested wheatgrass, Japanese brome and cheatgrass, it remains a major block of nearly 6,000 acres of native grassland habitat in a larger landscape where most of this valuable resource has been lost.

The refuge has tremendous value to grassland birds, the group of birds that have experienced the most severe population declines in recent history. For example, chestnut-collared longspurs and grasshopper sparrows are abundant and the Sprague's pipit, which is a candidate for listing under the ESA, regularly occurs on the refuge. The refuge sharp-tailed grouse viewing blind is extremely popular with the public. Even in dry years, the refuge would have value to wildlife and meet its purpose as a refuge and breeding ground for birds.

The removal of the nonnative tree plantings (up to 19 miles) established in native grasslands would occur. This would have the same effects as described for alternative B2, plus the most acreage of grassland habitat would become available or more desirable to grassland bird species by removing the trees (Bakker 2003). Up to 18 species of migratory birds that nest primarily in trees and shrubs may no longer nest on the refuge. However, there are many tree plantings that surround the refuge and 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 cost to remove all nonnative tree plantings would increase over those described in alternative B2 to approximately $3,500 and 40 days of staff time.

Wetlands and Riparian Areas

Water Quantity and Timing

The hydrology of the basin would be restored with flooding and drying cycles decided by natural runoff. In a wet cycle, the wetland basin would be greater than 50-percent full 3 years and could be dry 7 years out of 15. In a dry cycle, the refuge would be dry most years (Nimick et al. 2011). Historical records over the last century show that the refuge went through wet periods in the early 1920s, late 1930s, late 1950s, mid-1970s and early 1990s, or about every 10–20 years, with dry periods inbetween (Heitmeyer et al. 2009). Precipitation and runoff have increased in the last 2 years, which may be suggesting that over the initial 3–8 years of this plan, it may be a wet cycle.

Infrastructure

The Service would use an adaptive management approach to removing the wetland infrastructure.

Jeff Van Tine

A long-billed curlew with a wide-prairie view on the refuge complex.

Refuge staff would start with the smallest modifications necessary and only proceed to full removal if it is necessary because monitoring results show that sufficient progress is not being made toward the refuge objectives. By just restoring the natural hydrology, and decreasing the frequency and duration of flooding, subsurface and surface moisture gradients would be improved (Euliss et al. 2008). Unless infrastructure is modified; however, it may prevent full restoration of these gradients that directly influence vegetative and macro invertebrate distribution within the wetland basin.

Modifications may also be necessary to restore natural waterflow patterns into and through Benton Lake and wind- and water-related soil erosion and deposition patterns (Heitmeyer et al. 2009). For example, to restore the benefits of sheet flow that quickly moves across a wetland basin shallowly flooding the greatest area and warming quickly to make invertebrates, in particular, available to many birds, some or all of the ditches in the wetland may need to be filled. The dikes and ditches also create sediment traps altering the soil chemistry and microbial processes that support wetland function, can drive the system toward eutrophy, may prevent the scouring of sediment and transportation of mineralized nutrients as well as favor anoxia and inhibit the release of nutrients that may not be corrected for by just restoring the hydrology (Jarworski and Raphael 1978, Brix 1993, Euliss et al. 2008).

Water Quality

The restoration of Units 1 and 2 to wet meadow wetlands would almost completely preclude future selenium loading in this area as most water would be in Lake Creek and only occasionally overflow across the old units. However, selenium that has accumulated in sediment is not readily removed through volatization and can take several years (Zhang and Moore 1997). Added management actions, such as prescribed fire, may help (Zhang and Moore 1997).

The primary way to decrease selenium accumulation at Benton Lake is to decrease inputs (Zhang and Moore 1997). By ceasing pumping, the refuge would realize an automatic 40-percent decrease in selenium inputs over the long term and as much as a 75-percent decrease during dry years (Nimick et al. 1996) at no cost. Furthermore, the area where Lake Creek would again enter the refuge, and selenium deposition would expected to be highest, would be one of the first areas to dry out as waters recede. With reduced inputs and increased drying, the refuge would reach an equilibrium below the 2 µg/g threshold. Pre-1961 selenium levels were only 0.2–0.3 µg/g in Unit 3, even though crop–fallow agriculture had been widespread in the watershed for more than 40 years (Zhang and Moore 1997, Heitmeyer et al. 2009). In 1994, levels had only increased to 0.4–0.5 µg/g, which suggests that returning to a pre-1961 hydrological cycle (no pumping) should support selenium levels below toxic thresholds. Again, prescribed fire to support wetland vegetation health, may also help keep selenium levels low in the restored inlet area. However, intensive wetland management methods would not be necessary to reduce selenium.

Wetland Productivity

Overall wetland productivity would improve over alternatives A, B1 and B2, especially during wet cycles, but it will be more variable over time. Restoring the full variability in the wet–dry cycle should have a positive effect on ecosystem processes and increase nutrient cycling (Gosselink and Turner 1978, Mistsch and Gosselink 2007, Malson et al. 2008, Euliss et al. 2008). As wetland restoration progresses, wetland productivity in the Benton Lake ecosystem would likely follow long-term dynamics of production in other northern prairie systems as vegetation, invertebrate, and nutrient cycling changes when wetlands dry, reflood, reach peak flooding extent, and then begin drying again (for example, Murkin et al. 2000, Anteau 2012).

Dry conditions would be recurring and often last for several years in a 10 to 20 year cycle. During this time, the area of wetland vegetation and the vigor of wetland plants would be reduced while the extent of terrestrial plants would expand. Wetland-dependent species richness would be low for this period, but upland species would likely move into the basin and use grassland habitat. Once drought conditions are broken, the basin may flood rapidly when sufficient precipitation or spring runoff occurs. When a wetland refloods after a dry period, there is a pulse of nutrients that stimulates productivity in invertebrates, and some plants, which provides important food resources for waterfowl, shorebirds and other wetland-dependent wildlife (Magee 1995, Anteau 2012). These wet periods may occur for 1 to 3-plus years in the 10 to 20 year cycle (Heitmeyer et al. 2009). As precipitation declines, water levels would decline from evaporation, and vegetation would shift from wetland to a more terrestrial phase.

Restoring annual and long-term variability in the wetland basin would increase plant and animal diversity over the long term while providing optimal conditions for different suites of species at different times. Single species would be less likely to become dominant or the extent or length of monotypic conditions would be reduced (Euliss et al. 2008). Densities of certain species of macroinvertebrates may decline; however, species diversity should increase

(Collinson et al. 1995). For example, invertebrates that need a dry period during winter would be able to complete their life cycle and provide important food for avian spring migrants and breeders (Schneider 1999, Murkin and Ross 1999, Anderson and Smith 2000). This increase in variability and diversity should increase long-term sustainability (Peterson et al. 1998, Euliss et al. 2008).

The flooding and drying cycles would be synchronized at the refuge and the landscape scales. Long-term cycling at the refuge and landscape scale stimulate invertebrate communities, plant communities, and mammalian predators that create complex interactions that are not emulated by managing at the individual impoundment level (Schneider 1999, Murkin and Ross 1999, Krapu et al. 2004, Anteau 2012). The potential for reductions in wetland-dependent invasive species and mammalian predators during drought cycles would be greater than in alternatives A, B1 and B2.

Wetland Vegetation

Over the life of the plan, the precise distribution of wetland vegetation species groups would vary over time as surface water coverage and depth change with wet and dry cycles (for example, van der Valk and Davis 1978, van der Valk 1989). In general, a reduction in the coverage of robust, emergent vegetation such as cattail and alkali bulrush would be expected. Extended drying would be expected reduce Garrison creeping foxtail as well, but the duration and extent of these reductions is less certain. This vegetation would be replaced with wetland species adapted to more seasonal and temporary flooding cycles such as occurred historically on the refuge (see section 7.10).

The lowest elevations in the Benton Lake basin (about 73 acres) would contain some surface water throughout most years and supported open-water aquatic plant communities surrounded by concentric bands of robust emergent vegetation including cattail and hardstem bulrush. The width of this emergent vegetation band would vary depending on the extent and duration of flooding and chronological position of the long-term hydrological cycle. Submergent aquatic plants such as pondweeds, naiads, coontail, wigeon grass, and milfoil may be present in the deepest open areas along with rich algal blooms.

Semipermanently flooded sites that are slightly higher in elevation, next to cattail and bulrush zones, would support diverse sedge and rush species. These sedge–rush communities include diverse herbaceous wetland plants including alkali bulrush, three-square rush, Nuttall's alkaligrass, beaked sedge, Nebraska sedge, and water smartweed. This sedge–rush community may expand during wet periods to even higher elevation edges of the basin and then contract to lower elevations during extended dry periods. The periodic flooding and drying of these vegetation zones could cause moderate alkaline soil conditions.

Seasonally flooded areas would likely contain diverse annual and perennial herbaceous plants and wet-prairie meadow grasses such as spikerush, lambsquarter, annual smartweeds, prairie cordgrass, and saltgrass. Spikerush would be expected in relatively narrow bands along yearly flooded stream and tributary sites and the margins of the lake. Whereas, saltgrass would be common in more saline or alkali sites including areas where seeps flow into Benton Lake and in some overflow areas next to Lake Creek.

The highest elevation edges of Benton Lake would have short duration seasonal flooding regimes in the transition zone from wetland to upland grassland plant communities. Foxtail barley would occur on the higher, annually drawn down, margins of the lake basin and in some ephemeral depressions. Foxtail barley would likely gradually grade to western wheatgrass on terraces next to the lake.

If restoring the hydrology is not sufficient to achieve the expected vegetation communities, infrastructure will be modified or removed to facilitate this process.

Water Resources

The Service's solicitor suggested that the water rights for Muddy Creek will be kept by pumping the minimum amount required. This is expected to be at least once every 8 years. However, no indications of interest in the Service's right from other water users has occurred. The water right for Lake Creek would be supported.

Visitor Services

Opportunities to inform the public about restoration efforts would be featured in educational and interpretive programming. Outreach efforts with the community would increase due to the establishment of a position to address visitor services programming. Wildlife-dependent recreation for wetland species would be tied to natural runoff events. A decrease in late summer and fall standing water is expected to affect some recreational user groups.

Hunting

The availability of water for waterfowl hunting would depend on natural runoff. The water budget model developed by refuge staff and USGS to assess effects on changes in water management on the refuge (Nimick et al. 2011) is based on 30 years of data collection. Under the assumption that the next 30 years would be similar to the last 30 years, inferences about water conditions during waterfowl season (fall) can be extrapolated. Conservatively, the model suggests that for the life of the plan (15 years), 3–5 years should result in fall water exceeding 2,127 acres (greater than 50 percent of the managed wetland basin), 3 years of fall water levels varying from at least 0–97 acres of water, and 8 years of no water. Historical hydrographs suggest that wet cycles occur over a 5-year window. These wet cycles saturate the soils and result in portions of the wetland basin containing surface water year-round.

For the past 2 years, the refuge has experienced runoff characteristic of a wet cycle. It is expected that the next 2–3 years would also be wet in the fall with a gradual reduction in surface water in the basin for the next 5 years. During these wet years, hunter use has been documented to double over earlier levels (alternative A1). Approximately 600 visits annually during a wet cycle, can be expected for about 3 years. During 4 years of less than 97 acres of water, the ability to provide a waterfowl hunt will be evaluated on an annual basis. During the dry cycle (8 years), no waterfowl hunting is expected to occur. This would result in an estimated 1,800 waterfowl hunter use-days for the life of the plan. This is a 60-percent reduction in use compared to alternative A1; a 64-percent reduction in use compared to alternative B1; a 47-percent reduction in use compared to alternative B2; and similar use for alternative C2.

Waterfowl hunting experience is expected to be similar to the experiences currently occurring on the waterfowl production areas. In addition to the presence of water, waterfowl hunting experience is also influenced by the quality of the hunt based on bird availability and habitat condition. Improvements in habitat conditions would occur throughout the basin, which would provide open water, solidified sediment, vegetative diversity, increased forage and seed availability, and resulting increase in bird use.

Upland gamebird-hunting visits per year would increase over alternatives A1, B1, and B2 due to extending the refuge season to corresponded with the State designated season, increase in upland gamebird habitat during dry years, and promotion of upland hunting opportunities by the visitor services program during dry years. When the wetland basin is dry, a greater proportion of the refuge is available for upland gamebird habitat compared to alternatives A1 and B1.

Improvements in the grasslands habitats are expected to occur. Improvement to grasslands would involve the planned conversion of up to 728 acres of tame grassland to native prairie and the removal of shelterbelts (19 miles). This may negatively affect some of the nonnative upland gamebird species (pheasants and Hungarian partridges), and to a lesser extent native sharp-tailed grouse, that are accustomed to using nonnative grasslands and shelterbelts for shelter and food. This reduction in usage of nonnative habitats may affect upland gamebird hunting; however, the increase in hunting area and extended late season opportunities are expected to offset the effect of grassland restoration efforts.

Under this alternative, 1,500 upland gamebird hunter visits are expected over the life of the plan which is greater than alternatives A1, B1, and B2.) The expectation of 100 visits per year is not unrealistic, and actual usage may exceed this estimate as well. Upland gamebird hunter use is expected to be same as alternative C2.

Decisions would be made on a year-by-year basis about the location of open and closed areas for waterfowl hunting. Changes in the hunting area could lead to confusion for hunters and require increased awareness of regulations. An increase in communication efforts by staff to provide annual information and post hunt area would be necessary. In addition, modifications occurring to infrastructure such as dikes and ditches may create access challenges for hunters. All attempts would be made by refuge staff to reduce access issues whenever possible.

Total hunting visits over the life of the plan are expected to be the same as alternative C2 (3,300 vis-


Neal Mischler

Yellow-bellied marmot.

its), 47-percent less than alternative B1, 41-percent less than alternative A1, and 31-percent less than alternative B2.

Wildlife Observation and Photography

The ability to observe certain water-dependent wildlife would be more variable. Water modeling suggests that there would be water on the refuge during March–May in 22 years out of 30. This means that there would continue to be an opportunity to see water-dependent wildlife most years, although in some years it may be limited to migrating, as opposed to breeding birds. Refuge staff would expand upland wildlife observation opportunities. While grassland birds can be more challenging to observe, they are a group of birds of high conservation concern due to their continental population declines, and the refuge would like to increase education and awareness of these species.

The hiring of a park ranger to address visitor services issues would increase awareness of the refuge and wildlife observation and photography opportunities, restoration activities, ecological functions of wetlands, unique attributes of native prairies, and perils of grassland-dependent bird species. This increased exposure is estimated to increase visitation to the refuge 25 percent over alternative A1 for a total of approximately 143,440 visits over the life of the plan.

Modifications to the Prairie Marsh Drive and Lower Marsh Road auto tour routes may occur due to restoration efforts. More nature trails are expected to offset any visitation losses that could occur from the modifications.

The habitat restoration efforts would increase the health and vigor of wetland and grassland habitats resulting in the increase diversity and abundance of wildlife species for wildlife enthusiast to enjoy. Wildlife observation and photography are expected to continue to be the dominant recreational use occurring on the refuge.

Environmental Education and Interpretation

The addition of a park ranger to address visitor services issues on the refuge complex would increase environmental education and interpretive programming an estimated 25 percent over alternative A1, for a total of approximately 33,280 visits over the life of the plan. The focus would include such issues as restoration efforts, appreciation of native prairie habitats, wetland health and productivity. The understanding by the community of the refuge's purpose and importance of conserving management, and restoring healthy functioning ecosystems would be increased. The Service would communication more widely the importance of natural hydroperiods in wetlands. The communities' awareness and appreciation for the refuge and refuge complex would be enhanced beyond alternatives A, B1 and B2.

Staff and Funding

Staff necessary to accomplish this alternative would be the same as alternative B2; plus, slight shifts in the proportion of staff time spent on the refuge versus other complex units are expected to reduce slightly. This includes reduction of time by wetland district manager, wildlife refuge specialist, and maintenance worker. In addition, there would be the reduction of two, 0.8 biological technician positions and a full time maintenance worker. Under alternative C1; 50 percent of a park ranger position would be focused on the refuge while the remaining percentage would be spread across the complex units.

Over the life of the plan, the total expenses for operations and maintenance, pumping, monitoring, and prescriptive habitat management are estimated to range from $809,000 to $941,000. This is less than alternatives A1, B1 and B2 and slightly higher than alternative C2. As the system becomes more self-sustaining, resources would be allocated toward other units in the refuge complex such as conservation areas. Operations and maintenance is closely tied to pumping. Since this alternative includes limited pumping during the life of the plan, operations and maintenance expenses are expected to be extremely low compared to alternatives A1, B1 and B2. During nonpumping years, operations and maintenance expenses are estimated to total $5,000 per year. Operations and maintenance expenses throughout the life of the plan are estimated at $75,000.

Alternative C1 includes extremely limited pumping to support water rights (pumping once every 8 years) or as a habitat management tool. Because it is expected to be used minimally under this alternative, pumping expenses are estimated to be $20,000 over the life of the plan. This is less than alternatives A1, B1, B2, and higher than alternative C2.

During the course of restoration, monitoring the effects of management actions would be critical to figure out the next response as part of the ARM approach. Monitoring to document changes and progress toward meeting objectives for vegetation, selenium, macroinvertebrates, water quality and other factors would be occurring. Monitoring is estimated to cost $45,000 annually for the first 5 years while intensive monitoring evaluates the success of management actions and figures out the next management response. From years 6–15, monitoring is estimated to be reduced to $35,000 each year. Over the life of the plan, monitoring is estimated to total $575,000.

Prescriptive habitat treatment is expected to be reduced and primarily focused on invasive species control, prescribed fire, and grazing. Management treatments would be applied basin-wide to get the full effect of restoration efforts. Prescriptive habitat treatment throughout the life of the plan is estimated to range from $139,000 to $271,000 depending on natural runoff. This is less than alternatives B1 and B2, and same as alternative C2.

One-time costs associated with the alternative include the expenses made toward the restoration of the basin. These are estimated to range from $0 to $4,000,000 if full-restoration is necessary. Restoration efforts could include the removal of dikes, creating low water crossings, recontouring of the wetland basin, removal of riprap, filling of ditches and channels, and reestablishment of the Lake Creek channel. Restoration costs may be less than the entire amount if during the ARM approach it is found that only minor alternations are necessary versus complete removal of structures such as water control structures or dikes.

Added one-time costs associated with this alternative include: shelterbelt restoration of 19 miles and up to 728 acres of tame grass conversion to native species. Costs to remove 19 miles of planted trees would be approximately $3,500 and the conversion of up to 728 acres of tame grass is estimated to cost $115,000. This would be completed over multiple years.

Resource Protection

Due to changes in hunting area, increase patrol presence would be necessary along with preventative law enforcement efforts to reduce hunter confusion and violations.

7.17 Consequences of Alternative C2

The long-term sustainability of the whole refuge will be restored which will help a wide suite of migratory bird species (waterfowl, shorebirds, and grassland birds) over the life of the plan. Compared to alternative A1, selenium input into the wetland is expected to be reduced at least 40 percent and removal of accumulated selenium will exceed all other alternatives. A reduction in the toxic hazard to wildlife is expected. Restoring the full extent of the dry cycle and completely restoring the wetland basin improves the wetland health with long-term sustainability over all other alternatives, and is self-sustainable. Removal of wetland infrastructure would be irreversible and reduce management flexibility permanently. Improvement in grassland habitats expected from conversion up to 728 acres of tame grass and removal up to 19 miles of shelterbelt habitat. The ability of wetlands and grasslands to absorb perturbations in the system is maximized over all other alternatives, since resistance and resiliency is optimized from the restoration of natural processes. Over the life of the plan, wildlife-dependent recreation will be the same as alternative C1. Over the life of the plan, the total cost to carry out wetland basin management (operations and maintenance, pumping, monitoring, and prescriptive habitat treatment) is estimated to range from $601,000 to $733,000. One-time implementation costs for grassland restoration are expected to total $118,500. Restoration of the wetland basin is expected to range from $1,200,000 to $4,000,000 and complete removal of water management infrastructure including the decommissioning of the pump house will be completed within the first half of the life of the plan. Staffing to carry out the alternative are the same as alternative C1, except one less seasonal biological technician.

Grasslands

During the restoration phase, refuge complex resources may be focused on restoration of the Benton Lake basin, which could reduce efforts to manage and protect grasslands. However, after restoration, the effects would be the same as described in alternative C1.

Wetlands and Riparian Areas

Water Quantity and Timing

Same as alternative C1.

Infrastructure

Same as alternative C1, except any potential benefits from removing infrastructure would occur more quickly. Conversely, unnecessary and irreversible changes to the infrastructure could also occur.

Water Quality

Same as alternative C1, except any potential benefits from removing infrastructure would occur more quickly. However, without the infrastructure, the Service loses some management flexibility and possible tools to address unexpected problems.

Wetland Productivity

Same as alternative C1, except any potential benefits from removing infrastructure would occur more quickly. For example, infrastructure can alter moisture gradient diversity which directly influences vegetative and macroinvertebrate distribution within the wetland basin (Euliss et al. 2008). However, without the infrastructure, the Service loses some management flexibility and possible tools to address unexpected problems.

Wetland Vegetation

Same as alternative C1, except any potential benefits from removing infrastructure would occur more quickly. However, without the infrastructure, the Service loses some management flexibility and possible tools to address unexpected problems. For example, if deep flooding will decrease invasive plants more quickly than drying, this will not be a possible tool under this alternative.

Water Resources

The water rights for Muddy Creek could be lost if challenged in court for nonuse. The water right in Lake Creek would be kept.

Visitor Services

Hunting

Same as alternative C1, plus habitat improvements could occur more rapidly and across entire basin at relatively simultaneously improving habitat conditions at a faster pace than alternative C1.

Wildlife Observation and Photography

Same as alternative C1.

Environmental Education and Interpretation

Same as alternative C1.

Staff and Funding

Staff necessary to accomplish this alternative would be the same as alternative C1; plus, a slight shift in proportion of staff time spent on the refuge versus other complex units are expected to reduce slightly for the supervisory biologist. In addition, there would be the reduction of a 0.8 biological technician position.

Over the life of the plan, the total expenses for operations and maintenance, monitoring, and prescriptive habitat management are estimated to range from $601,000 to $733,000. This is less than alternatives A1, B1, B2 and C1. It is the most cost effective alternative. As the system becomes more self-sustaining, resources would be allocated toward other units in the refuge complex such as conservation areas.

Operations and maintenance is closely tied to pumping. Since this alternative does not include pumping, during the life of the plan, operations and maintenance expenses are estimated to be extremely low compared to alternatives A1, B1 and B2 and 50-percent less than C1 as well. Operations and maintenance expenses are estimated to total $5,000 per year, and totaling $37,500 over the life of the plan.

Under this alternative, no pumping will occur.

Monitoring is estimated to cost $35,000 annually for years 1–5 and $25,000 per year for years 6–15 for a total estimated monitoring cost for the life of the plan at $425,000. This is the least amount across the alternatives.

Prescriptive habitat treatments are estimated to be the same as alternative C1, ranging from $139,000 to $271,000.

One-time costs associated with the alternative include the complete restoration efforts. This is expected to occur rapidly within the first 6 years of the plan implementation. This would require an estimated $1,200,000 to $4,000,000 from the onset of plan implementation. Applying money saved from not pumping and the subsequent savings from operations and maintenance could be applied to other priority management actions and programs in the refuge complex like the conservation easement program more quickly than alternative C1.

Added one-time costs associated with this alternative include: shelterbelt restoration of 19 miles and up to 728 acres of tame grass conversion to native species same as alternative C1.

Resource Protection

Same as alternative C1.

7.18 Socioeconomic Environment

Impacts from Refuge Revenue Sharing

Under provisions of 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 (FY10), actual RRS payments were 21 percent of authorized levels. FY10 Benton Lake Refuge RRS payments (made in 2011) were: $338 to communities in Cascade County; $8 to communities in Chouteau County; and $235 to communities in Teton County for a total payment of $581. Table 37 shows the resulting economic impacts of RRS payments under all alternatives. Accounting for both the direct and secondary effects, RRS payments for alternatives A1, B1, B2, C1, and C2 would generate total annual economic impacts $200 in labor income and $300 in value added in the local three-county impact area.

Table 37. Annual impacts from refuge revenue sharing payments for all alternatives for Benton Lake National Wildlife Refuge, Montana.

	Employment (# full and part time jobs)	*Labor income (Thousands, $2011)*	*Value Added (Thousands, $2011)*
Alternatives A1, B1, B2, C1, and C2			
Direct effects	< 1	$0.2	$0.2
Secondary effects	< 1	$0.0	$0.1
Total economic impact	< 1	$0.2	$0.3

Impacts from Public Use and Access Management

Benton Lake National Wildlife Refuge Visitor Expenditures in Local Economy

The overarching goal of the Benton Lake Refuge 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: wildlife observation and photography, interpretation, environmental education, hunting, and fishing. Ducks, geese, coots, sharp-tailed grouse, gray partridge, and ring-necked pheasants can be hunted on Benton Lake Refuge. Hunting of all other species is prohibited. Benton Lake Refuge does not offer fishing opportunities on the main part of the refuge due to a lack of sport fish. The Pump House Unit is open for walk-in access to Muddy Creek which provides trout fishing opportunities. In FY11, approximately 300 waterfowl hunting visits, 75 upland game hunting visits, and 50 fishing visits occurred at Benton Lake Refuge.

The most popular recreational activity on the refuge is wildlife observation and photography. The Auto Tour Route, Prairie Marsh Boardwalk, Lower Marsh Road, and the sharp-tailed grouse blind are popular observation areas. In addition, Benton Lake Refuge has the potential to expand the environmental education and interpretation program. In FY11, approximately 9,425 nonconsumptive related visits occurred at Benton Lake Refuge including; wildlife observation (7,250 visits), environmental education (1,700 visits), wildlife photography (400 visits), and interpretation (75 visits).

This section focuses on the regional economic impacts associated with Benton Lake Refuge visitation. Annual visitation estimates for the refuge are based on several refuge statistic sources including: visitors entering the visitor center or office and general observation by refuge personnel. 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, counting each refuge visit as a full visitor day would overestimate the economic impact of Benton Lake Refuge visitation. To properly account for the amount of spending, the annual number of refuge visits were converted to visitor days. Refuge personnel estimate that anglers and upland game hunters spend approximately 4 hours (1/2 a visitor day) on the refuge, 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 three-county area are included in the analysis. The rationale for excluding local visitor spending is twofold. First, money flowing into the local three-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 three-county area visit Benton Lake Refuge more or less due to the management changes, they will correspondingly change the spending of their money elsewhere in the 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 personnel found out the percentage of nonlocal refuge visitors. Table 38 shows the estimated percent of current refuge visits and visitor days by visitor activity.

The refuge staff anticipates that the number of fishing visitors will remain constant for all the alternatives. Nonconsumptive use visitation will remain similar to current estimates for alternatives A1, B1, and B2 but is anticipated to increase by 25 percent under alternatives C1 and C2. The expected increase in visitation is due to the hiring of a Park Rangerwho will specialize on developing and enhancing educational, observation, and interpretative programming by tapping into the resources of Great Falls. Upland game hunting is expected to remain the same under alternative A1 but increase 10 percent under alternative B1, increase 23 percent under alternative B2, and increase 25 percent under alternatives


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Greater short-horned lizard.

Table 38. Estimated current annual visitation for Benton Lake National Wildlife Refuge, Montana.

Visitor Activity	*Total annual number of visits*	*Number of hours spent at Refuge*	*Total annual number of visitor days**	*Percentage of nonlocal visits (%)*	*Number of nonlocal visitor days**
Fishing	50	4	25	0%	0
Waterfowl Hunting	300	6	225	25%	56
Upland Game Hunting	75	4	38	10%	4
Non consumptive visitors: wildlife observation, photography, education, and interpretation	9,425	4	4,713	42%	1,980
Total Visitation	*9,850*		*5,001*		2,039

* One visitor day = 8 hours.

C1 and C2 due to extended season, increase in available hunt area offered during dry cycle years, grassland restoration efforts, and promotion of upland hunting experience by the visitor services program during dry years.

Waterfowl hunting visitation is expected to remain similar to current estimates for alternative A1. Under alternative B1, the refuge staff anticipates waterfowl hunting to increase slightly (10 percent) compared to alternative A1. The anticipated increase is due to improvement within individual units from management efforts to mimic natural processes such as drying. Under alternative B2, the refuge staff anticipates that there would be a split between the number of years of pumping and nonpumping. During the pumping period, annual waterfowl hunting use is anticipated to be similar to annual use under alternative B1 (on average 330 visits per year), and during nonpumping years, annual use is anticipated to be similar to alternatives C1 or C2 (on average 120 visits per year). Therefore, the number of waterfowl hunting visits over the life of the plan are estimated to be 3,375 visits which would equate to an annual average of 225 visits for alternative B2.

Under alternative C1, the availability of water for waterfowl hunting would be dependent upon natural run-off and would vary over the 15-year life of the plan. For the past 2 years, the refuge has experienced run-off characteristic of a wet cycle. It is expected that the next 2-3 years will also be wet in the fall with a gradual reduction in surface water in the basin for the next 5 years. During these wet years, the refuge has experienced a 100-percent increase in hunter use from alternative A1. This same usage (600 visits annually during a wet cycle) can be expected under alternative C1 for an estimated 3 years. During the anticipated 4 years of approximately 97 acres of water, the small surface area would likely result in very little area available for hunting. During this time period hunter use was conservatively estimated as the same as dry cycle. During the dry cycle of 8 years, no waterfowl hunting would occur. This would result in an estimated total of 1,800 waterfowl hunting use days for the life of the plan with a range of zero hunters to 600 waterfowl hunting visits (for 3 years). This reflects a 60-percent reduction in waterfowl hunting use compared to alternative A1; a 64-percent reduction in use compared to alternative B1; a 47-percent reduction in use compared to alternative B2; and similar use for alternative C2.

Table 39 summarizes the average annual estimated visits and visitor days by type of activity for all alternatives. For the purposes of the economic impact analysis, visitation over the 15 year life of the CCP must be converted to an average annual basis (as shown in table 18). The number of waterfowl hunters have the potential to fluctuate between 0 to 600 visits for the anticipated pumping and nonpumping years for alternatives C1, and C2. The economic impacts for the anticipated range of waterfowl hunters for pumping and nonpumping years will also be estimated. The anticipated 600 waterfowl hunting visits in pumping years would equate to 450 annual waterfowl hunter visitor days of which 113 visitor days would be from nonlocal waterfowl hunters.


