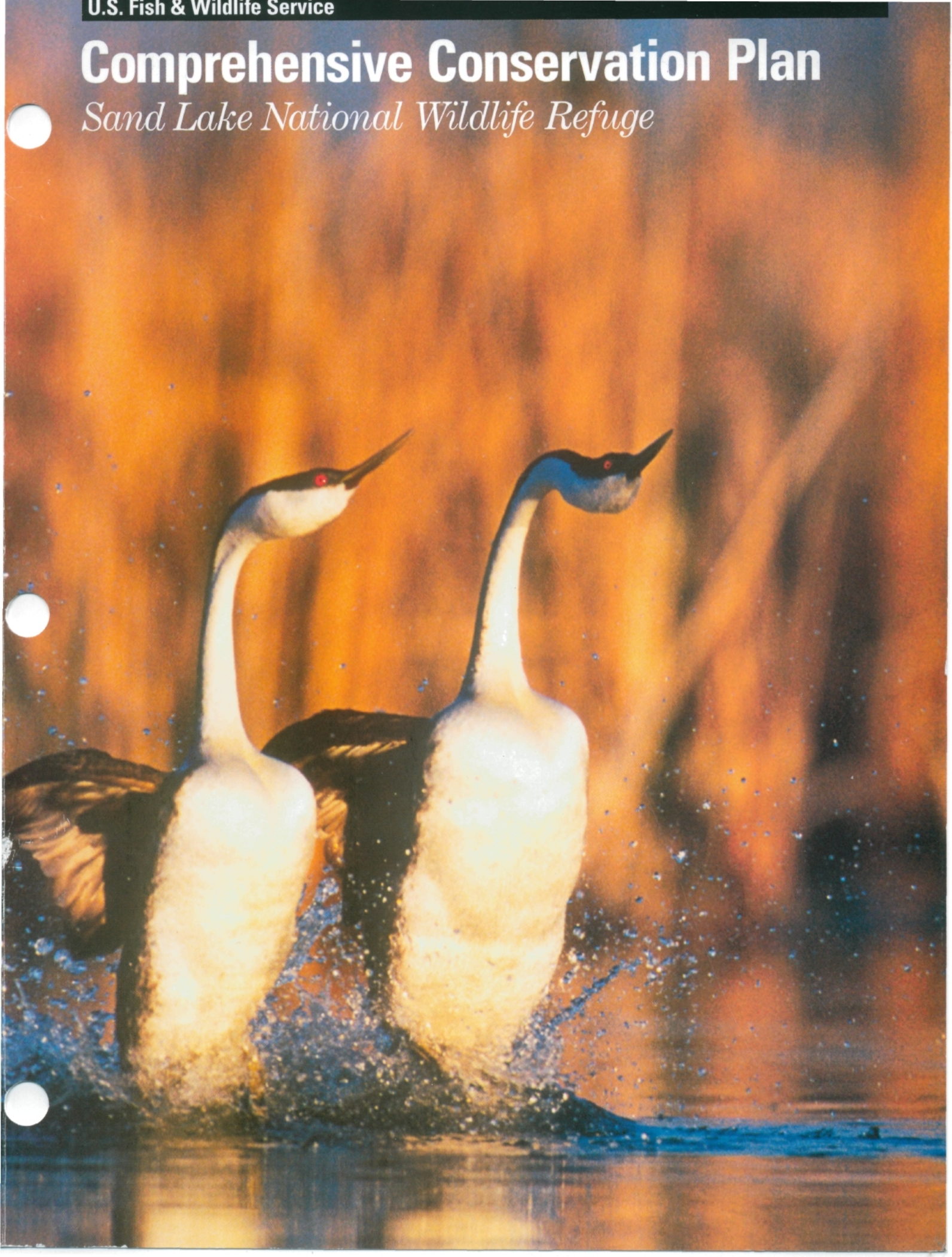
U.S. Fish & Wildlife Service

Comprehensive Conservation Plan

Sand Lake National Wildlife Refuge



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

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.

Comprehensive conservation plans provide long-term guidance for management decisions and set forth goals, objectives, and strategies needed to accomplish refuge purposes and identify the U.S. Fish and Wildlife Service's best estimate of future needs. These plans detail program planning levels that are sometimes substantially above current budget allocations and, as such, are primarily for Service strategic planning and program prioritization purposes. The plans do not constitute a commitment for staffing increases, operational and maintenance increases, or funding for future land acquisition.

Cover photograph of dancing western grebes, Sand Lake National Wildlife Refuge, South Dakota
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Comprehensive Conservation Plan

Sand Lake National Wildlife Refuge

September 2005

Prepared by the U.S. Fish and Wildlife Service

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Sand Lake National Wildlife Refuge

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Summary

This is a summary of the comprehensive conservation plan (CCP) for the Sand Lake National Wildlife Refuge in Brown County, South Dakota. This plan, approved in 2005, will guide management of the refuge for the next 15 years.

The restoration of a historical, well-functioning riverine system and provision of quality habitat for grassland-dependent birds were the key factors driving development of this CCP.

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American avocet in a Sand Lake wetland.

The National Wildlife Refuge System Improvement Act of 1997 requires the U.S. Fish and Wildlife Service to develop a comprehensive conservation plan by 2012 for each national wildlife refuge in the Refuge System.

The Heart of the Prairie

The Sand Lake National Wildlife Refuge was established in the mid-1930s as a refuge and breeding ground for migratory birds and other wildlife. The 21,498-acre refuge lies in the James River basin within Brown County, South Dakota. This northeastern area of South Dakota is in the heart of the prairie–pothole region of the northern Great Plains and plays a major role for migratory birds.

The refuge has been designated as a "Globally Important Bird Area" and a "Wetland of International Importance." The refuge supports the largest nesting colony of Franklin's gulls in the world, along with thousands of snow geese and other waterfowl, white pelicans, shorebirds, and colonial-nesting birds.

Habitat

The occurrence of 48 species of mammals illustrates the importance of the area for nongame, as well as game species such as white-tailed deer. Despite the frequent occurrence of adverse conditions, the James River maintains a substantial fish population including 60 species.

The refuge's nutrient-laden waters are contained in 11,450 acres of marsh and open water. Dams form the two main bodies of water—Mud and Sand lakes.

Most of the more than 8,000 acres of grassland is infested with invasive plant species including Canada thistle, leafy spurge, Russian olive, and wormwood sage.

Of the estimated 424 acres of woodlands, most occur as deteriorated shelterbelts planted by the Civilian Conservation Corps (CCC) in the late 1930s to control wind erosion and provide wildlife habitat. Historically, woody vegetation occurred along riparian corridors and around some wetlands.

Cultural Resources

Although there are no known prehistoric resources on the refuge, documented occupation of the general area spans a 10,000-year period.

The refuge contains clear ties to the Depression-era period based on the original landscape design and presence of buildings built by the CCC. The focus of many CCC projects was to preserve water in ponds, link channels, and build habitat islands for migratory birds.

Public Use

Each year, about 50,000 people recreate at the refuge. Areas open to visitors include a small visitor area, a 15-mile auto tour route with a viewing platform, a 20-mile loop road, an observation tower, and two day use areas.

Hunting for waterfowl, white-tailed deer, ring-necked pheasant, sharp-tailed grouse, and gray partridge is popular on the refuge. Fishing is offered year-round.

The Planning Process

The CCP process consisted of a series of steps including environmental analysis. Public and partner involvement were important throughout the process. Management alternatives were developed to meet the purposes, vision, and goals of the refuge. The Service selected alternative 3 (proposed action) as the CCP. Implementation of this CCP will be monitored throughout its 15-year effective period.

Issues

Public scoping initiated in 2001, along with refuge information, indicated that there are four major issues regarding refuge management, which are summarized below. This CCP addresses these issues.

Wildlife and Habitat

The quality of upland grassland habitats is important for providing the needs of migratory birds and meeting the establishment purposes of the refuge. Prior to the refuge's establishment, the native prairie within the vicinity of Sand Lake National Wildlife Refuge was almost entirely broken up and converted to cropland.

Refuge users want a great diversity of wildlife, including game species, supported by a variety of habitats. Waterfowl and deer are important recreational resources. The farm program on the refuge helps maintain populations of white-tailed deer and pheasant. Some refuge neighbors are losing crops of corn and alfalfa to foraging deer.

John Stehn/USFWS

White-tailed Deer

Water Management

The refuge must use, maintain, and protect its water rights for the use of James River water. Control of water levels on the refuge to manage wetlands is extremely dependent on river flows. Demands on the water resources of the James River require collaboration between many stakeholders.

The water cycle affects the wildlife and the fishery and subsequent recreational opportunities. There was some public concern that water management for waterfowl may have a detrimental impact on the fishery.

Water levels on the refuge may affect water tables on neighboring lands. Salt is surfacing on lands within Brown County.

Public Use

Recreational opportunities on the refuge and the James River are very important to local residents.

Hunting is a priority public use, when determined compatible with the refuge's purposes. Hunting, especially of deer, waterfowl, and pheasant, is very popular on the refuge.

People want more fishing opportunities, but the ability of the refuge to provide fishing that is compatible with management for migratory wetland birds is very limited.

To better accommodate increased public use and interest in environmental education, there is public support for an education center.

There is some public interest in camping and recreational trapping.

Invasive Plants

Invasive plants, especially Canada thistle, are dominating plant communities and impacting habitats in some areas. Without intensive management, the refuge would become a sea of smooth brome and Canada thistle, incapable of providing habitat for a diversity of grassland-dependent wildlife.

Neighbors view the refuge as a source of invasive plant expansion onto their lands.

Chemicals used for control are of concern from the standpoint of environmental contamination and negative impacts on desirable plant species.

The Future of the Refuge

The issues, along with resource conditions, were important considerations during the development of the vision and goals for the Sand Lake National Wildlife Refuge.

The Refuge Vision

Provide habitat for the production, maintenance, and basic life requirements for threatened and endangered species, migratory birds, and other wildlife species.

Promote the natural biological diversity of the region through preservation, management, and enhancement of refuge lands and waters.

Provide the public with the opportunity for wildlife-dependent recreation and the enjoyment and appreciation of America's wildlife resources.

Goals

These goals were developed to meet the refuge vision.

Biological Diversity Goal

Promote the natural biological diversity of the area and, through management of refuge habitats, provide for the greatest number of native fauna and flora species within the capabilities of the Sand Lake National Wildlife Refuge.

Threatened and Endangered Species Subgoal: Provide for the protection and welfare of any threatened or endangered plants and animals that may occur on the refuge.

Waterfowl and Grassland-nesting Birds Subgoal: Provide sufficient habitat (wetlands and grasslands) for the production and maintenance of waterfowl and grassland-nesting, nongame bird species.

Colonial Birds Subgoal: Provide and manage wetland habitats as nesting areas for the tremendous variety of colonial bird species using the refuge.

Resident Wildlife Subgoal: Contribute to habitat requirements for regional populations of resident wildlife including fish, reptiles, amphibians, mammals, and nonmigratory birds.

Grassland Habitat Subgoal: Restore, maintain, and provide quality habitat for the life requirements of a diversity of migratory birds and other wildlife species.

Wetland Habitat Subgoal: Maintain a diversity of quality wetland habitat that meets the needs of wetland-dependent wildlife species.

Wildlife-dependent Recreational Use Goal

Provide opportunities for quality, wildlife-dependent recreation for visitors to Sand Lake National Wildlife Refuge.

Consumptive Use Subgoal: Provide wildlife-dependent, consumptive, recreational opportunities that are compatible with refuge purposes and contribute to a quality outdoor hunting or fishing experience.

Nonconsumptive Use Subgoal: Provide wildlife-dependent, compatible, nonconsumptive, recreational activities on the refuge that increase public understanding and appreciation of wildlife and its conservation.

Public Education and Outreach Goal

Provide wildlife- and wildland-viewing opportunities for the public to enjoy and, through education and outreach, encourage them to gain a greater understanding and appreciation of national wildlife refuges and wildlife resources in general.

Outcomes of the Plan

This CCP is designed to optimize the biological potential for migratory birds and finds a balance with reducing cropland, while ensuring depredation is minimized.

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Ruddy Duck

The vegetative diversity of grasslands will be greatly enhanced by reseeding for native plants or rejuvenated dense nesting cover. Some shelterbelts, isolated trees, and invading Russian olives will be removed.

The five subimpoundments will be managed as shallow-water wetlands for waterfowl breeding pairs and broods, nesting black terns and pied-billed grebes, and foraging waterbirds and shorebirds. The ability to cycle vegetation and create interspersed cover and water through current water level manipulations will be hindered. Reduced invertebrate production

may impact wetland productivity, as well as limit a major food source for waterfowl.

Watershed-level conservation efforts through partnerships may result in a long-term reduction of sediment entering the James River and refuge.

Cropland acreage will be reduced. The size and location of remaining cropland will be based on the need to control invasive plants, especially Canada thistle, and will be coordinated with the South Dakota Department of Game, Fish and Parks to address resident wildlife issues. Canada thistle will be much more contained than it is currently, reducing the potential for a seed source to invade adjacent or downstream private lands.

Fire management will be used to protect life, property, and other resources from wildfire by safely suppressing all wildfires on the refuge. Prescribed fire will be used for habitat management, as well as for protection of property through fuel reduction.

Recreational opportunities will include wildlife-dependent and wildlife-compatible uses legislated by Congress and outlined in the National Wildlife Refuge System Improvement Act of 1997—hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation. Hiking has also been deemed a compatible use during limited times of the year.

USFWS

A school group "dip-nets" for invertebrates during a field trip.

Wildlife-dependent recreational and educational activities will be expanded and improved on- and off-refuge.

All hunting and fishing seasons will continue as presently managed. Support facilities will be improved.

The construction of an education center will provide visitors a quality experience and a focal point for public use activities.

1 Purpose and Need

The Sand Lake National Wildlife Refuge (figure 1, next page) manages the Sand Lake Wetland Management District (WMD), which contains 162 waterfowl production areas (WPAs). This entire area is known as the Sand Lake National Wildlife Refuge complex.

This comprehensive conservation plan (CCP) addresses management of the refuge itself; a separate CCP will be developed to guide management of the WMD.

The National Wildlife Refuge System Administration Act, as amended by the National Wildlife Refuge System Improvement Act (1997), requires that CCPs be in place for all national wildlife refuges within 15 years of enactment (2012).

A CCP is needed to guide the conservation and use of resources on the refuge for the next 15 years.

In general, a CCP serves to do the following:

- Ensure that the purpose of the refuge and mission of the National Wildlife Refuge System are being fulfilled.
- Ensure that national policy direction is incorporated into refuge management.
- Ensure that opportunities are available for interested parties to participate in the development of management direction.
- Provide a systematic process for making and documenting decisions.
- Establish broad strategies for programs and activities.
- Provide a basis for evaluating accomplishments.

Agency Guidance

The U.S. Fish and Wildlife Service is the principal agency responsible for conservation of our Nation's fish, wildlife, and plant resources. This responsibility is shared with other federal agencies and state and tribal governments.

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

The Service manages a diverse network of more than 540 national wildlife refuges within the National Wildlife Refuge System, which encompasses 95 million acres of lands and waters. Sand Lake is one of six national wildlife refuges in South Dakota and was the 71st national wildlife refuge established.

The mission of the National Wildlife Refuge System is to administer a 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.

Operation and management of national wildlife refuges are influenced by a wide array of laws, treaties, and executive orders (appendix A). The primary guidance comes from these laws:

- National Wildlife Refuge System Administration Act of 1966, as amended
- National Wildlife Refuge System Improvement Act of 1997

© John Jave

Scaup

All national wildlife refuges are established with these national goals (Service Director's Order No. 132):

- Fulfill our statutory duty to achieve refuge purpose(s) and further the Refuge System mission.
- Conserve, restore where appropriate, and enhance all species of fish, wildlife, and plants that are endangered or threatened with becoming endangered.
- Perpetuate migratory bird, inter-jurisdictional fish, and marine mammal populations.

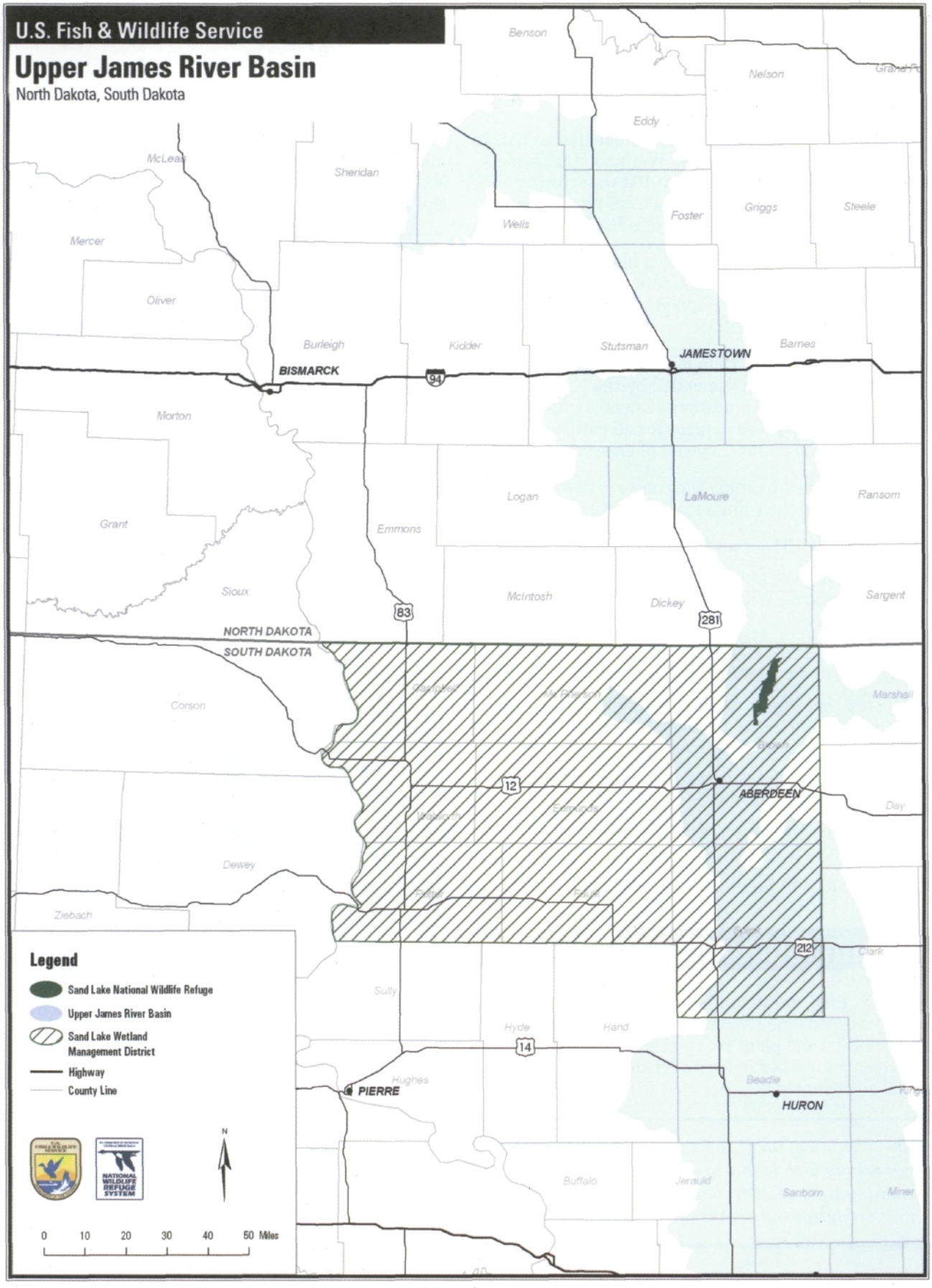


Figure 1. Vicinity map for Sand Lake National Wildlife Refuge, South Dakota

- Perpetuate migratory bird, inter-jurisdictional fish, and marine mammal populations.
- Conserve a diversity of fish, wildlife, and plants.
- Conserve and restore, where appropriate, representative ecosystems of the United States, including the ecological processes characteristic of those ecosystems.
- Foster understanding and instill appreciation of fish, wildlife, and plants, and their conservation, by providing the public with safe, quality, and compatible wildlife-dependent public use. Such use includes hunting, fishing, wildlife observation and photography, environmental education, and interpretation.

These goals help support the Refuge System mission and principles of the 1997 amendments to the National Wildlife Refuge System Administration Act. These goals serve as a foundation for stewardship of the Refuge System and define its role among various federal land systems.

The Improvement Act calls for making opportunities for wildlife-dependent recreation, as long as they are compatibly managed with other purposes and do not conflict with other use. Service policy allows use if it is appropriate (appendix B).

An appropriate use

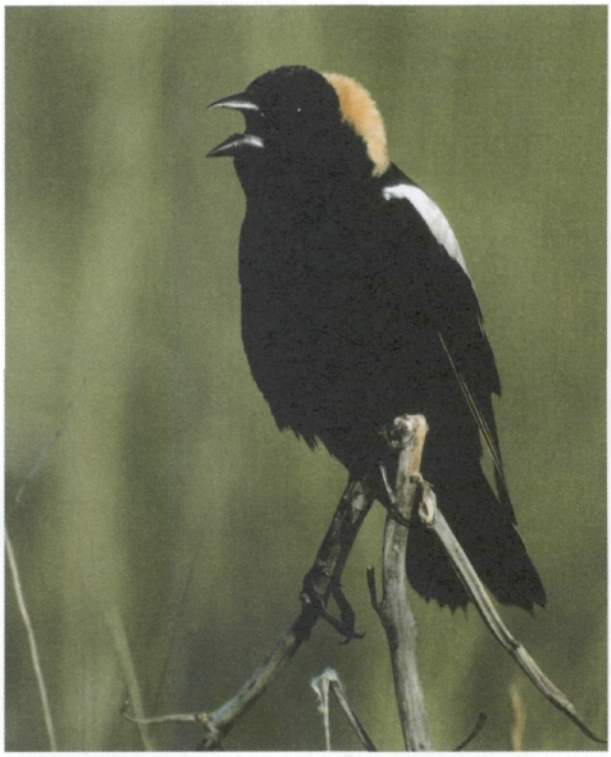
> contributes to the Refuge System mission, the refuge's major purposes, or refuge goals or objectives;
>
> is a priority public use (hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation);
>
> supports the safe and effective conduct of a priority public use.

It is the policy of the federal government—in cooperation with other nations and in partnership with states, local governments, Indian tribes, and private organizations and individuals—to administer federally owned, administered, or controlled prehistoric and historic resources in a spirit of stewardship for the benefit of present and future generations.

To maintain the health of individual national wildlife refuges, and the Refuge System as a whole, managers must anticipate future conditions—to avoid adverse effects and take positive actions to conserve and protect refuge resources. Effective management also depends on knowledge of larger systems and resource relationships.

Refuge Overview

Sand Lake National Wildlife Refuge was established in 1935 as a refuge and breeding ground for migratory birds and other wildlife.



© John Jave

Bobolink

The marshes and open water impoundments of the refuge are surrounded by prairie grasslands, cultivated fields, and scattered woodlands along the James River. The refuge was formed primarily from farms and homesteads that failed during the drought of the 1930s.