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Wilson's phalarope on the refuge complex.

Table 39. Annual average number of visits and visitor days by activity and alternative for Benton Lake National Wildlife Refuge, Montana.

	Alternative A1	*Alternative B1*	*Alternative B2*	*Alternative C1*	*Alternative C2*
Total Visits					
Fishing	50	50	50	50	50
Waterfowl Hunting	300	330	225	120	120
Upland Game Hunting	75	83	92	94	94
Non consumptive visitors: wildlife observation, photography, education, and interpretation	9,425	9,425	9,425	11,781	11,781
Total Annual Visits	9,850	9,888	9,792	12,045	12,045
Total Visitor Days					
Fishing	25	25	25	25	25
Waterfowl Hunting	225	248	169	90	90
Upland Game Hunting	38	41	46	47	47
Non consumptive visitors: wildlife observation, photography, education, and interpretation	4,713	4,713	4,713	5,891	5,891
Total Visitor Days	5,000	5,026	4,952	6,053	6,053
Nonlocal Visitor Days					
Fishing	0	0	0	0	0
Waterfowl Hunting	56	62	42	23	23
Upland Game Hunting	4	4	5	5	5
Non consumptive visitors: wildlife observation, photography, education, and interpretation	1,979	1,979	1,979	2,474	2,474
Total Nonlocal Visitor Days	2,039	2,045	2,026	2,501	2,501

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 (FWS, 2008). 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 upland game hunting ($176.03 per-day) and waterfowl hunting ($75.88 per-day), were used to estimate nonlocal visitor spending for refuge fishing and hunting related activities. The average daily nonresident spending profile for nonconsumptive wildlife recreation (observing, feeding, or photographing fish and wildlife) was used for nonconsumptive wildlife viewing activities ($157.62 per-day).

Total spending by nonlocal refuge visitors was figured out by multiplying the average nonlocal visitor daily spending by the number of nonlocal visitor days at the refuge. The economic impacts of each alternative were estimated using IMPLAN. Table 40 summarizes the total economic impacts associated with current nonlocal visitation by activity and alternative. Under alternative A1, nonlocal Benton Lake Refuge visitors would spend approximately $316.9 thousand in the local economy annually ($312 thousand in spending by nonconsumptive visitors, $4.3 thousand by waterfowl hunters, and $700 by upland game hunters). This spending would directly account for 3 jobs, $75.6 thousand in labor income, and $123.8 thousand in value added in the local economy. The secondary or multiplier effects would generate 1 job, $39.9 thousand in labor income, and $70.8 thousand in value added. Accounting for both the direct and secondary effects, spending by nonlocal visitors for alternative A1 would generate total economic impacts of 4 jobs, $115.5 thousand in labor income, and $194.6 thousand in value added. As shown in table 40, almost all (98.5 percent) of the nonlocal impacts are generated by nonconsumptive visitors.

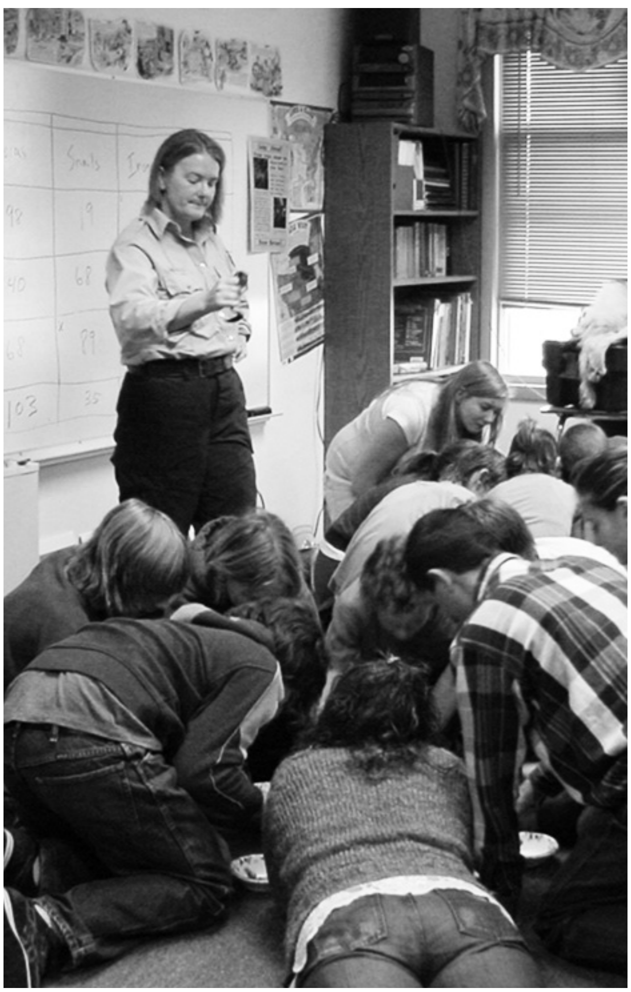
Under alternative B1, nonlocal Benton Lake Refuge visitors would spend approximately $317 thousand in the local area annually. Accounting for both the direct and secondary effects, average annual total spending by nonlocal visitors for alternative B1 would generate total economic impacts of 4 jobs, $115.7 thousand in labor income, and $195.3 thousand in value added. The total annual average economic impacts for alternative B2 would be similar to alternative A1.

Table 40. Average annual impacts of nonlocal visitor spending by activity and alternative for Benton Lake National Wildlife Refuge, Montana.

	Nonlocal Waterfowl Hunting			*Nonlocal Upland Game Hunting*			*Nonlocal Noncon-sumptive Visitation*			*Total Nonlocal Visitation*		
	Employ-ment	Labor Income	Value Added	Employ-ment	Labor Income	Value Added	Em-ploy-ment	Labor Income	Value Added	Employ-ment	Labor Income	Value Added
	(# full and part time jobs)	(Thousands, $2011)		(# full and part time jobs)	(Thousands, $2011)		(# full and part time jobs)	(Thousands, $2011)		(# full and part time jobs)	(Thousands, $2011)	
Alternative A1												
Direct effects	< 1	$1.0	$1.6	< 1	$0.1	$0.2	3	$74.5	$122.0	3	$75.6	$123.8
Secondary effects	< 1	$0.5	$0.8	< 1	$0.1	$0.1	1	$39.4	$69.8	1	$39.9	$70.8
Total effect	*< 1*	$1.5	$2.4	*< 1*	$0.2	$0.4	*4*	$113.9	$191.8	4	$115.5	$194.6
Alternative B1												
Direct effects	< 1	$1.1	$1.8	< 1	$0.2	$0.3	3	$74.5	$122.4	3	$75.8	$124.4
Secondary effects	< 1	$0.5	$0.9	< 1	$0.1	$0.2	1	$39.4	$69.8	1	$39.9	$70.9
Total effect	*< 1*	*$1.6*	*$2.6*	*< 1*	$0.3	$0.4	*4*	$113.9	$192.2	4	$115.7	$195.3
Alternative B2												
Direct effects	< 1	$0.8	$1.2	< 1	$0.2	$0.3	3	$74.5	$122.4	3	$75.5	$123.9
Secondary effects	< 1	$0.3	$0.6	< 1	$0.1	$0.2	1	$39.4	$69.8	1	$39.8	$70.6
Total effect	*< 1*	*$1.1*	*$1.8*	*< 1*	$0.3	$0.5	*4*	$113.9	$192.2	4	$115.2	$194.5
Alternatives C1 and C2												
Direct effects	< 1	$0.4	$0.6	< 1	$0.2	$0.3	4	$93.1	$153.0	4	$93.7	$154.0
Secondary effects	< 1	$0.2	$0.3	< 1	$0.1	$0.2	1	$49.2	$87.3	1	$49.5	$87.8
Total effect	*< 1*	$0.6	$1.0	*< 1*	*$0.3*	*$0.5*	*5*	*$142.3*	*$240.3*	5	$143.2	$241.7

Under alternatives C1 and C2, nonlocal Benton Lake Refuge visitors would spend more than $390 thousand in the local area annually. Accounting for both the direct and secondary effects, spending by nonlocal visitors for alternatives C1 and C2 would generate total economic impacts of 5 jobs, $143.2 thousand in labor income, and $241.7 thousand in value added.

The economic impacts for the anticipated range of waterfowl hunters for pumping and nonpumping years for alternatives C1 and C2 are shown in table 20. In nonpumping years, waterfowl hunting will not occur and therefore, there would be no economic impacts. In pumping years, it is anticipated that there would be 600 annual waterfowl hunting visits (450 visitor days of which 113 are nonlocal visitor days). Nonlocal waterfowl hunters would spend approximately $8.6 thousand in the local area annually. Accounting for both the direct and secondary effects, average annual spending by nonlocal waterfowl hunters during pumping years would generate total economic impacts $2.9 thousand in labor income, and $4.8 thousand in value added (table 41).



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Benton Lake National Wildlife Refuge staff regularly conduct educational outreach in local communities such as at the Ulm School in Ulm, Montana.

Table 41. Range of annual impacts of nonlocal waterfowl hunter spending for pumping and nonpumping years under alternatives C1 and C2 for Benton Lake National Wildlife Refuge, Montana.

	Employment (# full and part time jobs)	*Labor income (Thousands, $2011)*	*Value Added (Thousands, $2011)*
Nonpumping years			
Direct effects	0	$0	$0
Secondary effects	0	$0	$0
Total economic impact	0	$0	$0
Pumping years			
Direct effects	< 1	$2.00	$3.20
Secondary effects	< 1	$0.90	$1.60
Total economic impact	< 1	$2.90	$4.80
Average annual impacts over life of plan			
Direct effects	< 1	$0.4	$0.6
Secondary effects	< 1	$0.2	$0.3
Total economic impact	< 1	$0.6	$1.0

Neal Mischler

White-tailed jackrabbit.

Impacts from Benton Lake National Wildlife Refuge Administration

Staff–Personal Purchases

Benton Lake Refuge employees reside and spend their salaries on daily living expenses in the local area, thereby generating impacts within the local economy. Household consumption expenditures consist of payments by individuals/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 on the economic analysis, the FWS provided the percentage split of staff time spent working at Benton Lake Refuge for each position. Table 42 illustrates staffing and time spent working at Benton Lake Refuge (as well as working on Benton Lake Refuge-related issues) for each alternative. Under alternative A1, salary would total $465.2 thousand for that part of time 13 of the refuge complex staff members spent working on Benton Lake Refuge. Table 42 shows the changes in positions, time spent working, and total salary amounts for Benton Lake Refuge staffing by alternative.

Table 42. Staffing and percent of time allocated for working by alternative on Benton Lake National Wildlife Refuge, Montana.

		Percent of Time Spent Working on Benton Lake Refuge				
Positions by Alternative	*Full Time Equivalent*	*Alternative A1*	*Alternative B1*	*Alternative B2*	*Alternative C1*	*Alternative C2*
Administrative Officer	1	40%	40%	40%	40%	40%
Assistant Fire Management Officer	1	35%	25%	35%	35%	35%
Bio-Science Technician	0.8	90%	90%	90%	90%	90%
Bio-Science Technician	0.5	75%	90%	90%	75%	75%
Bio-Science Technician	0.5	0%	0%	0%	0%	0%
Bio-Science Technician	0.8	0%	100%	100%	100%	0%
Bio-Science Technician (2 positions)	0.8	0%	100%	100%	0%	0%
Budget Analyst	1	20%	20%	20%	20%	20%
Refuge Complex Manager	1	50%	60%	60%	60%	60%
Deputy Refuge Manager	1	50%	60%	60%	60%	60%
Generalist	0.5	40%	50%	50%	50%	50%
Generalist	0.5	20%	40%	40%	40%	40%
Law Enforcement Officer	1	0%	25%	25%	25%	25%
Maintenance Worker	1	75%	90%	90%	75%	75%
Maintenance Worker	1	0%	100%	100%	0%	0%
Maintenance Worker	1	0%	0%	0%	0%	0%
Park Ranger	1	0%	0%	0%	50%	50%
Supervisory Wildlife Biologist	1	0%	80%	70%	70%	60%
Wetland District Manager	1	25%	35%	25%	15%	15%
Wildlife Biologist	1	75%	90%	90%	90%	90%
Wildlife Refuge Specialist	0.5	0%	20%	0%	0%	0%
Wildlife Refuge Specialist	1	10%	25%	20%	0%	0%
Wildlife Refuge Specialist	0.5	0%	0%	0%	0%	0%
Wildlife Refuge Specialist	1.0	0%	0%	0%	0%	0%
Total Salary		$465,200	$851,800	$822,700	$701,500	$644,700

Refuge personnel estimate that annual salaries total around $465.2 thousand for alternative A1 and would increase under all other alternatives. Table 43 shows the economic impacts associated with spending of salaries in the local three-county area by Benton Lake Refuge employees under all alternatives. For alternative A1, salary spending by Benton Lake Refuge personnel would generate the secondary effects of 3 more jobs, $108.1 thousand in added labor income, and $198.7 thousand in value added in the local economy. Alternative B1 would have the largest increase in impacts, generating secondary effects of 6 jobs, $198.0 thousand in labor income, and $363.9 thousand in value added in the local economy. As shown in table 43, impacts for alternatives B2, C1, and C2 are slightly less than alternative B1 but higher than alternative A1.

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Ducks on Benton Lake.

Table 43. Annual local impacts of salary spending by personnel by alternative for Benton Lake National Wildlife Refuge, Montana.

	Employment (# full and part time jobs)	*Labor income (Thousands, $2011)*	*Value Added (Thousands, $2011)*
Alternative A1			
Direct effects	0	$0.0	$0.0
Secondary effects	3	$108.1	$198.7
Total economic impact	3	$108.1	$198.7
Alternative B1			
Direct effects	0	$0	$0
Secondary effects	6	$198.0	$363.9
Total economic impact	6	$198.0	$363.9
Alternative B2			
Direct effects	0	$0	$0
Secondary effects	6	$191.2	$351.5
Total economic impact	6	$191.2	$351.5
Alternative C1			
Direct effects	0	$0	$0
Secondary effects	5	$163.1	$299.7
Total economic impact	5	$163.1	$299.7
Alternative C2			
Direct effects	0	$0	$0
Secondary effects	4	$149.8	$275.4
Total economic impact	4	$149.8	$275.4

Work-related Purchases

A wide variety of supplies and services are purchased for refuge operations and maintenance activities. Refuge purchases made in the local three-county area contribute to the local economic impacts associated with the Benton Lake Refuge. Major local expenditures include: supplies and services related to annual maintenance costs; small equipment; auto repairs, parts, and fuel; and utilities. Average annual Benton Lake Refuge nonsalary expenditures are anticipated to be $240.3 thousand for alternative A1,

$336.9 thousand for alternative B1, $329.6 thousand for alternative B2, $299.3 thousand for alternative C1, and $285.1 thousand for alternative C2. According to refuge records, approximately 70 percent of the annual nonsalary budget expenditures are spent on goods and services purchased in the local three-county area. Table 44 shows the economic impacts associated with work related expenditures in local communities near the Benton Lake Refuge. For alternative A1, work related purchases would generate a total economic impact of 2 jobs, $52.2 thousand in labor income, and $83.4 thousand in value added. Work related purchases under alternative B1 would generate the largest total economic impact of 3 jobs, $73.2 thousand in labor income, and $116.9 thousand in value added. As shown in table 44, impacts for alternatives B2, C1, and C2 are less than alternative B1 but higher than alternative A1.

Table 44. Local economic impacts by alternative of purchases related to Benton Lake National Wildlife Refuge, Montana.

	Employment (# full and part time jobs)	*Labor income (Thousands, $2011)*	*Value Added (Thousands, $2011)*
Alternative A1			
Direct effects	2	$35.2	$52.4
Secondary effects	< 1	$17.1	$30.9
Total economic impact	2	$52.2	$83.4
Alternative B1			
Direct effects	2	$49.3	$73.5
Secondary effects	< 1	$23.9	$43.4
Total economic impact	3	$73.2	$116.9
Alternative B2			
Direct effects	2	$48.2	$71.9
Secondary effects	< 1	$23.4	$42.4
Total economic impact	3	$71.6	$114.4
Alternative C1			
Direct effects	2	$43.8	$65.3
Secondary effects	< 1	$21.3	$38.5
Total economic impact	3	$65.1	$103.9
Alternative C2			
Direct effects	2	$41.7	$62.2
Secondary effects	< 1	$20.3	$36.7
Total economic impact	2	$62.0	$98.9

In addition to the annual local purchases of supplies and services to support general refuge operations, one-time costs related to wetland management and restoration may occur under alternatives B1, B2, C1, and C2. Under alternative B1, a $100 thousand diversion structure may be constructed within the first few years of the 15-year CCP planning timeframe. Under alternative B2, up to 3.5 miles of shelterbelts could be removed and up to 207 acres of tame grass could be converted to native grasses at an estimated total cost of $35 thousand over five years. Under alternatives C1and C2, up to 19 miles of shelterbelts may be restored and up to 728 acres of tame grass may be converted to native grasses at an estimated cost of $115 thousand over the life of the plan. In addition, wetland infrastructure may be incrementally modified or remove to achieve target contaminant, vegetation, and wetland health and productivity levels under alternative C1 with an estimate cost ranging from $0 to $4 million over the life of the plan. Under C2, full basin restoration would occur with an estimated cost ranging from $1.2 to $4 million and would likely be completed within the first six years of the plan.

Restoration activities, particularly under alternatives C1, and C2, would generate economic activity in the region surrounding the refuge. Portions of the restoration work, especially under alternative C2, are expected to be contracted to local businesses for services such as construction and environmental and engineering consulting, and most of the materials required for the restoration would be purchased within the local economy. This economic activity would increase demand for services and materials and would support jobs and generate income in the local economy. Furthermore, the restored ecosystem would help local communities well beyond the completion of the restoration projects by mitigating human and wildlife health hazards.

Table 45 summarizes the direct and total economic impacts in the three-county area of refuge management activities for alternative A1. Under alternative A1, Benton Lake Refuge management activities directly related to refuge operations generate an estimated 5 jobs, $111.0 thousand in labor income, and $176.5 thousand in value added in the local economy. Including direct, indirect, and induced effects, all Benton Lake Refuge activities generate a total economic impact of 9 jobs, $276.1 thousand in labor income, and $477.0 thousand in value added. In 2009, total labor income was estimated at $2.3 billion and total employment was estimated at 60 thousand jobs for the local three-county area, according to IMPLAN 2009 data. Thus, total economic impacts associated with Benton Lake Refuge operations under alternative A1 represent less than .01 percent of total income and total employment in the overall three-county area economy. Total economic effects of refuge operations play a larger role in the communities near Benton Lake Refuge where most of the refuge related expenditures and public use related economic activity occurs.

Table 45. Summary of all management activities for alternative A1 for Benton Lake National Wildlife Refuge, Montana.

	Employment (# full and part time obs)	*Labor income (Thousands, $2011)*	*Value Added (Thousands, $2011)*
Revenue Sharing and Refuge Administration*			
Direct effects	2	$35.3	$52.6
Total Effects	5	$160.6	$282.4
Nonlocal Public Use Activities			
Direct effects	3	$75.6	$123.8
Total Effects	4	$115.5	$194.6
Aggregate Impacts			
Direct effects	5	$111.0	$176.5
Total effects	9	$276.1	$477.0

**Staff salary spending and work related purchases*

Table 46 summarizes the direct and total economic impacts in the three-county area of refuge management activities for alternative B1. Under alternative B1, Benton Lake Refuge management activities directly related to refuge operations generate an estimated 5 jobs, $125.2 thousand in labor income, and $198.2 thousand in value added in the local economy. Including direct, indirect, and induced effects, all Benton Lake Refuge activities generate a total economic impact of 13 jobs, $387.1 thousand in labor income, and $676.4 thousand in value added. In 2009, total labor income was estimated at $2.3 billion and total employment was estimated at 60 thousand jobs for the local three-county area, according to IMPLAN 2009 data. Thus, total economic impacts associated with Benton Lake Refuge operations under alternative B1 represent less than .01 percent of total income and total employment in the overall three-county area economy. Total economic effects of refuge operations play a larger role in the communities near Benton Lake Refuge where most related expenditures and public use-related economic activity occurs.

Table 46. Summary of all management activities for alternative B1 for Benton Lake National Wildlife Refuge, Montana.

	Employment (# full and part time jobs)	*Labor income (Thousands, $2011)*	*Value Added (Thousands, $2011)*
Revenue Sharing and Refuge Administration*			
Direct effects	2	$49.5	$73.7
Total Effects	9	$271.4	$481.1
Nonlocal Public Use Activities			
Direct effects	3	$75.8	$124.4
Total Effects	4	$115.7	$195.3
Aggregate Impacts			
Direct effects	5	$125.2	$198.2
Total effects	13	$387.1	$676.4

**Staff salary spending and work related purchases*

Table 47 summarizes the change in economic effects associated with Benton Lake Refuge operations under alternative B1 as compared to alternative A1. Due primarily to increases in refuge administration, alternative B1 would generate 3 more jobs, $111.0 thousand more in labor income, and $199.4 thousand more in value added as compared to alternative A1.

Table 47. Change in economic impacts under alternative B1 compared to alternative A1 for Benton Lake National Wildlife Refuge, Montana.

	Employment (# full and part time jobs)	*Labor income (Thousands, $2011)*	*Value Added (Thousands, $2011)*
Revenue Sharing and Refuge Administration*			
Direct effects	(+) < 1	(+) $14.1	(+) $21.1
Total Effects	(+) 3	(+) $110.9	(+) $198.7
Nonlocal Public Use Activities			
Direct effects	no change	(+) $0.1	(+) $0.6
Total Effects	no change	(+) $0.2	(+) $0.7
Aggregate Impacts			
Direct effects	(+) < 1	(+) $14.3	(+) $21.7
Total effects	(+) 3	(+) $111.0	(+) $199.4

**Staff salary spending and work related purchases*

Table 48 summarizes the direct and total economic impacts in the three-county area of refuge management activities for alternative B2. Under alternative B2, Benton Lake Refuge management activities directly related to refuge operations generate an estimated 5 jobs, $123.8 thousand in labor income, and $196.1 thousand in value added in the local economy. Including direct, indirect, and induced effects, all refuge activities generate a total economic impact of 13 jobs, $387.3 thousand in labor income, and $660.7 thousand in value added. In 2009, total labor income was estimated at $2.3 billion and total employment was estimated at 60 thousand jobs for the local three-county area, according to IMPLAN 2009 data. Thus, total economic impacts associated with Benton Lake Refuge operations under alternative B2 represent less than .01 percent of total income and total employment in the overall three-county area economy. Total economic effects of refuge operations play a larger role in the communities near Benton Lake Refuge where most of the related expenditures and public use-related economic activity occurs.

Table 48. Summary of all management activities for alternative B2 for Benton Lake National Wildlife Refuge, Montana.

	Employment (# full and part time jobs)	*Labor income (Thousands, $2011)*	*Value Added (Thousands, $2011)*
Revenue Sharing and Refuge Administration*			
Direct effects	2	$48.4	$72.1
Total Effects	8	$263.1	$466.2
Nonlocal Public Use Activities			
Direct effects	3	$75.5	$123.9
Total Effects	4	$115.2	$194.5
Aggregate Impacts			
Direct effects	5	$123.8	$196.1
Total effects	13	$378.3	$660.7

**Staff salary spending and work related purchases*

Table 49 summarizes the change in economic effects associated with Benton Lake Refuge operations under alternative B2 as compared to alternative A1. Due primarily to increases in refuge administration, alternative B2 would generate 3 more jobs, $102.2 thousand more in labor income, and $183.7 thousand more in value added as compared to alternative A1.

Table 49. Change in economic impacts under alternative B2 compared to alternative A1 for Benton Lake National Wildlife Refuge, Montana.

	Employment (# full and part time jobs)	*Labor income (Thousands, $2011)*	*Value Added (Thousands, $2011)*
Revenue Sharing and Refuge Administration*			
Direct effects	(+) < 1	(+) $13.1	(+) $19.5
Total Effects	(+) 3	(+) $102.5	(+) $183.8
Nonlocal Public Use Activities			
Direct effects	no change	(-) $0.2	(+) $0.1
Total Effects	no change	(-) $0.3	(-) $0.1
Aggregate Impacts			
Direct effects	(+) < 1	(+) $12.9	(+) $19.6
Total effects	(+) 3	(+) $102.2	(+) $183.7

**Staff salary spending and work related purchases*

Table 50 summarizes the direct and total economic impacts in the three-county area of refuge management activities for alternative C1. Under alternative C1, Benton Lake Refuge management activities directly related to refuge operations generate an estimated 6 jobs, $137.7 thousand in labor income, and $226.1 thousand in value added in the local economy. Including direct, indirect, and induced effects, all Benton Lake Refuge activities generate a total economic impact of 12 jobs, $371.5 thousand in labor income, and $707.9 thousand in value added. In 2009, total labor income was estimated at $2.3 billion and total employment was estimated at 60 thousand jobs for the local three-county area, according to IMPLAN 2009 data. Thus, total economic impacts associated with Benton Lake Refuge operations under alternative C1 represent less than .01 percent of total income and total employment in the overall three-county area economy. Total economic effects of refuge operations play a much larger role in the communities near Benton Lake Refuge where most of

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Prescribed fire.

the related expenditures and public -elated economic activity occurs.

Table 50. Summary of all management activities for alternative C1 for Benton Lake National Wildlife Refuge, Montana.

	Employment (# full and part time jobs)	*Labor income (Thousands, $2011)*	*Value Added (Thousands, $2011)*
Revenue Sharing and Refuge Administration*			
Direct effects	2	$44.0	$72.1
Total Effects	7	$228.3	$466.2
Nonlocal Public Use Activities			
Direct effects	4	$93.7	$154.0
Total Effects	5	$143.2	$241.7
Aggregate Impacts			
Direct effects	6	$137.7	$226.1
Total effects	12	$371.5	$707.9

** Staff salary spending and work related purchases*

Table 51 summarizes the change in economic effects associated with Benton Lake Refuge operations under alternative C1 as compared to alternative A1. Due to increases in refuge visitation and administration, alternative C1 would generate 3 more jobs, $95.4 thousand more in labor income, and $230.9 thousand more in value added as compared to alternative A1.

Table 51. Change in economic impacts under alternative C1 compared to alternative A1 for Benton Lake National Wildlife Refuge, Montana.

	Employment (# full and part time jobs)	*Labor income (Thousands, $2011)*	*Value Added (Thousands, $2011)*
Revenue Sharing and Refuge Administration*			
Direct effects	(+) < 1	(+) $8.6	(+) $19.5
Total Effects	(+) 2	(+) $67.8	(+) $183.8
Nonlocal Public Use Activities			
Direct effects	(+) 1	(+) $18.1	(+) $30.1
Total Effects	(+) 1	(+) $27.7	(+) $47.2
Aggregate Impacts			
Direct effects	(+) 1	(+) $26.7	(+) $49.6
Total effects	(+) 3	(+) $95.4	(+) $230.9

**Staff salary spending and work related purchases*

Table 52 summarizes the direct and total economic impacts in the three-county area of refuge management activities for alternative C2. Under alternative C2, Benton Lake Refuge management activities directly related to refuge operations generate an estimated 6 jobs, $135.6 thousand in labor income, and $226.1 thousand in value added in the local economy. Including direct, indirect, and induced effects, all Benton Lake Refuge activities generate a total economic impact of 12 jobs, $355.2 thousand in labor income, and $664.4 thousand in value added. In 2009, total labor income was estimated at $2.3 billion and total employment was estimated at 60 thousand jobs for the local three-county area, according to IMPLAN 2009 data. Thus, total economic impacts associated with Benton Lake Refuge operations under alternative C2 represent less than .01 percent of total income and total employment in the overall three-county area economy. Total economic effects of refuge operations play a larger role in the communities near Benton Lake Refuge where most of the related expenditures and public use-related economic activity occurs.

Table 52. Summary of all management activities for alternative C2 for Benton Lake National Wildlife Refuge, Montana.

	Employment (# full and part time jobs)	*Labor income (Thousands, $2011)*	*Value Added (Thousands, $2011)*
Revenue Sharing and Refuge Administration*			
Direct effects	2	$41.9	$72.1
Total Effects	7	$212.0	$466.2
Nonlocal Public Use Activities			
Direct effects	4	$93.7	$154.0
Total Effects	5	$143.2	$198.2
Aggregate Impacts			
Direct effects	6	$135.6	$226.1
Total effects	12	$355.2	$664.4

**Staff salary spending and work related purchases*

Table 53 summarizes the change in economic effects associated with Benton Lake Refuge operations under alternative C2 as compared to alternative A1. Due to increases in refuge visitation and administration, alternative C2 would generate 3 more jobs, $79.1 thousand more in labor income, and $187.4 thousand more in value added as compared to alternative A1.

Table 53. Change in economic impacts under alternative C1 compared to alternative A1 for Benton Lake National Wildlife Refuge, Montana.

	Employment (# full and part time jobs)	*Labor income (Thousands, $2011)*	*Value Added (Thousands, $2011)*
Revenue Sharing and Refuge Administration*			
Direct effects	(+) < 1	(+) $6.6	(+) $19.5
Total Effects	(+) 2	(+) $51.5	(+) $183.8
Nonlocal Public Use Activities			
Direct effects	(+) 1	(+) $18.1	(+) $30.1
Total Effects	(+) 1	(+) $27.7	(+) $3.6
Aggregate Impacts			
Direct effects	(+) 1	(+) $24.6	(+) $49.6
Total effects	(+) 3	(+) $79.1	(+) $187.4

** Staff salary spending and work related purchases*

7.19 Cumulative Impacts

Resource redistribution would be necessary to accomplish objectives under alternative A1 due to the intensity of management actions, monitoring, operations, and maintenance on Benton Lake. This redistribution would affect other refuge complex programs such as the conservation easement program. As a result, there would likely be a reduction in the capacity to protect native grasslands and wetlands.

Cumulative impacts for alternative B1 would be the same as for alternative A1, plus increasing partnership efforts should lead to improvements in water quality in both the Muddy Creek and Lake Creek watersheds.

Cumulative impacts for alternative B2 would be the same as for alternative B1, plus any dry years during the initial drying phase may cause localized changes in bird distribution as migratory birds adapt to the presence or absence of water. On a continental population level, no effects would be expected to migratory bird species that typically use the refuge (personal communication, USFWS, Region 6 Migratory Bird Program, Kathleen Burchett, Vanessa Fields, Toni Griffin).

On a very localized scale, effects on migratory gamebird hunting would occur during dry periods under alternative B2; however, other locations do exist to accommodate user groups. For example, opening weekend of 2011, a dramatic decline occurred in the number of hunters using the Freezeout Wildlife Management Area (121 hunters compared to average of 227 hunters). Interestingly, the Benton Lake Refuge experienced nearly the exact same increase in hunter use (94 hunters compared to average of 40 hunters). Many hunters stated that they went to the Benton Lake Refuge instead of Freezeout Wildlife Management Area this year due to increased water levels. Migratory gamebird hunt-

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This boardwalk is part of the infrastructure available for visitor use at Benton Lake National Wildlife Refuge.

ers generally have a variety of sites to select from within the landscape due to unpredictable climatic conditions.

During the drying phase when pumping is suspended, effects on the Muddy Creek watershed under alternative B2 would be expected. When pumping is suspended, the refuge would no longer reduce flows in Muddy Creek by 24 cfs. This increase in flows is estimated to increase sedimentation by 4,500 tons per year (personal communication, Alan Rollo).

Through implementation of alternatives C1 or C2, overall wetland protection would be increased. Once the basin's self-sustaining ecological functions return, the intensity of management actions would be reduced, allowing reallocation of resources. These resources can be applied to other refuge complex programs such as the conservation easement program. A result of this would be an increase in the capacity to protect native grasslands and wetlands. These effects would be realized on a landscape level rather than a locally.

There would be localized changes in bird distribution as migratory birds adapt to the presence or absence of water. On a continental population level, no effects are expected (personal communication, Region 6 Migratory Bird Program, Kathleen Burchett, Vanessa Fields, Toni Griffin).

On a very localized scale, impacts to migratory gamebird hunting under alternatives C1 or C2 would occur during dry periods; however, other locations do exist to accommodate user groups. For example, opening weekend of 2011, a dramatic decline occurred in the number of hunters at Freezeout Wildlife Management Area (121 hunters compared to average of 227 hunters). Interestingly, the refuge experienced nearly the exact same increase in hunter use (94 hunters compared to average of 40 hunters). Many hunters stated that they went to Benton Lake instead of Freezeout this year due to increased water levels.

Impacts to the Muddy Creek watershed would be expected under alternatives C1 or C2. Currently, Muddy Creek's erosion is low when flows are under 150 cfs. During the spring and fall when Benton Lake would normally be pumping (alternatives A1, B1, B2), average flows are at this target of 150 cfs (personal communication, Alan Rollo). The refuge would no longer reduce flows in Muddy Creek by 24 cfs when the pumps were run in spring or fall. This increase in flows is estimated to increase sedimentation by 4,500 tons/year (personal communication, Alan Rollo). Recent work by the Muddy Creek watershed group have found that for every 2 cfs reduction in flows, the project cost is approximately $100,000.

Alternatives C1 or C2 should be more effective in counteracting the impacts of wetland loss across the landscape on migratory birds than alternatives A1, B1 and B2. By shifting management of Benton Lake from intensively managed semipermanent water, to a wetland driven by natural hydrology, more complex resources can be directed to protecting the most vulnerable wetlands on the landscape. The Service's HAPET office has identified temporary and seasonal wetlands, often less than 1 acre in size, and totally or partially embedded in cropland, as the highest risk for conversion. The pressure to drain and fill these wetlands for tillage agriculture puts these basins at higher risk of conversion than those with more permanent water or embedded in grassland. At the same time, the value of these wetlands to the waterfowl resource is great. According to HAPET, for every ten 1-acre wetlands in the PPPLCC's Prairie Pothole Region, there would predictably be 20 breeding pairs of ducks; whereas, one 10-acre wetland would likely support only seven duck pairs. Managing Benton Lake as a semipermanent wetland does not provide the same resources as would managing most of the lost wetlands across the landscape. Protecting and restoring these vulnerable wetlands would be of greater benefit to migratory birds.

Although the Service is working to improve wetland health and sustainability in its impounded and managed wetlands across the Refuge System, few refuges have the opportunity or possibility to fully restore their wetlands. Many refuge impoundments are too highly modified or subject to forces beyond the Service's control, which make restoration impossible. In these systems, understanding the underlying hydrogeomorphology is still critical to long-term sustainability, but emulating natural processes may be all that is possible. Benton Lake Refuge is relatively unique in that simply restoring the hydrology is not only possible, but is likely to have a significant, positive impact on the health and long-term sustainability of the wetland. A fully functional, large, seasonal wetland basin that is protected, as proposed under alternatives C1 or C2, is a relatively rare and special wildlife resource on the Montana landscape.

7.20 Summary of the Alternatives' Actions and Consequences

Table 54 summarizes the actions of each alternative (detailed in sections 7.5–7.9) and the consequences of those actions (sections 7.13–7.17).

Table 54. Summary of the actions and consequences of the management alternatives for the Benton Lake National Wildlife Refuge, Montana.

Alternative A1—(No Action)	*Alternative B1*	*Alternative B2*	*Alternative C1—(Proposed action)*	*Alternative C2*
Grasslands—actions				
Protection of native grasslands through easements is a high priority in the complex; refuge grasslands managed to sustain health.	Same as alternative A1.	Same as alternative A1, plus: Up to 3.5 miles of nonnative tree plantings would be removed and up to 207 acres of degraded tame grass stands would be planted back to native grass species.	Same as alternative B2, plus: Up to 19 miles of nonnative tree plantings would be removed and up to 728 acres of degraded tame grass stands would be planted back to native grass species	Same as C1.
Grasslands—environmental consequences				
Resources insufficient to manage grasslands precisely. Cool-season, exotic grasses would likely continue to expand and further degrade the quality of the native prairie, which could affect reproductive success of grassland-nesting birds. Nonnative tree plantings provide habitat for wider diversity of birds but contribute to fragmentation, depredation and parasitism, which negatively affects grassland-dependent migratory birds.	Same as alternative A1, except increased focus on refuge wetlands may mean declines in biological diversity, ecological integrity and environmental health of refuge grasslands.	During the initial, drying period, more resources available to manage grasslands and health improved. Between 65 and 750 acres of grassland habitat would become available or more desirable to grassland species by removing nonnative trees.	More resources would be available to manage and improve the quality of native prairie. Up to 18 species of migratory birds that nest in nonnative trees may be displaced.	Same as C1 after basin restoration.
Wetlands and riparian areas—actions				
Pumping is used to supplement natural runoff to provide migration and breeding habitat every year for wetland-dependent wildlife, primarily waterfowl.	Same as A1, except short-term dry cycles of 3–7+ years would be rotated among wetland units. Added treatments of prescribed fire, discing, herbicide or reseeding would be used if needed. Intensive monitoring and annual adjustments made based on progress toward wetland health objectives.	Same as B1, except an initial, basin-wide drying period (8 plus years) would be implemented to “reset” the system. Pumping may be incrementally reintroduced if wetland health objectives are met.	All units on the refuge would be subject to natural hydrologic regimes. Limited pumping may occur to support water rights or for specific restoration purposes only. The pump house will be supported. Infrastructure on the refuge could be modified incrementally if monitoring results show that is necessary to achieve wetland health objectives.	Same as C1 except basin restoration would include the removal of all wetland infrastructure as well as the pumphouse.

Table 54. Summary of the actions and consequences of the management alternatives for the Benton Lake National Wildlife Refuge, Montana.

Alternative A1—(No Action)	*Alternative B1*	*Alternative B2*	*Alternative C1—(Proposed action)*	*Alternative C2*
Wetlands and riparian areas: water quantity and timing—environmental consequences				
Consistent flooding and minimal drying within wetland units; wetland basin is never completely dry.	More variable flooding and drying within wetland units; wetland basin is never completely dry.	Same as B1, except wetland basin may be completely dry during initial drying phase.	The hydrology of the basin would be determined by natural runoff.	Same as C1.
Wetlands and riparian areas: infrastructure—environmental consequences				
With current infrastructure, the ability to channel water to all units for management objectives is available. Infrastructure alters natural flow patterns across the basin, inhibits nutrient release, reduces dissolved oxygen, and traps and concentrates contaminants.	Same as alternative A1.	Same as alternative B1.	Modification of infrastructure may be necessary to decrease contaminants, restore moisture gradients and waterflow patterns, and increase soil oxygenation which directly influence nutrient release, vegetation and macroinvertebrate distribution in the wetland.	Same as alternative C1, except: Potential benefits from removing infrastructure identified under alternative C1 would occur more quickly. Conversely, unnecessary and irreversible changes to the infrastructure could also occur.
Wetlands and riparian areas: water quality—environmental consequences				
The average total load of selenium deposited on the refuge would be 152 pounds/year, (61% from natural run-off 39% from pumped water). Units 1 and 2 would become a toxic threat sufficient to cause complete reproductive failure in sensitive species of aquatic birds in 9 and 17 years.	Same as A1, except selenium levels reduced to minimal levels (no imminent toxic threat) through intensively managed drying rotations, prescriptive wetland treatments, monitoring, partnerships it the watershed and possibly a diversion channel.	Same as B1, except initial drying period will make it easier to keep selenium below minimum levels. Selenium inputs reduced by 15-20% over A1 and B1.	By ceasing pumping, the refuge would realize an automatic 40% decrease in selenium inputs over the long term and as much as a 75% decrease during dry years at no cost. Reduced inputs, coupled with increased drying, should result in an equilibrium well below the toxic threshold.	Same as C1.
Wetlands and riparian areas: wetland productivity—environmental consequences				
Stable water conditions would likely continue to lower wetland productivity at potentially all levels of the food chain.	Within wetland units, short-term dry cycles increase flooding and drying variability that stimulate productivity but is less than historic variability. Long-term wet-dry cycles absent at the refuge and landscape scale that stimulate cycles of invertebrate communities, plant communities, and mammalian predators. Not self-sustaining.	Increased over B1 at the wetland unit, refuge and landscape level. Not self-sustaining.	Increased over B2, especially during wet cycles, but it will be more variable over time. Restoring the full variability in the wet–dry cycle should have a positive effect on ecosystem processes and increase nutrient cycling. Long-term dynamics of production same as other northern prairie systems as vegetation, invertebrate, and nutrient cycling changes when wetlands dry, reflood, reach peak flooding extent, and then begin drying again. Self-sustaining.	Same as C1.

Table 54. Summary of the actions and consequences of the management alternatives for the Benton Lake National Wildlife Refuge, Montana.

Alternative A1—(No Action)	*Alternative B1*	*Alternative B2*	*Alternative C1—(Proposed action)*	*Alternative C2*
Wetlands and riparian areas: wetland vegetation—environmental consequences				
Stable water would likely cause existing stands of monotypic vegetation, such as alkali bulrush, cattails and invasive Garrison creeping foxtail to continue to expand or become denser, especially in a dry cycle.	Wetland vegetation diversity increased across the wetland basin. Drying will reduce monotypic stands of emergent vegetation and nonnative Garrison creeping foxtail within units. Nonnatives such as Kentucky bluegrass and Canada thistle may become established in newly exposed mudflats. In addition, in units that are not immediately dried, the emergent vegetation would continue to expand.	Same as B1, but improvements likely to be greater and more widespread across wetland basin.	A reduction in the coverage of robust, emergent vegetation such as cattail, alkali bulrush and Garrison creeping foxtail would be expected. This vegetation would be replaced with wetland species adapted to more seasonal and temporary flooding cycles such as occurred historically. The wetland basin would likely contain diverse annual and perennial herbaceous plants and wet-prairie meadow grasses.	Same as C1.
Water resources—actions				
Muddy Creek and Lake Creek water rights used annually.	Same as alternative A1.	Same as alternative C1.	The water rights for Muddy Creek could be lost unless water is pumped at least once every 8 years. The water right for Lake Creek would be supported.	The water rights for Muddy Creek could be lost if challenged in court for nonuse. The water right in Lake Creek would be kept.
Water resources—environmental consequences				
Annually about 4,000 acre-feet of water is pumped from Muddy Creek and runoff from the Lake Creek drainage is captured within the wetland basin.	Same as alternative A1, except: The total acre feet pumped would depend on progress toward wetland objectives.	Same as B1, except pumping water would not occur during the initial dry period and future pumping is less certain.	Only natural runoff would be captured on a regular basis. Pumping would be very rare.	Same as C1, except no pumping.
Visitor services: hunting—actions				
Hunting for waterfowl and upland gamebird would continue in designated areas. Hunt units do not change. Wetland hunt units flooded annually. Big game hunting, other wildlife species, including furbearers, would continue to be prohibited.	Same as alternative A1, except: the area open for waterfowl hunting could change annually.	Same as alternative C1 during initial drying phase; Same as alternative B1 when adequate water (pumping/run-off); Upland gamebird hunting would be expanded to the close of the State season (usually January 1).	During years with adequate water, the location and size of waterfowl Hunt Area could change depending on water conditions. Upland gamebird season would be same as alternative B2.	Same as alternative C1.

Table 54. Summary of the actions and consequences of the management alternatives for the Benton Lake National Wildlife Refuge, Montana.

Alternative A1—(No Action)	*Alternative B1*	*Alternative B2*	*Alternative C1—(Proposed action)*	*Alternative C2*
Visitor services: hunting—environmental consequences				
Total hunting visits over the life of the plan projected to be 5,625 visits, possibly less if habitat conditions decline. Waterfowl and upland gamebird hunting opportunities every year.	Total hunting visits over the life of the plan projected to be 6,195 visits. Overall hunter numbers may increase slightly (<10%) over A1, and the quality of the experience may improve. Annual changes in the waterfowl hunt area could be confusing. This would take greater effort from refuge staff to clearly communicate.	Total hunting visits over the life of the plan projected to be 4,755 (15% less than A1). Waterfowl-hunting visits greater than C1 and C2, but less than A1 and B1. Annual changes in the waterfowl hunt area could be confusing. This would take greater effort from refuge staff to clearly communicate.	Total hunting visits over the life of the plan projected to be 3,300 (41% less than A1). Waterfowl hunting experience similar to currently on waterfowl production areas in the complex. Annual changes in the waterfowl hunt area could be confusing. This would take greater effort from refuge staff to clearly communicate.	Same as C1.
Visitor Services: wildlife observation and photography—actions				
The Prairie Marsh Wildlife Drive would be open year-round. Lower Marsh Road would be open from July 15 until the opening day of waterfowl-hunting season. Annual grouse viewing would continue by reservation. Photographic blinds, Prairie Marsh Boardwalk, spotting scopes and interpretive panels supported.	Same as alternative A1, except the auto tour routes may be adjusted as needed due to changes in water management.	Same as alternative A1 during initial drying period,. Same as alternative B1 if pumping resumes.	Same as A1, except parts of the existing auto tour route could be changed and more hiking trails may be established if interior roads are modified/removed for habitat management purposes.	Same as C1.
Visitor services: wildlife observation and photography—environmental consequences				
Total visits over the life of the plan are projected to be 114,750. This use would continue to account for 73% of total visitor use. May be slight increase if another grouse blind is established. Opportunities would be negatively impacted if habitat conditions decline.	Same as the alternative A1, by changing water management within the units waterbirds may become less habituated to traffic. Annual changes in road closures could be confusing to visitors. This would take greater effort from refuge staff to clearly communicate.	Same as alternative B1, except during the initial dry period, the ability to observe certain water-dependent wildlife would be more variable. Opportunities to observe and photograph upland wildlife may be expanded.	Total visits over the life of the plan are projected to increase 25% over Al, for a total of 143,440. The ability to observe certain water-dependent wildlife would be more variable and occur primarily in spring. Upland wildlife observation opportunities expanded. The hiring of a park ranger would increase awareness of opportunities on the refuge. More nature trails would offset any visitation losses that may occur from modifications to the auto tour route.	Same as C1.

Table 54. Summary of the actions and consequences of the management alternatives for the Benton Lake National Wildlife Refuge, Montana.

Alternative A1—(No Action)	*Alternative B1*	*Alternative B2*	*Alternative C1—(Proposed action)*	*Alternative C2*
Visitor services: environmental education and interpretation—actions				
Partnership with the Great Falls Public Schools to provide an opportunity for all third graders to visit the refuge. Support Envirothon, STEM expo, MFWP clinics and other educational opportunities.	Same as alternative A1, plus: interpretive materials to explain the purpose of short-term dry cycles and any resulting changes to public use.	Same as alternative B1 plus: Interpretive panels and maps would also explain the purpose of initial drying period.	Same as alternative B1, except curriculum may be adapted to reflect changes in habitat from restoration efforts. Hire park ranger.	Same as C1.
Visitor services: environmental education and interpretation—environmental consequences				
Total visits over the life of the plan are projected to be 26,625.	Opportunities for interpretation and education would be similar to A1, although potentially in different locations.	Same as alternative A1, plus an emphasis on interpretation and education relating to the restoration efforts to meet habitat objectives and wetland health and productivity would begin.	Total visits over the life of the plan are projected to increase 25% over A1 and be 33,280. Increased environmental education and interpretive programming, particularly in relation to the importance of natural hydroperiods in wetlands.	Same as C1.
Staff and funding—actions				
5.5 FTE currently assigned to refuge management; Maintenance of pumphouse and wetland infrastructure; Pump an average of 4,000ac-ft annually.	Increase permanent staff by 2.8 FTE and 2 seasonal biological technicians. Maintenance of pumphouse and wetland infrastructure. Money for a diversion channel possibly needed.	Increase permanent staff by 2.7 FTE and 2 seasonal biological technicians. Maintenance of pumphouse and wetland infrastructure.	Increase permanent staff by 2.3 FTE. Maintenance of pumphouse and possible removal/modification of some wetland infrastructure.	Increase permanent staff by 1.5 FTE. Decommission pumphouse and all wetland infrastructure.
Staff and funding—environmental consequences				
Total costs for pumping and operations and maintenance over the life of the plan are estimated to total $1,785,000.	Total costs (water level management, pumping, operations, maintenance, prescriptive habitat treatment, and monitoring) over the life of the plan are predicted to range between $2,641,000 and $2,829,000, depending on how much natural runoff is received and how much pumping is necessary.	Total costs (water level management, pumping, operations, maintenance, prescriptive habitat treatment, grassland restoration and monitoring) over the life of the plan vary from $1,816,000 to $2,263,000 depending on how much natural runoff is received and how much pumping occurs.	Total costs (operations, maintenance, pumping, prescriptive habitat treatment, grassland restoration and monitoring) over the life of the plan vary from $809,000 - $941,000. The restoration of the basin could cost between $0–4 million dollars depending on modifications to infrastructure.	Total costs (operations, maintenance, prescriptive habitat treatment, grassland restoration and monitoring) over the life of the plan vary from $601,000 - $733,000. The restoration of the basin is projected to cost between $1.2–4 million dollars

Table 54. Summary of the actions and consequences of the management alternatives for the Benton Lake National Wildlife Refuge, Montana.

Alternative A1—(No Action)	*Alternative B1*	*Alternative B2*	*Alternative C1—(Proposed action)*	*Alternative C2*
Resource protection—actions				
Law enforcement patrols are limited to managing visitor services and resource protection.	Law enforcement patrols commitments would be increased. Preventative law enforcement efforts such as signing, news releases, informational open houses and notice posting would be increased.	Same as alternative B	Same as alternative B1	Same as alternative B1
Resource protection—environmental consequences				
Staff time for any particular activity would be limited.	Users would better understand changes in visitor access necessary to accommodate efforts to improve habitat. User confusion would be reduced and compliance with refuge rules and regulations would increase.	Same as alternative B	Same as alternative B1	Same as alternative B1

7.21 Management Direction

This section contains the specific objectives and strategies that would be used to carry out the Service's proposed action (alternative C1) for the Benton Lake Refuge. The Service recommends this as the alternative that could best achieve the refuge's purposes along with the refuge complex's vision and goals while helping to fulfill the Refuge System mission.

If the Regional Director selects alternative C1 as the preferred alternative, the objectives and strategies presented in this chapter would become the final plan to be carried out over the next 15 years. Once approved, the preferred alternative for Benton Lake Refuge, along with the preferred alternative for all the other management aspects of the refuge complex (refer to chapters 3 and 6), would become the final plan. The Service would publish a notice of availability in the Federal Register and send copies of the final CCP or CCP summary to individuals and groups on the mailing list.

The CCP would serve as the primary management document for the refuge complex until it is formally revised. The Service would carry out the final CCP with help from partner agencies, organizations, and the public. The management direction presented in this chapter would meet the purposes, vision, and goals of the refuge complex.

The Service is proposing alternative C1 as the most effective and safest way to manage Benton Lake Refuge. This section discusses goals, objectives, and strategies that serve as the steps needed to achieve the CCP vision. While a goal is a broad statement, an objective is a concise statement that describes what is to be achieved, the extent of the achievement, who is responsible, and when and where the objective should be achieved—all to address the goal. The strategies are the actions needed to achieve each objective. Unless otherwise stated, the refuge complex staff would carry out the actions in the objectives and strategies. The rationale for each objective provides context such as background information, assumptions, and technical details.

The goals and objectives for the Benton Lake Refuge are the same as those for the refuge complex and are not repeated here unless they have strategies specific to the refuge. Objectives and strategies specific to the refuge are described below.

Habitat Goal

Actively conserve, restore, and manage upland and wetland habitats across the northern prairies and intermountain valleys of the refuge complex through management strategies that perpetuate the integrity of ecological communities.

Grasslands Objective 1

Within the first 5 years of the plan, complete rangeland assessments on fee-title native grassland tracts greater than 80 acres in size. (Same as Grasslands Objective 1, chapter 6.)

Strategies

In addition to the refuge complex strategies (Grasslands Objective 1, chapter 6):

- Evaluate 5,014 acres of native grass on the refuge for existing native plant communities in comparison to the HCPC for that specific ecological site using NRCS ecological site description.

Rationale

Interpreting Indicators of Rangeland Health Technical Reference 1734–6 Version 4 (Pellant et al. 2005), is recognized by range professionals as the basis for inventory and assessment of rangeland health. This publication was a collaborative effort between the BLM, NRCS, the Agricultural Research Service and the USGS's Forest and Rangeland Ecosystem Science Center. The publication promotes the concept of rangeland heath as an alternative to range condition and assessing rangelands through ecological status concepts. These principles combined with NRCS Ecological Site Descriptions, provide the best available science for assessing the 5,014 acres of native prairie on the refuge.

Grasslands Objective 3

Within 15 years of the approved plan, convert up to 728 acres of tame grassland on Benton Lake Refuge to native-dominant perennial herbaceous cover including several species of native forbs.

Strategies

Same as the refuge complex strategies (Grasslands Objective 3, chapter 6).

USFWS

Conducting vegetation sampling on the Benton Lake National Wildlife Refuge.

Rationale
Same as the refuge complex rationale (Grasslands Objective 3, chapter 6).

Grasslands Objective 5

Within 15 years, remove up to 19 miles of nonnative tree plantings, starting with high-priority large native prairie tracts.

Strategies
Same as the refuge complex strategies (Grasslands Objective 5, chapter 6).

Rationale
The strategic removal of up to 19 miles of nonnative tree plantings on the refuge would restore contiguous grassland habitat and reduce negative effects of fragmentation, depredation and parasitism to grassland-dependent migratory birds (Bakker 2003). 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 65 and 750 acres of grassland habitat would become available or more desirable to grassland species by removing these trees (Bakker 2003). The highest priority plantings for removal are those that bisect large tracts of native prairie.

At the expense of grassland-obligate species, nonnative tree plantings provide an unnatural change to the vegetative structure of the prairies. This allows some species to nest where they otherwise would not. The result is an increase in local species diversity, but with negative impacts to regional biological diversity. As many as 18 other bird species occur on the refuge as a result of nonnative tree plantings (unpublished records on file at Benton Lake Refuge). Some of these include species of concern, such as loggerhead shrikes and Swainson's hawk (unpublished records on file at Benton Lake Refuge). These species have other nearby habitat including the Missouri River riparian area and neighboring tree plantings. Tree plantings may also contribute to and provide opportunities for invasive noxious weed infestations.

Wetlands and Riparian Areas Objective 1

Over the next 15 years, manage and protect water quality for wetlands and riparian habitats on fee-title lands within the refuge complex such that there is minimal hazard to wildlife from contaminants. (Same as Wetlands Objective 1, chapter 6.)

Strategies
In addition to the strategies for the refuge complex (Wetlands Objective 1, chapter 6):

- Cease pumping water to the refuge to reduce selenium loading and increase selenium volatilization. During dry cycles, use prescribed fire to increase selenium volatization from vegetation and exposed sediments

- Check selenium levels every 1–3 years depending on severity level.

- Identify the seeps next to Lake Creek and its tributaries to assess their discharge, and use this information to set clean-up priorities.

- Assign staff member to work with the Lake Creek watershed group, the Montana Salinity Control Association, USDA and other organizations to reduce selenium loading in natural runoff to the refuge.

Rationale
Same as the refuge complex rationale (Wetlands Objective 1, chapter 6), plus selenium has been a potentially serious problem on the Benton Lake Refuge. The refuge has a history of moderate to high hazard levels (Nimick et al. 1996, Zhang and Moore 1997, refuge unpublished data 2006). Recent monitoring data, combined with predictive models, show that the refuge could reach selenium levels that are associated with complete or nearly complete reproductive failure in sensitive wildlife species in as little as 10 years (Zhang and Moore 1997). Selenium enters the refuge in natural runoff from the surrounding Lake Creek watershed and from water pumped from the Muddy Creek watershed. While natural runoff has contributed most of the selenium loading on the refuge over the last 35 years, the pumped water has contributed approximately 40 percent of the total selenium load (Nimick et al. 1996). Furthermore, the addition of pumped water has reduced drying of the wetland sediments, which is the primary mechanism for selenium to leave the refuge. Dry periods also create opportunities to use prescribed fire, which may volatize more selenium from wetland vegetation (Zhang and Moore 1997).

The toxic threat to wildlife from selenium is based on the degree of contamination present and the extent of exposure. "Minimum hazard" level is defined as the concentration of selenium in various ecosystem components for which "no imminent toxic threat is identified" (Lemly 1995, 2002). For water this is less than 2 µg/l, sediment less than 2 µg/g, macroinvertebrates less than 3 µg/g, and aquatic bird eggs less than 5 µg/g. These values can be combined to create an overall hazard assessment for a given area, such as the wetland basin on the refuge (Lemly 1995, 2002).

For some fee-title wetlands, streams and rivers on the refuge complex, contaminants may be coming from offsite sources that are not directly under Service management. In these situations, partnerships with neighboring landowners, watershed groups and other government agencies may be necessary. This is particularly important for Benton Lake Refuge. While the elimination of pumped water alone is expected to reduce selenium levels to below the minimum hazard, the Service is still interested in working with partners in the Lake Creek watershed. A contaminant action planned developed by the refuge in 1991 (USFWS 1991), identified actions to further reduce selenium inputs in natural runoff such as working with landowners, the Montana Salinity Control Association and USDA farm programs to promote seep reclamation and encourage perennial planted cover. Improving the watershed condition, along with changes in refuge management, offer the best long-term protection of water quality on the refuge.

Wetlands and Riparian Areas Objective 2

Over the next 15 years, restore the natural hydrologic processes (wet–dry cycles) for the site-specific hydrogeomorphic condition of wetlands and riparian areas. (Same as Wetlands Objective 2, chapter 6.)

Strategies

In addition to the refuge complex strategies (Wetlands Objective 2, chapter 6):

- Cease pumping to the refuge from Muddy Creek except as necessary to support water rights. Support pumphouse in working condition.
- Restore Units 1 and 2 to wet meadow wetland, with water entering the refuge through the old Lake Creek channel and natural diffuse runoff.
- On the refuge, over the next 15 years, check indicators of wetland health to evaluate if removing infrastructure, breaching dikes and filling ditches to facilitate the return of natural sheet flow to the basin is necessary.
- Hire a supervisory refuge biologist to carry out ARM as the restoration proceeds and other duties in the complex as needed
- Hire a seasonal biological technician to help with implementation of ARM.

Rationale

Same as the refuge complex rationale (Wetlands Objective 2, chapter 6), plus an HGM assessment was completed for Benton Lake Refuge in 2009 (Heitmeyer et al. 2009). This analysis identified several significant alterations to the hydrologic cycles at the refuge. During the first 30 years of the refuge's history, the refuge experienced 10- to 20-year wet and dry cycles that sustained wetland health, plant diversity and wildlife diversity. During dry years, contaminants were volatized, sediments were solidified, robust emergent vegetation such as cattails and bulrush died back, and wetland-dependent wildlife used migration, hibernation, burrowing or other strategies to survive. When the wet cycle returned to Benton Lake it experienced a boom of wetland productivity as invertebrates and wetland-dependent wildlife took advantage of the newly available resources. Over the last 50 years, this cycle has been altered by pumped water that reduced or ended the dry cycles and the associated benefits. In addition, wet years are also less productive because the rejuvenating effects of the dry cycle did not occur.

Another important alteration of the hydrologic cycle at Benton Lake is the timing of flooding with pumped water. Historically, Benton Lake received most of its natural runoff and precipitation from spring snowmelt and rain during April-June. Conversely, pumped water is available and used for flooding primarily in the fall. While fall flooding may occur occasionally, repeated, annual fall flooding has likely reduced productivity in the wetlands, especially for spring migrants and breeding birds, by reducing seed availability altering plant germination and reducing invertebrate abundance and diversity (Schneider 1999, Murkin and Ross 1999, Anderson and Smith 2000, Greer et al. 2006).

The physical movement and storage of water on Benton Lake has also been significantly altered. Units 1 and 2 were originally an alluvial fan of Lake Creek and only flooding during high flows, probably during spring (Heitmeyer et al. 2009). Currently, these units are the deepest, most permanently flooded part of the refuge. This has led to selenium contamination and cattail encroachment problems. In addition, the dikes, ditches and canals on the refuge have disrupted the original flooding patterns that alter the microtopography of the wetland basin and ultimately wetland productivity (Heitmeyer et al. 2009; personal communication, L. Frederickson). Unlike many wetlands in the United States, especially on refuges, the hydrogeomorphic conditions of Benton Lake have not been altered to an extent that prevents restoration. While the land surrounding the refuge in the Lake Creek watershed has largely been converted from native prairie to small grain agriculture, much of the remaining influences on the refuge have not changed. In particular, there are no significant alterations to the inputs from Lake Creek to the refuge, and since it is a closed basin, there are no downstream users of the water.