The original purchase of 21,451 acres was completed by 1939. Since that time, several land exchanges with neighboring landowners and the South Dakota Department of Game, Fish and Parks (SDGFP) have resulted in boundary changes. An inholding along the west edge of the refuge was purchased in 1985, bringing the fee- title ownership to 21,498 acres. The refuge also has approximately 320 acres under agreement, lease, or easement, bringing the total acreage under refuge management to 21,820 acres.

Purposes of Establishment

Management is dictated, in large part, by legislation that created the refuge and defines the purposes for which the refuge was established.

Five authorities exist for the acquisition and establishment of Sand Lake National Wildlife Refuge:

- Executive Order 7169 (September 4, 1935), "...as a refuge and breeding ground for migratory birds and other wild life..."
- Migratory Bird Conservation Act, "...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds..."
- The Fish and Wildlife Act, "...for the development, advancement, management, conservation, and protection of fish and wildlife resources..."
- National Wildlife Refuge System Administration Act, "...conservation, management, and ...restoration of the fish, wildlife, and plant resources and their habitats...for the benefit of present and future generations of Americans...."
- The Refuge Recreation Act, "...for (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species...."

The refuge was specifically established to improve and maintain habitat for nesting and resting waterfowl and other migratory birds, such as diving and puddle ducks, geese, grebes, herons, egrets, gulls, and terns. Management continues to be directed toward meeting the habitat requirements of these priority species as well as other migratory and resident wildlife, such as white-faced ibis, double-crested cormorant, tundra swan, American white pelican, perching birds, ring-necked pheasant, white-tailed deer, and furbearers.

A complete list of vertebrate species that are known to occur on the refuge can be found in appendix C.

Purpose and Need for Action

As directed by the National Wildlife Refuge System Improvement Act, CCPs will be developed for all units of the National Wildlife Refuge System. These plans must include public involvement in their development. A CCP needs to set goals and objectives that meet the establishment purposes for the refuge, as well as contribute to the mission of the Refuge System. Wildlife has first priority in the management of national wildlife refuges.

The purpose of developing this CCP is to provide a 15-year management plan for the conservation of fish, wildlife, and plant resources and their related habitats on the refuge, while providing opportunities for compatible wildlife-dependent recreational uses.

This CCP, when fully implemented, should

achieve refuge purposes;

maintain and restore the ecological integrity of the refuge;

help fulfill the Refuge System mission;

meet other mandates.

Vision Statement

As part of the planning process, the refuge staff and planning team developed the following vision statement for the Sand Lake National Wildlife Refuge.

Provide habitat for the production, maintenance, and basic life requirements for threatened and endangered species, migratory birds, and other wildlife species.

Promote the natural biological diversity of the region through preservation, management, and enhancement of refuge lands and waters.

Provide the public with the opportunity for wildlife-dependent recreation and the enjoyment and appreciation of America's wildlife resources.

Goals

A goal is a descriptive, broad statement of desired future conditions that conveys a purpose, but does not define measurable units. Goals will direct work at carrying out the refuge's mandates and achieving the purposes.

These goals are derived from the purposes and vision statement for the refuge to reflect the refuge's contribution to the National Wildlife Refuge System.

Beth Ullenberg/USFWS

The goals reflect the core mission of the U.S. Fish and Wildlife Service to protect fish, wildlife, and plant resources while providing compatible opportunities for the public to appreciate and enjoy the natural environment of the region.

Biological Diversity Goal

Promote the natural biological diversity of the area and, through management of refuge habitats, provide for the greatest number of native fauna and flora species within the capabilities of Sand Lake National Wildlife Refuge.

Threatened and Endangered Species Subgoal: Provide for the protection and welfare of any threatened or endangered plants and animals that may occur on the refuge.

Waterfowl and Grassland-nesting Birds Subgoal: Provide sufficient habitat (wetlands and grasslands) for the production and maintenance of waterfowl and grassland-nesting, nongame bird species.

Colonial Birds Subgoal: Provide and manage wetland habitats as nesting areas for the tremendous variety of colonial bird species using the refuge.

Resident Wildlife Subgoal: Contribute to habitat requirements for regional populations of resident wildlife including fish, reptiles, amphibians, mammals, and nonmigratory birds.

Grassland Habitat Subgoal: Restore, maintain, and provide quality habitat for the life requirements of a diversity of migratory birds and other wildlife species.

Wetland Habitat Subgoal: Provide and maintain a diversity of quality wetland habitat that meets the needs of wetland-dependent wildlife species.

Wildlife-dependent Recreational Use Goal

Provide opportunities for quality, wildlife-dependent, recreation for visitors to Sand Lake National Wildlife Refuge.

Consumptive Use Subgoal: Provide wildlife-dependent, consumptive, recreational opportunities that are compatible with refuge purposes and that contribute to a quality outdoor hunting or fishing experience.

Nonconsumptive Use Subgoal: Provide wildlife-dependent, compatible, nonconsumptive, recreational activities that increase public understanding and appreciation of wildlife and its conservation.

Public Education and Outreach Goal

Provide wildlife- and wildland-viewing opportunities for the public to enjoy and, through education and outreach, encourage them to gain a greater understanding and appreciation of national wildlife refuges and wildlife resources in general.

Dave Menke/USFWS

Northern Pintail

An Ecosystem Approach

The Service has adopted an ecosystem approach to conservation to enable it to fulfill its federal trust resource responsibility with greater efficiency and effectiveness. Through this holistic approach to resource conservation, the Service can accomplish its mission to conserve, protect, and enhance the Nation's fish and wildlife and their habitats for the continuing benefit of the American people.

Landscape-level goals have been developed within several wildlife conservation plans for North America (appendix D).

An ecosystem approach to fish and wildlife conservation means protecting or restoring function, structure, and species composition of an ecosystem, while providing for its sustainable socioeconomic use. Key to implementing this approach is recognizing that partnerships are an essential part of a diverse management plan.

The Service has adopted watersheds as the basic building blocks for implementing ecosystem conservation. Sand Lake National Wildlife Refuge is located in the Mainstem Missouri River ecosystem, which includes the Dakotas and northeastern Montana. This ecosystem is depicted in figure 2 (next page).

Planning for the Mainstem Missouri River ecosystem sets forth visions and goals for prairies, wetlands, and rivers to conserve fish and wildlife by protecting and restoring the natural ecosystem (appendix E). The habitat and wildlife goals and objectives for the refuge will contribute to meeting the mission for the Mainstem Missouri River ecosystem.

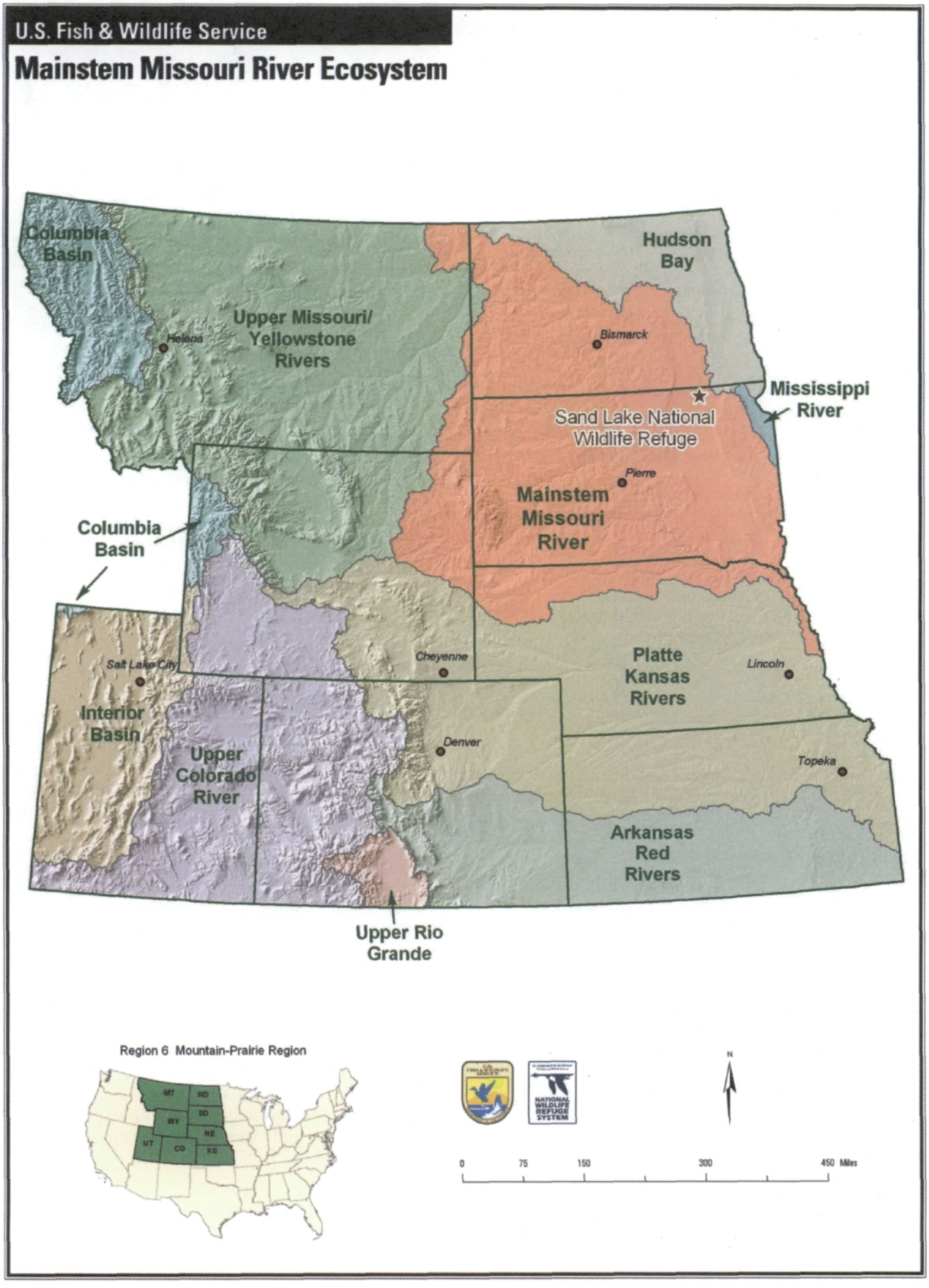


Figure 2. Mainstem Missouri River ecosystem

2 Planning Process

The National Wildlife Refuge System Improvement Act of 1997 directs the U.S. Fish and Wildlife Service to manage refuges in accordance with an approved CCP.

This section describes the planning process and issues specific to Sand Lake National Wildlife Refuge.

USFWS

Birdwatching is popular on many national wildlife refuges, including Sand Lake.

The Process

The Service is following the planning steps listed below to determine the future management of the refuge, in a thorough manner that meets requirements of the National Environmental Policy Act (NEPA) and Service policy.

The CCP process consists of a series of steps that are displayed sequentially; however, CCP planning, along with NEPA analysis and documentation, occur simultaneously. Although public involvement is listed as part of two steps, the Service will take public input at any point in the planning process.

- Preplan—form a planning team, review available data, organize efforts.
- Initiate public involvement and scoping—gather public input on issues.
- Develop draft vision and goal statements.
- Develop and analyze draft alternatives, including a proposed action—includes developing draft objectives.
- Prepare documentation of the NEPA analysis, including the draft plan (proposed action alternative).
- Conduct internal review (Service, state and tribal partners) and gather public input on draft document.
- Analyze and respond to public comments.
- Select one of the alternatives, which becomes the CCP.
- Make revisions as necessary and prepare the final CCP.
- Approve and implement the CCP.
- Monitor and evaluate actions and results.

The planning team for this CCP (appendix F) has carried out the process and prepared this CCP.

Coordination with the public, local groups, and other agencies has been essential in developing a realistic, meaningful plan.

Appendix G (environmental compliance) contains the "Environmental Action Statement" and "Finding of No Significant Impact" for this CCP.

Step-down Management Plans

This CCP is a broad umbrella plan that provides general concepts and specific wildlife, habitat, endangered species, public use, and partnership objectives. The purpose of step-down management plans is to provide greater detail than what is in this CCP to managers and employees who will implement the strategies described in this CCP.

Step-down management plans describe strategies, procedures, methods, and tasks for specific resources or functions. Often these plans require their own compatibility determinations, environmental assessments (EAs), or other justification before they can be implemented.

The preparation and execution of these plans is dependent on funding and the availability of staff or technical expertise. Additional step-down plans will need to be developed, revised, or amended as a result of this CCP (table 1, next page). Plans will be completed or revised, as needed, within 2 years of funding and necessary staff becoming available.

Plan Revision

Plans are dynamic—management strategies need to be reviewed and updated periodically. This CCP will be reviewed at least annually to determine if it requires any revisions.

Table 1. Step-down management plans for Sand Lake National Wildlife Refuge, South Dakota

Step-down Management Plan	*Completed Plan, Year Approved*	*New or Revised Plan, Completion Year*
Deer management plan	—	2006
Fire management plan	1999	—
Habitat management plan	—	2010
Integrated pest management plan	1996 (obsolete)	2005
Law enforcement plan	—	2010
Predator management plan	1992	—
Safety plan	2003	2010
Visitor services plan	1990 (obsolete)	2010
Water management plan	2001	—

Monitoring and evaluation will determine whether management activities are achieving the refuge purposes, vision, and goals. When significant new information becomes available, ecological conditions change, major refuge expansions occur, or other needs are identified, this CCP can be revised.

Revision will occur, at a minimum, every 15 years. If the plan requires a major revision, the CCP process starts anew. Plan revisions require NEPA compliance. The public will continue to be informed of, and involved with, any revision to this CCP.

Public Involvement

The NEPA process was used by the Service to engage the public in refuge planning, while determining whether the proposed action for management of the refuge would have significant effects.

"Scoping" is the term for requesting input from the public, in this case, regarding management of a refuge. The primary thrust for the planning process is to provide a forum for ideas and issues to be shared, reviewed, and evaluated among agency staff and the public.

Comments were reviewed to identify issues and public concerns about, or advocacies for, future management of the refuge. These issues are addressed in the EA and draft CCP, other plans, and decision documents.

Public scoping was initiated in a "Notice of Intent" published in the Federal Register (August 1, 2001), announcing the availability of an issue workbook and dates for open houses to be held for public input on management of the refuge. The open houses were held in October 2001.

The Service provided a 30-day review period for the draft CCP and EA, during which the public submitted comments. A summary of the public involvement, including a summary of the comments and the Service's responses, is in appendix H.

Planning Issues

The public scoping meetings, issues workbooks, and refuge information indicated that there are four major issues of concern regarding refuge management.

Wildlife and Habitat

The quality of upland grassland habitats is important for providing the needs of migratory birds and meeting the establishment purposes of the refuge. Prior to the refuge's establishment, the native prairie within the vicinity of Sand Lake National Wildlife Refuge was almost entirely broken up and converted to cropland.

Today, the uplands largely consist of smooth brome, a cool-season grass that lacks structural diversity and tends to form a less vigorous species monoculture as the stand ages. Dense nesting cover (DNC)—tame, introduced cool-season grasses with sweetclover and alfalfa—was planted on the uplands as nesting cover for migratory birds. Grazing has been the primary tool used to manage these stands. Eventually DNC needs intensive management to restore the best wildlife habitat. Either these uplands are replanted to DNC or native grass can be reestablished.

Tim McCabe/USFWS

Male Wood Duck

Refuge users want a great diversity of wildlife, including game species, supported by a variety of habitats. Game species, especially waterfowl and deer, are important recreational resources. Maintaining

the farm program would help maintain resident game species (white-tailed deer and pheasant). Some refuge neighbors are losing crops of corn and alfalfa to foraging deer.

Water Management

The refuge must use, maintain, and protect its water rights for the use of James River water. Refuge management strategies are impacted by the extremely low gradient of the James River in northern South Dakota. Water levels are manipulated on Sand and Mud lakes and five subimpoundments to modify emergent vegetation to help meet wetland objectives. During the nesting period, the refuge attempts to hold water levels steady to protect the nests of colonial, overwater-nesting birds. The critical period is May 15–August 1, during which sudden changes place nesters at risk.

With the refuge being located on the James River, control of water levels to manage wetlands is extremely dependent on river flows. Demands on the water resources of the James River require collaboration between a diversity of stakeholders including the following:

- Army Corps of Engineers
- Bureau of Reclamation
- Arrowwood National Wildlife Refuge
- Kulm Wetland Management District
- Oakes Test Area
- Garrison Diversion District
- North Dakota State Water Commission
- South Dakota Department of Environment and Natural Resources
- James River Water Development District
- Many private irrigation interests

The water cycle affects the wildlife and the fishery and subsequent recreational opportunities. There was some public concern that water management for waterfowl may have a detrimental impact on the fishery. For example, water drawdowns to winterkill rough fish also kill game fish.

Water levels on the refuge may affect water tables on neighboring lands. Salt is surfacing on lands within Brown County. It was asserted that water should be moved through the system as quickly as possible.

Public Use

Recreational opportunities on the refuge and the James River are very important to local residents.

Hunting is a priority public use to be considered on national wildlife refuges, when determined compatible with the refuge's establishment purposes. Hunting, especially of deer, waterfowl, and pheasant, is very popular on Sand Lake National Wildlife Refuge.

There is demand for fishing, particularly ice fishing. People want more fishing opportunities, but the ability of the refuge to provide fishing that is compatible with the purposes of the refuge (i.e., migratory wetland birds) is very limited. Insufficient fishing access occasionally creates minor traffic congestion at one access point when anglers use the road right-of-way for fishing.

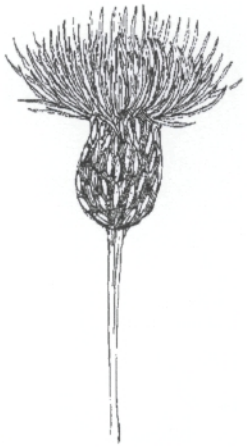
There is increasing demand for on-site educational and interpretive programs, including public support for an education center. In addition, there is some public interest in camping and recreational trapping.

Invasive Plants

Invasive plants, especially Canada thistle, are dominating plant communities and impacting habitats in some areas.

Canada thistle is a serious invasive species problem on the refuge. This plant tends to form monocultures in the absence of management actions such as herbicide application, haying, or replanting.

Without intensive management, the refuge would become a sea of smooth brome and Canada thistle, incapable of providing habitat for a diversity of grassland-dependent wildlife.



Canada Thistle
© Cindie Brunner

Invasive plants on the refuge are particularly troublesome for neighbors who are required by state and local laws to control invasive species on their lands and view the refuge as a source of invasive plant expansion onto their lands.

Chemicals used to control invasive plants are of concern from the standpoint of environmental contamination and negative impacts on desirable plant species.

3 Refuge Resources and Description

The Sand Lake National Wildlife Refuge is located in Brown County, South Dakota, approximately 25 miles northeast of Aberdeen.

To get to the refuge, visitors must travel 5 miles east of Aberdeen on South Dakota Highway 12, and then 20 miles north on Brown County Highway 16.

Beth Ullenberg/USFWS

Wetlands fill the backdrop behind the Sand Lake National Wildlife Refuge's sign.

The refuge lies in north–central South Dakota and covers 21,498 acres (figure 4, next page). This area of South Dakota is in the heart of the prairie–pothole region of the northern Great Plains and plays a major role for migratory birds associated with the Central Flyway. Since the refuge is located near the 100th meridian, both eastern and western migratory bird species may be found.

This chapter describes the current physical and socioeconomic environment of the refuge:

- Geographic setting
- Special management areas
- Physical resources
- Biological resources
- Fire regime and fire history
- Natural resources
- Population and habitat monitoring
- Cultural resources
- Wilderness review
- Socioeconomic setting
- Public use
- Partnerships

Geographic Setting

The Sand Lake National Wildlife Refuge is located in the upper James River basin (figure 1). The 21,116-square-mile area of the James River basin is divided between North Dakota (6,688 square miles) and South Dakota (14,428 square miles). The South Dakota portion of the basin is 350 miles long, with a maximum width of about 100 miles. The river begins west of Fessenden, North Dakota, flows east for a short distance, then follows a general southerly course through North Dakota and South Dakota to its confluence with the Missouri River east of Yankton, South Dakota.

The upper James River basin is a flat plain bounded by the Missouri River escarpment on the west and the Altamount, Antelope, and Gary moraines on the east. The basin contains extinct glacial lakes whose beds are distinguishable by the extremely flat topography. The basin slopes from an elevation of 1,630 feet above sea level in the headwaters, down to 1,300 feet above sea level at the North Dakota–South Dakota line, and to 1,170 feet above sea level at the mouth of the James River. The river follows 747 miles of winding channel across the 350-mile length of the basin (within South Dakota). This meandering stream lies in a shallow floodplain that varies from a few hundred feet to three miles in width.

The James River lowlands are bordered by the Missouri Coteau, which extends from the Missouri River on the west and the prairie coteau to the east. The major land features associated with this area of South Dakota are products of the Pleistocene glaciations that formed the Missouri River and the prairie potholes sometime between 12,000 and 40,000 years ago. This area of the prairie–pothole region provides important habitat for waterfowl production and other prairie birds (figure 3).