As the restoration progresses, refuge staff would be using ARM and monitoring feedback loops to inform the management decision-making process. An added full-time supervisory biologist and seasonal biological technician would be necessary to achieve this objective. A part of the supervisory biologist's time would be focused on developing, adjusting and providing oversight for the adaptive resource management of the restoration process. The daily implementation of the monitoring for the restoration process would be accomplished with the existing 1 FTE refuge biologist and two seasonal biological technicians, as well as one added technician.

Wetlands and Riparian Areas Objective 5

Within 15 years, begin management of refuge wetland vegetation so that refuge at least 80 percent of wetlands are in good vegetative condition as defined by the MNHP Wetland Condition Assessment method.

Strategies

- Manage wetland vegetation by using grazing, haying, or fire to emulate historical disturbances when natural flooding and drying cycles allow.
- Reduce competition and cover of nonnative vegetation by using discing, prescribed fire, grazing, haying or herbicides.
- Where proper and feasible, native plantings and seeding may be used to restore native vegetation.
- Priority would be given to invasive species management within wetlands using IPM and EDRR.
- Use natural flooding and drying cycle to favor native vegetation and reduce nonnative vegetation where applicable (rest).
- Check vegetation to find out if wetland vegetation is improving or declining.
- Identify and check key wildlife species as added indicators of wetland health and management success.

Rationale

Vegetation is a common indicator of wetland health (Fennessy et al. 2007). Many methods have been developed to try to capture this, but the methods of DeKeyser et al. (2003, 2009), Hargiss et al. (2008), and the MNHP (2010) have been developed on similar wetland basins similar to the refuge.

Objectively determining the breakpoints, or thresholds, for condition classes, such as defining what is a "good" wetland is difficult. The MNHP is currently working on a wetland reference network in Montana that would help clarify this definition. Until this is finished, the Service would use the vegetation metrics identified by the MNHP and strive to have wetlands in the top condition classes for each metric. At a minimum, the Service would conduct the rapid assessment and strive for at least 80-percent cover by native plants, less than 5-percent noxious weeds, less than 25-percent other nonnative or highly tolerant native species, moderate litter accumulation that does not prevent plant recruitment, and no single dominant plant type across entire wetland. For wetlands with active restoration or management, such as Benton Lake, the assessment can be augmented with data on the diversity of native plant species, their Coefficient of Conservatism and overall Floristic Quality Index (Northern Great Plains Floristic Quality Assessment Panel 2001; Montana Natural Heritage Program unpublished data). Reference conditions and cutoff values of "good" may be reassessed after the initial evaluation.

Visitor Services Goal

Provide opportunities to enjoy wildlife-dependent recreation on Service-owned lands and increase knowledge and appreciation for the refuge complex's ecological communities and the mission of the National Wildlife Refuge System.

Hunting Objective

Over the life of the plan, provide a variety of hunting opportunities for approximately 3,300 visits that support sustainable resources and provide participants with an opportunity to appreciate natural environment on Benton Lake Refuge. (Same as Hunting Objective, chapter 6.)

Strategies

In addition to the refuge complex strategies (Hunting Objective, chapter 6):

- Provide waterfowl hunting as conditions allow until November 30.
- Provide upland gamebird hunting at the refuge including increased opportunity by extending the season on the refuge to correspond with the

State season (generally first weekend in October to January 1) and expanding the locations available to hunt on the refuge.

- Provide youth waterfowl and upland gamebird hunting opportunities within State season.

- Annually evaluate and revise hunt location and seasonal availability to synchronize opportunity with water availability and to provide an inviolate sanctuary for migrating waterfowl.

Rationale
Same as the refuge complex rationale (Hunting Objective, chapter 6). Waterfowl and upland gamebird hunting occurs on the refuge. General refuge hunting begins with the opening of the State waterfowl season, with the exception of youth waterfowl and upland gamebird seasons. Waterfowl hunting season closes after November 30th and upland gamebird hunting will close in correspondence with the State season. When waterfowl hunting occurs, the hunting area would be flexible to make sure an inviolate sanctuary exists while concurrently providing for hunting. Decisions would be made on a year-by-year basis about the location of open and closed areas for waterfowl hunting.

Wildlife Observation and Photography Objective

Throughout the life of the plan, continue to provide opportunities for approximately 7,500 visits annually at Benton Lake Refuge to observe and photograph a variety of wildlife species. (Same as Wildlife Observation and Photography Objective, chapter 6.)

Strategies
In addition to the refuge complex strategies (Wildlife Observation and Photography Objective, chapter 6):

- Continue to support observation and photography blinds.

- Install another grouse observation and photography blind.

- Continue to support an information kiosk and Prairie Marsh boardwalk trail with a spotting scope.

- If habitat restoration efforts require it, change or reroute the existing auto tour routes.

- Evaluate locations for more walking trails.

- Restrict foot-traffic, including hiking, snowshoeing, and cross-country skiing, to designated trails; roads open to motorized vehicles; and to the refuge hunt area during the refuge hunting season.

- To provide an accessible alternative to the grouse blind, provide a video in the Visitor Center that shows grouse dancing and make sure that visitors are aware that it is available. Explore the possibility of putting the video on the refuge Web site.

Rationale
Same as refuge complex rationale plus, in 2011, wildlife observation and photography accounted for 7,650 visits to the refuge. The Benton Lake Visitor Center, the Prairie Marsh Drive, Lower Marsh Road, an informational kiosk, the Prairie Marsh Boardwalk with a spotting scope, a photography blind, and a Sharp-tailed Grouse observation blind facilitate wildlife observation and photography opportunities on the refuge.

Environmental Education and Interpretation Objective 1

During the life of the plan, enhance public knowledge and understanding of the restoration efforts and the progress being made. Expand environmental education programs for adults and children on and off the refuge, focusing on the wetland habitat and native prairie habitats and the natural, cultural, and historical resources of the refuge. Programs and activities would promote awareness of and advocacy for refuge resources and management activities for the more than 10,000 visitors and students annually at the Benton Lake Refuge.

Strategies
In addition to the refuge complex strategies (Environmental Education and Interpretation Objective 1, chapter 6):

- Develop a series of environmental outreach programs with specific themes (such as prairie and wetland conservation) as it relates to the restoration process for the refuge.

- Design and install interpretive panels that focus specifically on the restoration efforts and explain the restoration process and the progress.

- Adapt an environmental education curriculum in coordination with the Great Falls Public Schools to reflect the changes throughout the habitat restoration process.


USFWS

Prescribed fire is a managment tool used at Benton Lake National Wildlife Refuge.

- When safety permits, allow visitors access to areas undergoing restoration to highlight activities and restoration effects and resulting benefits to natural resources.
- Consider producing tear sheets on birdlife histories
- Develop a unified, professionally designed exhibit with a central theme for the entire visitor center area
- Provide outreach materials for people with disabilities (large print, audio), and make sure that all refuge environmental education programs are accessible.

Rationale

Same as the refuge complex rationale (Environmental Education and Interpretation Objective 1, chapter 6), plus in FY 2011, refuge staff reached 1,700 participants during on and offsite environmental education programs. Most of which, approximately 850, were third graders in the Great Falls Public School System who visit the Benton Lake Refuge as part of their education curriculum. In addition, 75 participants attended 3 special events and 75 participants attended interpretation programs on and off refuge facilities.

Understanding why the habitat restoration needs to be accomplished would generate more support from sportsmen and women, wildlife observers, and other interested public. Identifying and communicating important messages about natural resources to diverse audiences forges connections between interests of the audiences and develops understanding through appreciation and finally protection. It is essential to help the public become aware of the natural world around them and what they can do to help protect and restore it.

The refuge has the potential to provide an extraordinary environmental education and interpretation program. The refuge is located 12 miles from Great Falls, a city of 60,000 people, in north-central Montana. The population of Cascade County, where the refuge is located, is 82,000. The refuge staff has never included an environmental education position. Management staff has given occasional tours to school groups and nongovernmental organizations, but has not developed and implemented a professional Environmental education program. The environmental science department of the GFPS brings all third graders (800–900 students) to the refuge each year in May and June for a basic introduction to prairie grasslands and wetlands. The enthusiasm and interest found in these young minds provides a foundation on which the Service could build a positive outdoor ethic.

Administration Goal

Provide facilities, strategically allocate staff, and effectively use and develop funding sources, partnerships, and volunteer opportunities to maintain the long-term integrity of habitats and wildlife resources of the refuge complex.

Staff and Funding Objective

Throughout the life of the plan, strive to fill positions identified in the CCP as critical to accomplishing goals and objectives (table 28 in section 6.1).

Strategies

- Conduct site visits and prepare briefing packages for Service and other Federal officials (for example, congressional staff) to showcase complex achievements and potential acquisition growth.
- Use local media throughout the refuge complex to promote habitat improvements, outreach activities, and other accomplishments.
- Continue to cultivate good working relationships with the refuge complex's neighbors, other State and Federal agencies, nongovernmental organizations and other user groups to promote grassroot support and advocacy for refuge complex initiatives.
- Cooperate with organizations like TNC and the Conservation Fund to leverage resources for conservation easement programs.
- Continue to accurately document money and staff needs through memos and reports.
- Prove to neighbors, partners, and local communities the potential benefits of increased money and staff in the refuge complex.
- Establish a Friends group to help support and advocate for the refuge complex.
- Coordinate and take part in multi-agency youth and volunteer programs and initiatives.
- Refine and increase participation in the refuge complex volunteer program.

Rationale

Increases in the size and complexity of lands within the refuge complex require more staff and money. Several new or expanded easement initiatives (Blackfoot Valley, Rocky Mountain Front, and Swan Valley Conservation Areas) would need more staff for monitoring and administration of easements as well as more money to acquire easements.

Current staff and budget levels are not sufficient to complete required administrative functions. 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 cost of living adjustments. 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, a significant increase in LWCF appropriations for the Rocky Mountain Front Conservation Area has occurred in recent years. This money is highly variable and directly affects the refuge complex's ability to preserve intact landscapes.

To accomplish the goals and objectives identified in this plan, the refuge complex staff would need to maximize opportunities for in-kind help, both fiscal and human resources, in addition to experiencing increases in base (operations money) 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. Creative work force planning, partnerships, and using supplemental money making opportunities are mechanisms to successfully carry out recommendations. Other options are to use maintenance action teams, contracting, seasonal and temporary hires, volunteers, and youth initiatives.

Visitor and Employee Safety and Resource Protection Goal

Provide for the safety, security, and protection of visitors, employees, natural and cultural resources, and facilities throughout the refuge complex.

Resource Protection Objective

Over the life of the plan, strive to limit illegal activity to at or below levels to be figured out within 5 years of plan approval. (Same as Resource Protection Objective 2, chapter 6.)

Strategies
In addition to the refuge complex strategies (Resource Protection Objective 2, chapter 6):

- Increase patrol and preventative law enforcement efforts at the refuge by utilizing the full-time law enforcement officer hired for the refuge complex.

- Organize and distribute information about the changing routes of travel, access areas, designated closures, changes in refuge specific regulations to improve preventative law enforcement efforts.

- Submit news releases to local newspapers and radio stations and post on refuge Web site to increase the public's awareness about annual recreational opportunities, refuge specific regulations, and shifts in open and closed areas to hunting and other wildlife-dependent recreational uses.

- Host an annual hunter orientation "open house" before the hunting season to share refuge specific regulations and changes to the open and closed areas.

Rationale
Same as the refuge complex rationale (Resource Protection Objective 2, chapter 6), plus currently law enforcement support on the refuge consists of help from the collateral duty officer assigned to the wetland management district or the Montana-Wyoming Zone Officer stationed at the complex headquarters. Restoration efforts within the wetland basin may require shifts in open and close areas, auto tour routes, walking trails and other wildlife-dependent recreational activities. Preventative law enforcement efforts can help end or reduce the occurrence of refuge specific violations. Open houses, news releases, posting of regulatory information are effective ways to improve visitor compliance.

Glossary

accessible—Pertaining to physical access to areas and activities for people of different abilities, especially those with physical impairments.

A.D.—Anno Domini, "in the year of the Lord."

adaptive resource management (ARM)—The rigorous application of management, research, and monitoring to gain information and experience necessary to assess and change management activities. It is a process that uses feedback from research, monitoring, and evaluation of management actions to support or change objectives and strategies at all planning levels. It is also a process in which the Service carries out policy decisions within a framework of scientifically driven experiments to test predictions and assumptions inherent in management plans. Analysis of results helps managers decide whether current management should continue as is or whether it should be modified to achieve desired conditions.

alternative—Reasonable way to solve an identified problem or satisfy the stated need (40 CFR 1500.2); one of several different means of accomplishing refuge and district purposes and goals and contributing to the National Wildlife Refuge System mission ("Draft Fish and Wildlife Service Manual" 602 FW 1.5).

amphibian—Class of cold-blooded vertebrates that includes frogs, toads, and salamanders.

annual—Plant that flowers and dies within 1 year of germination.

baseline—Set of critical observations, data, or information used for comparison or a control.

biological control—Organisms or viruses used to control invasive plants or other pests.

biological diversity, biodiversity—Variety of life and its processes including the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur ("Fish and Wildlife Service Manual" 052 FW 1.12B). The National Wildlife Refuge System's focus is on indigenous species, biotic communities, and ecological processes.

biotic—Pertaining to life or living organisms; caused, produced by, or comprising living organisms.

breeding habitat—Environment used by migratory birds or other animals during the breeding season.

canopy—Layer of foliage, generally the uppermost layer, in a vegetative stand; midlevel or understory vegetation in multilayered stands. Canopy closure (also canopy cover) is an estimate of the amount of overhead vegetative cover.

CCP—See comprehensive conservation plan.

CFR—See Code of Federal Regulations.

CO2—Carbon dioxide.

Code of Federal Regulations (CFR)—Codification of the general and permanent rules published in the Federal Register by the Executive departments and agencies of the Federal Government. Each volume of the CFR is updated once each calendar year.

compact—Montana House bill 717–Bill to Ratify Water Rights Compact.

compatibility determination—See compatible use.

compatible use—Wildlife-dependent recreational use or any other use of a refuge or district that, in the sound professional judgment of the Director of the U.S. Fish and Wildlife Service, will not materially interfere with or detract from the fulfillment of the mission of the National Wildlife Refuge System or the purposes of the refuge or district ("Draft Fish and Wildlife Service Manual" 603 FW 3.6). A compatibility determination supports the selection of compatible uses and identified stipulations or limits necessary to make sure there is compatibility.

comprehensive conservation plan (CCP)—Document that describes the desired future conditions of the refuge or district and provides long-range guidance and management direction for the refuge manager to accomplish the purposes of the refuge or district, contribute to the mission of the National Wildlife Refuge System, and meet other relevant mandates ("Draft Fish and Wildlife Service Manual" 602 FW 1.5).

concern—See issue.

cool-season grasses—Grasses that begin growth earlier in the season and often become dormant in summer; grasses that germinate at lower temperatures. Examples of cool-season grasses in the refuge complex are western wheatgrass, needle and thread, and green needlegrass.

conservation—Management of natural resources to prevent loss or waste; actions may include preservation, restoration, and enhancement.

conservation easement—Perpetual agreement entered into by a landowner and the Service by which a landowner gives up or sells one or more of the rights on their property for conservation purposes, with terms set by the Service. In return for a single lump-sum payment, the landowner agrees not to drain, burn, level, or fill habitats covered by the easement. Conservation easements generally prohibit the cultivation of grassland and wetland habitats while still permitting the landowner traditional grazing uses. A single-habitat conservation easement is often referred to as either a wetland easement or a grassland easement.

coordination area—Wildlife management area made available to a State by a "cooperative agreement between the United States Fish and Wildlife Service and the State fish and game agency pursuant to section 4 of the Fish and Wildlife Coordination Act (16 U.S.C. 664); or (B) by long-term leases or agreements pursuant to the Bankhead–Jones Farm Tenant Act (50 Stat. 525; 7 U.S.C. 1010 et seq.)." States manage coordination areas, but they are part of the National Wildlife Refuge System. CCPs are not required for coordination areas.

cover, cover type, canopy cover—Present vegetation of an area; also see canopy.

cultural resources—Remains of sites, structures, or objects used by people in the past.

dense nesting cover (DNC)—Composition of grasses and forbs that allows for a dense stand of vegetation that protects nesting birds from the view of predators, usually consisting of one to two species of wheatgrass, alfalfa, and sweetclover.

district—See wetland management district.

district purpose—See purpose of the refuge.

disturbance—Significant alteration of habitat structure or composition from natural causes such as wildfire or human-caused activities and development such as timber harvest and road building.

DNC—See dense nesting cover.

drawdown—A manipulated water level in an impoundment that allows for the natural drying-out cycle of a wetland.

duck, dabbling—Duck that mainly feeds on vegetable matter by upending on the water surface or by grazing and only rarely dives.

duck, diving—Duck that mainly feeds by diving through the water.

EA—See environmental assessment.

ecosystem—Dynamic and interrelating complex of plant and animal communities and their associated nonliving environment; a biological community, together with its environment, functioning as a unit. For administrative purposes, the U.S. Fish and Wildlife Service has designated 53 ecosystems covering the United States and its possessions. These ecosystems generally correspond with watershed boundaries and their sizes and ecological complexity vary.

ecotype—Subspecies or race that is especially adapted to a particular set of environmental conditions.

emergent—Plant rooted in shallow water and having most of the vegetative growth above water such as cattail and hardstem bulrush.

endangered species, Federal—Plant or animal species listed under the Endangered Species Act of 1973, as amended, that is in danger of extinction throughout all or a significant part of its range.

endangered species, State—Plant or animal species in danger of becoming extinct or extirpated in a particular State within the near future if factors contributing to its decline continue; species with a population at a critically low level or having habitat that has been degraded or depleted to a significant degree.

environmental assessment (EA)—Concise public document, prepared in compliance with the National Environmental Policy Act, that briefly discusses the purpose and need for an action and alternatives to such action and that provides sufficient evidence and analysis of effects to determine whether to prepare an environmental impact statement or finding of no significant impact (40 CFR 1508.9).

evapoconcentration—Concentration of chemical constituents in a liquid due to evaporative processes.

extinction—Complete disappearance of a species from the earth; no longer existing.

extirpation—Extinction of a population; eradication of a species within a specified area.

°F—Temperature in degrees Fahrenheit.

fauna—Vertebrate and invertebrate animals in an area.

Federal trust resource—Resource managed by one entity for another who holds the ownership. The Service holds in trust many natural resources for the people of the United States of America because of Federal acts and treaties; examples are species listed under the Endangered Species Act, migratory birds protected by international treaties, and native plant or wildlife species found on a national wildlife refuge.

Federal trust species—Species where the Federal Government has primary jurisdiction including federally endangered or threatened species, migratory birds, anadromous fish, and certain marine mammals.

fee title—Acquisition of most or all of the rights to a tract of land.

Federal land—Public land owned by the Federal Government including lands such as national wildlife refuges, national forests, and national parks.

flora—Plant species in an area.

forb—Broad-leaved herbaceous plant; seed-producing annual, biennial, or perennial plant that does not develop persistent woody tissue but dies down at the end of the growing season.

fragmentation—Alteration of a large block of habitat that creates isolated patches of the original habitat interspersed with a variety of other habitat types; process of reducing the size and connectivity of habitat patches, making movement of individuals or genetic information between parcels difficult or impossible.

ft—Feet, length measure.

full-time equivalent (FTE)—One or more job positions with tours of duty that, when combined, equate to one person employed for the standard Government work-year.

FWS—See U.S. Fish and Wildlife Service.

Geographic Information System (GIS)—Computer system capable of storing and manipulating spatial data; set of computer hardware and software for analyzing and displaying spatially referenced features (such as points, lines and polygons) with nongeographic attributes such as species and age.

GIS—See Geographic Information System.

glyphosate—Glyphosate N–(phosphonomethyl) glycine; broad-spectrum systemic herbicide used to kill invasive plants, especially perennials. Glyphosate inhibits an enzyme involved in the synthesis of the amino acids tyrosine, tryptophan, and phenylalanine; absorbed through foliage and translocated to growing points, it is only effective on actively growing plants and is not effective as a preemergence herbicide.

goal—Descriptive, open-ended, and often broad statement of desired future conditions that conveys a purpose but does not define measurable units ("Draft Fish and Wildlife Service Manual" 620 FW 1.5).

gpm—Gallons per minute, waterflow.

grassland tract—Contiguous area of grassland that is not fragmented.

GS—General schedule pay rate schedule for certain Federal positions.

habitat—Suite of existing environmental conditions required by an organism for survival and reproduction; place where an organism typically lives and grows.

habitat type, vegetation type, cover type—Land classification system based on the concept of distinct plant associations.

hemimarsh—Emergent phase of a seasonal or semipermanent wetland where the ratio of open-water area to emergent vegetation cover is about 50:50 and vegetation and open-water areas are highly interspersed.

hydroperiod—Period during which soils, waterbodies, and sites are wet.

impoundment—Body of water created by collection and confinement within a series of levees or dikes, creating separate management units although not always independent of one another.

Improvement Act—National Wildlife Refuge System Improvement Act of 1997.

in—Inch.

indigenous—Originating or occurring naturally in a particular place.

integrated pest management (IPM)—Methods of managing undesirable species such as invasive plants; education, prevention, physical or mechanical methods of control, biological control, responsible chemical use, and cultural methods.

"interseed"—Mechanical seeding of one or several plant species into existing stands of established vegetation.

introduced species—Species present in an area due to intentional or unintentional escape, release, dissemination, or placement into an ecosystem because of human activity.

invasive species—Species that is nonnative to the ecosystem under consideration and whose introduction causes, or is likely to cause, economic or environmental harm or harm to human health.

inviolate sanctuary—Place of refuge or protection where animals and birds may not be hunted.

issue—Any unsettled matter that requires a management decision; for example, a Service initiative, opportunity, resource management problem, a threat to the resources of the unit, conflict in uses, public concern, or the presence of an undesirable resource condition ("Draft Fish and Wildlife Service Manual" 602 FW 1.5).

lek—An elevated patch of grassland used by male grouse to display and challenge one another to attract females; the elevation not only provides a clear view to interested female grouse, but it also enables the males to spot predators at a distance.

management alternative—See alternative.

management plan—Plan that guides future land management practices on a tract of land.

migration—Regular extensive, seasonal movements of animals between their breeding regions and wintering regions; to pass periodically from one region or climate to another for feeding or breeding.

migratory bird—Bird species that follows a seasonal movement from its breeding grounds to its wintering grounds; includes waterfowl, shorebirds, raptors, and songbirds.

mission—Succinct statement of purpose or reason for being.

mitigation—Measure designed to counteract an environmental effect or to make an effect less severe.

mixed-grass prairie—Transition zone between tallgrass prairie and shortgrass prairie dominated by grasses of medium height that are about 2–4 feet tall; soils are not as rich as in the tallgrass prairie and moisture levels are less.

monitoring—Collecting information to track changes of selected parameters over time.

national wildlife refuge (NWR)—Designated area of land, water, or an interest in land or water within the National Wildlife Refuge System but does not include coordination areas; listing of all units of the Refuge System is in the current Annual Report of Lands Under Control of the U.S. Fish and Wildlife Service.

National Wildlife Refuge System (Refuge System)—Various categories of areas administered by the Secretary of the Interior for the conservation of fish and wildlife including species threatened with extinction; all lands, waters, and interests therein administered by the Secretary as wildlife refuges; areas for the protection and conservation of fish and wildlife that are threatened with extinction; wildlife ranges, game ranges, wildlife management areas, and waterfowl production areas.

National Wildlife Refuge System Improvement Act of 1997 (Improvement Act)—Set administrative policy for all refuges and units in the National Wildlife Refuge System; defined a unifying mission for the Refuge System; established the legitimacy and appropriateness of the six priority public uses (hunting, fishing, wildlife observation, photography, environmental education, and interpretation); established a formal process for determining appropriateness and compatibility; established the responsibilities of the Secretary of the Interior for managing and protecting the Refuge System; required a comprehensive conservation plan for each unit by the year 2012; amended portions of the Refuge Recreation Act and National Wildlife Refuge System Administration Act of 1966.

native species—Species that, other than as a result of an introduction, historically occurred or currently occurs in a specific ecosystem.

neotropical migrant, migratory bird—Bird species that breeds north of the United States and Mexican border and winters primarily south of this border.

NEPA—National Environmental Policy Act.

nest success—Chance that a nest will hatch at least one egg.

nongovernmental organization—Group that is not comprised of Federal, State, tribal, county, city, town, local, or other governmental entities.

North American Waterfowl Management Plan—Recognized that the recovery and perpetuation of waterfowl populations depends on restoring wetlands and associated ecosystems throughout the United States and Canada; established cooperative international efforts and joint ventures comprised of individuals, corporations, conservation organizations, and local, State, Provincial, and Federal agencies drawn together by common conservation objectives.

noxious weed—Plant or plant product that can directly or indirectly injure or cause damage to crops (including nursery stock or plant products), livestock, poultry, or other interests of agriculture, irrigation, navigation, natural resources of the United States, public health, or the environment.

NRCS—Natural Resources Conservation Service.

NWR—See national wildlife refuge.

objective—Concise target statement of what will be achieved, how much will be achieved, when and where it will be achieved, and who is responsible for the work; derived from goals and provides the basis for determining management strategies; should be attainable, time specific, and stated quantitatively to the extent possible (if cannot be stated quantitatively, may be stated qualitatively) ("Draft Fish and Wildlife Service Manual" 602 FW 1.5).

palustrine—Relating to a system of inland, nontidal wetlands characterized by the presence of trees, shrubs, and emergent vegetation (vegetation that is rooted below water but grows above the surface); palustrine wetlands range from permanently saturated or flooded land to land that is wet only seasonally.

Partners in Flight Program—Western Hemisphere program designed to conserve neotropical migratory birds and officially endorsed by many Federal and State agencies and nongovernmental organizations; also known as the Neotropical Migratory Bird Conservation Program.

partnership—Contract or agreement entered into by two or more individuals, groups of individuals, organizations, or agencies in which each agrees to furnish a part of the capital or some in-kind service such as labor for a mutually beneficial enterprise.

patch—Area distinct from that around it; distinguished from its surroundings by environmental conditions.

perennial—Lasting or active through the year or through many years; waterbody that holds water year-round; plant species that has a lifespan of more than 2 years.

planning team—Group of individuals that prepares the comprehensive conservation plan; interdisciplinary in membership and function; generally consists of a team leader, refuge manager, biologist, staff specialists or other representatives of Service programs, ecosystems or regional offices, and State partner wildlife agencies as needed.

planning team leader—Professional planner or natural resource specialist knowledgeable of the requirements of National Environmental Policy Act and who has planning experience; manages the refuge planning process and makes sure that there is compliance with applicable regulatory and policy requirements.

planning unit—National wildlife refuge or wetland management district, or an ecologically or administratively related refuge complex, or a distinct unit of a refuge; may include lands outside refuge or district boundaries.

plant community—Assemblage of plant species unique in its composition that occurs in particular locations under particular influences; reflection or integration of the environmental influences on the site such as soil, temperature, elevation, solar radiation, slope, aspect, and rainfall; denotes a general kind of climax plant community such as ponderosa pine or bunchgrass.

preferred alternative—Alternative selected to becomes the final plan; it can be the proposed action, the no-action alternative, another alternative, or a combination of actions and alternatives described in the draft CCP and environmental analysis document.

prescribed fire—Skillful application of fire to natural fuel under specified conditions such as weather, fuel moisture, and soil moisture that allows confinement of the fire to a predetermined area and produces the intensity of heat and rate of spread to accomplish planned benefits to one or more objectives of habitat management, wildlife management, or hazard reduction.

pristine—Typical of original conditions.

private land—Land owned by a private individual, a group of individuals, or a nongovernmental organization.

private landowner—Individual, group of individuals, or nongovernmental organization that owns land.

private organization—Nongovernmental organization.

priority public use—One of six uses authorized by the National Wildlife Refuge System Improvement Act of 1997 to have priority if found to be compatible with a refuge or district's purposes; hunting, fishing, wildlife observation, photography, environmental education, and interpretation; also see wildlife-dependent recreational use.

proposed action—Alternative proposed to best achieve the purpose, vision, and goals of a refuge or district (contributes to the Refuge System mission, addresses the significant issues, and is consistent with principles of sound fish and wildlife management).

protohistoric—Pertaining to the transition period between prehistory and the earliest recorded history.

public—Individuals, organizations, and groups; officials of Federal, State, and local government agencies; Indian tribes; and foreign nations (may include anyone outside the core planning team); anyone who may or may not have shown an interest in Service issues and those who do or do not realize that Service decisions may affect them.

public domain, reserved from—See reserved from public domain.

public involvement or scoping—Process that offers affected and interested individuals and organizations an opportunity to become informed about and to express their opinions on Service actions and policies; in the process, these views are studied thoroughly and thoughtful consideration is given to public views when shaping decisions for refuge and district management.

purpose of the refuge, district—Reason for establishment and management of a national wildlife refuge or wetland management district that is specified in or derived from the law, proclamation, Executive order, agreement, public land order, donation document, or administrative memorandum establishing authorization or expansion of a refuge, refuge unit, refuge subunit, or district ("Draft Fish and Wildlife Service Manual" 602 FW 1.5).

raptor—Carnivorous bird such as a hawk, falcon, or vulture that feeds wholly or chiefly on meat taken by hunting or on carrion (dead carcasses).

Reclamation—Bureau of Reclamation.

redd—The spawning area or nest of trout or salmon.

refuge—See national wildlife refuge.

Refuge Operations Needs System—National database that contains the unfunded operational needs of each refuge and district; projects included are those required to carry out approved plans and meet goals, objectives, and legal mandates.

refuge purpose—See purpose of the refuge.

Refuge System—See National Wildlife Refuge System.

refuge use—Activity on a refuge, except administrative or law enforcement activity, carried out by or under the direction of an authorized Service employee.

reserved from public domain—Public land placed into permanent reserved status, such as a national wildlife refuge, that is not held in private ownership.

resident species or wildlife—Species inhabiting a given locality throughout the year; nonmigratory species.

resilience—the ability of system to recover from a disturbance or change without significant loss and return to a given ecological state

rest—Free from biological, mechanical, or chemical manipulation in reference to Service lands.

restoration—Management emphasis designed to move ecosystems to desired conditions and processes such as healthy upland habitats and aquatic systems.

riparian area, habitat, corridor—Area that transitions from a terrestrial to aquatic ecosystem including streams, lakes, wet areas, and adjacent plant communities and their associated soils that have free water at or near the surface; land and its vegetation immediately adjoining and directly influenced by a stream.

RLGIS—Refuge Lands Geographic Information System.

RONS—See Refuge Operations Needs System.

"round-outs"—Odd shapes and holes of non-Federal land within the boundary of Refuge System units that are straightened, or made whole, by the purchase of land tracts.

runoff—Water from rain, melted snow, or agricultural or landscape irrigation that flows over the land surface into a waterbody.

SAMMS—See Service Asset Maintenance Management System.

scoping—Process of obtaining information from the public for input into the planning process.

sediment—Material deposited by water, wind, and glaciers.

senior water rights—Rights to water that were legally filed earlier than junior (more recent) water rights, having precedence.

Service—See U.S. Fish and Wildlife Service.

Service Asset Maintenance Management System—National database that contains the unfunded maintenance needs of each refuge and district; projects include those required to support existing equipment and buildings and to correct safety deficiencies for the implementation of approved plans and to meet goals, objectives, and legal mandates.

shelterbelt—Single to multiple rows of trees and shrubs planted around cropland or buildings to block or slow down the wind.

shorebird—Suborder of birds (Charadrii) such as a plover or snipe that frequents the seashore or mudflat areas.

spatial—Relating to, occupying, or having the character of space.

special use permit—Special authorization from the refuge manager for any service, facility, privilege, or product of the soil provided at the Service's expense and not usually available to the public through authorizations in Title 50 CFR or other public regulations ("Refuge Manual" 5 RM 17.6).

species of concern—Species, while not falling under the definition of special status species, that is of management interest by virtue of being Federal trust species such as migratory birds, important game species, or significant keystone species; species that has a documented or clear population decline, a small or restricted population, or dependence on restricted or vulnerable habitats.

stand—Homogenous area of vegetation with more or less uniform soils, landform, and vegetation.

stepdown management plan—Specific plan that provides the details necessary to carry out management strategies identified in the comprehensive conservation plan ("Draft Fish and Wildlife Service Manual" 602 FW 1.5).

strategy—Specific action, tool, or technique or combination of actions, tools, and techniques used to meet unit objectives ("Draft Fish and Wildlife Service Manual" 602 FW 1.5).

submergent—Vascular or nonvascular plant adapted to grow in water, either rooted or nonrooted, that lies entirely beneath the water surface except for flowering parts in some species.

System—See National Wildlife Refuge System.

threatened species, Federal—Species listed under the Endangered Species Act of 1973, as amended, that is likely to become endangered within the foreseeable future throughout all or a significant part of its range.

threatened species, State—Species likely to become endangered in a particular State within the near future if factors contributing to population decline or habitat degradation or loss continue.

trust resource—See Federal trust resource.

trust species—See Federal trust species.

U.S.C.—United States Code.

USDA—United States Department of Agriculture.

U.S. Fish and Wildlife Service (Service, FWS)—Part of U.S. Department of the Interior; principal Federal agency responsible for conserving, protecting, and enhancing fish and wildlife and their habitats for the continuing benefit of the American people. The Service manages the National Wildlife Refuge System comprised of national wildlife refuges and waterfowl production areas. The Service runs national fish hatcheries and ecological service field stations, enforces Federal wildlife laws, manages migratory bird populations, restores national significant fisheries, conserves and restores wildlife habitat such as wetlands, administers the Endangered Species Act, oversees the Federal aid program that distributes millions of dollars in excise taxes on fishing and hunting equipment to State wildlife agencies, and helps foreign governments with their conservation efforts.

U.S. Geological Survey (USGS)—Federal agency in the U.S. Department of the Interior whose mission is to provide reliable scientific information to describe and understand the earth; reduce loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect our quality of life.

ungulate—Hoofed mammal.

vision statement—Concise statement of the desired future condition of a planning unit, based primarily on the Refuge System mission, specific refuge or district purposes, and other relevant mandates ("Draft Fish and Wildlife Service Manual" 602 FW 1.5).

volatilize—To cause a solid or liquid to be changed into a vapor. This is the means by which selenium is transferred from sediment to the air, thereby reducing levels in the wetland

wading birds—Birds having long legs that enable them to wade in shallow water such as egret, great blue heron, black-crowned night-heron, and bittern.

waterbird—Birds that depend on aquatic habitats to complete portions of their life cycles.

waterfowl—Category of birds that groups ducks, geese, and swans.

watershed—Geographic area within which water drains into a particular river, stream, or waterbody.

wetland—Land transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water.

wetland management district—Land that the Refuge System acquires with Federal Duck Stamp money for restoration and management, primarily as prairie wetland habitat critical to waterfowl and other wetland birds.

WG—Wage grade schedule, pay rate schedule for certain Federal positions.

wildfire—Free-burning fire requiring a suppression response; all fire other than prescribed fire that occurs on wildlands.

wildland fire—Wildfire or prescribed fire that occurs in undeveloped land.

wildlife-dependent recreational use—Use of a refuge or district involving hunting, fishing, wildlife observation, photography, environmental education, or interpretation; also see priority public use.

wildlife management—Practice of manipulating wildlife populations either directly through regulating the numbers, ages, and sex ratios harvested or indirectly by providing favorable habitat conditions and alleviating limiting factors.

woodland—Open stands of trees with crowns not usually touching, generally forming 25–60 percent cover.

WPA—Waterfowl production area.

Appendix A

Key Legislation and Policy

This appendix briefly describes the guidance for the National Wildlife Refuge System and other key legislation and policies that guide management of the Benton Lake National Wildlife Refuge Complex.

> *The mission of the Refuge System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.* (National Wildlife Refuge System Improvement Act of 1997)

A.1 Goals of the National Refuge System

- Conserve a diversity of fish, wildlife, and plants and their habitats, including species that are endangered or threatened with becoming endangered.
- Develop and support a network of habitats for migratory birds, anadromous and interjurisdictional fish, and marine mammal populations that is strategically distributed and carefully managed to meet important life history needs of these species across their ranges.
- Conserve those ecosystems, plant communities, wetlands of national or international significance, and landscapes and seascapes that are unique, rare, declining, or underrepresented in existing protection efforts.
- Provide and enhance opportunities to take part in compatible wildlife-dependent recreation (hunting, fishing, wildlife observation and photography, and environmental education and interpretation).
- Foster understanding and instill appreciation of the diversity and interconnectedness of fish, wildlife, and plants and their habitats.

A.2 Guiding Principles

There are four guiding principles for management and general public use of the Refuge System established by Executive Order 12996 (1996):

- *Public Use*—The Refuge System provides important opportunities for compatible wildlife-dependent recreational activities involving hunting, fishing, wildlife observation and photography, and environmental education and interpretation.
- *Habitat*—Fish and wildlife will not prosper without quality habitat and without fish and wildlife, traditional uses of refuges cannot be sustained. The Refuge System will continue to conserve and enhance the quality and diversity of fish and wildlife habitat within refuges.
- *Partnerships*—America's sportsmen and women were the first partners who insisted on protecting valuable wildlife habitat within wildlife refuges. Conservation partnerships with other Federal agencies, State agencies, tribes, organizations, industry, and the general public can make significant contributions to the growth and management of the Refuge System.
- *Public Involvement*—The public should be given a full and open opportunity to participate in decisions regarding acquisition and management of our national wildlife refuges.

A.3 Legal and Policy Guidance

Management actions on national wildlife refuges and wetland management districts are circumscribed by many mandates including laws and Executive orders. Regulations that affect refuge and district management the most are listed below.

American Indian Religious Freedom Act (1978)—Directed agencies to consult with native traditional religious leaders to determine proper policy changes necessary to protect and preserve Native American religious cultural rights and practices.

Americans with Disabilities Act (1992)—Prohibited discrimination in public accommodations and services.

Antiquities Act (1906)—Authorized the scientific investigation of antiquities on Federal land and provides penalties for unauthorized removal of objects taken or collected without a permit.

Archaeological and Historic Preservation Act (1974)—Directed the preservation of historic and archaeological data in Federal construction projects.

Archaeological Resources Protection Act (1979), as amended—Protected materials of archaeological interest from unauthorized removal or destruction, and requires Federal managers to develop plans and schedules to locate archaeological resources.

Architectural Barriers Act (1968)—Required federally owned, leased, or funded buildings and facilities to be accessible to persons with disabilities.

Clean Water Act (1977)—Required consultation with the U.S. Army Corps of Engineers (404 permits) for major wetland modifications. Section 404—Authorized the Secretary of the Army, acting through the Chief of Engineers, to issue permits, after notice and opportunity for public hearing, for discharge of dredged or fill material into navigable waters of the United States, including wetlands, at specified disposal sites. Required selection of disposal sites be in accordance with guidelines developed by the Administrator of the EPA in conjunction with the Secretary of the Army. Stated that the Administrator can prohibit or restrict use of any defined area as a disposal site whenever she or he determines, after notice and opportunity for public hearings, that discharge of such materials into such areas will have an unacceptable adverse effect on municipal water supplies, shellfish beds, fishery areas, wildlife, or recreational areas.

Dingell–Johnson Act (1950)—Authorized the Secretary of the Interior to provide financial help for State fish restoration and management plans and projects. Financed by excise taxes paid by manufacturers of rods, reels, and other fishing tackle. Known as the Federal Aid in Sport Fish Restoration Act.

Emergency Wetlands Resources Act (1986)—Promoted wetland conservation for the public benefit to help fulfill international obligations in various migratory bird treaties and conventions. Authorized the purchase of wetlands with LWCF monies.

Endangered Species Act (1973), as amended—Required all Federal agencies to carry out programs for the conservation of threatened and endangered species.

Environmental Education Act of 1990—Established the Office of Environmental Education within EPA to develop and administer a Federal environmental education program. Responsibilities of the office include developing and supporting programs to improve understanding of the natural and developed environment and the relationships between humans and their environment, supporting the dissemination of educational materials, developing and supporting training programs and environmental education seminars, managing a Federal grant program, and administering an environmental internship and fellowship program. Required the office to develop and support environmental programs in consultation with other Federal natural resource management agencies including the Service.

Executive Order 5228 (1929)—Established Benton Lake National Wildlife Refuge "as a refuge and breeding ground for birds."

Executive Order 11644, Use of Off-road Vehicles on Public Lands (1972)—Provided policy and procedures for regulating off-road vehicles.

Executive Order 11988, Floodplain Management (1977)—Required Federal agencies to provide leadership and take action to reduce the risk of flood loss, reduce the effect of floods on human safety, and preserve the natural and beneficial values served by the floodplains. Prevented Federal agencies from contributing to the "adverse impacts associated with occupancy and modification of floodplains" and the "direct or indirect support of floodplain development." In the course of fulfilling their respective authorities, Federal agencies "shall take action to reduce the risk of flood loss, to reduce the effect of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by floodplains."

Executive Order 11990, Protection of Wetlands (1977)—Directed Federal agencies to (1) reduce destruction, loss, or degradation of wetlands, and (2) preserve and enhance the natural and beneficial values of wetlands when a practical alterna¬tive exists.

Executive Order 12996, Management and General Public Use of the National Wildlife Refuge System (1996)—Defined the mission, purpose, and priority public uses of the Refuge System; presented four principles to guide management of the Refuge System.

Executive Order 13007, Indian Sacred Sites (1996)—Directed Federal land management agencies to accommodate access to and ceremonial uses of Indian sacred sites by Indian religious practitioners, avoid adversely affecting the physical integrity of such sacred sites, and where appropriate, support the confidentiality of sacred sites.

Executive Order 13443, Facilitation of Hunting Heritage and Wildlife Conservation (2007)—Directed Federal agencies that have programs and activities that have a measurable effect on public land management, outdoor recreation, and wildlife management, including the Department of the Interior and the Department of Agriculture, to facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitat.

Federal Noxious Weed Act (1990)—Required the use of integrated management systems to control or contain undesirable plant species and an interdisciplinary approach with the cooperation of other Federal and State agencies.

Federal Records Act (1950)—Required the preservation of evidence of the Government's organization, functions, policies, decisions, operations, and activities, as well as basic historical and other information.

Federal Water Pollution Control Act of 1972—Required any applicant for a Federal license or permit to conduct any activity that may result in a discharge into navigable waters to obtain a certification from the State in which the discharge originates or will originate, or, if appropriate, from the interstate water pollution control agency having jurisdiction over navigable waters at the point where the discharge originates or will originate, that the discharge will comply with applicable effluent limitations and water quality standards. Required that a certification obtained for construction of any facility must also pertain to subsequent operation of the facility.

Fish and Wildlife Act (1956)—Directed the Secretary of the Interior to develop the policies and procedures necessary for carrying out fish and wildlife laws and to research and report on fish and wildlife matters. Established the U.S. Fish and Wildlife Service within the Department of the Interior, as well as the positions of Assistant Secretary for Fish and Wildlife and Director of the Service.

Fish and Wildlife Coordination Act (1958)—Allowed the U.S. Fish and Wildlife Service to enter into agreements with private landowners for wildlife management purposes.

Fish and Wildlife Improvement Act of 1978—Improved the administration of fish and wildlife programs and amends several earlier laws including the Refuge Recreation Act, the National Wildlife Refuge System Administration Act, and the Fish and Wildlife Act of 1956. Authorized the Secretary to accept gifts and bequests of real and personal property on behalf of the United States. Authorized the use of volunteers for Service projects and appropriations to carry out volunteer programs.

Historic Sites, Buildings and Antiquities Act (1935), known as the Historic Sites Act, as amended (1965)—Declared a national policy to preserve historic sites and objects of national significance, including those located at refuges and districts. Provided procedures for designation, acquisition, administration, and protection of such sites and for designation of national historic and natural landmarks.

Land and Water Conservation Fund Act of 1965—Provided money from leasing bonuses, production royalties, and rental revenues for offshore oil, gas, and sulphur extraction to the Bureau of Land Management, the USDA Forest Service, the U.S. Fish and Wildlife Service, and State and local agencies for purchase of lands for parks, open space, and outdoor recreation.

Migratory Bird Conservation Act (1929)—Established procedures for acquisition by purchase, rental, or gifts of areas approved by the Migratory Bird Conservation Commission.

Migratory Bird Hunting and Conservation Stamp Act (1934)—Authorized the opening of part of a refuge to waterfowl hunting.

Migratory Bird Treaty Act (1918)—Designated the protection of migratory birds as a Federal responsibility and enabled the setting of seasons and other regulations including the closing of areas, Federal or non-Federal, to the hunting of migratory birds.

Mineral Leasing Act (1920), as amended—Authorized and governed leasing of public lands for development of deposits of coal, oil, gas and other hydrocarbons, sulphur, phosphate, potassium and sodium. Section 185 provided for granting of rights-of-way over Federal lands for pipelines.

National Environmental Policy Act (1969)—Required all agencies including the Service to examine the environmental effects of their actions, incorporate environmental information, and use public participation in the planning and implementation of all actions. Required Federal agencies to integrate this act with other planning requirements and prepare appropriate documents to facilitate better environmental decisionmaking (40 CFR 1500).

National Historic Preservation Act (1966), as amended—Established policy that the Federal Government is to provide leadership in the preservation of the Nation's prehistoric and historical resources.

National Wildlife Refuge System Administration Act (1966)—Defined the National Wildlife Refuge System and authorized the Secretary of the Interior to allow any use of a refuge, provided such use is compatible with the major purposes for which the refuge was established.

National Wildlife Refuge System Improvement Act of 1997—Set the mission and administrative policy for all refuges in the National Wildlife Refuge System. Mandated comprehensive conservation planning for all units of the Refuge System.

National Wildlife Refuge System Volunteer and Community Partnership Enhancement Act of 1998—Encouraged the use of volunteers to help the Service in the management of refuges within the Refuge System. Facilitated partnerships between the Refuge System and non-Federal entities to promote public awareness of the resources of the Refuge System and public participation in the conservation of those resources. Encouraged donations and other contributions by persons and organizations to the Refuge System.

Native American Graves Protection and Repatriation Act (1990)—Required Federal agencies and museums to inventory, determine ownership of, and repatriate cultural items under their control or possession.

North American Wetlands Conservation Act (1989)—Provided for the conservation of North American wetland ecosystems, waterfowl and other migratory birds, fish, and wildlife that depend on such habitats.

Pittman–Robertson Act (1937)—Taxed the purchase of ammunition and firearms and earmarks the proceeds to be distributed to the States for wildlife restoration. Known as the Federal Aid in Wildlife Restoration Act or P–R Act.

Refuge Recreation Act (1962)—Allowed the use of refuges for recreation when such uses are compatible with the refuge's primary purposes and when sufficient money is available to manage the uses.

Refuge Revenue Sharing Act, section 401 (1935)—Provided for payments to counties in lieu of taxes using revenues derived from the sale of products from refuges.

Refuge Trespass Act of June 28, 1906—Provided the first Federal protection for wildlife at national wildlife refuges. Made it unlawful to hunt, trap, capture, willfully disturb, or kill any bird or wild animal, or take or destroy the eggs of any such birds, on any lands of the United States set apart or reserved as refuges or breeding grounds for such birds or animals by any law, proclamation, or Executive order, except under rules and regulations of the Secretary. Protected Government property on such lands.

Rehabilitation Act (1973)—Required programmatic accessibility in addition to physical accessibility for all facilities and programs funded by the Federal Government to make sure that any person could take part in any program.

Salt Cedar and Russian Olive Control Demonstration Act (2006)—Furthered the purposes of the Reclamation Projects Authorization and Adjustment Act of 1992 by directing the Secretary of the Interior, acting through the Commissioner of Reclamation, to carry out an assessment and demonstration program to control saltcedar and Russian olive and for other purposes.

Transfer of Certain Real Property for Wildlife Conservation Purposes Act of 1948—Provided that, on determination by the Administrator of the General Services Administration, real property no longer needed by a Federal agency can be transferred without reimbursement to the Secretary of the Interior if the land has particular value for migratory birds or to a State agency for other wildlife conservation purposes.

U.S. Department of the Interior Order Number 3226 (2001)—Directed bureaus and offices of the Department to analyze the potential effects on climate change when undertaking long-range planning, setting priorities for scientific research, and making major decisions about use of resources.

Volunteer and Community Partnership Enhancement Act (1998)—Encouraged the use of volunteers to help in the management of refuges within the Refuge System. Facilitated partnerships between the

Refuge System and non-Federal entities to promote public awareness of the resources of the Refuge System and public participation in the conservation of the resources and encouraged donations and other contributions.

Wilderness Act of 1964—Directed the Secretary of the Interior, within 10 years, to review every roadless area of 5,000 or more acres and every roadless island (regardless of size) within the Refuge System and National Park Service for inclusion in the National Wilderness Preservation System.

Appendix B

Preparers and Contributors

This document is the result of extensive, collaborative, and enthusiastic efforts by the members of the planning team shown below.

Team member	*Position*	*Work unit*
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Many organizations, agencies, and individuals provided invaluable help with the preparation of this CCP. The Service acknowledges the efforts of the following individuals and groups toward the completion of the plan. The diversity, talent, and knowledge contributed dramatically improved the vision and completeness of this document.

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Appendix C

Public Involvement

A notice of intent to prepare the draft comprehensive conservation plan and EA was published in the Federal Register on August 18, 2008. The Service compiled a mailing list of more than 700 names during preplanning. The list includes private citizens; local, regional, and State government representatives and legislators; other Federal agencies; and interested organizations. Public scoping began immediately after publication of the notice of intent and was announced through news releases and issuance of the first planning update to the mailing list.

The planning update provided information on the history of the refuge complex and the CCP process, along with an invitation and schedule to upcoming public open houses to be held throughout the planning area. Each planning update included a comment form to give the public an opportunity to provide written comments. Emails were also accepted at the refuge complex's email address: bentonlake@fws.gov.

Open houses were announced to local newspapers, radio, and television stations. Flyers were posted, and announcements were made via email and at meetings of local organizations.

Four public open houses were held in local communities in the refuge complex area including Great Falls, Choteau, Ovando, and Kalispell, Montana, September 2–4, 2008. At the meetings informational posters, maps, and handouts, along with a power point presentation provided a history of the Refuge System, orientation to the planning area, and an overview of the CCP and NEPA processes. The draft vision statement developed for the refuge complex was also presented at the open houses. Service staff was available to answer questions on a variety of topics about refuge management and the CCP process. Attendees were encouraged to ask questions and offer comments. Verbal comments were recorded and each attendee was given a comment form to submit thoughts or questions in writing. The turnout was low, with 5–10 people attending each meeting.

All written comments were due September 15, 2008. Sixty comments were received during the scoping effort. Input obtained from public meetings, letters, emails, and comment forms was considered in developing the draft CCP. These comments identified biological, social, and economic concerns about refuge management.

The planning team's response to public comments will be completed before final approval of the CCP. The mailing list for the CCP and EA follows.

C.1 Federal Officials

U.S. Representative Dennis Rehberg, Washington, DC
U.S. Senator John Tester, Washington, DC
U.S. Senator Max Baucus, Washington, DC

C.2 Federal Agencies

BLM, Billings, Montana
BLM, Lewistown, Montana
Bureau of Reclamation, Billings, Montana
Department Natural Resources Conservation, Helena, Montana
Farm Service Agency, Bozeman, Montana
USDA National Resources Conservation Service, Bozeman, Montana
USDA Forest Service, Choteau, Montana
USDA Forest Service, Great Falls, Montana
USDA Forest Service, Libby, Montana
USDA Forest Service, Rocky Mountain Research Station, Missoula, Montana
USFWS, Air Quality Branch, Lakewood, Colorado
USFWS, Creston Fish and Wildlife Center, Creston, Montana
USFWS, Ecological Services, Helena, Montana
USFWS, Education and Visitor Services, Helena, Montana
USFWS, the Swan River Refuge, Bigfork, Montana
USGS, Bozeman, Montana
USGS, Biological Resources Division, Missoula, Montana

C.3 Tribal Officials

Blackfeet Tribal Business Council, Browning, Montana
Blood Tribes, Cardston, Alberta, Canada

Confederated Salish Kootenai Tribes, Pablo, Montana
Fort Belknap Community Council, Harlem, Montana
Peigan Tribe, Brocket, Alberta, Canada

C.4 State Officials

Governor Brian D. Schweitzer, Helena, Montana
Representative Shannon Augare, Browning, Montana
Representative Bill Beck, Whitefish, Montana
Representative Bob Bergren, Havre, Montana
Representative Jerry Black, Shelby, Montana
Representative Mark Blasdel, Somers, Montana
Representative John Brueggeman, Polson, Montana
Representative Edith Clark, Sweetgrass, Montana
Representative John Cobb, Augusta, Montana
Representative Douglas Cordier, Columbia Falls, Montana
Representative Aubyn Curtiss, Fortine, Montana
Representative Ken Hansen, Harlem, Montana
Representative Robin Hamilton, Missoula, Montana
Representative Ralph Heinart, Libby, Montana
Representative Joey Jayne, Arlee, Montana
Representative Mike Jopek, Whitefish, Montana
Representative Llew Jones, Conrad, Montana
Representative William Jones, Bigfork, Montana
Representative Carol Juneau, Browning, Montana
Representative Mike Milburn, Cascade, Montana
Representative Jerry O'Neil, Columbia Falls, Montana
Representative Rick Ripley, Wolf Creek, Montana
Representative Don Ryan, Great Falls, Montana
Representative Janna Taylor, Dayton, Montana
Representative Chas Vincent, Libby, Montana
Representative Dan Weinberg, Whitefish, Montana

C.5 State Agencies

Montana Department of Environmental Quality, Helena, Montana
Montana Department of Natural Resources and Conservation, Conrad, Montana
Montana Department of Natural Resources and Conservation, Helena, Montana
Montana Department of Natural Resources and Conservation, Missoula, Montana
Montana Fish, Wildlife & Parks, Helena, Montana
Montana Fish, Wildlife & Parks, Billings, Montana
Montana Natural Heritage Program, Helena, Montana
Montana Historical Society and Preservation Office, Helena, Montana
Montana State Lands, Helena, Montana

C.6 Local Government

Bigfork County Water and Sewer, Bigfork, Montana
Cascade County Mosquito Management District, Great Falls, Montana
City of Bigfork, Roadside Vegetation Program, Bigfork, Montana
City of Havre, Havre, Montana
Hill County Government, Havre, Montana
Hill County, Mosquito Management District, Havre, Montana
Teton County Commission, Choteau, Montana
Pondera County Commission, Conrad, Montana

C.7 Local Fire Departments

Marion Volunteer Fire Department, Marion, Montana

C.8 Local Businesses

AAA Weed and Pasture, Columbia Falls, Montana
American Public Lands Exchange, Missoula, Montana
Benton Lake Land Company, Great Falls, Montana
Bignell Ranch Company, Helmville, Montana
Brown and Brown of Montana, Great Falls, Montana
Glacier Colony, Cut Bank, Montana
Golden Acres Farm, Brady, Montana
Gollaher Ranch Company, Cascade, Montana
Gumbo Incorporated, Choteau, Montana
Harmon Properties LLC, Havre, Montana
Heavirland Enterprises, Choteau, Montana
Historical Research Associates Incorporated, Missoula, Montana
Ish Incorporated, Chester, Montana
Juedeman Grain Company, Geraldine, Montana
Klabzuba Oil and Gas Incorporated, Fort Worth, Texas
Klondike Ridge Farms, Sunburst, Montana
KRA Corporation, Bethesda, Maryland
Location Montana Incorporated, Bigfork, Montana
Mannix Brothers Incorporated, Helmville, Montana
McGinnis Meadows Guest Ranch, Libby, Montana
McGregor Lake Resort, Marion, Montana
Montana Power Company, Butte, Montana

Montana Salinity Control Associates,
Conrad, Montana
Muddy Creek Ranch, Choteau, Montana
Neuman Land and Livestock, Great Falls, Montana
Nevada Spring Creek Partners, Helena, Montana
NR Recording and Communications,
Great Falls, Montana
Pernell Partners LP, Kalispell, Montana
Plum Creek Land Company, Seattle, Washington
Plum Creek Timber Company,
Columbia Falls, Montana
PPL Montana, Hydro Licensing, Butte, Montana
Sheep Mountain Cattle Company,
Geraldine, Montana
Simmes Ranch Incorporated, Sunburst, Montana
Sliters Incorporated, Somers, Montana
Spring Coulee Ranch Incorporated,
Highwood, Montana
Springdate Colony Incorporated, Power, Montana
Starshine, Great Falls, Montana
Sveum Brothers Incorporated, Sunburst, Montana
Talent Properties Incorporated, Clayton, California
Tapper Lite LLC, Bigfork, Montana
Top Notch Land Company, Kalispell, Montana
Tungsten Holdings Incorporated, Libby, Montana
Twin Springs Incorporated, Kevin, Montana
White Swan Properties LLC, Bigfork, Montana
4M Farms Incorporated, Highwood, Montana

C.9 Organizations

American Wildlands, Bozeman, Montana
Bethel Cemetery Association, Somers, Montana
Big Meadows Grazing Association,
Hot Springs, Montana
Born Free, Sacramento, CA
Chain of Lakes Homeowner's Association,
Libby, Montana
Defenders of Wildlife, Missoula, Montana
Eagle Bend Homeowners Association,
Bigfork, Montana
Five Valley Audubon Society, Missoula, Montana
Friends of the Rocky Mountain Front,
Choteau, Montana
Glacier Natural History Association,
West Glacier, Montana
Mission Mountain Audubon, Polson, Montana
Montana Audubon, Helena, Montana
Montana Chapter of the Wildlife Society,
Bozeman, Montana
Montana Historical Society, Helena, Montana
Montana Land Reliance, Bigfork, Montana
Montana Stockgrowers Association,
Helena, Montana
Montana Wilderness Association,
Great Falls, Montana
Montana Wildlife Federation, Helena, Montana
National Wildlife Federation, Missoula, Montana
National Wildlife Refuge Association,
Colorado Springs, Colorado
Rocky Mountain Elk Foundation,
Missoula, Montana
Russell Country Sportsmen's Association,
Great Falls, Montana
Sands Memorial Foundation, Havre, Montana
Sonoran Institute, Choteau, Montana
Swan River Wildlife Protection Association,
Great Falls, Montana
TNC, Helena, Montana

C.10 Libraries

Columbia Falls Library, Columbia Falls, Montana
Lincoln County Library, Libby, Montana
Whitefish City Library, Whitefish, Montana

C.11 Universities and Schools

Helmville Elementary School, Helmville, Montana
Kila School District, Kila, Montana
Montana Academy, Marion, Montana
Montana State University, Research Center,
Bozeman, Montana
Pleasant Valley School Superintendent,
Marion, Montana
Skyline Education Center, Great Falls, Montana
University of Alaska,
Biology and Wildlife Department,
Fairbanks, AK
University of Great Falls, Great Falls, Montana
University of Illinois, Department of Geology,
Urbana, IL
University of Montana,
Department of Biological Sciences,
Missoula, Montana
University of Montana,
Grizzly Bear Recovery Office,
Missoula, Montana
University of Montana, Wildlife Biology Program,
Missoula, Montana
University of Washington, Department of Zoology,
Seattle, Washington

C.12 Media

Choteau Acantha, Choteau, Montana
Hungry Horse News, Columbia Falls, Montana

C.13 Individuals

540 private individuals

Appendix D

Species Lists

Common Name	*Scientific Name*	*Designation*
MAMMALS		
American Mink	*Mustela vison*	
Badger	*Taxidea taxus*	
Beaver	*Castor canadensis*	
Big Brown Bat	*Eptesicus fuscus*	
Bighorn Sheep	*Ovis canadensis*	
Bison	*Bison bison*	
Black Bear	*Ursus americanus*	
Black-tailed Prairie Dog	*Cynomys ludovicianus*	*Species of concern*
Bobcat	*Lynx rufus*	
Bushy-tailed Woodrat	*Neotoma cinerea*	
California Myotis	*Myotis californicus*	
Canada Lynx	*Lynx canadensis*	*Threatened*
Columbian Ground Squirrel	*Spermophilus columbianus*	
Coyote	*Canis latrans*	
Deer Mouse	*Peromyscus maniculatus*	
Dusky or Montane Shrew	*Sorex monticolus*	
Dwarf Shrew	*Sorex nanus*	*Species of concern*
Eastern Red Bat	*Lasiurus borealis*	*Species of concern*
Elk or Wapiti	*Cervus canadensis*	
Fisher	*Martes pennanti*	*Species of concern*
Fringed Myotis	*Myotis thysanodes*	*Species of concern*
Golden-mantled Ground Squirrel	*Spermophilus lateralis*	
Gray Wolf	*Canis lupus*	
Grizzly Bear	*Ursus arctos*	*Threatened*
Ground squirrel	*Spermophilus elegans*	
Heather Vole	*Phenacomys intermedius*	
Hoary Bat	*Lasiurus cinereus*	*Species of concern*
Hoary Marmot	*Marmota caligata*	*Potential species of concern*
Little Brown Myotis	*Myotis lucifugus*	
Long-eared Myotis	*Myotis evotis*	
Long-legged Myotis	*Myotis volans*	
Long-tailed Vole	*Microtus longicaudus*	
Long-tailed Weasel	*Mustela frenata*	
Marten	*Martes americana*	
Masked Shrew	*Sorex cinereus*	