Figure 3. The prairie–pothole region

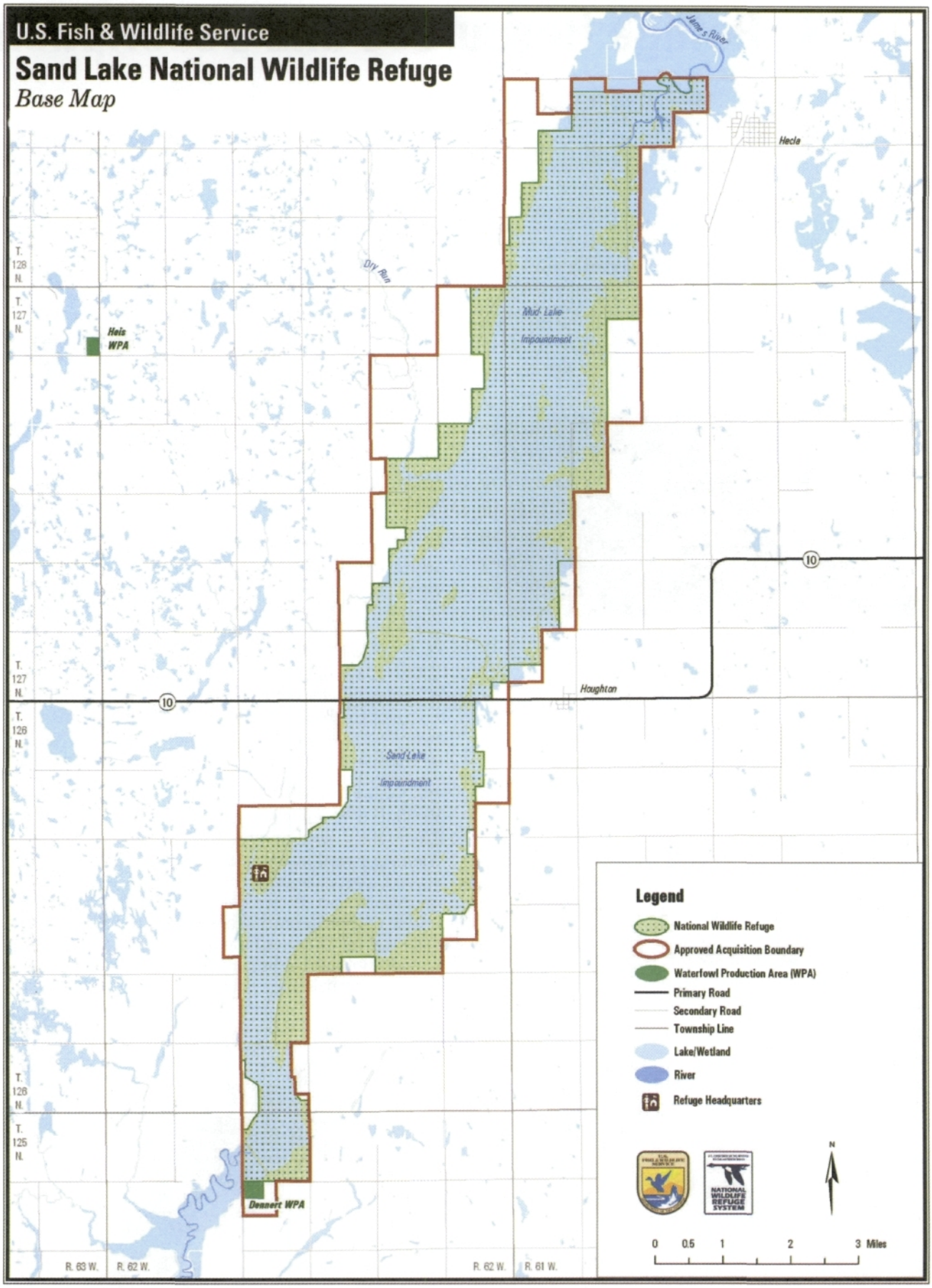


Figure 4. Base map for Sand Lake National Wildlife Refuge, South Dakota

The refuge is located in these rich lowlands along the James River. The James River bisects the refuge north and south and has the flattest gradient of any river its size in North America. From its source to its mouth, its average gradient is only 3 inches per mile. Through the refuge and most of Brown County, the river has a drop of only 1 inch per mile.

Two dams, with water-control structures, were built across the James River during the 1930s by the Civilian Conservation Corps (CCC). These structures impound and enhance two main pools, Mud Lake (containing 5,300 surface acres when full) and Sand Lake (containing 6,100 acres surface acres). Several other impoundments provide additional wetland habitat.

This region of South Dakota was once dominated by native prairie vegetation. The tall-grass prairie is located primarily east of the James River, and the mixed- and tall-grass transition dominates most of the James River basin physiographic region. Much of this zone has been farmed, but some prairie still exists, particularly in areas with numerous shallow wetlands or poor quality soils.

The Service has adopted watersheds as the basic building blocks for implementing ecosystem conservation. The Mainstem Missouri ecosystem includes portions of the Missouri River and Hudson Bay watersheds.

Special Management Areas

In recognition of its value to the conservation of birds and their habitats, Sand Lake National Wildlife Refuge has been designated as both a Globally Important Bird Area (GIBA) by the American Bird Conservancy (March 17, 2001), and a Wetland of International Importance (WII) (Convention on Wetlands of International Importance 1971).

The refuge has supported the largest nesting colony of Franklin's gulls in the world, with up to 150,000 breeding individuals. At the time, this amounted to about 50 percent of the entire population of this at-risk species (National Audubon Society 2002). In addition, many thousands of Franklin's gulls gather on the refuge in the fall.

Other colonial-nesting birds on the refuge include white-faced ibis, black-crowned night-heron, eared and western grebes, and Forster's and black terns. One large, mixed-species, heron rookery hosts up to 6,000 pairs.

The marbled godwit and the willet nest on the refuge, as do the short-eared owl, the bobolink, the Nelson's sharp-tailed sparrow, and the clay-colored sparrow. When mud flats are exposed during spring and fall migration, the refuge hosts thousands of shorebirds.

© John Jave

A Franklin's gull lands on a refuge lake.

Fall migrations of snow geese may reach peaks of 250,000 individuals, whereas the spring migration has been documented at more than 1.2 million. Hundreds of thousands of ducks also stop over on migration. As many as 12,000 American white pelicans are found on the refuge seasonally.

Physical Resources

Soil and water resources largely determine habitat communities, along with climatic factors. Mineral resources and air quality, other important resources, are also described in this section.

Soils

The refuge is located along the James River within the Dakota Lake plain, a lowland physiographic division of South Dakota. The area is characterized by the sandy bottom of an ancient lake, glacial uplands, and alluvial floodplains. Soil composition is strikingly different on opposite sides of the refuge. To the east, the soils are characteristically sandy and loamy soils similar to the lake plain. To the west and beyond the refuge, the soil is characteristically silty and sodium-affected silty soils (USDA 1993).

Water Resources

The upper James River is a unique portion of the total James River ecosystem in South Dakota. At the refuge, the flow of the sluggish James River is interrupted by two natural pools (Mud and Sand lakes) that have been regulated by low, earthen dams and water control structures. Both lakes are shallow; Mud Lake averages about 1.5 feet in depth and Sand Lake averages about 2.75 feet in depth with current management. The maximum depths of the pools are approximately 6 feet. Margins and other shallow areas of both impoundments produce dense stands of emergent vegetation.

The principal water right at the refuge is withdrawal number U.S. 1-3 (October 16, 1934). The withdrawal

covers 61,062 acre-feet of water (27,021 acre-feet storage and 34,041 acre-feet seasonal use) from the James River. The water's principal use is for migratory waterfowl use, supplemental use, game and fish propagation, and public recreation.

The refuge also holds water license number 4225-3 (February 2, 1978) for 0.67 cubic feet per second (totaling 150 acre-feet annually) from a well at headquarters, with supplemental pumping to a marsh.

© John Jave

Cattail Wetland

Water license number 4258-3 (March 24, 1978) allows 63 acre-feet of water storage and sufficient water annually to maintain the water level at outlet elevation 1,291.0 feet mean sea level from Dry Run for waterfowl production.

Water permit number 5516-3 (March 8, 1991) allows for impoundment of 295 acre-feet with sufficient water annually to maintain water level to the outlet elevation of 1288.5 feet mean sea level in Columbia Marsh. This water is diverted from James River overflow during high, spring runoff events to provide habitat for fish and wildlife production.

The refuge also holds a vested right for an artesian well drilled in 1935 by the CCC. The well flows approximately 5 gallons per minute and the water is used for domestic purposes.

Climatic Conditions

Large seasonal fluctuations of climate in the region are the rule, rather than the exception. Extreme cold in the winter, with mean minimum temperatures of -2.7°F in January, is normal. During the summer, mean maximum temperatures are commonly near 83.5°F in July. Precipitation averages 20.3 inches annually, but cycles of drought and heavy precipitation are evident (NOAA 2002).

Mineral Resources and Reserved Rights

During the withdrawal of lands establishing the refuge in 1935, and as additional lands were acquired, there were no reservations of surface or subsurface mineral rights (to other than the federal government) on all the land owned fee-title by the federal government. Purchase of some land tracts were subject to existing rights-of-way at the time of acquisition. These rights-of-way include a buried telephone line, an electric distribution line, and three highway easements to the South Dakota Department of Highways.

Air Quality

Visibility and clean air are primary resource values. The protection of these resources must be given full consideration in fire management planning and operations. Additionally, smoke can have serious health and safety effects that must be considered. The management of smoke will be incorporated into the planning of prescribed fires and, to the extent possible, in the suppression of wildfire. South Dakota does not have a permit system for air quality, but does have regulations concerning agricultural burning.

The Environmental Protection Agency's (EPA) air quality index rates air quality in Brown County, South Dakota as "good" (U.S. EPA 2004). In 2001, Brown County ranked among the best, i.e., cleanest, 20 percent of all counties in the U.S. in terms of total environmental releases.

Based on the EPA's most current data, Brown County ranked among the cleaner 40 percent of all counties in the U.S. in terms of an average individual's added cancer risk from hazardous air pollutants (Environmental Defense Network 2004). Conversely, Brown County ranked among the worst, i.e., dirtiest, 20 percent of all counties in the U.S. in terms of aerial emissions of fine particles (Environmental Defense Network 1999), 70 percent of which is a result of agricultural practices (EPA 1999).

Biological Resources

This section describes the existing plant and animal communities on the refuge. Figure 5 shows existing habitat conditions.

Habitat

The nutrient-laden waters contained in the 11,450 acres of marsh and open water form the heart of the 21,498-acre Sand Lake National Wildlife Refuge.

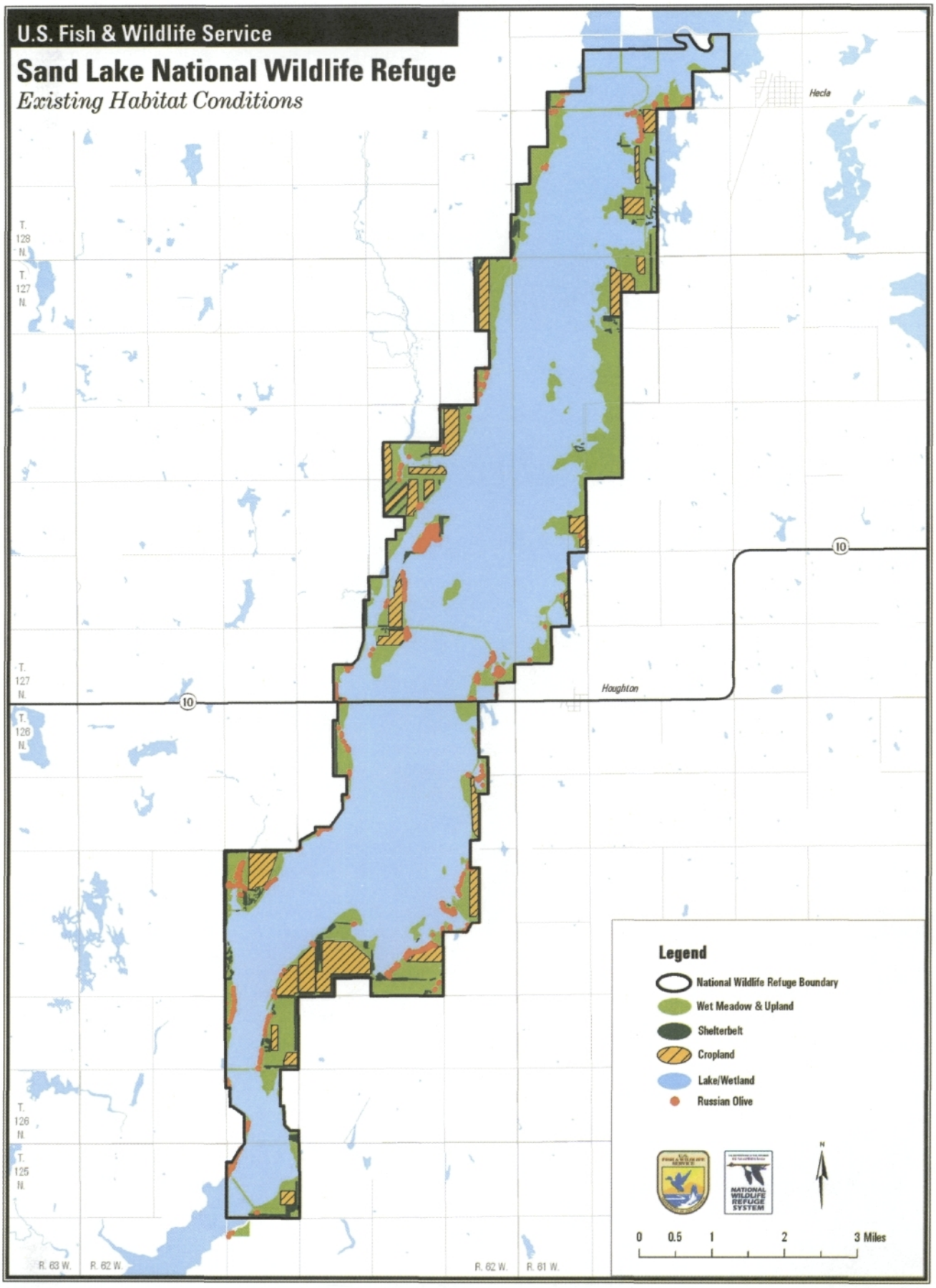


Figure 5. Existing habitat conditions at Sand Lake National Wildlife Refuge, South Dakota

The remaining 10,000 acres of uplands consist of 424 acres of shelterbelts; 1,217 acres of croplands; and more than 8,000 acres of grasslands.

Downstream from the refuge, the meandering, wooded channel provides a scenic contrast to the surrounding agricultural landscape. Terrestrial habitat associated with the upper James River channel is generally characterized by a hardwood corridor, interspersed with thickly vegetated marshes and brushy fields. The existing natural woodland and forest habitat consists primarily of mature, mixed stands of American elm, green ash, boxelder, and willow. This habitat offers scenic beauty and provides the diverse habitat necessary for wildlife to reproduce and survive in the typical prairie environment that surrounds it.

Grasslands

Grassland vegetation makes up 8,600 of the 21,498-acre refuge. These grassland acres are primarily composed of reseeded exotic grass and forb species, mainly smooth brome and alfalfa with some fields of intermediate wheatgrass and sweetclover.

Grasslands are managed with emphasis on providing optimum nesting cover for upland-nesting waterfowl.

Approximately 8,000 acres of tame grass and legumes (DNC) and restored native grass plantings are on the refuge. Most DNC fields have degraded to smooth brome. These fields have not been recently restored by farming and reseeding to maintain stand vigor. Because Canada thistle tends to invade new grass-seeded areas, the breakup of DNC fields slowed. Instead, management actions such as grazing or haying, followed by a disking, were used to improve the existing stands by encouraging the forb component.

Nearly 500 acres of cropland has been removed from production and planted to restored native grass. These native sites generally consist of six or seven grass species, which may include big and little bluestem, green needlegrass, western wheatgrass, Indiangrass, sideoats grama, and switchgrass. The seeding of forbs in the restoration process has been limited due to high seed costs, difficulty in acquiring seed, and problems associated with the control of Canada thistle in the plantings.

Grasslands are managed using grazing, haying, and prescribed burning. The management tool selected is dependent on the availability of water, fences, livestock, ease of firebreak construction, and suitability for haying. Management is focused on obtaining the maximum height and density of grasslands with some type of management action occurring every 4–5 years.

The refuge has been divided into management zones; individual units are selected each year within a zone depending on the monitoring results. Grazing is used most commonly to reduce litter, stimulate forb species, and promote active healthy growth of the grasslands. Grazing is also used help control invasive species. Permittees for all grassland management actions are selected by the bid process and only farmers and ranchers who operate on land within 2 miles of the refuge boundary are eligible to bid.

Wetlands

The wetland component is comprised of two main bodies of water, Mud and Sand lakes. The construction of the two low-lying dams changed the habitat conditions of these historical marshes.

Wetland habitat on the marsh is characterized by open water, submergent vegetation (e.g., sago pondweed and coon's tail), emergent vegetation (e.g., cattail and common reed), and temporary and seasonal vegetation (e.g., rush, sedge, and prairie cordgrass).

Water management on the refuge is greatly dependent on flows in the James River, largely due to the low gradient. Spring flows are generally allowed to fill Mud and Sand lakes to full-pool level by early May. The pools are held near full-pool level through mid-August. Water levels are dropped 1 foot below full-pool level prior to freeze-up to protect the water control structures and dikes from ice damage. Summer drawdowns are scheduled when needed to reestablish emergent vegetation within the pools.

In addition to the two main impoundments, there are five subimpoundments and many smaller, natural wetlands scattered throughout the uplands. Management of the subimpoundments is opportunistic, being dependent on water levels in the James River or local runoff. Efforts are made to draw down the subimpoundments when wetlands surrounding the refuge are full. The subimpoundments are reflooded during periods of drought to provide quality habitat when it is most beneficial to wetland-dependent wildlife.

Woodlands

Most of the estimated 424 acres of woodlands are in shelterbelts planted by the CCC in 1937–38 to control wind erosion and provide wildlife habitat. The shelterbelts have been deteriorating and no active management has been done to restore them. Most of these plantings consist of American and Chinese elms and green ash. Dutch elm disease has been gradually killing the American elms in these plantings (figure 6, next page).

© Cindie Brunner

Historically, woody vegetation occurred along riparian corridors and around some wetlands. Native cottonwood seedlings have colonized naturally into many of the marsh edges due to flood conditions on the James River during much of the 1990s. These isolated, scattered trees, with an understory of cattail and Canada thistle, have been allowed to grow naturally in the floodplain, except where controlled by upland management activity.

Management of native woodland vegetation has not been emphasized in previous habitat management efforts.

Croplands

The uplands have a long history of agricultural crop production and virtually all native prairie on the refuge has been lost to the plow. Approximately 3,146 acres of cropland was farmed on the refuge in 1952. In response to a variety of factors, including complaints of short-stopping geese from the southern states, management emphasis for uplands has shifted from providing food for migrating snow geese to waterfowl production. Much of the cropland was replanted with DNC.

Beginning in the late 1990s, additional cropland was replanted to grassland because of the lack of use by the snow geese, and because the midcontinent population of lesser snow geese were well above objectives set for the species. The planting of agricultural crops was not needed for the management of migratory birds.

A total of 1,217 acres of cropland is currently farmed by 8 cooperators on the refuge. Farming is conducted to restore native grass on deteriorating tame grasslands, to reduce use of nonselective broadleaf herbicides, to control invasive plants and to provide, indirectly, food for white-tailed deer.

Fields are typically rotated between corn and spring wheat or soybeans. Refuge cooperators maintain the food plots on a 25:75 sharecrop basis. The kinds of herbicides permitted are limited and no insecticides are allowed. The refuge's share is taken in corn, which is left standing to provide food for wintering white-tailed deer.

Invasive Plants

Canada thistle, leafy spurge, Russian olive, and wormwood sage are the primary invasive species in the grasslands on the refuge. At least 3,000 acres of uplands and wetlands are heavily infested with Canada thistle. Most control efforts are directed at Canada thistle using grazing, haying, mowing, and biological methods. This species is a pervasive pest, partly because control measures are limited and generally require repeated application.

Canada thistle has infested almost all wetland margins in northeastern South Dakota, providing an endless seed source. The James River just ended an unprecedented, extended period of flooding during the 1990s. During this period, above-normal precipitation provided ideal germination and growing conditions for this species.

On the refuge, Canada thistle colonizes the wetland margins, spreading from there into the grasslands. Areas identified for treatment have generally been grazed, mowed, or burned prior to chemical application. To keep infestations in check, an average of 800 acres has been chemically treated annually. The uplands are often reinfested within 4–5 years.

While efforts are made to limit the amount of herbicide used on the refuge, control efforts are never complete because of the tolerance of Canada thistle to control efforts. In addition, an endless seed source from public and private lands makes reinfestation highly likely.

Prescribed fire is an important tool for grassland management; however, Canada thistle usually responds well to fire. Application of herbicides following prescribed burns is essential. There are 2,900 acres of wet meadows. While such areas often have the most severe infestations, these areas are extremely difficult to burn effectively.

Herbicides used to control invasive plants have a disastrous impact on the forb/legume component of a plant community. Chemical control is driving vegetative "succession" toward a chemical-tolerant grass community. The high water table on the refuge is problematic for herbicide application, particularly in the lower wet areas where infestations are the most severe.

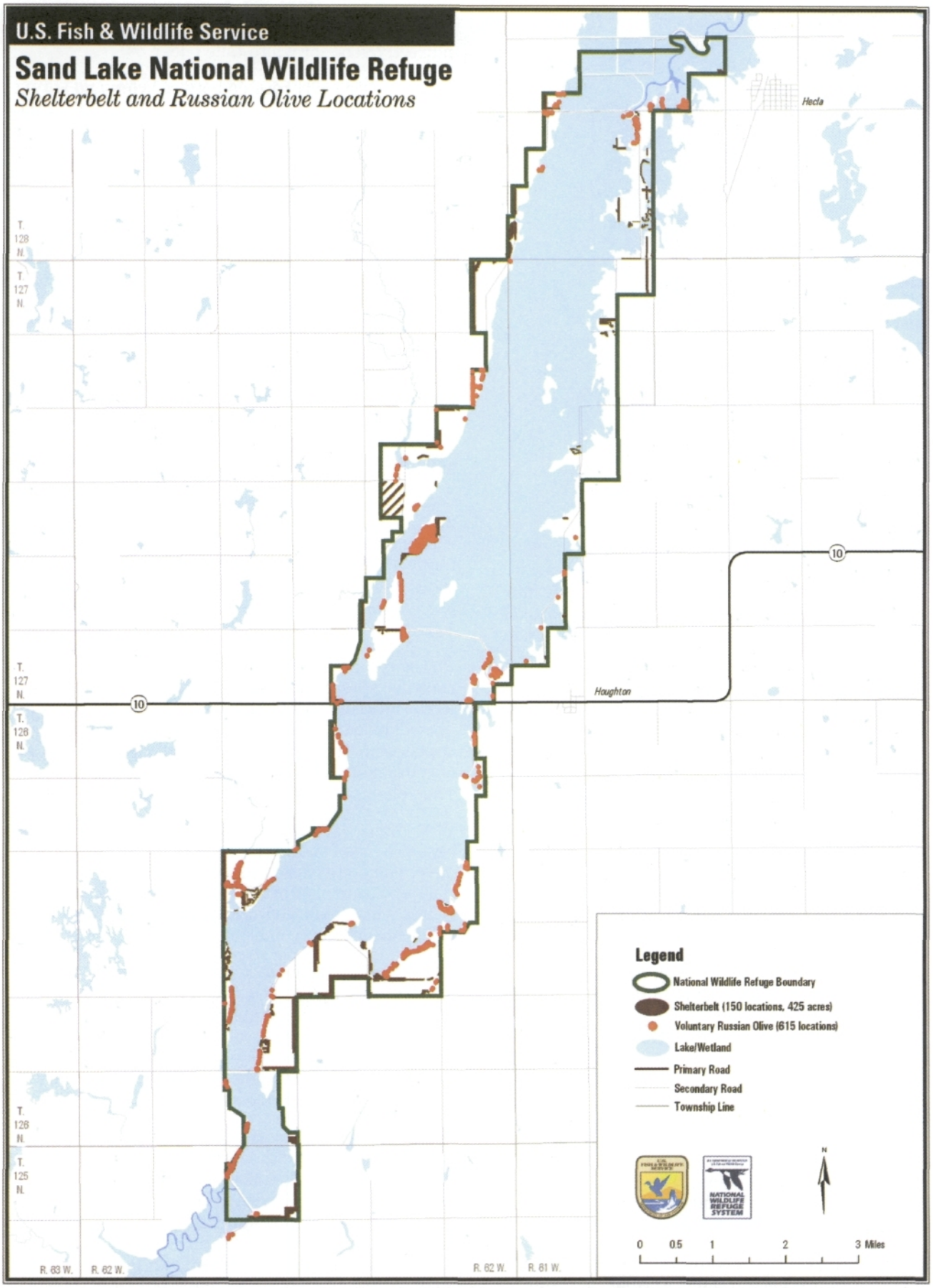


Figure 6. Shelterbelt and Russian olive locations at Sand Lake National Wildlife Refuge, South Dakota

Four species of insects were introduced on the refuge for biological control of Canada thistle, two of which have been found to overwinter. However, no reduction in thistle stands has yet been observed. Flea beetles have been introduced to control leafy spurge, with mixed results.