Common Name	Scientific Name	Designation
Meadow Vole	*Microtus pennsylvanicus*	
Merriam's Shrew	*Sorex merriami*	*Species of concern*
Mice	*Onychomys spp.* *Peromyscus spp.* *Reithrodontomys spp.*	
Mink	*Mustela vison*	
Montane Vole	*Microtus montanus*	
Moose	*Alces americanus*	
Mountain Cottontail	*Sylvilagus nuttallii*	
Mountain Lion	*Puma concolor*	
Mule Deer	*Odocoileus hemionus*	
Muskrat	*Ondatra zibethicus*	
northern Bog Lemming	*Synaptomys borealis*	*Species of concern*
northern Flying Squirrel	*Glaucomys sabrinus*	
northern Pocket Gopher	*Thomomys talpoides*	
northern river Otter	*Lontra canadensis*	
Pika	*Ochotona princeps*	
Porcupine	*Erethizon dorsatum*	
Preble's Shrew	*Sorex preblei*	*Species of concern*
Pronghorn	*Antilocapra americana*	
Pygmy Shrew	*Sorex hoyi*	
Raccoon	*Procyon lotor*	
Red Fox	*Vulpes vulpes*	
Red Squirrel	*Tamiasciurus hudsonicus*	
Red-tailed Chipmunk	*Tamias ruficaudus*	
river Otter	*Lutra canadensis*	
Short-tailed Weasel	*Mustela erminea*	
Silver-haired Bat	*Lasionycteris noctivagans*	*Potential species of concern*
Snowshoe Hare	*Lepus americanus*	
Spotted Bat	*Euderma maculatum*	*Species of concern*
Southern Red-backed Vole	*Myodes gapperi*	
Striped Skunk	*Mephitis mephitis*	
Swift Fox	*Vulpes velox*	
Townsend's Big-eared Bat	*Corynorhinus townsendii*	*Species of concern*
Vagrant Shrew	*Sorex vagrans*	
Water Shrew	*Sorex palustris*	
Water Vole	*Microtus richardsoni*	
Western Jumping Mouse	*Zapus princeps*	
Western Small-footed Myotis	*Myotis ciliolabrum*	
White-tailed Deer	*Odocoileus virginianus*	
White-tailed Jackrabbit	*Lepus townsendii*	
Wolverine	*Gulo gulo*	*Species of concern*
Yellow-bellied Marmot	*Marmota flaviventris*	

Common Name	Scientific Name	Designation
Yellow-pine Chipmunk	*Tamias amoenus*	
Yuma Myotis	*Myotis yumanensis*	Potential species of concern
BIRDS		
Alder Flycatcher	*Empidonax alnorum*	Species of concern
American Avocet	*Recurvirostra americana*	
American Bittern	*Botaurus lentiginosus*	Species of concern
American Coot	*Fulica americana*	
American Crow	*Corvus brachyrhynchos*	
American Dipper	*Cinclus mexicanus*	
American Goldfinch	*Spinus tristus*	
American Kestrel	*Falco sparverius*	
American Pipit	*Anthus rubescens*	
American Redstart	*Setophaga ruticilla*	
American Robin	*Turdus migratorius*	
American Three-toed Woodpecker	*Picoides dorsalis*	
American Tree Sparrow	*Spizella arborea*	
American White Pelican	*Pelecanus erythrorhynchos*	*Species of concern*
American Wigeon	*Anas americana*	
Anna's Hummingbird	*Calypte anna*	
Audubon's Warbler	*Dendroica coronata auduboni*	
Baird’s Sparrow	*Ammodramus bairdii*	
Bald Eagle	*Haliaeetus leucocephalus*	*Species of concern*
Band-tailed Pigeon	*Patagioenas fasciata*	
Bank Swallow	*Riparia riparia*	
Barn Swallow	*Hirundo rustica*	
Barred Owl	*Strix varia*	
Barrow's Goldeneye	*Bucephala islandica*	*Potential species of concern*
Belted Kingfisher	*Megaceryle alcyon*	
Black Rosy-Finch	*Leucosticte atrata*	*Species of concern*
Black Swift	*Cypseloides niger*	*Species of concern*
Black Tern	*Chlidonias niger*	*Species of concern*
Black-backed Woodpecker	*Picoides arcticus*	*Species of concern*
Black-billed Cuckoo	*Coccyzus erythropthalmus*	*Species of concern*
Black-billed Magpie	*Pica hudsonia*	
Black-capped Chickadee	*Poecile atricapillus*	
Black-chinned Hummingbird	*Archilochus alexandri*	
Black-crowned Night-Heron	*Nycticorax nycticorax*	*Species of concern*
Black-headed Grosbeak	*Pheucticus melanocephalus*	
Black-necked Stilt	*Himantopus mexicanus*	*Species of concern*
Black-throated Blue Warbler	*Dendroica caerulescens*	
Black-throated Sparrow	*Amphispiza bilineata*	
Blue Jay	*Cyanocitta cristata*	
Blue-winged Teal	*Anas discors*	

Common Name	Scientific Name	Designation
Bobolink	*Dolichonyx oryzivorus*	*Species of concern*
Bohemian Waxwing	*Bombycilla garrulus*	
Boreal Chickadee	*Poecile hudsonicus*	*Species of concern*
Boreal Owl	*Aegolius funereus*	
Brambling	*Fringilla montifringilla*	
Brewer's Blackbird	*Euphagus cyanocephalus*	
Brewer's Sparrow	*Spizella breweri*	*Species of concern*
Brown Creeper	*Certhia americana*	*Species of concern*
Brown Thrasher	*Toxostoma rufum*	
Brown-headed Cowbird	*Molothrus ater*	
Bufflehead	*Bucephala albeola*	
Bullock's Oriole	*Icterus bullockii*	
Burrowing Owl	*Athene cunicularia*	
California Gull	*Larus californicus*	
Calliope Hummingbird	*Stellula calliope*	
Canada Goose	*Branta canadensis*	
Canvasback	*Aythya valisineria*	
Canyon Wren	*Catherpes mexicanus*	
Caspian Tern	*Hydroprogne caspia*	*Species of concern*
Cassin's Finch	*Carpodacus cassinii*	*Species of concern*
Cassin's Vireo	*Vireo cassinii*	
Cedar Waxwing	*Bombycilla cedrorum*	
Chestnut-backed Chickadee	*Poecile rufescens*	
Chestnut-collared Longspur	*Calcarius ornatus*	
Chipping Sparrow	*Spizella passerina*	
Cinnamon Teal	*Anas cyanoptera*	
Clark's Grebe	*Aechmophorus clarkii*	*Species of concern*
Clark's Nutcracker	*Nucifraga columbiana*	*Species of concern*
Clay-colored Sparrow	*Spizella pallida*	
Cliff Swallow	*Petrochelidon pyrrhonota*	
Common Goldeneye	*Bucephala clangula*	
Common Grackle	*Quiscalus quiscula*	
Common Loon	*Gavia immer*	*Species of concern*
Common Merganser	*Mergus merganser*	
Common Moorhen	*Gallinula chloropus*	
Common Nighthawk	*Chordeiles minor*	
Common Raven	*Corvus corax*	
Common Redpoll	*Acanthis flammea*	
Common Tern	*Sterna hirundo*	*Species of concern*
Common Yellowthroat	*Geothlypis trichas*	
Cooper's Hawk	*Accipiter cooperii*	
Cordilleran Flycatcher	*Empidonax occidentalis*	
Dark-eyed Junco	*Junco hyemalis*	
Dark-eyed Junco (Gray-headed)	*Junco hyemalis caniceps*	

Common Name	Scientific Name	Designation
Dark-eyed Junco (Montana Junco)	*Junco hyemalis montanus*	
Dark-eyed Junco (Pink-sided)	*Junco hyemalis mearnsi*	
Dark-eyed Junco (Slate-colored)	*Junco hyemalis cismontanus*	
Double-crested Cormorant	*Phalacrocorax auritus*	
Downy Woodpecker	*Picoides pubescens*	
Dusky Flycatcher	*Empidonax oberholseri*	
Dusky Grouse	*Dendragapus obscurus*	
Eared Grebe	*Podiceps nigricollis*	
Eastern Phoebe	*Sayornis phoebe*	
Eastern Kingbird	*Tyrannus tyrannus*	
Eurasian Wigeon	*Anas penelope*	
European Starling	*Sturnus vulgaris*	*Exotic species (not native to Montana)*
Evening Grosbeak	*Coccothraustes vespertinus*	
Ferruginous Hawk	*Buteo regalis*	*Species of concern*
Field Sparrow	*Spizella pusilla*	
Flammulated Owl	*Otus flammeolus*	*Species of concern*
Forster's Tern	*Sterna forsteri*	*Species of concern*
Fox Sparrow	*Passerella iliaca*	
Franklin's Gull	*Leucophaeus pipixcan*	*Species of concern*
Gadwall	*Anas strepera*	
Golden Eagle	*Aquila chrysaetos*	*Species of concern*
Golden-crowned Kinglet	*Regulus satrapa*	
Grasshopper Sparrow	*Ammodramus savannarum*	*Species of concern*
Gray Catbird	*Dumetella carolinensis*	
Gray Jay	*Perisoreus canadensis*	
Gray Partridge	*Perdix perdix*	*Exotic species (not native to Montana)*
Gray-crowned Rosy-Finch	*Leucosticte tephrocotis*	*Species of concern*
Great Blue Heron	*Ardea herodias*	*Species of concern*
Great Egret	*Ardea alba*	
Great Gray Owl	*Strix nebulosa*	*Species of concern*
Great Horned Owl	*Bubo virginianus*	
greater sage-grouse	*Centrocercus urophasianus*	*Species of concern*
greater Yellowlegs	*Tringa melanoleuca*	
Green-tailed Towhee	*Pipilo chlorurus*	
Green-winged Teal	*Anas crecca*	
Hairy Woodpecker	*Picoides villosus*	
Hammond's Flycatcher	*Empidonax hammondii*	
Harlequin Duck	*Histrionicus histrionicus*	*Species of concern*
Harris's Sparrow	*Zonotrichia querula*	
Hermit Thrush	*Catharus guttatus*	
Hoary Redpoll	*Acanthis hornemanni*	
Hooded Merganser	*Lophodytes cucullatus*	*Potential species of concern*
Horned Grebe	*Podiceps auritus*	*Species of concern*

Common Name	Scientific Name	Designation
Horned Lark	*Eremophila alpestris*	
House Finch	*Carpodacus mexicanus*	
House Sparrow	*Passer domesticus*	
House Wren	*Troglodytes aedon*	
Killdeer	*Charadrius vociferus*	
Lark Bunting	*Calamospiza melanocorys*	
Lark Sparrow	*Chondestes grammacus*	
lazuli Bunting	*Passerina amoena*	
Least Flycatcher	*Empidonax minimus*	
Least Sandpiper	*Calidris minutilla*	
Le Conte's Sparrow	*Ammodramus leconteii*	
Lesser Scaup	*Aythya affinis*	
Lesser Yellowlegs	*Tringa flavipes*	
Lewis's Woodpecker	*Melanerpes lewis*	*Species of concern*
Lincoln's Sparrow	*Melospiza lincolnii*	
Loggerhead Shrike	*Lanius ludovicianus*	*Species of concern*
Long-billed Curlew	*Numenius americanus*	*Species of concern*
Long-billed Dowitcher	*Limnodromus scolopaceus*	
Long-eared Owl	*Asio otus*	
MacGillivray's Warbler	*Oporornis tolmiei*	
Magnolia Warbler	*Dendroica magnolia*	
Mallard	*Anas platyrhynchos*	
Marbled Godwit	*Limosa fedoa*	
Marsh Wren	*Cistothorus palustris*	
McCown's Longspur	*Rhynchophanes mccownii*	*Species of concern*
Merlin	*Falco columbarius*	
Mountain Bluebird	*Sialia currucoides*	
Mountain Chickadee	*Poecile gambeli*	
Mountain Plover	*Charadrius montanus*	*Species of concern*
Mourning Dove	*Zenaida macroura*	
Myrtle Warbler	*Dendroica coronata coronata*	
Nashville Warbler	*Vermivora ruficapilla*	
northern Flicker	*Colaptes auratus*	
northern Flicker (Red-shafted)	*Colaptes auratus cafer*	
northern Goshawk	*Accipiter gentilis*	*Species of concern*
northern Harrier	*Circus cyaneus*	
northern Hawk Owl	*Surnia ulula*	*Potential species of concern*
northern Oriole	*Icterus galbula*	
northern Pintail	*Anas acuta*	
northern Pygmy-Owl	*Glaucidium gnoma*	
northern Rough-winged Swallow	*Stelgidopteryx serripennis*	
northern Saw-whet Owl	*Aegolius acadicus*	
northern Shoveler	*Anas clypeata*	

Common Name	Scientific Name	Designation
northern Shrike	*Lanius excubitor*	
northern Waterthrush	*Seiurus noveboracensis*	
Olive-sided Flycatcher	*Contopus cooperi*	
Orange-crowned Warbler	*Vermivora celata*	
Osprey	*Pandion haliaetus*	
Ovenbird	*Seiurus aurocapilla*	*Potential species of concern*
Pacific Loon	*Gavia pacifica*	
Pacific Wren	*Troglodytes pacificus*	*Species of concern*
Painted Redstart	*Myioborus pictus*	
Peregrine Falcon	*Falco peregrinus*	*Species of concern*
Pied-billed Grebe	*Podilymbus podiceps*	
Pileated Woodpecker	*Dryocopus pileatus*	*Species of concern*
Pine Grosbeak	*Pinicola enucleator*	
Pine Siskin	*Spinus pinus*	
Pinyon Jay	*Gymnorhinus cyanocephalus*	*Species of concern*
Piping Plover	*Charadrius melodus*	*Threatened*
Prairie Falcon	*Falco mexicanus*	
Pygmy Nuthatch	*Sitta pygmaea*	
Red Crossbill	*Loxia curvirostra*	
Red-breasted Merganser	*Mergus serrator*	
Red-breasted Nuthatch	*Sitta canadensis*	
Red-eyed Vireo	*Vireo olivaceus*	
Red-naped Sapsucker	*Sphyrapicus nuchalis*	
Red-necked Grebe	*Podiceps grisegena*	
Red-necked Phalarope	*Phalaropus lobatus*	
Red-tailed Hawk	*Buteo jamaicensis*	
Red-winged Blackbird	*Agelaius phoeniceus*	
Redhead	*Aythya americana*	
Ring-billed Gull	*Larus delawarensis*	
Ring-necked Duck	*Aythya collaris*	
Ring-necked pheasant	*Phasianus colchius*	*Exotic species (not native to Montana)*
Rock Pigeon	*Columba livia*	*Exotic species (not native to Montana)*
Rock Wren	*Salpinctes obsoletus*	
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	
Ross's Goose	*Chen rossii*	
Rough-legged Hawk	*Buteo lagopus*	
Ruby-crowned Kinglet	*Regulus calendula*	
Ruddy Duck	*Oxyura jamaicensis*	
Ruffed Grouse	*Bonasa umbellus*	
Rufous Hummingbird	*Selasphorus rufus*	*Potential species of concern*
Sabine's Gull	*Xema sabini*	
Sage Thrasher	*Oreoscoptes montanus*	*Species of concern*
Sandhill Crane	*Grus canadensis*	

Common Name	Scientific Name	Designation
Say’s Phoebe	*Sayornis saya*	
Savannah Sparrow	*Passerculus sandwichensis*	
Scissor-tailed Flycatcher	*Tyrannus forficatus*	
Semipalmated Plover	*Charadrius semipalmatus*	
Sharp-shinned Hawk	*Accipiter striatus*	
Sharp-tailed Grouse	*Tympanuchus phasianellus*	*Species of concern*
Short-eared Owl	*Asio flammeus*	*Potential species of concern*
Snow Bunting	*Plectrophenax nivalis*	
Snow Goose	*Chen caerulescens*	
Snowy Owl	*Bubo scandiacus*	
Solitary Sandpiper	*Tringa solitaria*	
Solitary Vireo	*Vireo solitarius*	
Song Sparrow	*Melospiza melodia*	
Sora	*Porzana carolina*	
Spotted Sandpiper	*Actitis macularius*	
Spotted Towhee	*Pipilo maculatus*	
Sprague’s Pipit	*Anthus spragueii*	
Spruce Grouse	*Falcipennis canadensis*	
Steller's Jay	*Cyanocitta stelleri*	
Surf Scoter	*Melanitta perspicillata*	
Swainson's Hawk	*Buteo swainsoni*	*Potential species of concern*
Swainson's Thrush	*Catharus ustulatus*	
Tennessee Warbler	*Vermivora peregrina*	*Potential species of concern*
Townsend's Solitaire	*Myadestes townsendi*	
Townsend's Warbler	*Dendroica townsendi*	
Tree Swallow	*Tachycineta bicolor*	
Trumpeter Swan	*Cygnus buccinator*	*Species of concern*
Tundra Swan	*Cygnus columbianus*	
Turkey Vulture	*Cathartes aura*	
Varied Thrush	*Ixoreus naevius*	
Vaux's Swift	*Chaetura vauxi*	
Veery	*Catharus fuscescens*	*Species of concern*
Vesper Sparrow	*Pooecetes gramineus*	
Violet-green Swallow	*Tachycineta thalassina*	
Virginia Rail	*Rallus limicola*	
Warbling Vireo	*Vireo gilvus*	
Western Bluebird	*Sialia mexicana*	
Western Grebe	*Aechmophorus occidentalis*	
Western Kingbird	*Tyrannus verticalis*	
Western Meadowlark	*Sturnella neglecta*	
Western Screech-Owl	*Megascops kennicottii*	*Potential species of concern*
Western Tanager	*Piranga ludoviciana*	
Western Wood-Pewee	*Contopus sordidulus*	
White-breasted Nuthatch	*Sitta carolinensis*	

Common Name	*Scientific Name*	*Designation*
White-crowned Sparrow	*Zonotrichia leucophrys*	
White-faced Ibis	*Plegadis chihi*	*Species of concern*
White-tailed Ptarmigan	*Lagopus leucura*	*Species of concern*
White-throated Sparrow	*Zonotrichia albicollis*	
White-throated Swift	*Aeronautes saxatalis*	
White-winged Crossbill	*Loxia leucoptera*	
White-winged Scoter	*Melanitta fusca*	
Wild Turkey	*Meleagris gallopavo*	*Exotic species (not native to Montana)*
Willet	*Tringa semipalmata*	
Williamson's Sapsucker	*Sphyrapicus thyroideus*	
Willow Flycatcher	*Empidonax traillii*	
Wilson's Phalarope	*Phalaropus tricolor*	
Wilson's Snipe	*Gallinago delicata*	
Wilson's Warbler	*Wilsonia pusilla*	
Winter Wren	*Troglodytes troglodytes*	*Species of concern*
Wood Duck	*Aix sponsa*	
Yellow Warbler	*Dendroica petechia*	
Yellow-breasted Chat	*Icteria virens*	
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	
Yellow-rumped Warbler	*Dendroica coronata*	
REPTILES		
Common Garter Snake	*Thamnophis sirtalis*	
Common Sagebrush Lizard	*Sceloporus graciosus*	Species of concern
Eastern Racer	*Coluber constrictor*	
greater Short-horned Lizard	*Phrynosoma hernandesi*	*Species of concern*
northern Alligator Lizard	*Elgaria coerulea*	*Species of concern*
Painted Turtle	*Chrysemys picta*	
Plains Garter Snake	*Thamnophis radix*	
Rubber Boa	*Charina bottae*	
Spiny Softshell	*Apalone spinifera*	*Species of concern*
Terrestrial Garter Snake	*Thamnophis elegans*	
Western Hog-nosed Snake	*Heterodon nasicus*	*Species of concern*
Western Rattlesnake	*Crotalus viridus*	
AMPHIBIANS		
Boreal Chorus Frog	*Pseudacris maculata*	
Columbia Spotted Frog	*Rana luteiventris*	
Great Plains Toad	*Bufo cognatus*	*Species of concern*
Long-toed Salamander	*Ambystoma macrodactylum*	
northern Leopard Frog	*Rana pipiens*	*Species of concern*
Pacific Treefrog	*Pseudacris regilla*	
Plains Spadefoot	*Spea bombifrons*	
Rocky Mountain Tailed Frog	*Ascaphus montanus*	
Tiger Salamander	*Ambystoma tigrinum*	
Western Toad	*Bufo boreas*	*Species of concern*

Common Name	Scientific Name	Designation
FISH		
Arctic Grayling	*Thymallus arcticus*	
Blue Sucker	*Cycleptus elongatus*	Species of concern
Brook Stickleback	*Culaea inconstans*	Potential species of concern
bull trout	*Salvelinus confluentus*	Threatened
Columbia River Redband Trout	*Oncorhynchus mykiss gairdneri*	Species of concern
Deepwater Sculpin	*Myoxocephalus thompsonii*	Species of concern
Iowa Darter	*Etheostoma exile*	Species of concern
Longnose Sucker	*Catostomus catostomus*	
Mottled Sculpin	*Cottus bairdi*	
northern Pikeminnow	*Ptychocheilus oregonensis*	
northern Redbelly Dace	*Phoxinus eos*	
northern redbelly x finescale dace	*Phoxinus eos x phoxinus neogaeus*	*Species of concern*
Paddlefish	*Polyodon spathula*	*Species of concern*
Pallid Sturgeon	*Scaphirhynchus albus*	*Species of concern*
Pearl Dace	*Margariscus margarita*	*Species of concern*
Pygmy Whitefish	*Prosopium coulteri*	*Species of concern*
Sauger	*Sander canadensis*	*Species of concern*
Slimy Sculpin	*Cottus cognatus*	
Spoonhead Scalpin	*Cottus ricei*	*Species of concern*
Sturgeon Chub	*Macrhybopsis gelida*	*Species of concern*
Torrent Sculpin	*Cottus rhotheus*	*Species of concern*
Trout-perch	*Percopsis omiscomaycus*	*Species of concern*
Westslope Cutthroat Trout	*Oncorhynchus clarkii lewisi*	*Species of concern*
Yellowstone Cutthroat Trout	*Oncorhynchus clarkii bouvieri*	*Species of concern*
INVERTEBRATES		
caddisfly	*Anagapetus debilis*	
caddisfly	*Arctopsyche grandis*	
caddisfly	*Brachycentrus americanus*	
caddisfly	*Brachycentrus occidentalis*	
caddisfly	*Chyrandra centralis*	
caddisfly	*Dicosmoecus atripes*	
caddisfly	*Dicosmoecus gilvipes*	
caddisfly	*Helicopsyche borealis*	
caddisfly	*Hesperophylax designatus*	
caddisfly	*Hydropsyche confusa*	
caddisfly	*Lepidostoma cascadense*	
caddisfly	*Lepidostoma unicolor*	
caddisfly	*Micrasema bactro*	
caddisfly	*Neophylax rickeri*	
caddisfly	*Neophylax splendens*	
caddisfly	*Neothremma alicia*	
caddisfly	*Onocosmoecus unicolor*	

Common Name	*Scientific Name*	*Designation*
caddisfly	*Rhyacophila betteni*	
Cave-obligate Isopod	*Salmasellus steganothrix*	*Species of concern*
Eukiefferiellan Chironomid	*Eukiefferiella brehmi*	
Eukiefferiellan Chironomid	*Eukiefferiella devonica*	
Eukiefferiellan Chironomid	*Eukiefferiella gracei*	
Freshwater Sponge	*Ephydatia cooperensis*	*Species of concern*
Leech	*Helobdella stagnalis*	
Limnephilid Caddisfly	*Nemotaulius hostilis*	
mayfly	*Acentrella turbida*	
mayfly	*Attenella margarita*	
mayfly	*Baetis bicaudatus*	
mayfly	*Baetis tricaudatus*	
mayfly	*Caenis youngi*	*Species of concern*
mayfly	*Caudatella hystrix*	
mayfly	*Drunella coloradensis*	
mayfly	*Drunella doddsi*	
mayfly	*Drunella grandis*	
mayfly	*Drunella spinifera*	
mayfly	*Epeorus longimanus*	
mayfly	*Ephemerella excrucians*	
mayfly	*Parameletus columbiae*	*Species of concern*
mayfly	*Plauditus punctiventris*	
mayfly	*Serratella tibialis*	
mayfly	*Timpanoga hecuba*	
millipede	*Endopus parvipes*	*Species of concern*
millipede	*Ergodesmus compactus*	
millipede	*Lophomus laxus*	*Species of concern*
millipede	*Orophe cabinetus*	*Species of concern*
rhyacophilan Caddisfly	*Rhyacophila alberta*	
rhyacophilan Caddisfly	*Rhyacophila brunnea*	
rhyacophilan Caddisfly	*Rhyacophila ebria*	*Species of concern*
rhyacophilan Caddisfly	*Rhyacophila glaciera*	*Species of concern*
rhyacophilan Caddisfly	*Rhyacophila narvae*	
rhyacophilan Caddisfly	*Rhyacophila potteri*	*Species of concern*
rhyacophilan Caddisfly	*Rhyacophila verrula*	
riffle Beetle	*Cleptelmis addenda*	
riffle Beetle	*Heterlimnius corpulentus*	
riffle Beetle	*Lara avara*	
riffle Beetle	*Narpus concolor*	
riffle Beetle	*Optioservus quadrimaculatus*	
riffle Beetle	*Ordobrevia nubifera*	
riffle Beetle	*Zaitzevia parvula*	
sand-dwelling mayfly	*Lachlania saskatchewanensis*	*Species of concern*

Common Name	Scientific Name	Designation
stonefly	*Amphinemura banksi*	
stonefly	*Claassenia sabulosa*	*Claassenia sabulosa*
stonefly	*Despaxia augusta*	
stonefly	*Doroneuria theodora*	
stonefly	*Hesperoperla pacifica*	
stonefly	*Isocapnia crinita*	*Species of concern*
stonefly	*Isoperla petersoni*	*Species of concern*
stonefly	*Kogotus modestus*	
stonefly	*Prostoia besametsa*	
stonefly	*Setvena bradleyi*	
stonefly	*Yoraperla brevis*	
stonefly	*Zapada cinctipes*	
stonefly	*Zapada columbiana*	
stonefly	*Zapada cordillera*	*Species of concern*
stonefly	*Zapada oregonensis*	
true fly	*Atherix pachypus*	
Tvetenian Chironomid	*Tvetenia bavarica*	
Afranius Duskywing	*Erynnis alfranius*	
Alexander's Rhyacophilan Caddisfly	*Rhyacophila alexanderi*	*Species of concern*
Alpine Mountainsnail	*Oreohelix alpina*	*Species of concern*
Amber Glass	*Nesovitrea electrina*	
American Emerald	*Cordulia shurtleffii*	
American Salmonfly	*Pteronarcys dorsata*	
Agapetus Caddisfly	*Agapetus montanus*	*Potential species of concern*
amphipod	*Hyalella azteca*	*Exotic species (not native to Montana)*
Anicia Checkerspot	*Euphydryas anicia*	
Anise Swallowtail	*Papilio zelicaon*	
Artic Blue	*Plebejus glandon*	
Banded Tigersnail	*Anguispira kochi*	
Band-winged Meadowhawk	*Sympetrum semicinctum*	
Belted Whiteface	*Leucorrhinia proxima*	
Black Meadowhawk	*Sympetrum danae*	
Blue-eyed Darner	*Rhionaeschna multicolor*	*Potential species of concern*
Blue Glass	*Nesovitrea binneyana*	
Boreal Whiteface	*Leucorrhinia borealis*	*Species of concern*
Brown Hive	*Euconulus fulvus*	
Brush-tipped Emerald	*Somatochlora walshii*	*Species of concern*
California Darner	*Rhionaeschna californica*	*Potential species of concern*
California Tortoiseshell	*Nymphalis californica*	
Callippe Fritillary	*Speyeria callippe*	
Canada Darner	*Aeshna canadensis*	
Carinate Mountainsnail	*Oreohelixelrod*	*Species of concern*
Chalk-fronted Corporal	*Ladona julia*	*Potential species of concern*

Common Name	Scientific Name	Designation
Checkered White	*Pontia protodice*	
Cherry-faced Meadowhawk	*Sympetrum internum*	
Chocolate Arion	*Arion rufus*	
Common Green Darner	*Anax junius*	
Common Whitetail	*Plathemis lydia*	
Coeur d'Alene Oregonian	*Crytomastix mullani*	
Crimson-ringed Whiteface	*Leucorrhinia glacialis*	*Potential species of concern*
Cross Vertigo	*Vertigo modesta*	
Cuneate Arches	*Lacinipolia cuneata*	
Depressed Rocky Mountainsnail	*Oreohelix stringosa depressa*	
Dot-tailed Whiteface	*Leucorrhinia intacta*	
Eight-spotted Skimmer	*Libellula forensis*	
Emerald Spreadwing	*Lestes dryas*	
Ethologist Fairy Shrimp	*Eubranchipus serratus*	
Fir Pinwheel	*Radiodiscus abietum*	*Potential species of concern*
Forest Disc	*Discus whitneyi*	
Four-spotted Skimmer	*Libellula quadrimaculata*	
Gillette's Checkerspot	*Euphydryas gillettii*	*Species of concern*
Glacier Amphipod	*Stygobromus glacialis*	*Species of concern*
Green Comma	*Polygonia faunus*	
Grooved Fingernailclam	*Sphaerium simile*	
Hagen's Small Minnow Mayfly	*Diphetor hageni*	
Herrington Fingernailclam	*Sphaerium occidentale*	
Hudsonian Whiteface	*Leucorrhinia hudsonica*	
Idaho Forestsnail	*Allogona ptychophora*	
Keeled Mountainsnail	*Oreohelix carinifera*	*Species of concern*
Lake Darner	*Aeshna eremita*	*Potential species of concern*
Lake Disc	*Discus brunsoni*	*Species of concern*
Lance-tipped Darner	*Aeshna constricta*	*Potential species of concern*
Large-mantle Physa	*Physa megalochlamys*	*Species of concern*
Lorquin's Admiral	*Limenitis lorquini*	
Lustrous Copper	*Lycaena cupreus*	
Lyre Mantleslug	*Udosarx lyrata*	*Species of concern*
Magnum Mantleslug	*Magnipelta mycophaga*	*Species of concern*
Meadow Slug	*Deroceras laeve*	*Exotic species (not native to Montana)*
Meltwater Lednian Stonefly	*Lednia tumana*	*Species of concern*
Milbert's Tortoiseshell	*Aglais milberti*	
Mountain Emerald	*Somatochlora semicircularis*	*Potential species of concern*
Mourning Cloak	*Nymphalis antiopa*	
northern Bluet	*Enallagma annexum*	
northern Checkerspot	*Chlosyne palla*	
northern Rocky Mountains refugium caddisfly	*Goereilla baumanni*	*Species of concern*