Russian olives have invaded many wetland margins and lowland areas. While annual herbicide treatments control new seedling growth, scattered mature trees continue to serve as seed sources.

Mowing prevents seed germination and dispersal. In addition, mowing prepares areas for subsequent herbicide application if needed. Hundreds of acres are mowed every year.

Grazing is used on a limited scale as part of the integrated approach to invasive plant control; however, the availability of interested cooperators is limited. Grazing serves as a site preparation prior to herbicide applications.

Fire Regime and Fire History

Wildfire is one of the primary natural disturbances of native prairie. Historical records describe huge prairie fires started by lighting or humans. Fires burned millions of acres, as there were few natural fuel breaks and no suppression. Wright (1980) and others believe that fire frequency in the prairie grasslands is 5–10 years. Other studies indicate that a longer frequency of 10–20 years may be more accurate (Jave 1999).

Prior to the 20th century, the role of fire in the northern plains had been one of continued perpetuation of the prairie ecosystem. Fire restored vigor to plant growth, increased seed production, released nutrients, and reduced accumulations of litter (Higgins 1986a, b). This included the area now designated as the Sand Lake National Wildlife Refuge.

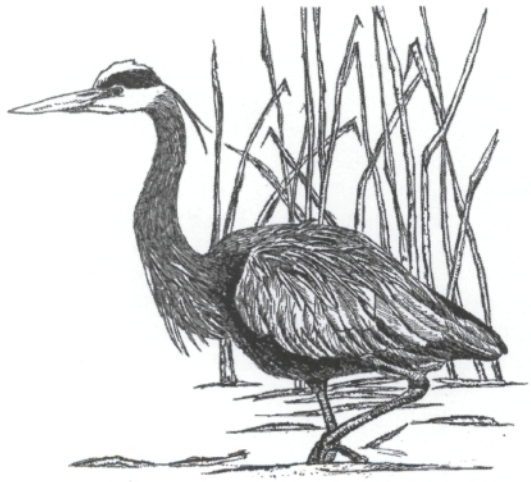
Since the early 20th century and the establishment of the refuge, nearly all fires within the boundaries have been suppressed and adjacent habitat has been fragmented by agricultural practices. These activities have significantly reduced the role fire plays as a vital element of the prairie ecosystem in north–central South Dakota. In addition, grassland composition and structure have changed (i.e., exotics). This has influenced fuel type, extent, and micro-environmental factors (moisture). Recently, there has been an accumulation of knowledge, now being translated into management practices, that recognizes fire as an essential process of the mixed-grass prairie.

Over a 20-year period (1977–97), only 16 wildland fires, burning a total of 517 acres of Service and non-Service lands, have been reported. This limited acreage burned is partly attributed to barriers such as roads, plowed fields, lakes, ponds, or rivers that serve as breaks. Remaining areas within the refuge had been mostly hayed or grazed, making them less fire prone.

Natural Resources

The upper James River provides aquatic habitat for a wide range of plants and animals that have persisted through the years, despite multiple human alterations and fluctuating conditions. The James River basin is one of few major north–south migration corridors in the northern Great Plains with relatively intact riparian vegetation. This draws large numbers of migratory birds to move through the Dakotas in spring and fall.

The James River, running more than 600 miles through North Dakota and South Dakota, forms a natural flight path for migrating birds—one of the most heavily used in the Central Flyway. The upper James River is an important migration route for many species of songbirds, marsh birds, and other nongame birds.



Great Blue Heron
Tom Kelley/USFWS

As part of the only continuous north–south corridor of woodland habitat in South Dakota, at least 161 species of birds have been identified in this area during migration periods, many of which remain there to nest. Schneider (1978) identified 138 species on his census routes, including 103 in woodlands, 71 in savannahs, 67 in marshes, and 62 in grasslands. In addition, a minimum of 48 species of mammals have been identified. The bird and mammal diversity demonstrate the importance of the river system (including the refuge) to both nongame and game species.

Mud and Sand lakes are managed for intensive use by waterfowl and other migratory birds during the

spring, summer, and fall and for rough fish control during the winter. Production of sago pondweed and other submergents that are important food resources for birds are encouraged.

Waterfowl

The prairie–pothole region is the primary breeding grounds for waterfowl in the United States. Mallards, wood ducks, and blue-winged teal are the most common breeding ducks (Schneider 1978). Populations are variable, peaking in high-water years.

Dave Menke/USFWS

Snow Geese

Studies conducted by the Service found concentrations as high as 15 breeding pairs per square mile. Wood duck densities of two breeding pairs per square mile use the refuge woodlands. Breeding densities on the river were the highest in Brown County, primarily at the Stratford Slough area.

Large concentrations of migrating waterfowl use the floodplain and temporary and seasonal wetlands in the area for resting and feeding. On the refuge, waterfowl populations have averaged approximately 184,000 ducks and 216,000 geese annually.

Colonial Birds

Colonial-nesting grebes, gulls, ibises, terns, and herons are found on the refuge. Fall concentrations of Franklin's gulls and ring-billed gulls have peaked at 150,000 and 5,000, respectively.

Information gathered by the Service (USFWS 1985) indicates that use of the James River by colonial-nesting species, including the great blue heron and double-crested cormorant, may be greater than previously realized. The preliminary list includes 24 rookery sites below the refuge, 9 of which are in Brown County. These birds depend on trees for nesting and on aquatic habitats for food, mostly fish.

Shorebirds

Shorebird surveys have been conducted annually since 2000. Refuge data contributes to Manomet's International Shorebird Survey and the U.S. Geological Survey (USGS) prairie–potholes shorebird survey. Analyses of shorebird numbers in conjunction with records of water levels in Mud and Sand lakes may be helpful in making future decisions regarding management of impoundments for shorebirds.

Fish

The upper James River, from the North Dakota border to near Redfield, South Dakota (including the refuge), is an important fish production area for the James River.

Currently, 60 species of fish have been identified as occurring in the James River and at least 22 in the upper reaches in South Dakota. Owen and others (1981) collected 41 species in the river. Primary game fish species are black bullhead, walleye, northern pike, yellow perch, channel catfish, and crappie. The majority of fish biomass in the river is made up of nongame species such as carp, buffalo, and freshwater drum.

The upper James River, which includes the refuge, provides excellent spawning habitat and has highly productive rearing areas during spring floods. Occasional test-netting by SDGFP showed an annual influx of fish during the spawning season.

There is important reproductive and rearing habitat for the northern pike, which is probably the only game fish that occurs on the refuge.

Fish greatly influence relationships of species in aquatic systems. In the upper James River, fish are an important food source for birds such as cormorants and herons and mammals such as mink and raccoon. In turn, fish depend on a rich supply of aquatic insects, crustaceans, and other organisms for food. Collectively, these organisms are dependent on the diverse environment of pools, riffles, brush piles, and overhanging vegetation that the upper James River provides.

Northern Pike
Tom Kelley/USFWS

The quality of the aquatic habitat is directly related to stream flow characteristics. The James River is a typical prairie stream, subject to heavy organic and sediment loads, low oxygen levels, and wide fluctuations in stream flow. Historical flows range from zero in dry years to several hundred-thousand acre-feet.

Generally, stream flow is at a minimum in winter and reaches maximum in the spring (March–June). Dissolved oxygen levels sometimes reach zero in stretches of the river, usually during periods of low

flow, resulting in fish kills. Despite frequent occurrence of these adverse conditions, the upper James River maintains a substantial fish population with its diversity of habitat types—deepwater pools (protective areas) and spawning sites (reproductive areas)—and the migration of fish from other areas.

Deer

The white-tailed deer population in Brown and Spink counties largely depends on the James River for production and survival.

Data gathered on the Oahe Irrigation Project (Solomon 1982) showed that deer sightings ranged from 0.117 to 0.431 adults per mile in the irrigation areas and from 0.477 to 1.555 adults per mile on the James River. In this study, 91.2 percent of the sightings were along the river's floodplain.

A standardized spotlight survey was developed to obtain total deer counts and doe/fawn ratios for the prehunting population of deer on the refuge in 1990.

A postseason spotlight survey was standardized to provide comparative data. This data was collected by Bill Antonides of the SDGFP, with annual assistance from refuge staff. The data provides an index of the total deer population used by SDGFP and refuge staff to set hunting licenses for population control.

© John Jave

Doe with Fawn

Other Wildlife

The upper James River's marsh habitat (Brown and Spink counties) is important to the pheasant population as protection from winter storms. Winter concentrations of more than 1,000 birds have been reported in this area (SDGFP 1976). In addition, the brushy, wooded cover provides roosting and loafing areas.

Furbearing mammals are closely tied to the river ecosystem, depending on both the terrestrial and aquatic habitat. Mink, raccoon, and beaver thrive and fox and badger make use of available cover.

The importance of the natural river habitat for wildlife is also indicated by the diversity of species found there. In addition to game species, many nongame species including the belted kingfisher, red-headed woodpecker, white-breasted nuthatch, and bank swallow are found in this area. These species, although not important from a harvest perspective, are a vital part of the total ecosystem. Their presence indicates the unique nature of the upper James River.

Trapping for Management Purposes

The refuge has had a furbearer trapping program for both recreation and management purposes throughout most of its history. Interest in trapping has decreased in recent years partially because of a decrease in fur prices. Consequently, the knowledge and skills are being passed on to fewer young people.

Most interest is in trapping muskrats after freeze-up. Trapping success is based on the muskrat population, which fluctuates depending on hydrologic conditions of the James River. Wetter conditions following a period of drought provide resources such as flooded stands of cattails and adequate water depths for lodges that allow muskrat populations to flourish. Fall trapping can be used to remove muskrats causing damage to dikes and roads.

The Service discourages fall trapping of furbearers for recreation on national wildlife refuges. Trapping was not included in the wildlife-compatible uses legislated by Congress and outlined in the National Wildlife Refuge System Improvement Act of 1997. The fall trapping of fox, raccoon, and skunk does not increase the spring nesting success of upland-nesting species of waterfowl.

A 90-acre predator exclosure was constructed near the refuge headquarters as a Ducks Unlimited project in 1990. Waterfowl nest depredation is reduced by trapping predators inside the exclosure and along the perimeter. These species include red fox, raccoon, striped skunk, mink, and Franklin's ground squirrel. Nest success is 60–80 percent, with a record number of 220 nests recorded in 2000. As a result, a spring trapping program was initiated on Mud Lake Island during periods of high water in the James River.

Population and Habitat Monitoring

Population monitoring of migratory and breeding birds occurs annually. Nest dragging is conducted to determine preferred habitat use by upland-nesting waterfowl and to determine waterfowl production in the predator exclosure. Other on-going monitoring is achieved through the cooperation of various agencies, volunteers, and individuals.

Sand Lake National Wildlife Refuge is an official banding station as part of the North American Duck Banding Program. More than 51,000 ducks were banded on the refuge from 1982 through 2004.

Bill Schultze/USFWS

Refuge staff doing early-morning duck banding.

Nesting activity of various bird species is monitored. Waterfowl-nesting success is monitored within the 90-acre predator exclosure. Refuge staff monitors the use of wood duck boxes, bluebird boxes, goose tubs, and mallard baskets, and checks for signs of bald eagle-nesting activity.

Until recently, habitat monitoring has not received the primary emphasis or the attention as population monitoring. A grassland-monitoring plan was developed in 2003–4 and a program of formal habitat monitoring was begun. Upland grassland habitats were classified and are monitored annually by refuge staff. The results are used to make future management decisions and to evaluate past techniques.

Monitoring of wildlife diseases is limited primarily to detection of waterfowl botulism outbreaks in wetlands. Other diseases of recent concern include West Nile virus, avian chlamydiosis, and chronic-wasting disease.

Cultural Resources

Documented occupation in the vicinity of Sand Lake National Wildlife Refuge spans a 10,000-year period, thus there is potential for presence of archeological resources on the refuge. There are no known cultural resources on the refuge; however, a comprehensive cultural resource inventory has not been conducted. Individual sites that may be affected by management activities are surveyed for cultural resources prior to disturbance.

As indicated on a plaque, the Columbia Day Use Area is the location of the first Catholic mass in South Dakota in 1845.

The refuge contains clear ties to the Depression-era period, based on the original landscape design and presence of all but one of the original buildings. An evaluation of the historical context of structures built during the Depression-era identified one historical site; however, the buildings have been altered.

The eight-stall vehicle building is probably the most intact and unique. In addition, the entrance sign represents the standard sign originally designed for refuges.

In South Dakota, most refuges were established in the 1930s, during the Depression. The CCC, formed during the Depression years, performed early construction activities on Sand Lake National Wildlife Refuge. Projects focused on holding water, linking channels, and creating habitat islands for migratory birds.

The CCC Camp BF-2, for Company #2749 was opened in June 1935 and closed in July 1939. Various works were accomplished, as described in the following excerpt from a report (CCC 1939).

> "Forty miles of very satisfactory refuge trails provide travel facilities to almost any part of the area. Seventy miles of fence surround the refuge.
>
> More than one-half million new trees are now thriving on the area and enhancing its appearance.
>
> Two major and seven minor dams have been constructed or reconstructed.
>
> Where 17 sets of farm buildings once existed, a portion of three now remain.
>
> More than 200 miles of undesirable and run down farm fences have been removed.
>
> Nesting and resting islands, a network of low water system channels and a complete set of water controls now are in evidence on the large marsh area that used to be marked only by hay stacks.
>
> The foundations of two public picnic grounds have been laid.
>
> New buildings have been constructed on the headquarters and secondary residence sites.
>
> Large signs are located in strategic locations near the refuge, proclaiming the purpose and sponsor of the refuge.
>
> Many upland game shelters are observed as one tours the refuge.
>
> Large areas have been seeded to aquatic plants and an abundance of natural cover growth is present.
>
> As a result of the display pool dam, the first CCC project, a small lake with pinioned geese and many broods of wild ducks swimming around on it is the first picture seen when entering."

USFWS

The 108-foot observation tower at refuge headquarters in the 1930s.

Beth Ullenberg/USFWS

Looming over a small wetland, the tower continues to be a favorite with visitors.

Wilderness Review

To be designated a wilderness area, 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 as 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 Sand Lake National Wildlife Refuge meets the size and scientific, scenic, and ecological value criteria for wilderness. However, roads, fences, grazing, agriculture, and wetland drainage have modified the refuge. These alterations prevent designation as a wilderness area.

Socioeconomic Setting

This section is a summary of the socioeconomic setting. The complete economic analysis is in appendix I.

The refuge is located in Brown County, South Dakota. The county is part of the glacial lakes and prairies region of South Dakota and is sometimes called the heart of the prairie–pothole region of North America. Brown County has a total area of 1,713 square miles (1,096,320 acres).

Brown County offers such attractions as the Dacotah Prairie Museum, the Centennial Village, pari-mutuel horse racing, the Brown County Fair, and the Richmond Lake Youth Camp (Brown County 2004).

Aberdeen, the third largest city in South Dakota, is the county seat and the center of commerce for the region. Aberdeen was nicknamed the "Hub City" because it served as an important intersection for many busy railroad lines. Today's "Hub City" has grown into a diverse, regional trade center with service and manufacturing industries, attractive retail shopping opportunities, convention facilities, a private college, a state university, and two large medical centers (Aberdeen Area Chamber of Commerce 2004).

Population, Employment, and Income

The 2000 census estimated Brown County's population at 35,460 persons (U.S. Census Bureau 2002). Approximately 70 percent of the county's residents reside in Aberdeen (Discover Aberdeen 2004).

While South Dakota experienced a 7.8 percent population increase from 1990 to 2000, Brown County's population decreased 0.4 percent over the same time frame (U.S. Census Bureau 2002). In 2000, Brown County averaged 21 persons per square mile; the state average was 10 persons per square mile.

The 2000 census reported the following for the county's population:

- 95.1 percent are white persons not of Hispanic/Latino origin

- 2.7 percent are American Indian and Alaska Native persons
- 0.7 percent are persons of Hispanic or Latino origin
- 0.4 percent are Asian persons
- 0.3 percent are Black or African American persons

Approximately, 86 percent of the county population 25 years and older were high-school graduates and 24 percent were college graduates (U.S. Census Bureau 2002). There are two colleges in Aberdeen—Northern State University and Presentation College.

South Dakota's major exports include computers and electronic production, machinery manufactures, processed foods, and crop production (U.S. Department of Commerce 2002).

In 2000, 83.5 percent of county jobs were in private wage and salary employment (people who work for someone else) as compared to 79.2 percent for South Dakota. According to the Discover Aberdeen website, the major employers in Aberdeen are health services, education, manufacturing, hotel reservations, agriculture, higher education, the call center, and support services.

Recreational Activities

The refuge offers a wide variety of year-round accessible recreational opportunities that are wildlife dependent. Hunting, fishing, wildlife observation (e.g., bird watching), wildlife photography, and education are all popular activities.

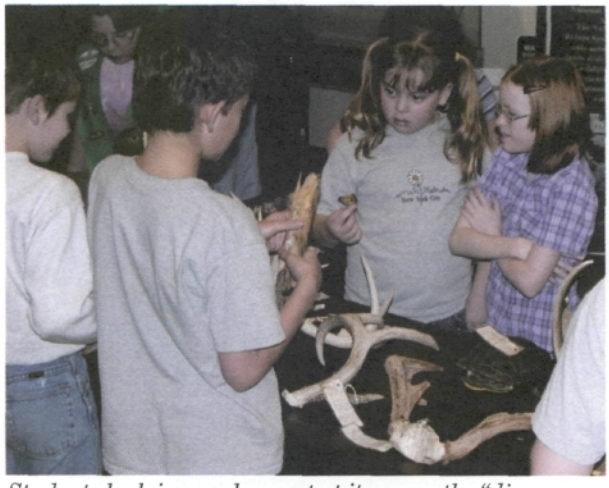
The refuge is a nationally recognized wildlife sanctuary and offers opportunities for big game, upland game, and waterfowl hunters. Pheasant hunting draws outdoorsmen and women from across the country each fall. Fishing is allowed year-round at five locations on the refuge.

Major visitor expenditure categories include lodging, food, and supplies. Current visitors to the refuge spend about $655,500 annually in the Brown County economy. The current level of visitor spending directly generates more than $152,000 in personal income and 9.4 jobs for local businesses accommodating visitors including hotels, restaurants, supply stores, and gas stations. The associated indirect and induced effects generate an additional 4.3 jobs and more than $102,000 in personal income throughout the Brown County economy. This has a total economic impact of 13.7 jobs and more than $254,000 in personal income associated with the current level of refuge visitation.

Refuge Staffing and Budgeting

Current refuge staffing and budgeting generates 13 permanent and 4 temporary and seasonal employees. The current staff accounted for an annual payroll, including salaries and benefits, of $910,600 in 2003.

In addition to providing salaries and benefits, the refuge purchased goods and services totaling $165,200 in 2003, approximately 65 percent of which was spent locally in the Brown County economy.



Beth Ullenberg/USFWS

Students look in wonderment at items on the "discovery table" in the visitor center.

Public Use

In addition to the various fish and wildlife habitats, the James River provides a scenic contrast to the agriculturally dominated prairie. An appreciation of this value was shown with the nomination of the upper James River as a Scenic and Recreational River by the SDGFP (1976).

Studies have documented the recreational value of the river. Hanson (1981) surveyed recreational and other uses of the river from 1975 to 1979. He divided the river into three segments beginning at Sand Lake National Wildlife Refuge. The upper section, just south of the refuge, included the river from Columbia to Fisher Grove State Park. In 1 year, this upper section had an estimated 357,590 hours of recreation, including 27 different activities. Camping and fishing were the highest uses. In Hanson's discussion, he stated:

> "The number and variety of uses observed are proof that the James River is truly a multi-use resource. Uses such as sightseeing, that do not directly consume a product of the river, were consistently important to the total recreational value. Impacts upon this total recreational value, rather than a single use or value, must be considered in any management plans for the river."

The refuge offers a variety of public use activities (figure 7, next page). Approximately 50,000 people visit annually to participate in some form of recreation. Activities include hunting, fishing, wildlife observation, wildlife photography, environmental education, interpretation, and hiking.

Interpretive displays, a book sales outlet, various brochures, and accessible rest rooms are located at refuge headquarters; the visitor area and main office are open year-round.

A small room adjacent to the lobby serves as space for educational activities and as a small visitor area housing exhibits, displays, wildlife mounts, and audio equipment. This space also holds two employee offices. Maximum capacity is 20–25 elementary students and 20 or fewer junior and high school students. Classes of more than 25 students find it difficult to use the facility because of the limited size; it also has no classroom or laboratory-type space.

There is increasing demand for on-site educational and interpretive programs. Educational programs are limited to videos or floor activities. The current facility can accommodate only one school group at a time and, during peak use, groups have to be turned away. This space is used for special refuge events, which are also limited due to the facility's small size.

The Columbia Day Use Area is often used for birding and it provides accessible restrooms and parking, a hiking trail, tables, and a sun shelter.

Public access to the interior of the refuge is limited during hunting seasons from mid-October to February 1. During this time, gates and roads are closed and access is limited only to hunters to avoid user conflicts and ensure safety.

Wildlife observation, wildlife photography, environmental education, interpretation, and hiking are best from April 1 through mid-October when wildlife is more prevalent and roads and gates are open.

Areas open to visitors include the 15-mile "wildlife drive" auto tour route, the 20-mile North Loop Road, and the Columbia and Hecla day use areas.

Hunting

The refuge has long been famous for waterfowl hunting and huge fall concentrations of snow geese. In fiscal year 2004, there were approximately 1,100 waterfowl-hunting visits.

Pass shooting for waterfowl is offered from approximately 200 waterfowl blinds placed around the refuge perimeter (figure 8). This program was set up in response to the article, "Carnage at Sand Lake," published in the National Audubon Society magazine (1970), documenting excessive crippling of waterfowl.

In 1970, in cooperation with the state of South Dakota, certain road rights-of-way were closed to hunting to reduce waterfowl crippling, reduce road congestion, and space hunters in blinds for a higher quality hunt. In recent years, the hunting from these blinds has been less productive. Many blinds on the northern portion of the refuge receive very little use because of changed use-patterns of snow geese. It is anticipated that the number and locations of these blinds may change in the future, if the lack of use continues.

The refuge is a popular area for white-tailed deer hunters, with archery, muzzleloader, and rifle seasons occurring in November and December. In fiscal year 2004, there were approximately 2,200 deer-hunting visits.

The local agri-business community is appreciative of the refuge's efforts to provide for additional deer harvest, in addition to what is available in Brown County surrounding the refuge. Cooperative plans and strategies have been ongoing for years with SDGFP to address the dynamics of the regional deer herd.

Upland game birds include ring-necked pheasant, sharp-tailed grouse, and gray partridge. A December season for upland birds, primarily ring-necked pheasant, is offered each year at the close of the rifle seasons. In fiscal year 2004, there were approximately 900 upland game-hunting visits.

© John Jave

Ring-necked Pheasant

Fishing

The angling pressure on the upper and middle sections of the James River is significant, comparing favorably to the better lakes in northeastern South Dakota.

Fishery resources on the James River in the vicinity of Jamestown Reservoir and isolated reaches upstream are also important fishery resource areas.

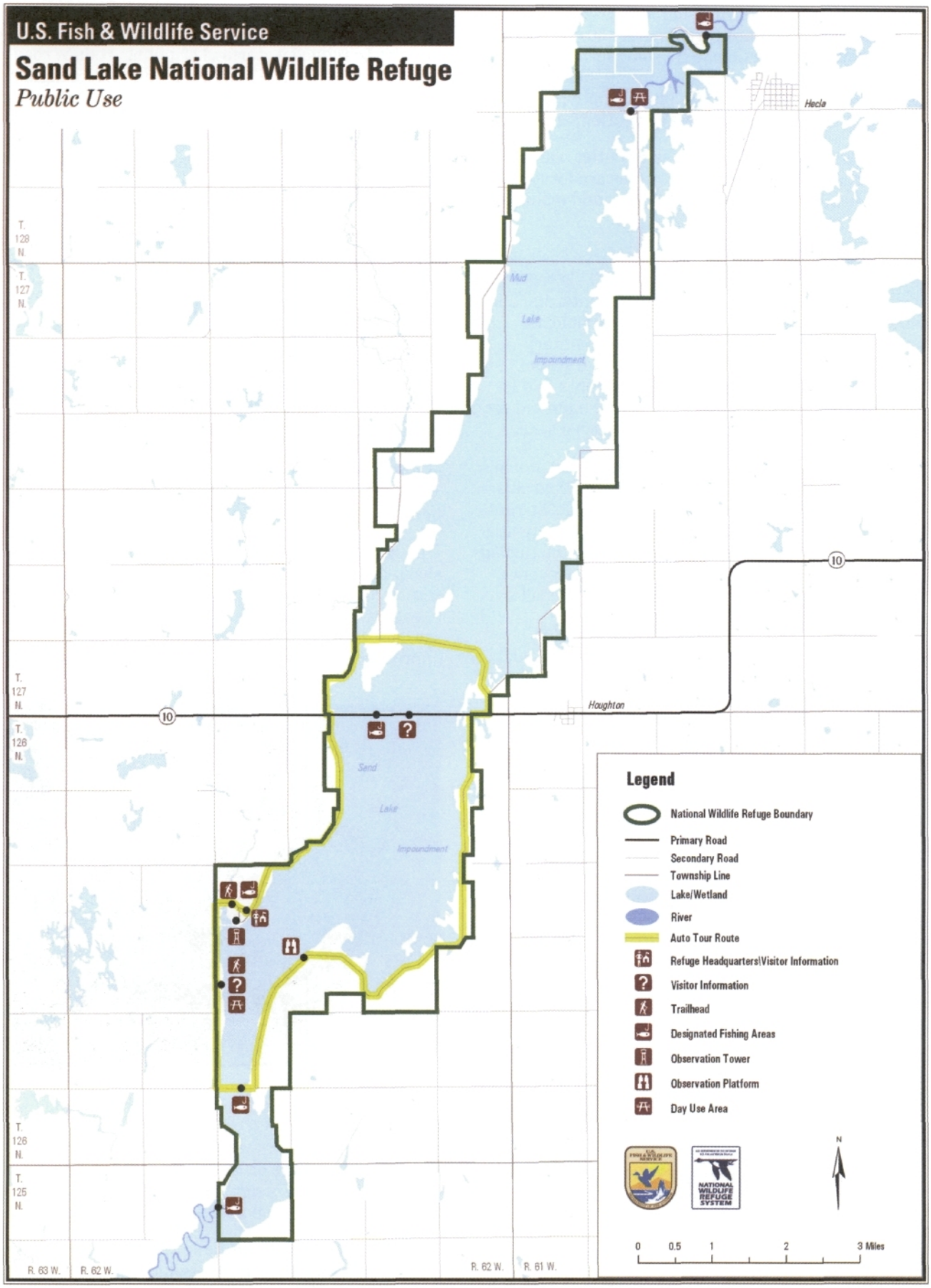


Figure 7. Public use at Sand Lake National Wildlife Refuge, South Dakota

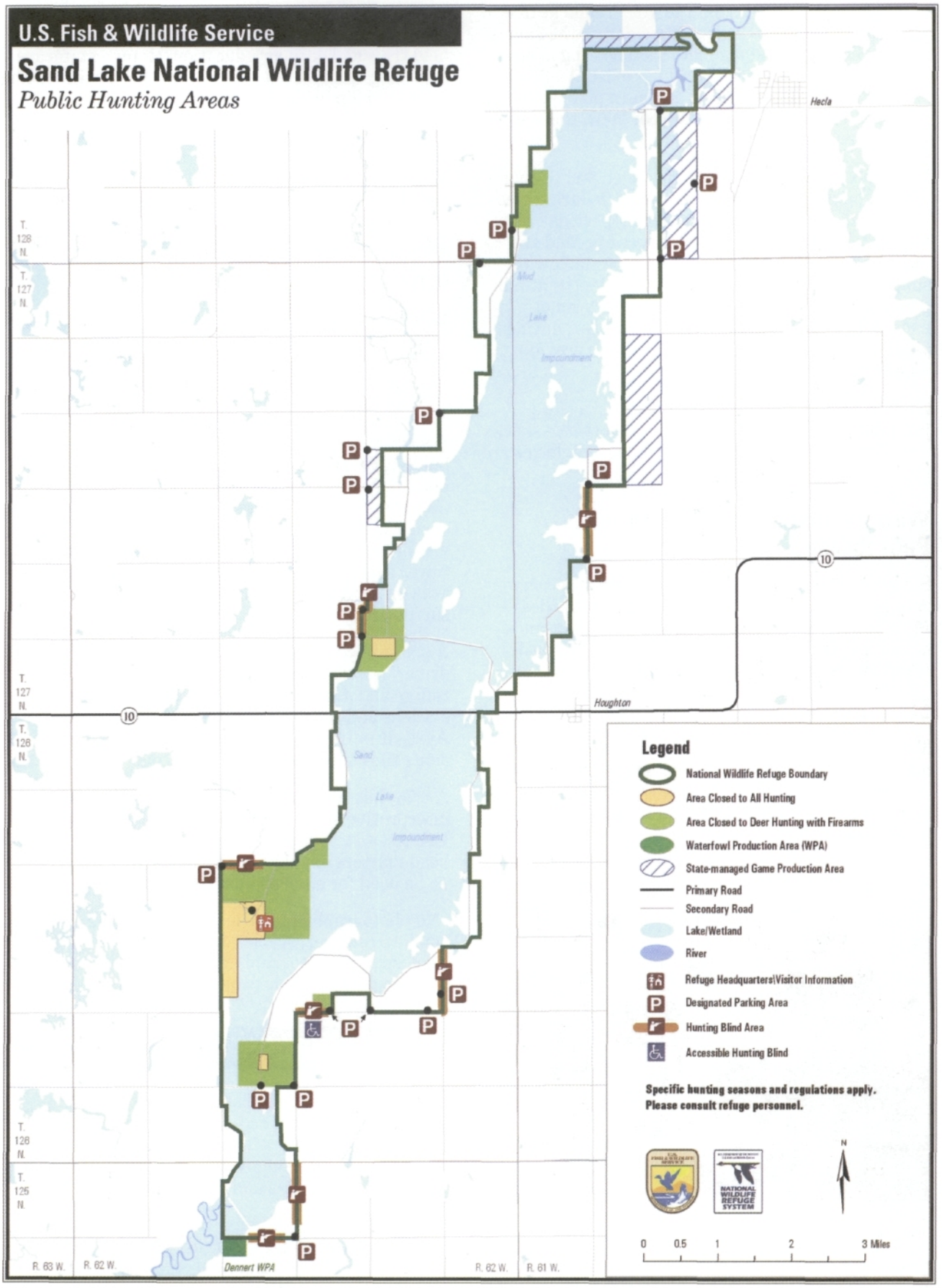


Figure 8. Public hunting areas at Sand Lake National Wildlife Refuge, South Dakota

Fishing on the refuge is offered year-round at five locations, where road rights-of-way cross the James River. Motorized and nonmotorized boating is not allowed and no facilities for fishing exist. Angler preferences include walleye, northern pike, yellow perch, and rough fish. In fiscal year 2004, there were approximately 1,200 angler visits.

The fisheries are not actively managed and fishing is opportunistic. Fish populations flourish during wet cycles and decline (winterkill) during periods of low flow or when lower water levels occur in Mud and Sand lakes. Sand Lake is generally too shallow to support a viable game fishery. Water depths at full-pool level pool are less than 6 feet, which is not enough to overwinter game fish. However, during years of high flow, the James River may provide winter fish habitat.

Anglers are limited to ice fishing within a close proximity of the designated fishing areas. Ice shacks are allowed, but must be removed daily. Vehicles are not allowed on the ice.

Wildlife Observation and Wildlife Photography

Several state and county highways traverse the refuge and offer excellent viewing opportunities. Most activity is in spring and fall, when thousands of people visit to see large concentrations of birds when migrations are at their peak.

Environmental Education

The Sand Lake National Wildlife Refuge has an active on- and off-site environmental education program. Special events include several water festivals, Scout camps, 4-H camps, local fairs, and a free fishing day.

USFWS

Eagle Day visitors learn about birds of prey at a live bird exhibit.

Each year, more than 600 students visit the refuge on school field trips. This use is dropping due to budget constraints within local school districts, which includes the elimination of busing for nonessential activities and decreased funding for field trips and outdoor education. Refuge staffs are exploring creative ways to assist schools with busing issues to help bring field trips to the refuge.

Due to constraints on school budgets, off-site environmental education programs have flourished. More than 3,000 students are reached through staff- and educator-led programs and special events each year. Classroom programs use The Prairie Learning Trunk, The Shorebird Trunk, and other teaching kits.

Interpretation

Refuge facilities for public use are somewhat limited. Interpretive kiosks on Highway 10, at the refuge headquarters, and in the Columbia Day Use Area provide visitors with information about wildlife and the Sand Lake National Wildlife Refuge.

A small visitor area, located within the headquarters building, provides information and exhibits. The building is open during regular work hours (Monday–Friday, 8:00 am–4:30 pm). During the spring waterfowl migration, volunteers staff the visitor area on weekends. A 100-foot observation tower that is open for public use in the headquarters area provides panoramic views of the refuge and the surrounding area.

A self-guided auto tour route, known as the "wildlife drive," is available for the public to learn about the refuge and its wildlife. The route has 12 numbered stations and is open, when conditions permit, from April through mid-October. A viewing platform along the route overlooks Sand Lake.

A 0.75-mile-long, self-guided hiking trail with interpretive signs is located in the Columbia Day Use Area. A second nature trail is planned for the headquarters display pool area along with a shelter to be used for environmental education.

No photography blinds are maintained for the public. However, special-use permits are issued to professional photographers who are working on specific photographic projects.

Partnerships

The refuge has a long history of fostering partnerships to help accomplish its mission and goals. These partners include city, county, state, and federal agencies; nongovernmental organizations; conservation groups; and private citizens.

The refuge's partners have assisted in wildlife and habitat management, public use and recreational activities, and community outreach. Many of these relationships have developed into formalized partnerships that have written agreements or

understandings, while others remain more informal. Existing and potential partners are listed below.

Organizations

- 4-H Clubs of Brown County
- Aberdeen Bird Club
- American Bird Conservancy
- Aberdeen Chamber of Commerce
- Aberdeen Convention and Visitors Bureau
- American Rivers
- Booth Society
- Boy Scouts–Sioux Council
- Dacotah Prairie Museum
- Ducks Unlimited
- Girl Scouts–Nyoda Council
- Glacial Lakes and Prairies Tourism
- Hecla Sportsmen's Club
- Manomet Center for Conservation Sciences
- National Audubon Society
- National Wildlife Refuge Association
- Pheasants Forever
- South Dakota Ornithologists' Union
- South Dakota Wildlife Federation
- Sportsmen's Club of Brown County
- The Nature Conservancy–Ordway Prairie
- The Wildlife Society–South Dakota Chapter
- Whitetail Bowmen
- Whitetails Unlimited

Educational Institutions

- Northern State University
- South Dakota State University

Governmental Groups

- Aberdeen Parks, Recreation and Forestry
- Brookings Wildlife Habitat Office
- Brown County Commission
- Brown County Emergency Manager
- Brown County Extension Service
- Brown County Farm Service Agency
- Brown County Highway Department
- Brown County Natural Resources Conservation Service
- Brown/Marshall Conservation District
- Bureau of Reclamation–Dakotas Area Office
- Convention on Wetlands of International Importance
- Garrison Diversion Conservancy District
- Local and Regional School Districts
- Lower Crow Creek Watershed District
- National Weather Service
- Northern Prairie Wildlife Research Center
- Patuxent Wildlife Research Center
- South Dakota Department of Agriculture
- South Dakota Department of Environment and Natural Resources
- South Dakota Department of Game, Fish and Parks
- South Dakota Water Rights Program
- South Dakota Division of Forestry
- South Dakota State Historic Preservation Officer
- U.S. Army Corps of Engineers–Omaha District
- U.S. Fish and Wildlife Service (international conservation, ecological services)
- USGS (water resources)

Potential Partners

A "friends group" within the community could be established and other potential partners include:

- American Fisheries Society–Dakota Chapter
- Wildlife Management Institute
- Northeast South Dakota Walleye Club
- Izaak Walton League

4 Management Direction

© John Jave

Pied-billed Grebe

This CCP takes an integrated approach that optimizes the biological potential for migratory birds and finds a balance with reducing cropland, while ensuring depredation is minimized.

The management direction in this chapter meets the purposes, vision, and goals of the refuge. Objectives and strategies to carry out the goals will provide for ecosystem and resource needs and public use.

- A goal is a descriptive, broad statement of desired future conditions that conveys a purpose, but does not define measurable units.
- An objective is a concise statement of
  what is to be achieved;
  how much is to be achieved;
  when and where it is to be achieved;
  who is responsible to achieve it.
- Strategies are ways to achieve an objective.
- Rationale for each objective includes background information, assumptions, and technical details used to formulate the objective. The rationale provides context to enhance comprehension and facilitate future evaluations.

Development of refuge goals and objectives involved multiple sources of information:

- a review and interpretation of national plans
- a review of existing scientific literature
- an evaluation of habitat conditions
- the personal knowledge of planning team participants

Management Summary

Upland habitat management will be geared toward providing tall and dense nesting cover on a high percentage of the uplands for nesting birds, especially waterfowl. Rejuvenation of decadent grasslands and the control of invasive plant species will be emphasized. This will be accomplished through an active management program of grazing, prescribed burning, haying, farming, reseeding, invasive plant control, and habitat monitoring.

- Cropland acreage will be reduced.
- No new shelterbelts will be planted. Existing shelterbelts will be allowed to die out to increase the size of grassland blocks for nesting migratory birds. In addition, selected shelterbelts will be removed and the disturbed sites seeded to grass.

- Invading Russian-olive trees will be removed or controlled where they are threatening the productiveness of grassland-nesting migratory bird species.

The refuge will acquire areas approved by the Migratory Bird Conservation Commission when the land becomes available from willing sellers.

Both Mud and Sand lakes will be managed to provide a wetland category preferred by overwater-nesting birds and waterfowl. The five subimpoundments (figure 9) will be managed as shallow-water, seasonally flooded wetlands—used by waterfowl breeding pairs and broods, nesting black terns and pied-billed grebes, and foraging waterbirds and shorebirds. Drawdowns will be accomplished, depending on the amount of flow in the James River; water can only be moved out of the units when there are low flows in the river. Siltation problems within Mud and Sand lakes will be addressed.

The refuge will manage its wildland fire program according to the steps outlined in appendix J.

Neil Powers/USFWS

Prescribed fire is a tool to rejuvenate grassland.

The section 7 biological evaluation for threatened and endangered species can be found in appendix K.

Wildlife-dependent recreational activities will be expanded and improved on and off refuge lands.

- The building of an education center will allow visitors a quality experience and provide a focus point for public use. This new education center, larger than the current headquarters facility, will meet current demand for educational materials and activities, as well as for special events.
- Support facilities for hunting and fishing opportunities will be improved.
- The Columbia and Hecla day use areas will continue to be managed for public activities. Improvements such as updated signing, interpretive kiosks, and expanded trails will be made to each site.
- On-site tours, school field trips, and educational activities will be promoted and associated facilities will be improved.
- Off-site programs will promote visitation to the refuge.

Bald Eagle
© Cindie Brunner

MANAGEMENT DIRECTION

The biological diversity goal will be met through the following objectives and strategies. Expected habitat conditions are shown in figure 10.

BIOLOGICAL DIVERSITY GOAL

Promote the natural biological diversity of the area and, through management of refuge habitats, provide for the greatest number of native fauna and flora species within the capabilities of the Sand Lake National Wildlife Refuge.

Threatened and Endangered Species Subgoal

Provide for the protection and welfare of any threatened or endangered plants and animals that may occur on the refuge.

Threatened and Endangered Species Objective: Provide nesting and roosting habitat for bald eagles during the course of the year. Make special efforts to protect and provide for the well-being of any threatened or endangered species, such as the whooping crane, that is found to be present.

Strategy

— Allow riparian zone trees, especially cottonwoods, to grow except where affected by habitat management activities.

Waterfowl and Grassland-nesting Birds Subgoal

Provide sufficient habitat (wetlands and grasslands) for the production and maintenance of waterfowl and grassland-nesting, nongame bird species.

Waterfowl and Grassland-nesting Birds Objective: Maintain or develop a minimum of 8,000 acres of nesting habitat for waterfowl and grassland-nesting nongame birds within 10 years of CCP approval.

Strategy

— Maintain upland habitats through applied management such as grazing, haying, and prescribed fire.

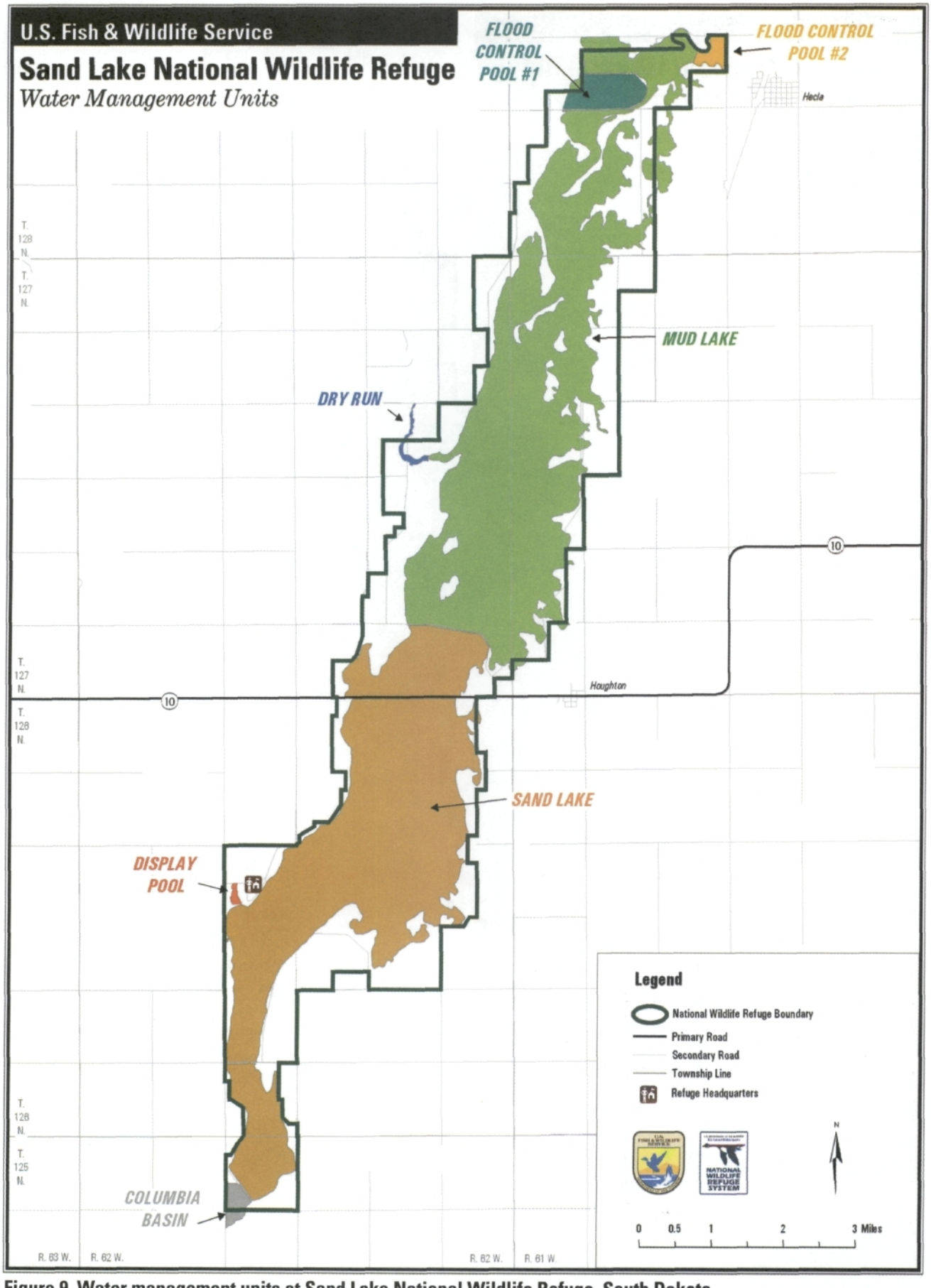


Figure 9. Water management units at Sand Lake National Wildlife Refuge, South Dakota

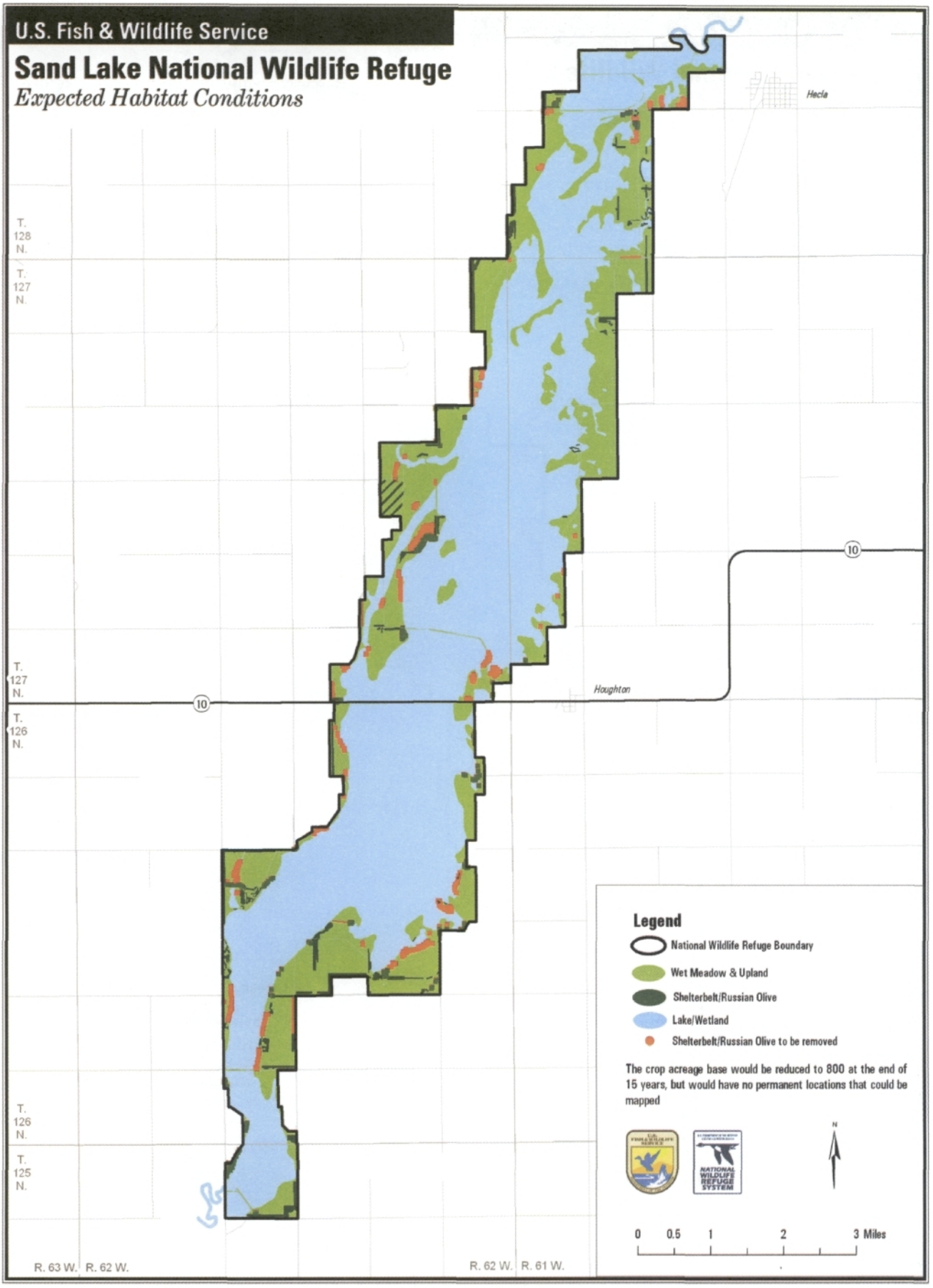


Figure 10. Expected habitat conditions at Sand Lake National Wildlife Refuge, South Dakota

Colonial Birds Subgoal

Provide and manage wetland habitats as nesting areas for the tremendous variety of colonial bird species using the refuge.