Common Name	Scientific Name	Designation
northern Rocky Mountains refugium mayfly	*Caudatella edmundsi*	*Potential species of concern*
northern Spreadwing	*Lestes disjunctus*	
Orange-banded Arion	*Arion fasciatus*	
Pacific Forktail	*Ischnura cervula*	
Pacific Spiketail	*Cordulegaster dorsalis*	
Paddle-tailed Darner	*Aeshna palmata*	
Pale Snaketail	*Ophiogomphus severus*	
Pale Swallowtail	*Papilio eurymedon*	
Police Car Moth	*Gnophaela vermiculata*	
Quick Gloss	*Zonitoides arboreus*	
Ranchman's tiger Moth	*Platyprepia virginalis*	
Red-veined Meadowhawk	*Sympetrum madidum*	*Potential species of concern*
Red-winged Wave	*Dasyfidonia avuncularia*	
Reticulate Taildropper	*Prophysaon andersoni*	*Species of concern*
Ribbed Spot	*Punctum californicum*	
river Jewelwing	*Calopteryx aequabilis*	
Rocky Mountain Capshell	*Acroloxus coloradensis*	*Species of concern*
Rocky Mountain Duskysnail	*Colligyrus greggi*	*Species of concern*
Rocky Mountainsnail	*Oreohelix strigosa*	
Saffron-winged Meadowhawk	*Sympetrum costiferum*	
Salmonfly	*Pteronarcys californica*	
Sandhill Skipper	*Polites sabuleti*	
Sedge Darner	*Aeshna juncea*	*Potential species of concern*
Shadow Darner	*Aeshna umbrosa*	
Sheathed Slug	*Zacoleus idahoensis*	*Species of concern*
Shiny Tightcoil	*Pristiloma wascoense*	*Species of concern*
Signal Crayfish	*Pacifastacus leniusculus*	
Silky Vallonia	*Vallonia cyclophorella*	
Sinuous Snaketail	*Ophiogomphus occidentis*	*Potential species of concern*
Smoky Taildropper	*Prophysaon humile*	*Species of concern*
Spiny Baskettail	*Epitheca spinigera*	*Potential species of concern*
Spotted Spreadwing	*Lestes congener*	
Spruce Snail	*Microphysula ingersolli*	
Spurge Hawkmoth	*Hyles euphorbiae*	*Exotic species (not native to Montana)*
Striate Disc	*Discus shimekii*	*Species of concern*
Striped Meadowhawk	*Sympetrum pallipes*	
Subalpine Mountainsnail	*Oreohelix subrudis*	
Subarctic Bluet	*Coenagrion interrogatum*	*Species of concern*
Taiga Bluet	*Coenagrion resolutum*	
Tapered Vertigo	*Vertigo elatior*	
Twelve-spotted Skimmer	*Libellula pulchella*	
Two-ridge Rams-horn	*Helisoma anceps*	
Variable Darner	*Aeshna interrupta*	

Common Name	Scientific Name	Designation
Variegated Meadowhawk	*Sympetrum corruptum*	
Western Glacier Stonefly	*Zapada glacier*	*Species of concern*
Western Glass-snail	*Vitrina pellucida*	
Western Pearlshell	*Margaritifera falcata*	*Species of concern*
Western Red Damsel	*Amphiagrion abbreviatum*	
Western Tailed Blue	*Cupido (Everes) amyntula*	
White-faced Meadowhawk	*Sympetrum obtrusum*	
Wrinkled Marshsnail	*Stagnicola caperata*	
Zigzag Darner	*Aeshna sitchensis*	*Potential species of concern*
VASCULAR PLANTS		
Adder's Tongue	*Ophioglossum pusillum*	*Species of concern*
Aspen		*Populous tremuloides*
Austin's Knotweed	*Polygonum austiniae*	*Species of concern*
Beaked Spikerush	*Eleocharis rostellata*	*Species of concern*
Beck Water-marigold	*Bidens beckii*	*Species of concern*
Blunt-leaved Pondweed	*Potamogeton obtusifolius*	*Species of concern*
Chaffweed	*Centunculus minimus*	*Species of concern*
Cliff Toothwort	*Cardamine rupicola*	*Species of concern*
Clustered Lady's-slipper	*Cypripedium fasciculatum*	*Species of concern*
Crawe's Sedge	*Carex crawei*	*Species of concern*
Creeping Sedge	*Carex chordorrhiza*	*Species of concern*
Crested Shieldfern	*Dryopteris cristata*	*Species of concern*
Deer Indian Paintbrush	*Castilleja cervina*	*Species of concern*
Douglas-fir	*Pseudotsuga menziesii*	
English Sundew	*Drosera anglica*	*Species of concern*
Flexible Collomia	*Collomia debilis var. camporum*	*Species of concern*
Giant Helleborine	*Epipactis gigantea*	*Species of concern*
Glaucus Beaked Sedge	*Carex rostrata*	*Species of concern*
Hall's Rush	*Juncus hallii*	*Species of concern*
Howell's Gumweed	*Grindelia howellii*	*Species of concern*
Hutchinsia	*Hutchinsia procumbens*	*Species of concern*
Idaho fescue	*Festuca idahoensis*	
Keeled Bladderpod	*Physaria carinata*	*Species of concern*
Lake-bank Sedge	*Carex lacustris*	*Species of concern*
Limber pine	*Pinus flexilis*	
Linearleaf Moonwort	*Botrychium lineare*	*Species of concern*
Linear-leaved Sundew	*Drosera linearis*	*Species of concern*
Loesel's Twayblade	*Liparis loeselii*	*Species of concern*
Lyall Phacelia	*Phacelia lyallii*	
Mingan Island Moonwort	*Botrychium minganense*	*Potential species of concern*
Mission Mountain Kittentails	*Synthyris canbyi*	*Species of concern*
Missoula Phlox	*Phlox kelseyi var. missoulensis*	*Species of concern*
Moonwort Grape-fern	*Botrychium lunaria*	*Potential species of concern*
Mountain Moonwort	*Botrychium montanum*	*Species of concern*

Common Name	Scientific Name	Designation
northern Bog Clubmoss	*Lycopodium inundatum*	*Species of concern*
northern Moonwort	*Botrychium pinnatum*	*Status under review*
Pale Sedge	*Carex livida*	*Potential species of concern*
Pod Grass	*Scheuchzeria palustris*	*Species of concern*
Ponderosa pine	*Pinus ponderosa*	
Pygmy Water-lily	*Nymphaea leibergii*	*Species of concern*
Round-leaved Orchis	*Amerorchis rotundifolia*	*Species of concern*
Short-flowered Monkeyflower	*Mimulus breviflorus*	*Species of concern*
Slender Cottongrass	*Eriophorum gracile*	*Species of concern*
Small Yellow Lady's-slipper	*Cypripedium parviflorum*	*Potential species of concern*
Sparrow's-egg Lady's-slipper	*Cypripedium passerinum*	*Species of concern*
Spoon-leaf Moonwort	*Botrychium spathulatum*	*Species of concern*
Stalk-leaved Monkeyflower	*Mimulus ampliatus*	*Species of concern*
Stalked Moonwort	*Botrychium pedunculosum*	*Species of concern*
Thinsepal monkeyflower	*Mimulus hymenophyllus*	*Status under review*
Tufted Club-rush	*Trichophorum cespitosum*	*Species of concern*
Upward-lobed Moonwort	*Botrychium ascendens*	*Species of concern*
Water Bulrush	*Schoenoplectus subterminalis*	*Species of concern*
Watershield	*Brasenia schreberi*	*Species of concern*
Water Howellia	*Howellia aquatilis*	*Threatened*
Wavy Moonwort	*Botrychium crenulatum*	*Species of concern*
Western Moonwort	*Botrychium hesperium*	*Species of concern*
NONVASCULAR PLANTS		
Barnes' eurhynchium moss	*Eurhynchium pulchellum var. barnesii*	*Status under review*
Brick-spored Firedot Lichen	*Brigantiaea praetermissa*	*Potential species of concern*
Bryum moss	*Bryum calobryoides*	
Chocolate Chip Lichen	*Solorina bispora*	*Species of concern*
Douglas' neckera moss	*Neckera douglasii*	*Species of concern*
Gray Lungwort Lichen	*Lobaria hallii*	*Species of concern*
Hooded Ramalina Lichen	*Ramalina obtusata*	*Species of concern*
Jelly Lichen	*Collema curtisporum*	*Species of concern*
Lead Lichen	*Parmeliella triptophylla*	*Species of concern*
Magellan's Peatmoss	*Sphagnum magellanicum*	*Species of concern*
Mountain Oakmoss Lichen	*Evernia divaricata*	*Potential species of concern*
Netted Specklebelly Lichen	*Pseudocyphellaria anomala*	*Species of concern*
Powdery Twig Lichen	*Ramalina pollinaria*	*Species of concern*
Speck Lichen	*Verrucaria kootenaica*	*Species of concern*

Appendix E

Draft Compatibility Determinations

E.1 Refuge Complex Name and Dates Established

Benton Lake National Wildlife Refuge Complex:

- Benton Lake National Wildlife Refuge—November 21, 1929
- Benton Lake Wetland Management District—1975
- Swan River National Wildlife Refuge—May 14, 1973

Establishing and Acquisition Authorities

16 U.S.C. § 715(d),
Migratory Bird Conservation Act 1929
16 U.S.C. § 718(c),
Migratory Bird Hunting and Conservation Stamp of 1934
16 U.S.C. § 661–667e,
Fish and Wildlife Coordination Act of 1934
16 U.S.C. § 742(a–j),
Fish and Wildlife Act of 1956
16 U.S.C. § 718d(b),
Small Wetlands Acquisition Program 1958
25 U.S.C. § 488,
Consolidated Farm and Rural Development Act of 1985

E.2 Refuge Complex Purposes

The establishing and acquisition authorities set out the purposes for each unit of the refuge complex, as described below.

Benton Lake National Wildlife Refuge

- As "a refuge and breeding ground for migratory birds."
- Executive Order 5228, November 21, 1929
- For "use as an inviolate sanctuary, or for any other management purpose, for migratory birds."
- Migratory Bird Conservation Act

Benton Lake Wetland Management District

- As "Waterfowl Production Areas subject to [...] all of the provisions of such Act [Migratory Bird Conservation Act] [...] except the inviolate sanctuary provisions."
- Migratory Bird Hunting and Conservation Stamp
- For "any other management purpose, for migratory birds."
- Migratory Bird Conservation Act
- For "conservation purposes."
- Consolidated Farm and Rural Development Act

Swan River National Wildlife Refuge

- For "use as an inviolate sanctuary, or for any other management purpose, for migratory birds"
- Migratory Bird Conservation Act

National Wildlife Refuge System Mission

The mission of the Refuge System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

E.3 Description of Uses

The following uses are evaluated for compatibility within the refuge complex:

- Hunting

- Fishing
- Wildlife observation and photography
- Environmental education and interpretation
- Cooperative farming, haying, and grazing
- Commercial filming, audio recordings, and still photography
- Research and monitoring
- Special one-time events
- Virtual geocaching
- Dry lot for up to 4 horses

Hunting

The refuge complex's hunting program will be driven by its compatibility with wildlife population objectives and the availability of water during the hunting season. In addition to the site-specific regulations mentioned below, the State hunting regulations apply to all Service-owned lands in the refuge complex. Hunters may only possess and use Service-approved, nontoxic shot loads on Service-owned lands, and vehicle travel and parking is restricted to public roads, pullouts, and parking areas. The refuge complex Web site and public use brochures provide guidance onsite-specific regulations. The general hunting regulations are available from MFWP.

The CCP proposes to continue the hunting uses described for each unit below. In addition, the Service will increase regulatory hunting signage (for example, closed to hunting area signs, nontoxic shot required signs) and interpretive materials (for example, an updated and more comprehensive refuge complex hunting leaflet, hunting factsheets) to reduce unintentional hunting violations throughout the refuge complex.

Benton Lake National Wildlife Refuge

Public hunting of migratory gamebirds including ducks, geese, coot, swan (by permit only) and upland gamebirds including pheasant, sharp-tailed grouse, and gray partridge is permitted in designated areas of the refuge.

Big game hunting and hunting rabbits or any other wildlife species, including furbearers is not be permitted on Benton Lake Refuge.

Benton Lake Wetland Management District

Except for the Sands WPA in Hill County and H2-O WPA in Powell County, all waterfowl production areas within the district are open to hunting of migratory gamebirds, upland game, and big game. Approximately 14,127 acres of upland and wetland habitat are available for hunting. Unless otherwise noted, all Service lands open to hunting are subject to State hunting regulations and seasons.

Swan River National Wildlife Refuge

Hunting of migratory gamebirds including ducks, geese, swans (by permit only), and coots is permitted in designated areas of the refuge.

Upland gamebird hunting, big game hunting, and guided hunting is not permitted on the refuge.

Availability of Resources

Existing programs such as current refuge directional signs and brochures are occasionally updated with available resources. Maintenance of access roads, parking, hunting and information kiosks, and public use signs is closely tied to Service Asset Maintenance Management System funding. The refuge complex's base money would fund the update and printing of existing and new brochures.

More law enforcement staff and resources would be required (1) to manage significant changes to the hunting program to reduce disturbance to wildlife and habitat, (2) carry out and encourage preventative law enforcement efforts, and (3) to check compliance with public use and hunting regulations.

Anticipated Impacts of Use

The hunting program on Service lands in the refuge complex will continue to provide hunters ample quality hunting opportunities without materially detracting from the mission of the Refuge System or the establishing purposes of the refuge complex lands. Public use brochures and the refuge complex's Web site will be kept up to date and made readily available to hunters. Hunter success and satisfaction will continue to be monitored through random contacts with hunters in the field and in the refuge complex office.

The National Wildlife Refuge System Act of 1966, other laws, and the Service's policy permit hunting on a national wildlife refuge when it is compatible with the purposes for which the refuge was established and acquired. As practiced on the refuge complex, hunting does not pose a threat to the wildlife populations. By its very nature, hunting creates a disturbance to wildlife and directly affects the individual animals being hunted. Hunting will be designed and monitored to offer a safe and quality program and to keep adverse effects within acceptable limits.

Although hunting directly affects the hunted species and may indirectly disturb other species, limits on harvest and access for recreational hunting would make sure that populations do not fall to unsustainable levels. Closed areas on the refuge complex provide sanctuary to migratory birds during the hunting season.

Other effects from hunting activity include conflicts with individuals participating in wildlife-dependent, priority public uses such as wildlife observation and photography. This could decrease the visitors' satisfaction during the hunting season.

Public Review and Comment

This Compatibility Determination is presented for public review and comment as part of the 30-day public comment period for the Draft Comprehensive Conservation Plan and Environmental Assessment for the Benton Lake National Wildlife Refuge Complex.

Determination

Hunting is a compatible use on the refuge complex.

Stipulations Necessary for Compatibility

- Hunters will be required to use approved nontoxic shot for migratory bird and upland gamebird hunting on Service-owned lands.
- Vehicles will be restricted to county and public roads and parking areas in the refuge complex.
- Signage, news releases, open-houses, and brochures will be used to provide hunters information on where and how to hunt on the refuge complex to make sure there is compliance with public use regulations.

Justification

Hunting is a form of wildlife-dependent recreation and is identified as a priority public use in the Improvement Act. Based on anticipated biological effects described above and in the EA, the Service has found that hunting within the refuge complex would not interfere with the purposes for which the refuges and district were established. Limiting access and monitoring the use could help limit any adverse effects. Except for the H2–O and Sands WPAs, all lands and waters within the wetland management district would be open to hunting in accordance with the Migratory Bird Hunting and Conservation Stamp Act, under which they were acquired.

Mandatory 15-year Reevaluation Date: 2027

Fishing

This use will be a continuation of the historic activity of noncommercial fishing. Public use areas such as parking and fishing areas, as well as interpretive panels, signs, kiosks, and other structures may be installed and supported to facilitate this program. Areas on the refuge complex that are seasonally sensitive to migratory birds will remain closed to public entry and use. Only selected areas of the refuge complex will be open to fishing. Special refuge regulations governing fishing will be available in refuge brochures.

The CCP proposes the fishing uses described for each unit below in accordance with State regulations. The CCP does not call for the implementation of any new fishing programs; however, opportunities may be expanded with more purchases of waterfowl production areas within the district.

Benton Lake National Wildlife Refuge

The main part of the refuge offers no fishing opportunities due to a lack of sport fish. The Pump House Unit of the refuge is open for fishing.

Benton Lake Wetland Management District

Lands acquired as waterfowl production areas are open to fishing subject to the provisions of State laws and regulations. Fishing or entry on all or any part of individual areas may be temporarily suspended by posting on occasions of unusual or critical conditions of, or affecting, land, water, vegetation or fish and wildlife populations.

Fishing on waterfowl production areas throughout the district is permitted. Known game fish populations exist at the Arod Lakes, H2–O, proposed acquisition at Upsata Lake, and Blackfoot WPAs. At the Arod Lakes and Upsata Lake WPAs, walk-in access would be permitted year-round. On Arod Lakes WPA, vehicle access to Middle and Round Lakes is permitted January 2 until April 1.

Swan River National Wildlife Refuge

Fishing is permitted on portions of the Swan River that flow through the refuge year-round. Walk-in access for fishing from Bog Road may occur throughout the year.

Availability of Resources

The refuge complex has adequate administrative and management staff to support its fishing program.

Anticipated Impacts of Use

Temporary disturbance of wildlife may occur near fishing activity. Fishing will temporarily decrease the fish population until natural reproduction or stocking replenishes the population. Frequency of use is directly dependent upon fish populations and their feeding activity. When fish populations are high and active, public use will increase. Minimal disturbance to ground nesting birds may occur from anglers walking along rivers and streams. Littering can also become a problem. No long-term negative impacts to resources are anticipated.

Public Review and Comment

This Compatibility Determination is presented for public review and comment as part of the 30-day public comment period for the Draft Comprehensive Conservation Plan and Environmental Assessment for Benton Lake National Wildlife Refuge Complex.

Determination

Fishing is a compatible use on the Benton Lake and Swan River Refuges and waterfowl production areas in the district in accordance with State regulations.

Stipulations Necessary for Compatibility

- Vehicles will be restricted to county and public roads and parking areas on the waterfowl production areas.
- Use of motorized boats is prohibited on the Benton Lake Refuge, except the Swan River where no-wake regulations are in effect.
- Boats, fishing equipment, and all other personal property must be removed at the end of each day.

Justification

Fishing is a form of wildlife-dependent recreations and is identified as a priority public use in the Improvement Act. Based on the biological effects addressed above and in the EA, the Service has found that fishing would not interfere with the purposes for establishment of the refuges and waterfowl production areas within the refuge complex. Current staffing levels and monetary resources are adequate. Special refuge regulations are in place to reduce negative impacts to refuge habitat and wildlife.

Mandatory 15-year Reevaluation Date: 2027

Wildlife Observation and Photography

A variety of habitats and many species of wildlife throughout the refuge complex provide observation and photography opportunities year-round. The Benton Lake Refuge received most of the visitation.

Wildlife observation and photography opportunities would continue to be provided throughout the refuge complex, and would be supported by providing observation blinds, supporting an up-to-date bird species list for the refuges in the refuge complex, and allowing the public the opportunity to use portable viewing and photography blinds through the issuance of special use permits. These activities may take place on foot, bicycle, automobile, horse, cross-country skis and snowshoes.

Facilities exist on the Benton Lake and Swan River Refuges that support these activities by bringing visitors closer to wildlife: Boardwalk Nature Trail, Swan River Overlook, Sharp-tailed Grouse Observation Blind, Benton Lake Refuge photography blind, and Prairie Marsh Wildlife Drive. Modifications and relocations may occur to the existing facilities and auto tour routes to accommodate restoration activities to the wetland basin at the Benton Lake Refuge. New facilities for observing and photographing wildlife (such as observation decks, trails, auto tour routes, and photography blinds) may be developed.

The CCP proposes to continue wildlife observation and photography on the following units of the refuge complex as described below.

Benton Lake National Wildlife Refuge

The Prairie Marsh Wildlife Drive would provide year-round wildlife-viewing and photography opportunities via auto, foot, cycling, snowshoes, or cross-country skis. Hazardous road conditions would occasionally require periodic closures.

Lower Marsh Road would continue to be available to vehicles, hiking, and bicycling for wildlife-viewing and photography opportunities from July 15 until the opening day of waterfowl-hunting season. Rough road conditions prevent the use of recreational vehicles, vehicles towing trailers, and large vehicles.

Facilities providing more opportunities for wildlife observation and photography include the Unit 1 Photographic Blind and the Boardwalk Nature Trail with spotting scope and interpretive panels. More opportunities for wildlife observation and photography by means of temporary blinds year-round on Prairie Marsh Wildlife Drive would be provided. Blinds in other selected areas may be provided as well through SUP.

The Sharp-Tailed Grouse Blind would continue to be available to the public by reservation on weekends during April and May. The grouse blind provides a highly sought-after opportunity for visitors to observe and photograph the courting rituals of sharp-tailed grouse. Another blind may be installed at another lek location due to extreme interest in this opportunity exceeding current availability.

Foot traffic, including hiking, cross country skiing, and snowshoeing, for wildlife observation and photography is also permitted throughout the hunt area during hunting season. At other times of the year, public use is limited to the designated roads and trails described above.

All facilities and infrastructure may be altered in location or experience periodic closures to accommodate modifications to existing infrastructure in support of basin wide restoration efforts.

Benton Lake Wetland Management District

Wildlife observation and photography opportunities are available year-round on 22 waterfowl production areas. Most visitors view wildlife from public roads.

Swan River National Wildlife Refuge

Swan River Refuge is a popular destination point for visitors traveling through the Swan Valley. The existing observation platform, kiosk, and interpretive panels would continue to be supported and provide opportunity for wildlife observation and photography. Bog Road, which provides access to the interior of the refuge, will be supported as a walking trail which will allow foot traffic, including hiking, cross country skiing, and snowshoeing.

Availability of Resources

Sufficient resources are available to administer, manage and check the use. Infrastructure exists on the refuge complex to support these activities. Observation areas are placed in areas that provide consistent wildlife viewing opportunity with minimum disturbance to wildlife. The construction and maintenance of roadways, kiosks, observation platforms, and trails, as well as law enforcement activities to make sure that visitors comply with refuge regulations while conducting these activities, are the principle expenses associated with wildlife observation and photography. Resources are available within the existing staffing and budget allocations of the refuge complex. An extra park ranger, law enforcement officer, and maintenance worker, as proposed in the comprehensive conservation plan, will enhance public opportunities for these uses and improve quality and quantity of opportunities.

Anticipated Impacts of the Use

Short-term effects may include the temporary displacement of birds and other wildlife to adjacent habitats during the initial positioning and removal of portable blinds, cameras, and other equipment. Some birds will be flushed from foraging or resting habitats by the approach of people on trails. However, the area impacted by these disturbances is small compared to the overall habitat area available. Disturbance caused by these uses is not anticipated to cause wildlife to leave or abandon the refuge, and all areas are available to wildlife for undisturbed use during closed hours.

Winter activities, such as cross-country skiing, and snowshoeing, would have no effect on nesting birds and little effect on vegetation. Winter disturbance to resident wildlife is temporary and minor. Hiking during the breeding season, when confined to open trails and roads would have little or no effect on wildlife. Equestrian use on the Benton Lake Refuge is restricted to roadways to prevent spread of weeds, erosion from hoof action, and trampling disturbance to wildlife. Bicycling is restricted to roadways open to vehicular traffic to reduce disturbance to wildlife.

Disturbance resulting from wildlife observation and photography programs is deemed to be biologically insignificant. No long-term effects are expected if recommended stipulations are followed. The proposed uses, including development of facilities to support those uses, will foster public appreciation and understanding of the prairie ecosystem and the importance of refuge and district habitats for wildlife conservation.

Public Review and Comment

This Compatibility Determination is presented for public review and comment as part of the 30-day public comment period for the Draft Comprehensive Conservation Plan and Environmental Assessment for Benton Lake National Wildlife Refuge Complex.

Determination

Wildlife observation and noncommercial photography are compatible uses on the Benton Lake and Swan River Refuges and waterfowl production areas in the district.

Stipulations Necessary for Compatibility

- ❑ A special use permit will be issued to all individuals using blinds for photography and observation within the complex.. A total of five special use permits would be issued in any given year on any unit of the refuge complex for the use of small observation blinds on a first-come-first-served basis. If the number of requests for blinds exceeds five, the permitting process would be revisited and modified as necessary. Visitors using permanent or portable observation and photography blinds will be provided with information on proper use and etiquette of these structures to reduce disturbance to wildlife and their natural environments and other refuge complex visitors.
- ❑ Blinds will be erected and removed daily.
- ❑ Blind location will be decided by complex staff and may be limited to areas next to public access roads.
- ❑ Refuge complex staff must be notified before arrival at the refuge for observation and photography.
- ❑ Refuge complex staff will decide if, when, where and for how long access may be allowed to photograph at individual areas.

- Seasonal closures to protect sensitive wildlife areas and reduce disturbance to fish and wildlife will be supported.
- Non-Service vehicles will be restricted to county and public access roads in the refuge complex.
- Viewing areas will be designed to reduce disturbance effects on wildlife and all refuge resources while providing a good opportunity to view wildlife in their natural environments.
- On the Benton Lake and Swan River Refuges, foot traffic (hiking, cross-country skiing and snowshoeing) will be permitted only on designated trails, roads open to motorized vehicles, and in the refuge hunt area during the refuge hunting season.
- On the Benton Lake Refuge, equestrian use will be restricted to roadways open to motorized vehicles year-round and prohibited on all other units of the refuge complex.
- On the Benton Lake Refuge and the district, bicycling will be restricted to roadways open to motorized vehicles year-round.

Justification

Wildlife observation and photography are a form of wildlife-dependent recreation and are identified as priority public uses in the Improvement Act. These uses, including existing and future enhanced programs as prescribed in the Comprehensive Conservation Plan for the Benton Lake National Wildlife Refuge Complex are compatible with the purposes, and with the mission of the Refuge System. These uses are not only justified but are encouraged by the National Wildlife Refuge Improvement Act of 1997. Wildlife observation and photography can instill, in citizens of all ages, a greater appreciation for wildlife and its habitat. This appreciation may extend to the Refuge System and other conservation agencies.

Disturbance from wildlife observation and photography is not expected to adversely impact wildlife populations. Most wildlife observation is confined to within a set distance from existing roadways, and in some locations, the infrastructure helps to concentrate public use in areas that can allow wildlife observation and photography opportunities at safe distances that reduce disturbance to wildlife.

Based on anticipated biological effects described above and in the EA, the Service has found that wildlife observation and noncommercial photography within the refuge complex would not interfere with the purposes for which the refuges and district were established. Limiting access and monitoring the uses could help limit any adverse effects.

Mandatory 15-year Reevaluation Date: 2027

Environmental Education and Interpretation

The refuge complex provides opportunity for student field trips on an “as-arranged” basis. Temporary and impromptu outdoor classrooms may be established or used in wetland and riparian habitats; however, seasonal closures may occur to avoid impacts to threatened and endangered species or sensitive habitats.

Interpretive panels and auto tour brochures provide users on Benton Lake and Swan River Refuges information about habitat, wildlife, management actions, and activities along the Boardwalk Nature Trail, the Swan River Overlook, and other interpretive kiosks is passive in nature from self-guided opportunities, interpretive panels, brochures, Web sites, and tear-sheets.

The CCP proposes to continue environmental education and interpretation and add the following to improve these programs:

- The Service would expand the opportunities for environmental education and interpretation to foster appreciation and understanding of the Refuge System and the resources of the refuge complex.

- More interpretive panels may be developed for the refuge complex.

- More accessible observation sites will be developed in the refuge complex.

- The mammal, reptile and amphibian lists will be updated for the refuge complex and a brochure will be developed.

- Refuge complex staff may take part in offsite special events and activities to bring the refuge complex message to large numbers of people as time and staff allow.

- Interpretive panels, brochures, tear-sheets, Web sites, and maps will be updated..

- Many of the proposed actions are contingent on hiring a visitor services park ranger to develop and carry out these programs.

Benton Lake National Wildlife Refuge

The refuge offers joint-sponsored outdoor education courses with the MFWP, including a Youth Waterfowl Hunting Clinic and the Becoming an Outdoor Woman series.

Partnership with the Great Falls Public School provides the opportunity for all third graders in the Great Falls Public School system to come to the refuge and learn about natural resources. This highly popular activity includes more than 850 students annually. Refuge staff provides information about the refuge and education specialists from the GFPS perform onsite activities and learning modules.

Refuge staff takes part in the annual Montana Envirothon Event in Lewistown, Montana, The event attracts student teams from all across Montana while they compete for the opportunity to represent Montana at the National Envirothon Competition. Refuge staff helps students learn about fish and wildlife resources and the habitat they depend on. More than 200 students and teachers take part in the annual event. As time allows, the refuge would continue to collaborate with other school groups to provide tours, teach science, and work together on monitoring projects.

Refuge staff recently took part in the STEM Expo hosted in Great Falls, Montana. This annual event invigorates the community and students in the areas of science, technology, engineering, and math. Staff have the opportunity to reach more than 550 children, teachers, and parents.

Greater emphasis would occur with interpretive panels and maps to explain (1) the purpose and importance of conserving, managing, and restoring healthy functioning ecosystems, (2) the importance of natural hydroperiods in wetlands, and (3) changes to public use regulations and access areas to accommodate changes in wetland and water management. In addition, environmental education curriculum may be adapted to reflect changes in habitat from restoration efforts as well.