Colonial Birds Objective: Manage the emergent vegetative zones through water level manipulations to provide nesting and roosting habitat for the hundreds of thousands of colonial-nesting birds that use the refuge. Maintain 750 acres of emergent vegetation south of Highway 10 within the traditional nesting area.

Rationale

Overwater colonial-nesting birds rank high on the hierarchy of wildlife priorities of the refuge (table 2). This objective describes the deepwater/dense-emergent category of wetland habitat preferred as overwater nest sites by a high percentage of colonial-nesting birds found on the refuge, as follows:

- Franklin's gull (Burger 1974, Guay 1968)
- White-faced ibis (Ryder and Manry 1994, Zeiner et al. 1990)
- Black-crowned night-heron (Davis 1993)
- Eared grebe (Dechant et al. 2002)
- Western grebe (Short 1984)
- Forster's tern (Gorenzel 1977, McNicholl 1979)

Table 2. Priority ratings of bird groups relative to habitat management on Sand Lake National Wildlife Refuge, South Dakota

Priority Rating	*Bird Group*
1	Waterfowl
2	Colonial-nesting birds
3	Grassland-nesting passerine birds
4	Shorebirds
5	Other marsh and waterbirds
6	Raptors
7	Woodland-nesting passerine birds
8	Resident species

By managing areas of Sand and Mud lakes (see impoundment objectives in the wetland habitat section) for overwater-nesting birds, habitat for other wetland birds will naturally be provided in areas of different depth.

- Deepwater/sparse-emergent habitat will be provided along the edges of deepwater/dense-emergent areas and in areas of variable depth.
- Shallow-water/emergent habitat will be provided along the marshy edges of Sand and Mud lakes and in the northern part of Mud Lake.
- Open-water/submergent habitat will be provided in the deeper, center part of Sand Lake and in the deeper pockets of Mud Lake.
- Shallow-water/sparse habitat will be provided along the lake edges and shorelines.

The location and amount of each habitat type will vary with the natural wetland cycles. As emergent vegetation gradually decreases, the habitat type will change. This can happen gradually over time or within several years if water levels are extreme.

In addition, water levels in the subimpoundments are intended to vary like natural wetlands. The success and timing of such management actions are subject to dynamic weather patterns.

Plant communities in prairie wetlands are continually changing because of short- and long-term fluctuations in water levels and salinity. Prairie wetlands have evolved under these fluctuating conditions. The process of cycling with wet and dry periods makes prairie wetlands productive. For instance, exposure of mud flats during drought periods is necessary for the germination of many emergent macrophytes and facilitates the oxidation of organic sediments and nutrient releases that maintains high productivity.

Within the framework of a dynamic wetland system, management of the subimpoundments is directed toward waterfowl (foraging, breeding pairs, and broods), shorebirds, and wading birds. This objective sets an upper and lower threshold of emergent vegetation, because an interspersion of emergent vegetation and wetland openings is preferred by both dabbling and diving ducks and their broods (Kantrud 1986).

Interspersed emergent vegetation also benefits other marsh-dwelling birds and mammals (Seabloom 1958, Vogl 1973, Weller and Spatcher 1965). Such conditions may also result in avian communities of greater species diversity or richness (Weller 1978, Weller and Spatcher 1965). In addition, Voigts (1976) found maximum invertebrate abundance occurring where beds of submerged vegetation were interspersed with stands of emergent vegetation.

A lower invertebrate biomass threshold is part of the subimpoundment objective. Invertebrate abundance is quantified relative to biomass in June, because that is when invertebrate biomass is known to peak in most wetlands (Euliss and Mushet 2003).

Abundance of aquatic macroinvertebrates is positively related to waterfowl use (Kaminski and Prince 1981, Schroeder 1973, Swanson and Meyer 1973) and early growth of ducklings (Chura 1961, Perret 1962, Sugden 1973). Aquatic invertebrates also are important food resources for shorebirds (Eldridge 1987), amphibians (Clark 1978, Deutschman 1984), and other marsh birds (Weller 1981).

Shallow water conditions during some portion of the year are also favorable. Deep water may reduce the availability of invertebrates to feeding waterfowl (Laperle 1974, Murkin and Kadlec 1986) and shorebirds. Optimum foraging depths for dabbling ducks, shorebirds, and wading birds are 2–9.8 inches, 0–9.8 inches, and 3–23.6 inches, respectively (Jasmer 2000). Diving ducks can also exploit food resources in shallow water (Fredrickson and Reid 1988).

© John Jave

Young eared grebes keep watch from their mother's back.

Strategy

— Manipulate water levels in the major impoundments.

When emergent cover is in optimal condition, conventional water strategies will be applied. This consists of moving spring runoff through the refuge as quickly as possible, until water levels have fallen to full-pool elevation (1,287.52 feet above sea level). Full-pool elevation will be maintained through the nesting season (May 15–August 1). Refuge staff will continue to coordinate with upstream dam managers to minimize negative impacts to overwater nesters.

Control of water levels to manage wetland habitats is dependent on the flows of the James River. Conditions on the river can change quickly and need to be continually evaluated.

After multiple years of high water, cattail stands often need to be reestablished through managed drawdowns. The best time to reestablish cattail in Sand Lake is during low-flow years, when water levels can be drawn down during the summer months.

In Mud Lake, drawdowns will be limited by the level in Sand Lake, but conditions should be sufficient to reestablish cattail during low-flow years.

The coordinated release of water from Dakota Lake National Wildlife Refuge, just north of Mud Lake, may also be an option if the releases benefit both refuges or if the benefits to Sand Lake National Wildlife Refuge override the benefits to Dakota Lake National Wildlife Refuge. The managers at both refuges will determine this. These releases may be needed to reflood part of Mud Lake after a drawdown or to address a botulism problem in Mud or Sand lakes.

If the wetland experiences only shallow flooding, emergent vegetation may eventually expand through vegetative propagation to dominate the entire wetland. The resultant buildup of litter and organic material from emergent species can reduce water depth or eliminate shallow water areas (Hammond 1961; Ward 1942, 1968). Decreased waterfowl use is commonly associated with the decreased habitat variation in stands of tall, emergent hydrophytes, which typically form monotypes in the absence of disturbance.

General references (Kozlowski and Ahlgren 1974, Wright and Bailey 1982) indicate that burning of marsh vegetation releases nutrients and opens the canopy and detrital layer. Reduction in the height and density of tall, emergent hydrophytes by fire generally benefits breeding waterfowl. Such benefits are an increase in pair density probably related to increased interspersion of cover and open water, which decreases visibility among conspecific pairs (Kantrud 1986). Grazing by cattle also may remove much organic matter and create open water areas where submersed plants flourish (Schultz 1987).

Prolonged deepwater flooding reduces emergent macrophytes due to extended inundation and the expansion of muskrats and their consumption of macrophytes (Euliss et al. 1999). Drawing the wetlands down early in the summer when mud temperatures are too cool to allow cattail germination helps discourage cattail invasions. Alternately, allowing the subimpoundments to drain naturally will expose the mud flats in midsummer and likely encourage cattail proliferation.

The James River is embedded within an agricultural landscape where cultivation of wetland catchment areas has likely increased

the intensity of runoff events and decreased the time available for infiltration.

Although all major dams constructed on rivers have a finite life span due to natural sedimentation processes, human-caused influences on sedimentation rates have great potential to fill prematurely Mud and Sand lakes, degrading their wetland functions.

Increased sediment in water generally reduces the depth of the photic zone, reducing the light available for primary production by aquatic macrophytes and algae (Ellis 1936, Robel 1961). Sediment depths of 0.1 inch can significantly reduce species richness, emergence, and germination of wetland macrophytes (Jurik et al. 1994, Wang et al. 1994).

Because of the negative impacts on aquatic vegetation from sediments, water quality functions may be altered (Gleason and Euliss 1998). Such loss of standing vegetation structure and algal biomass generally makes wetlands less productive for invertebrates (Euliss and Grodhaus 1987, Krecker 1939, Krull 1970, Neill and Cornwell 1992). Aside from their obvious role in the feeding ecology of waterfowl and other birds, invertebrates provide critical food chain support for a wide variety of other organisms and play significant roles in nutrient cycling and overall wetland productivity (Murkin and Batt 1987).

In 2000, the USGS estimated the vertical accretion rate of sediment near the Mud Lake dike to be 0.5 inch per year, with sedimentation rates greater than 0.8 inch per year during the 1990s when river flows were especially high (Gleason et al. 2003).

At the current rate of sedimentation, the projected loss of water depth over the next 20 years would prohibit manipulation of water levels in Mud Lake. Lacking the ability to cycle vegetation and create an interspersion of cover and water, current wildlife objectives would not be met. Once Mud Lake fills with sediment, sedimentation rates are expected to escalate in Sand Lake as well.

If Mud Lake basin continues to fill with silt at its current rate, it could lose most of its original wetland volume. Methods to restore the basin will need to be evaluated within the context of economics and the postrestoration potential to provide targeted functions. Future work should assess current sedimentation rates in Sand Lake to project the life span of this impoundment.

Maintenance of the topographic relief of the basins of Mud and Sand lakes is essential to maintaining the functions and biological diversity of the wetlands. Management of the upper basin may be the most practical alternative to reducing sediment in these lakes.

Conservation practices that target sustained agricultural production and long-term wetland management can be quite effective in slowing overland input into the James River, as follows:

- fencing out riparian zones
- creating greenways
- establishing grassed waterways and vegetative buffer strips
- implementing the Natural Resources Conservation Service's (NRCS) best management practices

The NRCS has already implemented the wetland reserve and conservation reserve programs on scattered lands along the James River. However, based on lack of significant enrollment in these programs, a new approach may be necessary to achieve coordinated effort among landowners to address effectively runoff issues along the James River.

One approach may include an entirely new program designed specifically for protection of the James River basin. Economic incentives could be used to facilitate landowner implementation of the program. Partners will be needed to develop such a large-scale program and could include the James River Watershed District, soil conservation districts, state and federal agencies, and other conservation organizations.

This approach could also involve a presentation of existing programs with a coordinated effort among multiple state and federal agencies. This outreach effort could be directed toward property owners on the James River floodplain to ensure that they are made aware of their options. Region 6's Partners for Fish and Wildlife Program will be one avenue for promoting new and existing programs to private landowners.

The U.S. Department of Agriculture (USDA) has the conservation reserve enhancement program (CREP), which has great potential although it has not yet been implemented in South Dakota. Based on observations in other states, the CREP program may prove to be a valuable tool to achieve the desired James River environmental goals.

In addition, the possibility of land easements or purchases could be made available. Perpetual protection of the floodplain is preferable to a temporary solution. However, consideration should be given to the fact that perpetuity clauses may inhibit landowner participation.

Water could be moved in and out of the five subimpoundments opportunistically, as flows in the James River and water levels in Mud and Sand lakes allow.

When management action is necessary and water elevations in the main pools are not conducive to take advantage of gravity flow, a 16-inch Crisafulli pump could be used to move water into or out of these subimpoundments. This will add significantly to the cost, will be time consuming, and must not violate restrictions placed on the refuge's water rights. However, it could create the desired habitat conditions when other management alternatives are not available.

Most of the subimpoundments are smaller areas separated from the main pools by an embankment. Water could be diverted into or out of the subimpoundments by gravity flow. Because of their smaller size and isolation from the main pools, it will be possible to provide some water level control, thereby influencing the plant and invertebrate communities, as well as the productivity of the subimpoundments.

Plant and invertebrate production could be maximized through carefully planned drawdowns and subsequent reflooding events. Drawdowns of the subimpoundments will be accomplished in different years to provide a diversity of habitat conditions during any given year. The need for rejuvenation of plant and invertebrate communities within each unit and the ability to move water out of the unit will largely determine when drawdowns could be conducted.

Resident Wildlife Subgoal

Contribute to habitat requirements for regional populations of resident wildlife including fish, reptiles, amphibians, mammals, and nonmigratory birds.

Red Fox
Bob Savannah/USFWS

Resident Wildlife Objective: Work with the South Dakota Cooperative Research Unit and the South Dakota Heritage Program on nongame wildlife issues.

Strategy

— Work with the South Dakota Cooperative Research Unit and the South Dakota Heritage Program on inventories and development of habitat management techniques to support resident, nongame wildlife species.

Deer Management Objective: Continue working cooperatively with SDGFP to meet winter food requirements for white-tailed deer.

Strategy

— Allow the refuge's share of the farm program crop to remain in the field and available during winter months.

Grassland Habitat Subgoal

Restore, maintain, and provide quality habitat for the life requirements of a diversity of migratory birds and other wildlife species.

Directly connected to this subgoal, the refuge's farm program serves two purposes:

First and foremost, it has tremendous value as a habitat management tool. Farming is used to reclaim decadent grasslands and monotypic stands of undesirable grass species (brome and bluegrass), and to combat invasive plant infestations.

In addition to its use as a habitat management tool, farming provides direct benefits to wildlife.

Over the next 15 years, the scope of the farm program on the refuge will be reduced. However, a base acreage of approximately 800 acres will be maintained to address these needs.

Grassland Block Objective: Manage at least 8,000 acres of grassland habitat with a minimum of 80 percent of the grassland habitat managed in blocks of at least 160 acres within 15 years of CCP approval.

Rationale

With the United States' grasslands listed as critically endangered, i.e., greater than 98 percent declines (Noss et al. 1995), larger blocks of contiguous grassland will benefit grassland-dependent species.

An extensive, 8-year study in Manitoba, Saskatchewan, and Alberta, Canada found hatching rates of waterfowl were generally higher in larger patches of habitat (Howerter 2002). In Minnesota's tall-grass prairie, nest-depredation rates were lower

on large (321–1,201 acres) versus small (40–79 acres) grassland blocks (Johnson and Temple 1990).

By creating larger grassland blocks, more favorable habitat is created for grassland birds of special concern that are known to nest on the refuge (table 3). Of these 15 species, 9 use grassland growth forms in the tall- or medium-height category (Dechant et al. 1998b–d, 1998f, 1999a–c, 1999e, 1999f). These nine species, along with the more abundant savannah sparrow, bobolink, sedge wren, and clay-colored sparrow (Dechant et al. 1998a, 1998e, 1999d; Swanson 1998), have the greatest capacity to indirectly benefit from the management of tall, dense vegetation for nesting waterfowl (table 4, next page).

Table 3. Grassland birds of special concern with known nesting activity on Sand Lake National Wildlife Refuge[1], South Dakota

	PIF[2] Priority Species[3]		USFWS[2]	Audubon	TNC[2]	SDNHP[2]
Species	*Northern Mixed-Grass Prairie*[4]	*Prairie Potholes*[5]	*Birds of Conservation Concern*[6]	*Watchlist*[7]	*"Unlucky 13"*	*Rare Bird Species*[8]
American bittern		X	X			
Chestnut-collared longspur	X	X	X		X	
Dickcissel			X	X		
Grasshopper sparrow		X	X			
Le Conte's sparrow	X	X	X			X
Loggerhead shrike			X			
Marbled godwit	X	X	X	X		
Nelson's sharp-tailed sparrow	X	X	X	X		X
Northern harrier		X	X			
Sharp-tailed grouse		X				
Short-eared owl		X	X	X		
Swainson's hawk	X	X	X	X		X
Upland sandpiper		X	X			
Willet	X	X	X			
Wilson's phalarope	X	X	X	X		

[1]*Source: U.S. Fish and Wildlife Service 1996b, Meeks and Higgins 1998.*
[2]*PIF=Partners in Flight; TNC=The Nature Conservancy; SDNHP=South Dakota Natural Heritage Program; USFWS=U.S. Fish and Wildlife Service.*
[3]*Based on input from the breeding bird survey (Sauer et al. 2001) and other sources.*
[4]*Physiographic area S37 (Partners in Flight 2002a).*
[5]*Bird conservation region 11 (Partners in Flight 2002b).*
[6]*U.S. Fish and Wildlife Service 2002.*
[7]*National Audubon Society 2002.*
[8]*South Dakota Ornithologist's Union 2002.*

Eight of these 13 species (table 4) avoid woody vegetation (Dechant 1998a, 1999f; Wildlife Habitat Management Institute 1999); 7 of the 13 are area sensitive (Dechant et al. 1998b, 1998d, 1999a, 1999d, 1999f; Swanson 1998); and 6 of the 13 experience brood parasitism by brown-headed cowbirds (Dechant et al. 1998a–b, 1998f, 1999d–e; Swanson 1998).

Vegetative Structure and Composition Objective: Manage habitat blocks of DNC so that, in 7 out of 10 years, the habitat blocks would have a mean vegetative visual obstruction reading (VOR) of 11 inches, a litter depth of 0.5–2.5 inches, and a habitat composition of 50 percent forbs and 0 percent trees during late spring (May 25–June 15).

Introduced, Cool-season Grasses Objective: Manage habitat blocks of introduced, cool-season grasses so that, in 7 out of 10 years, habitat blocks would have a mean vegetative VOR of 7 inches, a litter depth of 0.5–2.5 inches, and a habitat composition of 5 percent forbs and 0 percent trees during late spring (May 25–June 15).

Seeded Natives Objective: Manage habitat blocks of seeded native grasses so that, in 7 out of 10 years, habitat blocks would have a mean vegetative VOR of 11 inches, a litter depth of 0.5–2.5 inches, and a habitat composition of 10 percent forbs and 0 percent trees during late spring (May 25–June 15).

Table 4. Species benefiting from grassland management of Sand Lake National Wildlife Refuge[1,2], South Dakota

Species	*Avoids Woody Vegetation*	*Area Sensitive*	*Brown-headed Cowbird Brood Parasitism*
American bittern[3]			
Bobolink	X	X	X
Clay-colored sparrow			X
Dickcissel			X
Grasshopper sparrow	X	X	X
Le Conte's sparrow	X		X
Northern harrier	X		
Savannah sparrow	X	X	X
Sedge wren[3]			
Sharp-tailed grouse		X	
Short-eared owl	X	X	
Upland sandpiper	X	X	
Wilson's phalarope	X	X	

[1]Grassland birds that use grassland growth forms in the tall- or medium-height categories for nesting, which can benefit most from active management for nesting waterfowl. The Nelson's sharp-tailed sparrow also uses grassland growth forms in the tall and medium categories, but was not included due to a lack of information.
[2]This is not an all-inclusive list.
[3]This species would benefit from grassland management, but does not avoid woody vegetation, is not area sensitive, and is not affected by cowbird parasitism.

Rationale (for the above vegetation, grasses, and natives objectives)

Grasslands are categorized as DNC, introduced cool-season grasses, and seeded native grasses. Vegetative structure differs greatly between the three habitat types; therefore, it was necessary to set grassland objectives specific to each habitat type. Despite the quantitative differences between objectives, all three objectives are similar in that they describe the maximum height-density of vegetation that can realistically be achieved for that habitat type within the constraints of climate and soil type.

Refuge grasslands are managed for tall dense cover because it is attractive to ducks. Several studies have reported high nest success in dense cover (Cowardin et al. 1985, Duebbert and Lokemoen 1976, Higgins and Barker 1982, Kirsch et al. 1978, Livezey 1981, Schranck 1972).

In addition to benefiting waterfowl, moderate to tall vegetation is also favored by many other grassland-nesting birds (Dechant et al. 1998a–f, 1999a–f; Swanson 1998).

As the refuge was specifically established to improve and maintain habitat for nesting waterfowl and other migratory birds, managing grasslands in the tall–dense category aligns well with the refuge's mandates and wildlife priorities (table 3).

A majority of the lands surrounding the refuge are annually managed as cropland or nonresidual grasslands, which provide some habitat in the other categories of short–sparse and medium height density. Therefore, managing grasslands in the tall–dense category of vegetation provides a vegetation class that is not well represented in Brown County.

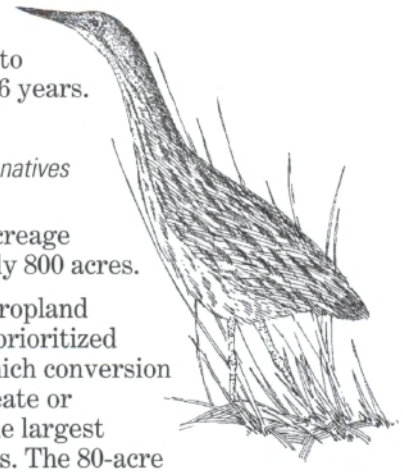
In the process of applying treatments to habitat in greatest need of management, blocks of grassland that conform to the short–sparse and medium height density vegetation categories will be created, thereby providing a diversity of vegetative structure within any given year.

Forb composition varies with treatment type and time since last disturbance. Forb coverage typically is 20–40 percent of the vegetation in the year following a habitat treatment, and gradually decreases to 10 percent within 5–6 years.

Strategies (for the above vegetation, grasses, and natives objectives)

— Reduce tilled acreage to approximately 800 acres.

Conversion of cropland to grassland is prioritized according to which conversion projects can create or contribute to the largest grassland blocks. The 80-acre block of cropland adjacent to Goose Corner (cropland block A-99a) was converted to grassland in 2004.



American Bittern
© Cindie Brunner

Cropland blocks A-94 (202 acres) and A-99 (57 acres), which are adjacent to Goose Corner and Hanson's Point, also have been identified as priority areas for conversion to grassland. Conversion of these three cropland blocks will create a 339-acre contiguous block of grassland and reduce the total cropland acreage from 1,217 acres to approximately 800 acres.

— Use farming as a tool to rejuvenate DNC, fight colonization of invasive plants, prepare ground for native grass seeding, and reduce use of non-selective broadleaf herbicides over the long term.

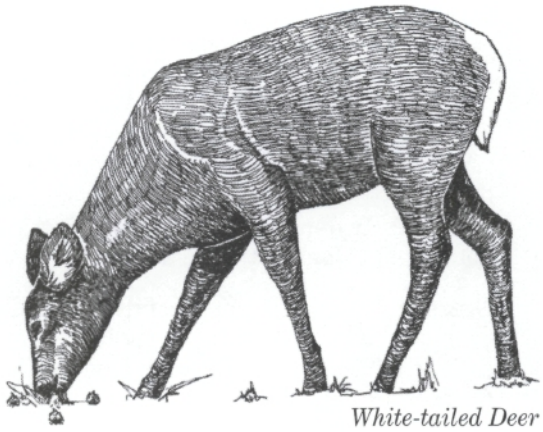
The focus of the farming program will change. Short of a more effective tool to control invasive plants on the James River floodplain, tillage holds the most promise and will be aggressively applied. By using the 800-acre farm model described under the invasive plant strategy below, the refuge will have the opportunity to renovate 3,000 acres of decadent, invasive plant-infested habitat blocks during the life of this CCP. The future of farming beyond 15 years will be determined by how effective the refuge is at improving upland habitat through use of this tool and others, and by success in developing a management strategy with SDGFP and the public to deal with the deer depredation issue.

— Prepare a management plan in cooperation with SDGFP that deals with wildlife depredation, invasive species management, and upland grassland restoration. The public, in particular local landowners, will be part of this management planning process.

The farming program will provide critical habitat for white-tailed deer during severe winters. Continuation of some level of farming on the refuge will provide for flexibility in management options while working cooperatively on the deer depredation issue with the SDGFP. By recognizing and acting on the fact that the Service has a stake in deer management on and near the refuge, it will preserve credibility with the SDGFP, refuge neighbors, and the public.

Thousands of acres of cattails provide thermal cover used extensively by the regional deer herd. There is seasonal movement into the James River corridor that appears directly related to winter severity. A study conducted by South Dakota State University between 1992–94 documented movements as far as 132 miles (Kernohan et al. 1994). Local landowner tolerance for whitetails relates directly to deer density and damage to crops, particularly during summer months (Naugle et al. 1994).

Depredation of crops on private lands adjoining the refuge has been, and will continue to be, a concern. The partnership previously described will address this issue.



White-tailed Deer
Tom Kelley/USFWS

— Control invasive plants.

The future of the refuge and the value of its grassland habitats will be shaped largely by how effective management is in combating the invasion of Canada thistle. Canada thistle is a pervasive pest for which there is no known control measure available for effective, one-time use on the refuge.

Canada thistle reduction will remain the highest priority until sufficiently controlled. Refuge staff will collaborate with other agencies and specialists to incorporate new control methods as they become available.

Prescribed fire will continue to be used as a tool to control exotic cool-season grasses such as quackgrass, smooth brome, and Kentucky bluegrass in reseeded native grass areas. In addition, grazing, mowing, and haying will continue to be used to fight invasive plants.

Additional exotic species such as purple loosestrife and spotted knapweed will be prevented from colonizing through a rigorous program of monitoring and complete eradication of initial patches.

It is estimated that no less than 3,000 acres of uplands and wetlands are heavily infested with Canada thistle. In the past, an average of 800 acres was treated annually using the Service's integrated pest management (IPM) program. Current control measures within the integrated pest management program include prescribed fire, chemical application, haying, grazing, biological agents, and rotary mowing. Despite aggressive efforts to control Canada thistle using these control measures, infestations continue to increase.

Grasslands that are infested with Canada thistle will be completely renovated by converting those areas to cropland and replanting them to grassland once the infestation is controlled. This strategy is based on the premise that Canada thistle will not grow in fields planted with genetically modified varieties of "Roundup® ready" corn or soybeans that are sprayed with the nonselective herbicide, Roundup®. By maintaining these no-till crops in production for several years, the percentage of viable Canada thistle seed in the upper soil layer should be significantly depleted and the germination potential of Canada thistle probably reduced.

Grassland areas that are heavily infested with Canada thistle are the best candidates for conversion to farmed acreage. Meanwhile, farmed acreage deemed to be free of viable invasive plant seed will be replanted to a grass and forb mixture. The farmed acreage will then shift to other weedy grassland areas in need of renovation. Such an approach will provide a cost-effective alternative to control methods such as chemical application or mowing. These control methods, which often contribute to degraded grassland habitat, will likely need to be used only on small areas of infestation within new seeding. As a result, this approach should provide for reestablishment of a more diverse plant community and higher quality habitat for migratory birds.

Averaged over the next 15 years, rotation of approximately 800 acres of cropland will improve control of Canada thistle on an estimated 3,000 acres of upland grassland. Under this CCP, 200 acres per year could be reasonably converted to deal with invasive plants. This will involve "breaking out" (i.e., sod preparation) of 200 acres of invasive plant-infested grassland and planting another 200 acres of retired cropland to a grass/forb mixture. For those 200 acres of invasive plant-infested grasslands identified annually, the rotation will progress as shown below.

Year 1	Till areas dominated by invasive plants and fallow
Year 2	Plant with "Roundup® ready" crop variety
Year 3	Rotate field into different "Roundup® ready" crop variety
Year 4	Prepare seedbed with "Roundup® ready" soybeans
Year 5	Replant to grasses and forbs

In any given year, 200 acres of upland will be in fallow, 600 acres will be in cropland, and 200 acres will be replanted to grasses and forbs. Several key factors will create the dynamic in which this invasive-plant reduction program will be applied, including the following:

- The speed at which Canada thistle is encroaching on farmable uplands
- The time required to significantly reduce the amount of viable invasive plant seed in the upper soil layer
- Funding and staff constraints
- The robustness and growth of the invasive plant problem in other areas such as marsh edges, fence lines, and tree belts, i.e., size of the local source of invasive plant seed
- The ability of the refuge to find interested cooperators as the size of farm fields shrinks
- Annual budgetary constraints associated with the cost of the grass/forb seed mixture and herbicides

Adjustments may need to be made to the extent of the overall invasive plant reduction program and to the acreage slated for cropland retirement in any given year. Regardless of the annual retirement rate, the acreage base of cropland will be reduced to 800 acres at the end of 15 years.

— Use DNC and native grasses to improve waterfowl and grassland bird production.

The value of grassland habitats will be shaped largely by how effectively habitat blocks of decadent DNC and smooth brome are reclaimed. As infestations of Canada thistle expanded, renovation of grassland blocks was minimized to avoid breaking sod. Without renovation, these stands of tame grass lost their vigor and became root-bound. In addition, use of herbicides to control Canada thistle has degraded the plant diversity within these established grasslands. Much of the desirable broadleaf forb component has been exterminated.

The degraded condition of 2,136 acres of smooth brome and decadent DNC within manageable habitat blocks demands attention. There are also 495 acres of reseeded native grasses that may need to be renovated in the future, should those areas become overrun with invasive species such as smooth brome.

Areas of cropland appropriate for conversion to dense nesting cover or native grass will be identified through development of a step-down plan. As concern for native species restoration continues to increase, some DNC may be converted to native grass where appropriate.

Historically, native grass has established better on the east side of the refuge, which is dominated by sandy and loamy soils of the Hecla–Hamar–Ulen association (USDA 1993). Native grasses seem to thrive better in these soils, which are less likely to harden or compact during dry conditions than the silty and sodium-affected silty soils of the Great Bend–Beotia association on the west side of the refuge (USDA 1993).

The DNC establishes more aggressively and is more resilient to silty soils and, therefore, may be favored over native grass on the west side of the refuge. Staff will continue to expand their knowledge of restoration techniques including site-specific seed mixes, site preparation, planting, and postplanting methods to improve their ability to successfully establish native grasses and forbs. Additional information is needed on the use of DNC and native and tame grasses by nesting waterfowl and grassland birds to improve management decisions.

— Provide some degree of water development for livestock if grazing were to be used as a tool for management of established grassland blocks.

The construction of a small dugout in each grazing unit is probably the most viable option to meet any short-duration livestock-watering needs.

— Remove selected shelterbelts.

Further fragmentation is not likely to benefit the upland wildlife species of highest priority. As a result, new shelterbelts or tree rows will not be planted. The majority of shelterbelts will be allowed to die out naturally.

In the past, shelterbelts were planted on the refuge, largely by homesteaders and the CCC (figure 6). Shelterbelts in agricultural areas provide substantial benefits for 29 species of birds (Johnson and Beck 1988). Avian communities were dominated by edge and generalist species in planted woodlands in eastern South Dakota (Bakker and Higgins 2003) and farmstead shelterbelts in Minnesota (Yahner 1982).

However, providing edge habitat such as shelterbelts to maximize local wildlife diversity may not always be a desirable objective if it is detrimental to habitat specialists or rare species that are dependent on extensive stands of undisturbed habitat (Hair 1980, Harris 1984). Shelterbelts decrease the size of grassland blocks and increase the amount of edge habitat, which can allow greater invasion by exotic species, predators, and brood parasites (Hagan and Johnston 1992).

An extensive, 8-year study in Manitoba, Saskatchewan, and Alberta, Canada found that duck-hatching rates increased with distance from a habitat edge (Howerter 2002). Habitat loss and fragmentation on the breeding grounds of grassland birds are known to contribute to poor reproductive success (Best 1978; Gates and Gysel 1978; Johnson and Temple 1986, 1990).

In Minnesota's tall-grass prairie, nest depredation and brown-headed cowbird brood parasitism on grassland birds decreased farther from woody edges (Johnson and Temple 1990). Grassland birds that nested in remnants of tall-grass prairie near wooded edges produced fewer young than birds that nested far from wooded edges (Johnson and Temple 1986).

Due to the high expense of tree removal, most of the current shelterbelts and tree rows will not be actively removed. A few select shelterbelts dividing large grassland blocks with high wildlife potential will be removed when funds allow. For example, the tree row bordered by habitat block SN-16 on the north and D-50 on the south is a high priority for removal as it is dissecting two large grassland areas on Hanson's Point.

— Reduce volunteer Russian-olive trees.

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Historically, Russian-olive trees were planted in the shelterbelts. The trees produce a heavy crop of persistent fruit every year that is a favored food of more than 40 kinds of birds and mammals (Borell 1951). However, the species is considered invasive because the seeds are widely dispersed by wildlife (particularly birds), remain viable for up to 3 years, and can germinate even on well-vegetated soils (Pearce and Smith 2001).

"Volunteer" Russian-olive trees are invading lowland areas and wetland (figure 6). As a result, Russian-olive woodlands threaten to displace native riparian vegetation (Olson and Knopf 1986a), as they have in many South Dakota marshlands (Olson and Knopf 1986b). In addition, Russian olives may depreciate waterfowl-nesting habitat, as waterfowl may avoid wetlands rimmed by dense stands of Russian olive (Olson and Knopf 1986b).

Volunteer Russian-olive trees in undesirable locations will be removed by cutting the trees

and painting or spraying the stumps with an herbicide to prevent regrowth. This control method is most effective (Olson and Knopf 1986b), although repeated aerial application of 2,4-D or 2,4,5-T for 1–2 years has also been found effective for large trees (Bovey 1965).

Removal priority will be given to volunteer Russian-olive trees that are adjacent to or encroaching on valuable wetlands or larger habitat blocks. Russian-olive trees within shelterbelts will be allowed to remain. Volunteer olive trees adjacent to the shelterbelts, which likely originated from seed trees within the shelterbelts, will be removed.

— Proactively manage predators.

To enhance nesting success, waterfowl nest predators will be removed from selected areas during the nesting period via trapping. Priority will be given to the predator exclosure, which provides the greatest potential for human manipulation of waterfowl-nesting success. Intensive predator management will be implemented inside the exclosure using Conibear traps. The integrity of the exclosure near the outside boundary will be maintained by removing predators.

In addition, Mud Lake Island has the potential for enhanced nesting success with management, but it will only be managed as time and resources permit.

— Monitor and react to wildlife disease issues.

Avian populations will be monitored for mortality due to avian botulism, West Nile virus, avian chlamydiosis, and other potential wildlife diseases. In the case of a disease outbreak, infected carcasses will be collected and properly disposed. Freshly-collected specimens will be sent for testing to confirm the cause of death.

Personal protective equipment will be used by refuge staff when contact with sick or dead birds and other wildlife presents a human-health risk.

If the threat of chronic-wasting disease increases, refuge staff will cooperate with the SDGFP to assess the impact on the refuge population of white-tailed deer. The refuge will continue to make use of the most current information to stay informed of current wildlife disease threats.

— Monitor habitat using adaptive resource management.

Adaptive management requires an ongoing commitment to evaluate and monitor the effects of habitat management strategies and incorporate new knowledge into updated plans and objectives. An upland monitoring plan that is consistent with the requirements of adaptive resource management, as well as the goals and objectives of this CCP, is being developed.

This habitat-monitoring plan emphasizes monitoring on three levels:

- Refuge monitoring determines whether habitat objectives are being met
- Habitat block monitoring determines which habitat blocks are in greatest need of treatment
- Treatment monitoring assesses vegetative response to treatments and determines whether treatment objectives were met

Through treatment monitoring, the future application of successful treatments can be validated and methods that were not successful in meeting treatment objectives can be modified. In addition, monitoring vegetative response to habitat treatments will produce the most reliable information, as site-specific effects are more informative than data gleaned from research conducted elsewhere.

— Improve technological support, especially using the geographic information system (GIS).

Technological support of management actions will be improved. Spatial and GIS data will be collected and analyzed with the assistance of the habitat and populations evaluation team in Bismarck, North Dakota and the area GIS coordinator for North Dakota and South Dakota. Selected staff will be responsible for maintaining and sharing these databases.

To use fully the potential of spatial databases in refuge management, selected staff will become familiar with the use of global positioning systems (GPS), Trimble GPS Pathfinder Office, ERDAS Imagine geographic imaging, Environmental Systems Research Institute (ESRI) ArcView and ArcGIS, and Microsoft Access, or use the expertise of others to analyze spatial data. Additional technological advances including the use of spreadsheets, Microsoft PowerPoint, and statistical software will be increasingly used.

— Acquire remaining land within the legislated boundary of the refuge.

The boundary of the refuge was established on September 4, 1935, by executive order of President Franklin D. Roosevelt. Of the 23,103 acres encompassed within that original legislative boundary, 21,498 acres have been acquired.

In an effort to provide a wider buffer zone around the edge of the wetland habitat and to establish larger tracts of habitat for grassland-dependent wildlife species, purchase of the final 1,605 acres of privately owned land within the legislated boundary will be strongly considered when that land becomes available for purchase.

Wetland Habitat Subgoal

Maintain a diversity of quality wetland habitat that meets the needs of wetland-dependent wildlife species.

Impoundment Objectives:

- Manage the Mud Lake impoundment for 30–50 percent emergent vegetation within the area from Mud Lake dike to 2 miles north of the dike, with a mean vegetation height of 19.7 inches above water, a mean vegetative VOR of 11.8 inches, and a water depth of 7.9–19.7 inches.
- Manage the Sand Lake impoundment to provide 30–60 percent emergent vegetation within the area from State Highway 10 to 2 miles south of the highway, with a mean vegetation height of 19.7 inches above water, a mean vegetative VOR of 11.8 inches, and a water depth of 7.9–19.7 inches.

Rationale

Overwater colonial-nesting birds rank high on the hierarchy of wildlife priorities of the refuge (table 2). This objective describes the deepwater/dense-emergent category of wetland habitat preferred as overwater nest sites by a high percentage of colonial-nesting birds found on the refuge, as follows:

- Franklin's gull (Burger 1974, Guay 1968)
- White-faced ibis (Ryder and Manry 1994, Zeiner et al. 1990)
- Black-crowned night-heron (Davis 1993)
- Eared grebe (Dechant et al. 2002)
- Western grebe (Short 1984)
- Forster's tern (Gorenzel 1977, McNicholl 1979)

Bill Schultze/USFWS

Forster's Tern

By managing the specified areas of Sand and Mud lakes for overwater-nesting birds, habitat for other wetland birds will naturally be provided in areas of different depth.

- Deepwater/sparse-emergent habitat will be provided along the edges of deepwater/dense-emergent areas and in areas of variable depth.
- Shallow-water/emergent habitat will be provided along the marshy edges of Sand and Mud lakes and in the northern part of Mud Lake.
- Open-water/submergent habitat will be provided in the deeper, center part of Sand Lake and in the deeper pockets of Mud Lake.
- Shallow-water/sparse habitat will be provided along the lake edges and shorelines.

The location and amount of each habitat type will vary with the natural wetland cycles. As emergent vegetation gradually decreases, the habitat type will change. This can happen gradually over time or within several years if water levels are extreme.

Strategies

— Maintain consistent water elevations.

When emergent cover is in optimal condition, conventional water strategies will be applied. This consists of moving spring runoff through the refuge as quickly as possible, until water levels have fallen to full-pool elevation (1,287.52 feet above sea level). Full-pool elevation will be maintained through the nesting season (May 15–August 1). Refuge staff will continue to coordinate with upstream dam managers to minimize negative impacts to overwater nesters.

— Manage drawdowns.

Control of water levels to manage wetland habitats is dependent on the flows of the James River. Conditions on the river can change quickly and need to be continually evaluated.

After multiple years of high water, cattail stands often need to be reestablished through managed drawdowns. The best time to reestablish cattail in Sand Lake is during low-flow years, when water levels can be drawn down during the summer months.

In Mud Lake, drawdowns will be limited by the level in Sand Lake, but conditions should be sufficient to reestablish cattail during low-flow years.

The coordinated release of water from Dakota Lake National Wildlife Refuge, just north of Mud Lake, may also be an option if the releases benefit both refuges or if the benefits to Sand Lake National Wildlife Refuge override the benefits to Dakota Lake National Wildlife Refuge.

This will be determined by the managers at both refuges. These releases may be needed to reflood part of Mud Lake after a drawdown or to address a botulism problem in Mud or Sand lakes.

— Control cattail.

If the wetland experiences only shallow flooding, emergent vegetation may eventually expand through vegetative propagation to dominate the entire wetland. The resultant buildup of litter and organic material from emergent species can reduce water depth or eliminate shallow water areas (Hammond 1961; Ward 1942, 1968). Decreased waterfowl use is commonly associated with the decreased habitat variation in stands of tall, emergent hydrophytes, which typically form monotypes in the absence of disturbance.

General references (Kozlowski and Ahlgren 1974, Wright and Bailey 1982) indicate that burning of marsh vegetation releases nutrients and opens the canopy and detrital layer. Reduction in the height and density of tall, emergent hydrophytes by fire generally benefits breeding waterfowl. Such benefits are an increase in pair density probably related to increased interspersion of cover and open water, which decreases visibility among conspecific pairs (Kantrud 1986). Grazing by cattle also may remove much organic matter and create open water areas where submersed plants flourish (Schultz 1987).

Prolonged deepwater flooding reduces emergent macrophytes due to extended inundation and the expansion of muskrats and their consumption of macrophytes (Euliss et al. 1999). Drawing the wetlands down early in the summer when mud temperatures are too cool to allow cattail germination helps discourage cattail invasions. Alternately, allowing the subimpoundments to drain naturally will expose the mud flats in midsummer and likely encourage cattail proliferation.

— Control sedimentation within the upper James River basin.

The James River is embedded within an agricultural landscape where cultivation of wetland catchment areas has likely increased the intensity of runoff events and decreased the time available for infiltration.

Although all major dams constructed on rivers have a finite life span due to natural sedimentation processes, human-caused influences on sedimentation rates have great potential to fill prematurely Mud and Sand lakes, degrading their wetland functions.

Increased sediment in water generally reduces the depth of the photic zone, reducing the light available for primary production by aquatic macrophytes and algae (Ellis 1936, Robel 1961). Sediment depths of 0.1 inch can significantly reduce species richness, emergence, and germination of wetland macrophytes (Jurik et al. 1994, Wang et al. 1994).

Because of the negative impacts on aquatic vegetation from sediments, water quality functions may be altered (Gleason and Euliss 1998). Such loss of standing vegetation structure and algal biomass generally makes wetlands less productive for invertebrates (Euliss and Grodhaus 1987, Krecker 1939, Krull 1970, Neill and Cornwell 1992). Aside from their obvious role in the feeding ecology of waterfowl and other birds, invertebrates provide critical food chain support for a wide variety of other organisms and play significant roles in nutrient cycling and overall wetland productivity (Murkin and Batt 1987).

In 2000, the USGS estimated the vertical accretion rate of sediment near the Mud Lake dike to be 0.5 inch per year, with sedimentation rates greater than 0.8 inch per year during the 1990s when river flows were especially high (Gleason et al. 2003).

At the current rate of sedimentation, the projected loss of water depth over the next 20 years would prohibit manipulation of water levels in Mud Lake. Lacking the ability to cycle vegetation and create an interspersion of cover and water, current wildlife objectives would not be met. Once Mud Lake fills with sediment, sedimentation rates are expected to escalate in Sand Lake as well.

If Mud Lake basin continues to fill with silt at its current rate, it could lose most of its original wetland volume. Methods to restore the basin will need to be evaluated within the context of economics and the postrestoration potential to provide targeted functions. Future work should assess current sedimentation rates in Sand Lake to project the life span of this impoundment.

Maintenance of the topographic relief of the basins of Mud and Sand lakes is essential to maintaining the functions and biological diversity of the wetlands. Management of the upper basin may be the most practical alternative to reducing sediment in these lakes.

Conservation practices that target sustained agricultural production and long-term wetland management can be quite effective in slowing overland input into the James River, as follows:

- fencing out riparian zones
- creating greenways
- establishing grassed waterways and vegetative buffer strips
- implementing the NRCS's best management practices

The NRCS has already implemented the wetland reserve and conservation reserve programs on scattered lands along the James River. However, based on lack of significant enrollment in these programs, a new approach may be necessary to achieve coordinated effort among landowners to address effectively runoff issues along the James River.