Benton Lake Wetland Management District

The waterfowl production areas would remain open for environmental education and interpretation. Staff will provide occasional onsite educational visits on the waterfowl production areas. A facility exists on the H2–O WPA to provide onsite education within the Blackfoot Valley. Interpretive displays would continue to be available on the north and south parking areas of the Blackfoot WPA.

The proposed acquisition of Upsata Lake WPA may offer more onsite interpretive and environmental education opportunities. In addition, cooperative efforts with University of Montana in Missoula may further develop opportunities.

Swan River National Wildlife Refuge

An interpretive kiosk is located on the refuge.

Availability of Resources

Environmental education and interpretation activities, directional signs, and brochures would be mainly supported by annual operations money and other sources such as grants, regional project proposals, and challenge cost-share agreements to enhance programming.

New facilities and maintenance of existing facilities will occur as visitor facility enhancement projects.

Anticipated Impacts of the Use

The use of the refuge complex for onsite activities for environmental education or interpretation may impose a short-term, low-level effect on the immediate and surrounding area. Effects may include trampling of vegetation and temporary disturbance to nearby wildlife species during the activities. Development and implementation of interpretive and education programs will have minimal and biologically insignificant impacts on refuge complex resources.

Refuge complex brochures, interpretive panels, and other educational materials will continue to be updated as needed. Features such as the auto tour route and accessible observation sites will continue to provide access to the many sights and sounds of the refuge complex.

The Service will continue to promote a greater public understanding and appreciation of the refuge complex resources, programs, and issues through interpretive, outreach, and environmental educational programs. Establishing and engaging with a Friends group and other local groups, the Service will continue to provide environmental education and interpretation both on and off Service lands. Presentations, both on and off Service lands, will be provided to refuge visitors, school groups, and organizations, allowing the Service to reach a broader audience. Onsite presentations will be managed to reduce disturbance to wildlife, habitat, and cultural resources.

Public Review and Comment

This Compatibility Determination is presented for public review and comment as part of the 30-day public comment period for the Draft Comprehensive Conservation Plan and Environmental Assessment for Benton Lake National Wildlife Refuge Complex.

Determination

Environmental education and interpretation are compatible uses on the Benton Lake and Swan River Refuges and waterfowl production areas in the district.

Stipulations Necessary for Compatibility

- Onsite activities will be held where minimal effect on wildlife and habitats will occur.
- The Service will review new environmental education and interpretation activities to make sure these activities meet program objectives and are compatible.
- All motor vehicles associated with these uses will remain on designated roads open to vehicular traffic.
- Staff will check use patterns and would make adjustments in timing, location, and duration of activities as needed to limit disturbance to wildlife and habitat.

Justification

Environmental education and interpretation are forms of wildlife-dependent recreation and are priority public uses of the National Wildlife Refuge System. Environmental Education and interpretation will increase public awareness and appreciation of the significant wildlife and habitat values of the refuge complex, and the Refuge System. It is anticipated that such appreciation and understanding will foster increased public support for the Refuge System and conservation of America’s wildlife resources.

Based on anticipated biological effects described above and in the EA, the Service has found that environmental education and interpretation on the refuge complex would not interfere with the purposes for which the refuges and district were established. Limiting access and monitoring the uses could help limit any adverse effects.

Mandatory 15-year Reevaluation Date: 2027

Cooperative Farming, Haying, and Grazing

The Service would continue to use cooperative farming and prescriptive livestock grazing and haying as management tools throughout the refuge complex. These tools would be used to meet habitat objectives, control vegetative litter, promote native plant production and diversity, control the spread of invasive plant species, and help convert disturbed grasslands back to native plant species.

The district currently uses cooperative farming and haying as tools to manage upland habitats, including control of invasive plant species and cattails. In the past, these techniques were also used on Benton Lake Refuge. The draft CCP proposes to use cooperative farming and haying to manage habitats. Furthermore, the draft CCP establishes goals and objectives for specific habitat types where cooperative farming and haying may be used. The refuge complex would improve the monitoring and research programs for vegetation and wildlife to assess habitat and wildlife population responses to cooperative farming and haying.

The refuge complex currently uses prescriptive livestock grazing as a tool to manage a variety of uplands and seasonal wetlands. Fencing and controlling livestock is the responsibility of the cooperating rancher. The Service provides instruction and guidance within the special use permit for placement of fences, water tanks, and livestock supplements to make sure that sensitive habitats or refuge complex assets are protected. Temporary electric fencing is used. Current forage conditions, habitat objectives, and available water would decide stocking rates in each grazing unit. The draft CCP proposes to continue using prescriptive livestock grazing to meet habitat objectives. Furthermore, the draft CCP establishes goals and objectives for specific habitat types where prescriptive livestock grazing may be used. The refuge complex would improve the monitoring and research programs for vegetation and wildlife to assess habitat and wildlife population responses to prescriptive livestock grazing. Different grazing rates and management strategies would be investigated to figure out the best methods for meeting the habitat goals and objectives.

Availability of Resources

Existing resources would be sufficient to administer the farming, haying, and grazing programs at current levels. These programs would continue to be conducted through special use permits or cooperative farming agreements, which reduce the need for staff time and Service assets to complete work.

Anticipated Impacts of the Use

The cooperative farming and haying program and prescriptive livestock-grazing program would be used to meet habitat- and species-specific goals and objectives identified in the draft CCP. These programs are intended to support and enhance habitat conditions to help a wide variety of migratory birds and other wildlife that use the refuge complex. Minimal negative effects are expected. Control of invasive plant species through these programs would be a long-term benefit.

Some wildlife disturbance may occur during farming operations and some animals may be temporarily displaced. Wildlife would receive the short-term benefit of standing crops or stubble for food and shelter and the long-term benefit of having cropland or other poor-quality habitat converted to native grasses or DNC. In addition, restoration of cropland to grassland cover would prevent soil erosion, improve water quality, and the need for chemical use.

Some trampling of areas by livestock may occur around watering areas or mineral licks. If fences are not supported, it may be difficult to meet habitat objectives. It is anticipated that grazing would be in a mosaic pattern with some areas more intensively grazed than others in certain years. Grazing, as well as fire, is known to increase the nutrient cycling of nitrogen and phosphorous (Hauer and Spencer 1998, McEachern et al. 2000). Hoof action may break up mats of clubmoss and allow native plant seeds to become established. Cattle grazing may also increase the risk of invasive plants getting established. In addition, the presence of livestock may be disturbing to some wildlife species and some public users. The long-term benefits of this habitat management tool should outweigh the short-term negative effects.

Public Review and Comment

This Compatibility Determination is presented for public review and comment as part of the 30-day public comment period for the Draft Comprehensive Conservation Plan and Environmental Assessment for Benton Lake National Wildlife Refuge Complex.

Determination

Cooperative farming, haying, and grazing as a habitat management tools would be compatible uses on the Benton Lake and Swan River Refuges and waterfowl production areas in the district.

Stipulations Necessary for Compatibility

- To make sure there is consistency with management objectives, the Service will require general and specific conditions for each farming, haying, or grazing permit.
- Only areas that have a prior crop history, an invasive plant problem, or decadent DNC will be

included in the farming and haying program. To reduce effects on nesting birds and other wildlife, the staff will determine and incorporate any needed timing constraints on the permitted activity into the cooperative farming agreement or special use permit. For example, haying will not be permitted on Service lands until after July 15 to avoid destroying bird nests on the management unit unless the complex staff deems it necessary to hay earlier to control invasive plants or restore grasslands.

- The cooperative farming agreement or special use permit will specify the type of crop to be planted. Farming permittees will be required to use Service-approved chemicals that are less detrimental to wildlife and the environment.

- Control and confinement of livestock are the responsibility of the permittee, but the Service will decide where fences, water tanks, and livestock supplements would be placed within the management unit. Temporary electric fence may be used to keep livestock within grazing cells as well as to protect sensitive habitat areas and refuge complex assets such as water control structures. Cooperators would be required to remove fences at the end of the grazing season.

Justification

Some habitat management needs to occur to support and enhance habitat for migratory birds and other wildlife. When properly managed and monitored, prescriptive farming and haying are options that can be used to improve wildlife cover and restore disturbed habitats to desirable grassland cover. Prescriptive livestock grazing can rejuvenate native grasses and help control the spread of some invasive plant species. Each of these tools can be controlled and the results would be monitored (for example, vegetation monitoring) so that adjustments in the programs can be made to meet habitat goals and objectives.

Using local cooperators to accomplish the work is a cost-effective method to accomplish the habitat objectives. The long-term benefits of habitat restoration and management far outweigh the short-term effects caused by cooperative farming, haying, and grazing.

Mandatory 10-year Reevaluation Date: 2022

Commercial Filming, Audio Recording, and Still Photography

Commercial motion pictures and audio recordings are defined as the digital or film recording of a visual image or sound recording by a person, business, or other entity for a market audience, such as for a documentary, television, feature film, advertisement, or similar project. It does not include news coverage or amateur/visitor use. Commercial photography is defined a visual recording (motion or still) by firms or individuals (other than news media representatives) who intend to distribute their photographic content for money or other consideration. This includes the creation of educational, entertainment, or commercial enterprises as well as advertising audio-visuals for the purpose of paid product or services, publicity, and commercially oriented photo contests.

Benton Lake National Wildlife Refuge Complex provides tremendous opportunities for commercial filming and photography of migratory birds and other wildlife. Each year, the refuge complex staff receives an average of two requests to conduct commercial filming or photography on Service lands. Refuge complex staff review requests for commercial photography, motion pictures, and audio recordings, and issue a special use permit if the request is approved. Each request is evaluated on an individual basis, using several DOI, USFWS, and National Wildlife Refuge System policies (for example, 43 CFR Part 5, 50 CFR 27.71, 8 RM 16).

Evaluation criteria will include, but not be limited to, the following:

- Commercial photography, motion pictures, and audio recordings must (1) show a means to increase public appreciation and understanding of wildlife or natural habitats, (2) enhance public knowledge, appreciation, and understanding of the Refuge System, or (3) facilitate outreach and education goals of the refuge complex. Failure to show any of these criteria results in a special use permit being denied.

- Activities that cause undue disturbance to wildlife or their habitat are not approved. The degree and type of disturbance are carefully weighed when evaluating a request.

- Requests that will conflict with other management programs or will impair existing wildlife-dependent recreational uses are not approved.

- If staffing or logistics make it impossible for the refuge complex to check the activity, this may cause the request to be denied, depending on the specific circumstances.

Availability of Resources

The commercial filming, audio recording, and still photography uses are administered with current resources. Administrative costs for review of applications, issuance of special use permits, and staff time to conduct compliance checks may be offset by a fee system designated for the agencies within the DOI.

Anticipated Impacts of Use

Wildlife filmmakers and photographers tend to create the greatest disturbance of all wildlife observers (Dobb 1998, Klein 1993, Morton 1995). While observers frequently stop to view wildlife, photographers are more likely to approach the animals (Klein 1993). Even a slow approach by photographers tends to have behavioral consequences to wildlife (Klein 1993). Photographers often remain close to wildlife for extended periods in an attempt to habituate the subject to their presence (Dobb 1998). Furthermore, photographers with low-power lenses tend to get much closer to their subjects (Morton 1995). This usually results in increased disturbance to wildlife as well as habitat including the trampling of plants. Handling of animals and disturbing vegetation (such as cutting plants and removing flowers) or cultural artifacts is prohibited on Service lands.

Issuance of special use permits with strict guidelines and follow-up by refuge complex staff for compliance help to reduce or avoid these effects. Permittees who do not follow the stipulations of their special use permits could have their permits revoked, and further applications for filming or photographing on refuge complex lands would be denied.

Public Review and Comment

This Compatibility Determination is presented for public review and comment as part of the 30-day public comment period for the Draft Comprehensive Conservation Plan and Environmental Assessment for Benton Lake National Wildlife Refuge Complex.

Determination

Commercial filming, audio recording, and still photography would be compatible uses on the Benton Lake and Swan River Refuges and waterfowl production areas in the district.

Stipulations Necessary for Compatibility

- Commercial filming or still photography must (1) show a means to extend public appreciation and understanding of wildlife or natural habitats, (2) enhance education, appreciation, and understanding of the Refuge System, or (3) facilitate outreach and education goals of the refuge complex. Failure to show any of these criteria will result in a special use permit being denied.

- All commercial filming requires a special use permit that would (1) describe conditions that protect the refuge complex's values, purposes, resources, and public health and safety, and (2) prevent unreasonable disruption of the public's use and enjoyment of the refuge complex. Such conditions may be, but are not limited to: specifying road conditions when access would not be allowed, establishing time limitations, and identifying routes of access. These conditions are identified to prevent excessive disturbance to wildlife, damage to habitat or refuge complex infrastructure, or conflicts with other visitor services or management activities.

- The special use permit stipulates that imagery produced on refuge complex lands will be made available for use in environmental education and interpretation, outreach, internal documents, or other suitable uses. In addition, any commercial products must include proper credits to the refuge complex, the Refuge System, and the Service.

- Still photography requires a special use permit (with specific conditions as outlined above) if one or more of the following would occur:

  - it takes place at locations where or when members of the public are not allowed

  - it uses models, sets, or prop that are not part of the location's natural or cultural resources or administrative facilities

  - the Service incurs added administrative costs to check the activity

- ❑ the Service needs to provide management and oversight to avoid impairment of the resources and values of the site, limit resource damage, or decrease health and safety risks to the visiting public
- ❑ the photographer intends to intentionally manipulate vegetation to create a shot, for example, cutting vegetation to create a blind

- To reduce the impact on Service lands and resources, the refuge complex staff will make sure that all commercial filmmakers and commercial still photographers (regardless of whether a special use permit is issued) comply with policies, rules, and regulations. The staff will watch and assess the activities of all filmmakers, audio recorders, and still photographers.

Justification

Commercial filming, audio recording, and still photography are economic uses that must contribute to the achievement of the refuge complex purposes, mission of the National Wildlife Refuge System, or the mission of the Service. Providing opportunities for these uses should result in an increased public awareness of the refuge complex's ecological importance as well as advancing the public's knowledge and support for the Refuge System and the Service. The stipulations outlined above and conditions imposed in the special use permits issued to commercial filmmakers, audio recorders, and still photographers would make sure that these wildlife-dependent activities occur with minimal adverse effects to resources or visitors.

Mandatory 10-year reevaluation date: 2022

Research and Monitoring

The refuge complex allows research and monitoring on a variety of biological, physical, and social issues and concerns to address management information needs or other issues. Studies are conducted by federal, state, and private entities, including the USGS, state and private universities such as the University of Montana, and independent researchers and contractors.

Each year, the refuge complex issues special use permits for biological and physical research studies. Five to ten requests are received each year. Priority is given to studies that contribute to the enhancement, protection, preservation, and management of the refuge complex's native plant, fish, and wildlife populations and their habitats. Research applicants must submit a proposal that outlines the objectives of the study; justification for the study; detailed study methods and schedule; and potential impacts on wildlife and habitat, including short and long-term disturbance, injury, or mortality. This includes a description of measures the researcher will take to reduce disturbances or impacts; a personnel required and their qualifications and experience; status of necessary permits (scientific collecting permits, endangered species permits, etc.); costs to the refuge complex and refuge complex staff time requested, if any; and anticipated progress reports and end products, such as reports or publications. Refuge staff will review research permit applications and issue special use permits if approved.

Evaluation criteria for the issuance of special use permits will include, but not be limited to, the following:

- Research that will contribute to specific management issues, the purposes of the refuge complex, or the mission of the National Wildlife Refuge System will be given higher priority over other requests.
- Research that will conflict with other ongoing research, monitoring, or management programs will not be approved.
- Research projects that can be conducted off-complex lands are less likely to be approved.
- Research that causes undue disturbance or is intrusive are likely not to be approved. The degree and type of disturbance will be carefully weighed when evaluating a research request.
- Research evaluation will determine if any effort has been made to reduce disturbance through study design, including adjusting location, timing, number of permittees, study methods, and number of study sites.
- If staffing or logistics make it impossible for staff to check researcher activity in a sensitive area, the request will likely be denied.
- Length of the project will be considered and agreed-upon before approval. Projects will be reviewed annually and an annual progress report will be required.
- To reduce disturbance to wildlife, researchers will not be permitted in closed areas, unless spe-

cifically authorized. Vehicular access will only be permitted on roads and trails normally open to the public.

Availability of Resources

The refuge complex uses existing staff to issue special use permits for research projects that occur on the complex. Currently, staff resources are deemed adequate to manage this use at anticipated levels. Review of the permit application, drafting and issuing the special use permit, and compliance assessments use an average of 3 hours of staff time per permit. Access points, vehicles, miscellaneous equipment, and limited logistical support may be available at the refuge complex at the refuge complex manager's discretion. Temporary housing located on the refuge complex may be available for use by researchers while studying refuge complex resources, at the refuge complex manager's discretion.

Anticipated Impacts of Use

Some degree of disturbance is expected with all research activities, since researchers may use Service roads or enter areas that are closed to the public; in addition, some research may require collection of samples or handling of wildlife. Research activities may disturb fish and wildlife and their habitats. For example, the presence of researchers can cause waterfowl to flush from resting and feeding areas, cause disruption of birds and other wildlife on nests or breeding areas, or increase predation on individual nests and individual animals as predators follow human scent or trails. Efforts to capture animals can cause disturbance, injury, or death to groups of wildlife or to individuals. To wildlife, the energy cost of disturbance may be appreciable in terms of disruption of feeding, displacement from preferred habitat, and the added energy expenditure to avoid disturbance. Sampling activities can cause compaction of soils and the trampling of vegetation, the establishment of temporary foot trails through vegetation beds, and disruption of bottom sediments in wetlands. The removal of vegetation or sediments by core sampling methods can cause increased localized turbidity and disrupt nontarget plants and animals. Installation of posts, equipment platforms, collection devices, and other research equipment may present a hazard to heavy equipment operators if these items are not adequately marked and removed at the right times or upon completion of the project. Minimal impact on refuge wildlife and habitats is expected with research studies on the refuge complex because special use permits will include conditions to make sure that impacts to wildlife and habitats are kept to a minimum.

Public Review and Comment

This Compatibility Determination is presented for public review and comment as part of the 30-day public comment period for the Draft Comprehensive Conservation Plan and Environmental Assessment for Benton Lake National Wildlife Refuge Complex.

Determination

Research and monitoring would be compatible uses on the Benton Lake and Swan River Refuges and waterfowl production areas in the district.

Stipulations Necessary for Compatibility

- Extremely sensitive wildlife habitats and species will be sufficiently protected from disturbance by limiting research activities in these areas. All refuge complex rules and regulations will be followed unless otherwise exempted by refuge complex management. Projects will be reviewed annually and annual progress reports will be submitted.

- Refuge complex staff will use the above criteria for evaluating and determining whether to approve a proposed study. If research methods are found to have potential effects on habitat or wildlife, it must be shown that the research was necessary for conservation management of resources on the refuge complex. Measures to reduce potential effects will be developed and included as part of the study design; these measures would be conditions on the special use permit.

- Refuge complex staff will check research activities for compliance with conditions of the special use permit. At any time, refuge complex staff may accompany the researchers to determine potential effects. Staff may decide that approved research and special use permits be terminated due to observed effects. The refuge manager will also have the ability to cancel a special use permit if the researcher was out of compliance or to make sure there is wildlife and habitat protection.

- Before conducting investigations, researchers will obtain a special use permit from the refuge complex that contains specific stipulations related to when, where, and how the research will be conducted. The refuge complex manager keeps the choice to prohibit research which causes undo harm or disturbance or which does not contribute to the purposes of the refuge complex or the mission of the Refuge System.

- Refuge staff will use the criteria for evaluating a special use permit application for research, as outlined above under "Description of Use", when determining whether to approve a proposed study on the refuge. If proposed research methods are determined to have potential impacts on refuge complex resources, it must be shown that the research is necessary for refuge complex resource conservation management. Measures to reduce potential impacts will need to be developed and included as part of the study design. In addition these measures will be listed as conditions on the special use permit.

- Specific stipulations in the special use permit will vary by research project, but will be designed to reduce impacts to wildlife and their habitats and to make sure visitors, researchers, and refuge complex staff are safe.

- Refuge complex staff will check research activities for compliance with conditions of the special use permit. At any time, refuge complex staff may accompany the researchers. The refuge complex manager may decide that the approved research and special use permit be terminated due to noncompliance with permit conditions or due to observed disturbance to wildlife or habitat.

- Researchers must possess all applicable State and Federal permits for the capture and possession of protected species, for conducting regulated activities in wetlands, and for any other regulated activities.

- Researchers will promptly submit findings, such as annual status reports and a final report, to the refuge complex manager for inclusion in the decision-making and management process.

- To reduce potential safety hazards, researchers must clearly mark posts, equipment platforms, fencing materials, and other equipment left unattended. Such items shall be promptly removed upon completion of the research.

- Research involving collections will be extremely restricted. Collections will be limited to type or voucher specimens only and require preapproval by the refuge manager and include verification of compliance with all State and Federal collection permits and requirements.

Justification

The Service discourages the granting of special privileges to employees; however, certain personal privileges may be authorized when circumstances and conditions warrant., such as when employees are required to live on station. According to the Service Manual policy 055 FW 4 persons living on Service lands may keep livestock, not to exceed five animals per family. The stipulations identified make sure that this activity is compatible under current circumstances.

Mandatory 10-year Reevaluation Date

(Based on date of final plan)

D.8 Signatures

Submitted by:

Kathleen A. Burchett, Project Leader Date
Benton Lake National Wildlife Refuge Complex
Great Falls, Montana

Reviewed by:

Dean Rundle, Refuge Supervisor Date
U.S. Fish and Wildlife Service
Mountain–Prairie Region
National Wildlife Refuge System
Lakewood, Colorado

Approved by:

Richard A. Coleman, Ph.D. Date
Assistant Regional Director
U.S. Fish and Wildlife Service
Mountain–Prairie Region
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Lakewood, Colorado

Appendix F

Fire Management Program

The Service has administrative responsibility for fire management at the Benton Lake National Wildlife Refuge Complex: Benton Lake National Wildlife Refuge, Benton Lake Wetland Management District, and the Swan River National Wildlife Refuge.

F.1 The Role of Fire

In ecosystems of the Great Plains, vegetation has evolved under periodic disturbance and defoliation from grazing, fire, drought, and floods. This periodic disturbance is what kept the ecosystem diverse and healthy while supporting significant biodiversity for thousands of years.

Historically, natural fire and Native American ignitions have played an important disturbance role in many ecosystems by removing fuel accumulations, decreasing the effect of insects and diseases, stimulating regeneration, cycling nutrients, and providing a diversity of habitats for plants and wildlife.

When fire or grazing is excluded from prairie landscapes, the fuel load increases due to the buildup of thatch and invasion of woody vegetation. This increase in fuel load leads to an increase in a fire's resistance to control, which threatens firefighter and public safety as well as Federal and private facilities. However, fire when properly used can do the following:

- Reduce hazardous fuel buildup in both wildland-urban interface and non–wildland-urban interface areas
- Improve wildlife habitats by reducing the density of vegetation or changing the plant species composition, or both
- Sustain or increase biological diversity
- Improve woodland and shrubland by reducing plant density
- Reduce susceptibility of plants to insect and disease outbreaks
- Improve the quality and quantity of livestock forage
- Improve the quantity of water available for municipalities and activities that depend on wildlands for their water supply

F.2 Wildland Fire Management Policy and Guidance

Based on Federal interagency policy (Fire Executive Council 2009), wildland fire is defined as any nonstructure fire that occurs in the wildland including wildfire and prescribed fire. Response to wildland fire is based on consideration of a full range of fire management actions—allowing the fire to help the resource where possible or taking suppression action when those benefits are not attainable or there is a likely risk to important resources or adjacent lands.

Considerations, guidance, and direction for wildland fire management should be addressed in the land use resource plans (for example, this CCP). Fire management plans are stepdown processes from the land use plans and habitat plans and provide details about fire suppression, fire use, and fire management activities.

The 1995 Federal Fire Policy Wildland Fire Management Policy was updated in 2001. This revised policy directs Federal agencies to achieve a balance between fire suppression to protect life, property, and resources and fire use to regulate fuel and support healthy ecosystems. The following guiding principles and policy statements are excerpted from this document titled Review and Update of the 1995 Federal Wildland Fire Management Policy; these are the foundational principles for Federal wildland fire management policy.

Guiding Principles

1. Firefighter and public safety is the first priority in every fire management activity.

2. The role of wildland fire as an essential ecological process and natural change agent will be incorporated into the planning process.
   Federal agency land and resource management plans set the objectives for the use and desired future condition of the various public lands.

3. Fire management plans, programs, and activities support land and resource management plans and their implementation.

4. Sound risk management is a foundation for all fire management activities.
   Risks and uncertainties relating to fire management activities must be understood, analyzed, communicated, and managed as they relate to the cost of either doing or not doing an activity. Net gain in public benefit will be an important component of decisions.

5. Fire management programs and activities are economically viable, based on values to be protected, costs, and land and resource management objectives.
   Federal agency administrators are adjusting and reorganizing programs to reduce costs and increase efficiencies. As part of this process, investments in fire management activities must be evaluated against other agency programs to effectively accomplish the overall mission, set short- and long-term priorities, and clarify management accountability.

6. Fire management plans and activities are based on the best available science.
   Knowledge and experience are developed among all Federal wildland fire management agencies. An active fire research program combined with interagency collaboration provides the means to make these tools available to all fire managers.

7. Fire management plans and activities incorporate public health and environmental quality considerations.

8. Federal, State, tribal, local, interagency, and international coordination and cooperation are essential.
   Increasing costs and smaller workforces require that public agencies pool their human resources to successfully deal with the ever-increasing and more complex tasks of fire management. Full collaboration among Federal wildland-fire management agencies and between these agencies and international, State, tribal, and local governments and private entities results in a mobile fire management workforce available for the full range of public needs.

9. Standardization of policies and procedures among Federal wildland-fire management agencies is an ongoing objective.
   Consistency of plans and operations provides the fundamental platform on which these agencies can cooperate, integrate fire activities across agency boundaries, and provide leadership for cooperation with State, tribal, and local fire management organizations.

F.3 Management Direction

The refuge complex will protect life, property, and other resources by safely suppressing all wildfires.

Prescribed fire, as well as manual and mechanical fuel treatments, would be used in an ecosystem context to protect both Federal and private property and for habitat management purposes. Fuel reduction activities would be applied in collaboration with Federal, State, private, and nongovernmental partners. In addition, the Service would set priorities for fuel treatment based on guidance for prioritization established in the goals and strategies outlined in the following documents: (1) “U.S. Fish and Wildlife Service National Wildlife Refuge System Wildland Fire Management Program Strategic Plan 2003–2010”; and (2) “Region 6 Refuges Regional Priorities FY07–11.” For wildland-urban interface treatments, areas with community wildfire protection plans and designated “communities at risk” would be the primary focus. All aspects of the fire management program would be conducted consistent with applicable laws, policies, and regulations. The refuge complex would support a fire management plan to accomplish the fire management goals described below. Prescribed fire and manual and mechanical fuel treatments would be applied in a scientific way under selected weather and environmental conditions.

Fire Management Goals

Fire management goals are set at national, regional, and local levels.

National Fire Management Goals

The goals and strategies of the "U.S. Fish and Wildlife Service National Wildlife Refuge System Wildland Fire Management Program Strategic Plan" are consistent with the following guidance:

- Policies of the Department of the Interior and the Service
- National Fire Plan direction
- The President's Healthy Forest Initiative
- The 10-Year Comprehensive Strategy and Implementation Plan
- National Wildfire Coordinating Group Guidelines
- Initiatives of the Wildland Fire Leadership Council
- Interagency Standards for Fire and Aviation Operations

Regional Fire Management Goals

The "Region 6 Refuges Regional Priorities FY07–11" are consistent with the refuges' vision statement for the Mountain–Prairie Region, "to maintain and improve the biological integrity of the region, ensure the ecological condition of the region's public and private lands are better understood, and endorse sustainable use of habitats that support native wildlife and people's livelihoods."

Refuge Complex Fire Management Goals

The fire management goal for the refuge complex is to use prescribed fire and manual and mechanical treatments to (1) reduce the threat to life and property through hazardous-fuel reduction treatments, and (2) meet the habitat goals and objectives identified in this CCP..

Fire Management Objective

Fire is an important natural component in the maintenance and restoration of native prairie ecosystems. The primary objective of the prescribed fire management program is to reduce fuel loads while restoring and supporting native prairie habitats. Prescribed fire would be used to recycle nutrients, reduce or end invasive plants, increase the growth and production of native plants, improve wildlife habitat and nesting cover for migratory birds, and reduce the risk of wildfire.

Achieving this objective would require 500 acres to 2000 acres of upland, and wetland habitat annually, until every upland acre has been burned at least once. Thereafter, the Service would attempt to mimic a natural cycle of prescribed fire by retreating the same piece of native prairie every 6–8 years, or on whatever cycle is necessary for restoration.

Strategies

Strategies and tactics that consider public and firefighter safety, as well as resource values at risk, would be used. Wildfire suppression, prescribed fire methods, manual and mechanical means, timing, and monitoring would be described in detail within the stepdown fire management plans for the refuge complex.

All fire management actions would use prescribed fire and manual or mechanical means to reduce hazardous fuel, restore and support desired habitat conditions, control nonnative vegetation, and control the spread of woody vegetation within the diverse ecosystem habitats. The fuel treatment program would be site specific and follow the most recent interagency template for burn plans.

A prescribed fire would temporarily decrease air quality by reducing visibility and releasing components through combustion. The refuge complex would meet the Clean Air Act emission standards by adhering to the Montana requirements during all prescribed fire activities..

F.4 Fire Management Organization, Contacts, and Cooperation

Using the fire management district approach, Region 6 of the Service would establish qualified technical oversight of fire management for the refuge complex. Under this approach, the level of fire management staff would be determined by established modeling systems and be based on the fire management workload of a group of refuges and possibly that of interagency partners. Workload is based on historical wildfire suppression activities as well as historical and planned fuel treatments.

Depending on budgets, fire management staff and support equipment may be located at the headquarters of the refuge complex or at other refuges within the district and shared between all units. Fire management activities would be conducted in a coordinated and collaborative manner with Federal and non-Federal partners.

On approval of this CCP, one or more fire management plans would be developed for the refuge complex. The fire management plans may be prepared as (1) plans that cover each individual refuge and wetland management district, (2) a plan that covers the area identified within this CCP, (3) a plan that covers the fire management district, or (4) an interagency fire management plan.

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