One approach may include an entirely new program designed specifically for protection of the James River basin. Economic incentives could be used to facilitate landowner implementation of the program. Partners will be needed to develop such a large-scale program and could include the James River Watershed District, soil conservation districts, state and federal agencies, and other conservation organizations.

This approach could also involve a presentation of existing programs with a coordinated effort among multiple state and federal agencies. This outreach effort could be directed toward property owners on the James River floodplain to ensure that they are made aware of their options. Region 6's Partners for Fish and Wildlife Program will be one avenue for promoting new and existing programs to private landowners.

The USDA has the CREP, which has great potential although it has not yet been implemented in South Dakota. Based on observations in other states, the CREP program may prove to be a valuable tool to achieve the desired James River environmental goals.

In addition, the possibility of land easements or purchases could be made available. Perpetual protection of the floodplain would be preferable to a temporary solution. However, consideration should be given to the fact that perpetuity clauses may inhibit landowner participation.

Subimpoundment Objective: Manage the subimpoundments as dynamic wetland systems that cycle between drawdown and flood events, within 5 years of CCP approval, to provide quality habitat for waterfowl, shorebirds, and wading birds. During periods between drawdowns, manage the subimpoundments to provide 10–75 percent emergent vegetation and annuals, a mean water-column invertebrate biomass of 0.007 ounce per activity trap per 24-hour set during the June sampling period, and water depths of 0.4–9.8 inches over 50 percent of the flooded area for a portion of the time between April 1 and October 15.

USFWS

American Avocets

Rationale

The subimpoundment objective purposely includes broad ranges, as water levels are intended to vary like natural wetlands. The success and timing of such management actions are subject to dynamic weather patterns.

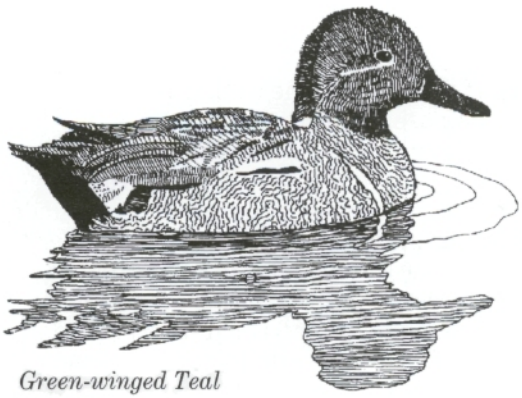
Plant communities in prairie wetlands are continually changing because of short- and long-term fluctuations in water levels and salinity. Prairie wetlands have evolved under these fluctuating conditions. The process of cycling with wet and dry periods makes prairie wetlands productive. For instance, exposure of mud flats during drought periods is necessary for the germination of many emergent macrophytes and facilitates the oxidation of organic sediments and nutrient releases that maintains high productivity.

Within the framework of a dynamic wetland system, management of the subimpoundments is directed toward waterfowl (foraging, breeding pairs, and broods), shorebirds, and wading birds. This objective sets an upper and lower threshold of emergent vegetation, because an interspersion of emergent vegetation and wetland openings is preferred by both dabbling and diving ducks and their broods (Kantrud 1986).

Interspersed emergent vegetation also benefits other marsh-dwelling birds and mammals (Seabloom 1958, Vogl 1973, Weller and Spatcher 1965). Such conditions may also result in avian communities of greater species diversity or richness (Weller 1978, Weller and Spatcher 1965). In addition, Voigts (1976) found maximum invertebrate abundance occurring where beds of submerged vegetation were interspersed with stands of emergent vegetation.

A lower invertebrate biomass threshold is part of the subimpoundment objective. Invertebrate abundance is quantified relative to biomass in June, because that is when invertebrate biomass is known to peak in most wetlands (Euliss and Mushet 2003). Abundance of aquatic macroinvertebrates is positively related to waterfowl use (Kaminski and Prince 1981, Schroeder 1973, Swanson and Meyer 1973) and early growth of ducklings (Chura 1961, Perret 1962, Sugden 1973). Aquatic invertebrates also are important food resources for shorebirds (Eldridge 1987), amphibians (Clark 1978, Deutschman 1984), and other marsh birds (Weller 1981).

Shallow water conditions during some portion of the year are also favorable. Deep water may reduce the availability of invertebrates to feeding waterfowl (Laperle 1974, Murkin and Kadlec 1986) and shorebirds. Optimum foraging depths for dabbling ducks, shorebirds, and wading birds are 2–9.8 inches, 0–9.8 inches, and 3–23.6 inches, respectively (Jasmer 2000). Diving ducks can also exploit food resources in shallow water (Fredrickson and Reid 1988).



Green-winged Teal
© Cindie Brunner

Strategies

— Conduct drawdowns and subsequent reflooding events.

Water could be moved in and out of the five subimpoundments opportunistically, as flows in the James River and water levels in Mud and Sand lakes allow.

When management action is necessary and water elevations in the main pools are not conducive to take advantage of gravity flow, a 16-inch Crisafulli pump could be used to move water into or out of these subimpoundments. This will add significantly to the cost, will be time consuming, and must not violate restrictions placed on the refuge's water rights. However, it could create the desired habitat conditions when other management alternatives are not available.

Most of the subimpoundments are smaller areas separated from the main pools by an embankment. Water could be diverted into or out of the subimpoundments by gravity flow. Because of their smaller size and isolation from the main pools, it will be possible to provide some water level control, thereby influencing the plant and invertebrate communities, as well as the productivity of the subimpoundments.

Plant and invertebrate production could be maximized through carefully planned drawdowns and subsequent reflooding events. Drawdowns of the subimpoundments will be accomplished in different years to provide a diversity of habitat conditions during any given year. The need for rejuvenation of plant and invertebrate communities within each unit and the ability to move water out of the unit will largely determine when drawdowns could be conducted.

— Control cattail.

If the wetland experiences only shallow flooding, emergent vegetation may eventually expand through vegetative propagation to dominate the entire wetland. The resultant buildup of litter and organic material from emergent species can reduce water depth or eliminate shallow water areas (Hammond 1961; Ward 1942, 1968). Decreased waterfowl use is commonly associated with the decreased habitat variation in stands of tall, emergent hydrophytes, which typically form monotypes in the absence of disturbance.

General references (Kozlowski and Ahlgren 1974, Wright and Bailey 1982) indicate that burning of marsh vegetation releases nutrients and opens the canopy and detrital layer. Reduction in the height and density of tall, emergent hydrophytes by fire generally

benefits breeding waterfowl. Such benefits are an increase in pair density probably related to increased interspersion of cover and open water, which decreases visibility among conspecific pairs (Kantrud 1986). Grazing by cattle also may remove much organic matter and create open water areas where submersed plants flourish (Schultz 1987).

Prolonged deepwater flooding reduces emergent macrophytes due to extended inundation and the expansion of muskrats and their consumption of macrophytes (Euliss et al. 1999). Drawing the wetlands down early in the summer when mud temperatures are too cool to allow cattail germination helps discourage cattail invasions. Alternately, allowing the subimpoundments to drain naturally will expose the mud flats in midsummer and likely encourage cattail proliferation.

Public Use Goals

The six wildlife-dependent priority public uses specified in the National Wildlife Refuge System Improvement Act are hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation.

All six activities are allowed and provided for at Sand Lake National Wildlife Refuge within the bounds of refuge mandates and purposes.

The public use goals will be met through the following objectives and strategies.

Wildlife-dependent Recreational Use Goal

Provide opportunities for quality, wildlife-dependent recreation for visitors to Sand Lake National Wildlife Refuge.

Consumptive Use Subgoal: Provide wildlife-dependent, consumptive, recreational opportunities that are compatible with refuge purposes and contribute to a quality outdoor hunting or fishing experience.

Hunting Objective: Allow annual, compatible, fall-hunting opportunities for deer, upland game birds, and waterfowl, consistent with applicable state regulations and principles of sound game management.

Strategies

— Provide hunting opportunities for deer, upland game birds, and waterfowl.

Areas will be designated for deer, upland game birds, and perimeter-boundary waterfowl hunting. An additional universally accessible hunting blind and parking area will be developed to increase opportunities for physically challenged hunters.

The refuge will open to upland bird hunting after the close of refuge rifle deer seasons according to state regulations and permit archery and firearm deer seasons based on consultation with the state, local landowners, and hunters.

— Create an updated hunting brochure and map for distribution at various locations around the refuge to provide hunters with up-to-date hunting rules and regulations.

— Develop a proactive law enforcement program including the establishment of a permanent, full-time law enforcement position to regulate hunting activities on the refuge and enforce wildlife laws.

Fishing Objective: When available and accessible, allow open water and ice fishing yearly from the five designated fishing areas only. Prohibit motorized and nonmotorized boating.

Paul Kerris/USFWS

Strategies

— Allow fishing at five designated locations.

The public will be made aware of the fishing program through notification of rules, updated brochures, and information in the state fishing handbook.

— Develop a proactive law enforcement program including the establishment of a permanent full-time law enforcement position to monitor and regulate fishing activities and enforce wildlife laws.

Nonconsumptive Recreation Subgoal: Provide wildlife-dependent, compatible, nonconsumptive, recreational activities on the refuge that increase public understanding and appreciation of wildlife and its conservation.

On-site Visitors Objective: Educate an additional 5,000 on-site refuge visitors about local and regional conservation issues, the National Wildlife Refuge System, and Sand Lake National Wildlife Refuge within 5 years of CCP approval.

Bob Savannah/USFWS

Strategy

— Develop, update, and maintain visitor services.

An on-site education center will be constructed to provide space and materials to inform students, educators, and the visiting public about the refuge, wildlife conservation, and the National Wildlife Refuge System.

Updated kiosk panels will reflect modern wildlife management practices and conservation issues, and provide general refuge information.

All brochures will be updated, using the Service's graphic standards format, to provide visitors with current information and refuge policies.

Nonconsumptive Recreation Objective: Provide opportunities for wildlife observation, wildlife photography, and interpretation annually, from April 1 to October 15, sunrise to sunset daily.

Strategy

— Develop, update, and maintain on-site nonconsumptive recreational facilities.

The 15-mile auto tour route ("wildlife drive") will be maintained and improved to provide visitors with a quality experience for viewing wildlife. This will include updating the route's self-guided brochure, updating and improving signs on the route, and maintaining pull-off sites.

The observation tower and viewing platform will continue to be maintained for public use. The currently accessible Columbia Day Use Area will be improved to provide better wildlife-viewing opportunities through hiking trails, kiosk information, and wildlife blinds.

At least one permanent photography blind will be constructed to allow photographers better access to wildlife species.

Information kiosks will be enhanced to provide visitors with up-to-date refuge information at the refuge headquarters, the Columbia Day Use Area, and on Highway 10.

An education center will be constructed to provide the visiting public with space and materials for educating about the refuge, wildlife conservation, and the Refuge System.

Public Education and Outreach Goal

Provide wildlife- and wildland-viewing opportunities for the public to enjoy and, through education and outreach, encourage them to gain a greater understanding and appreciation of national wildlife refuges and wildlife resources in general.

Public Education and Outreach Objectives:

- Annually host an average of two to three on-site special events designed to educate the public about wildlife resources and the National Wildlife Refuge System.
- Continue the off-site program and continue working with the radio, television, and print media. Provide an annual average of 24 radio and 8 television interviews, and annually provide information for newspaper articles at least 30 times.
- Construct an education center.

USFWS

Students learn hands-on about waterfowl during a field trip to the refuge.

Local School Districts Objective: Increase and maintain awareness within all local school districts of the education resources and opportunities available at the refuge, through additional on- and off-site programs and workshops within 5 years of CCP approval.

Strategy

— Increase education and outreach opportunities.

A survey to determine the level of awareness of the refuge's education programs will be conducted within all local school districts.

An education outreach plan will be developed and an education brochure will be created to promote on- and off-site field trip opportunities and to inform educators of the availability of learning trunks, the education trail, and teacher guides.

Up to 25 additional educational opportunities will be created including teacher workshops, in-classroom programs, promotion of conservation learning trunks, and teacher resource kits.

An on-site education center will be built and will offer space for programs and other materials needed for students and teachers who use the refuge for outdoor classroom activities.

Communities Objective: Promote awareness of, and generate support for, Sand Lake National Wildlife Refuge and the National Wildlife Refuge System within local and regional communities through participation in a minimum of 3 additional off-site special events within 5 years of funding.

Strategies

— Increase outreach activities and education activities.

Opportunities will be sought to promote the refuge and wildlife conservation to the public. Off-site opportunities include: (1) providing speakers for community and civic groups; (2) frequently updating local congressional offices and key staff on emerging or potentially controversial issues; (3) participating in local fairs, outdoor shows, and other public events; and (4) continued participation in the Water Festival.

— The refuge's website will be maintained and improved to provide up-to-date information to the public on refuge policies, regulations, and wildlife.

— New educational and interpretive kiosks promoting the refuge and wildlife conservation issues will be developed at the Aberdeen Regional Airport, Wylie Park, Northern State University, and other strategic locations within the community.

— Five new partnerships with local and or regional interest groups will be sought and fostered to build support for the refuge and general conservation issues.

— A "friends group" will be established to provide the public with an opportunity to support the refuge.

— Weekly media contacts will continue with the "Refuge Corner Update," and news releases and articles will be made available to local media outlets including television, radio, and newsprint.

Monitoring and Evaluation

Habitat management on refuges is an ongoing process and the Service recommends that planning be conducted within the context of adaptive resource management (USFWS 1995b, 1996a).

Vegetative structure, as indicated by VORs, will be the primary method for monitoring vegetation. The dominant and subdominant species of vegetation also will be recorded annually. At present, more detailed species' descriptions are not necessary for the floristically simple habitat blocks.

Vegetative species composition will be evaluated relative to the percentage of forbs present and the percentage of Canada thistle present. More in-depth evaluations of vegetative species may be necessary once seeded natives become a more prominent component of the overall upland habitat.

Time permitting, wildlife response to habitat treatments should also be evaluated. However, monitoring wildlife response must be conducted in concurrence with habitat monitoring, as it is difficult and unreliable to evaluate the merits of various treatments when relying on wildlife response alone.

A more specific protocol for the habitat-monitoring plan will be outlined within a section of the step-down plan for habitat management.

Plan Monitoring and Evaluation

Implementation of this CCP will be monitored throughout its effective period, 2005–19.

Accomplishment of objectives listed in this CCP will be monitored annually by the supervisor of the project leader for the refuge. Monitoring of accomplishments is critical to the implementation of this CCP.

It is reasonable to believe that substantial changes could occur within the Service during the next 15 years. The objectives of this CCP will be examined at least every 5 years to determine if revisions are necessary and to allow the addition or deletion of objectives.

Personnel and Funding

The personnel and funding needed to carry out this CCP are described below.

Personnel

Currently, the refuge complex has a staff of 13 full-time employees to manage the refuge and the Sand Lake WMD. Table 5 (next page) lists these positions, along with seven new positions that are needed for full implementation of this CCP (those positions

needed only for the refuge). The proposed positions are also included in the database for refuge operations needs (appendix L).

Bill Schultze/USFWS

The staff carpenter builds a footbridge on the new education trail.

FUNDING

Funding to implement this CCP is derived from three sources:

- The refuge operations needs system (RONS) includes requests made to the Congress for funding and staffing above the existing base budget needed to administer programs and carry out projects.
  - Five of the seven new refuge positions are associated with RONS projects and will have a first-year cost of $589,500 with an annual cost of $296,000 (this does not include proposed visitor use or fire positions).
- The maintenance management system (MMS) is a database that documents the maintenance and replacement needs for existing equipment, buildings, roads, fences, and other property (appendix M).
- Cost estimates are developed for projects needed to implement this CCP, which are not yet reflected in the RONS or MMS.

Table 5. Current and proposed staff, Sand Lake National Wildlife Refuge, South Dakota

	Current Positions	*Additional Proposed Positions (Unfunded)*
Management Staff	Refuge complex project leader, GS[1]-14 Deputy project leader, GS-13 Supervisory refuge operations specialist[2], GS-12 Refuge operations specialist[2], GS-9 Refuge operations specialist[2], GS-9	Supervisory refuge operations specialist, GS-11
Biological Staff	Refuge complex biologist, GS-12 Biologist trainee, GS-9 Private lands biologist[2], GS-11	Resource specialist, GS-11
Public Use Staff	Outdoor recreation planner, GS-11	Law enforcement officer, GS-9 Law enforcement officer, GS-9 (0.5 FTE[3]) Visitor use assistant, GS-5
Administrative Staff	Administrative officer, GS-9	Clerk, GS-5
Maintenance Staff	Engineering equipment operator, WG[1]-10 Carpenter, WG-9 Biological science technician, GS-6	None
Fire Management Staff	Range technician, GS-6	Fire management officer, GS-9

[1]*GS=general schedule employee; WG=wage grade employee.*
[2]*This position supports both the refuge and the wetland management district (WMD).*
[3]*FTE=full-time equivalent.*

Glossary

accessible—Pertaining to physical access to areas and activities for people of different abilities, especially those with physical impairments.

adaptive management—The rigorous application of management, research, and monitoring to gain information and experience necessary to assess and modify management activities; a process that uses feedback from research, monitoring, and evaluation of management actions to support or modify objectives and strategies at all planning levels; a process in which policy decisions are implemented within a framework of scientifically driven experiments to test predictions and assumptions inherent in management plan. Analysis of results helps managers determine whether current management should continue as is or whether it should be modified to achieve desired conditions.

alternative—A reasonable way to solve an identified problem or satisfy the stated need (40 CFR 1500.2); one of several different means of accomplishing refuge purposes and goals and contributing to the Refuge System mission (Draft Service Manual 602 FW 1.5).

amphibian—A class of cold-blooded vertebrates including frogs, toads or salamanders.

ATV—All-terrain vehicle.

baseline—A set of critical observations, data, or information used for comparison or a control.

biological control—The use of organisms or viruses to control invasive plants or other pests.

biological diversity, *also* **biodiversity**—The 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 (Service Manual 052 FW 1.12B). The National Wildlife Refuge System's focus is on indigenous species, biotic communities, and ecological processes.

biomass—The total amount of living material, plants and animals, above and below the ground in a particular habitat or area.

biotic—Pertaining to life or living organisms; caused, produced by, or comprising living organisms.

canopy—A 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.

CCC—*See* Civilian Conservation Corps.

CCP—*See* comprehensive conservation plan.

CFR—*See* Code of Federal Regulations.

Civilian Conservation Corps (CCC)—Peacetime civilian "army" established by President Franklin D. Roosevelt to perform conservation activities from 1933–42. Activities included erosion control; firefighting; tree planting; habitat protection; stream improvement; and building of fire towers, roads, recreation facilities, and drainage systems.

Code of Federal Regulations (CFR)—The 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.

colony—The nests or breeding place of a group of birds such as herons or gulls occupying a limited area.

compatible use—A wildlife-dependent recreational use or any other use of a refuge 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 Refuge System or the purposes of the refuge (Draft Service Manual 603 FW 3.6). A compatibility determination supports the selection of compatible uses and identified stipulations or limits necessary to ensure compatibility.

comprehensive conservation plan (CCP)—A document that describes the desired future conditions of the refuge and provides long-range guidance and management direction for the refuge manager to accomplish the purposes of the refuge, contribute to the mission of the Refuge System, and to meet other relevant mandates (Draft Service Manual 602 FW 1.5).

concern—*See* issue.

conspecific—An individual belonging to the same species as another.

cool-season grasses—Grasses that begin growth earlier in the season and often become dormant in the summer. These grasses will germinate at lower temperatures. Examples of cool-season grasses at the refuge are western wheatgrass, needle and thread, and green needlegrass.

coteau—A hilly upland including the divide between two valleys; a divide; the side of a valley.

cover, *also* **cover type, canopy cover**—Present vegetation of an area.

CREP—conservation reserve enhancement program.

cultural resources—The remains of sites, structures, or objects used by people in the past.

cultural resource inventory—A professionally conducted study designed to locate and evaluate evidence of cultural resources present within a defined geographic area. Inventories may involve various levels including background literature search, comprehensive field examination to identify all exposed physical manifestations of cultural resources, or sample inventory to project site distribution and density over a larger area. Evaluation of identified cultural resources to determine eligibility for the National Register follows the criteria found in 36 CFR 60.4 (Service Manual 614 FW 1.7).

cultural resource overview—A comprehensive document prepared for a field office that discusses, among other things, its prehistory and cultural history, the nature and extent of known cultural resources, previous research, management objectives, resource management conflicts or issues, and a general statement on how program objectives should be met and conflicts resolved. An overview should reference or incorporate information from a field office background or literature search described in Section VIII of the Cultural Resource Management Handbook (Service Manual 614 FW 1.7).

dense nesting cover (DNC)—A 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.

depredation—Destruction or consumption of eggs, broods, or individual wildlife due to a predatory animal; damage inflicted on agricultural crops or ornamental plants by wildlife.

DNC—*See* dense nesting cover.

drawdown—The act of manipulating water levels in an impoundment to allow for the natural drying-out cycle of a wetland.

EA—*See* environmental assessment.

ecological diversity—The 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 (Service Manual 052 FW 1.12B).

ecosystem—A 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 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.

emergent—A plant rooted in shallow water and having most of the vegetative growth above water such as cattail and hardstem bulrush.

endangered species, federal—A 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 portion of its range.

endangered species, state—A 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. Populations of these species are at critically low levels or their habitats have been degraded or depleted to a significant degree.

environmental assessment (EA)—A 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 provides sufficient evidence and analysis of impacts to determine whether to prepare an environmental impact statement or finding of no significant impact (40 CFR 1508.9).

EPA—Environmental Protection Agency.

ESRI—Environmental Systems Research Institute.

extinction—The complete disappearance of a species from the earth; no longer existing (Koford et al. 1994).

extirpation—The extinction of a population; complete eradication of a species within a specified area.

fauna—All the vertebrate and invertebrate animals of an area.

federal trust resource—A trust is something 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 as a result 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—All species where the federal government has primary jurisdiction including federally endangered or threatened species, migratory birds, anadromous fish, and certain marine mammals.

flora—All the plant species of an area.

FMP—fire management plan.

forb—A broad-leaved, herbaceous plant; a 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—The alteration of a large block of habitat that creates isolated patches of the original habitat that are interspersed with a variety of other habitat types (Koford et al. 1994); the process of reducing the size and connectivity of habitat patches, making movement of individuals or genetic information between parcels difficult or impossible.

"friends group"—Any formal organization whose mission is to support the goals and purposes of its associated refuge and the National Wildlife Refuge Association overall; "friends organizations" and cooperative and interpretive associations.

FTE—full-time equivalent employee.

FWS—*See* U.S. Fish and Wildlife Service.

geographic information system (GIS)—A computer system capable of storing and manipulating spatial data; a set of computer hardware and software for analyzing and displaying spatially referenced features (i.e., points, lines and polygons) with nongeographic attributes such as species and age (Koford et al. 1994).

GIBA—Globally Important Bird Area, as designated by the American Bird Conservancy.

GIS—*See* geographic information system.

global positioning system (GPS)—A system that, by using satellite telemetry, can pinpoint exact locations of places on the ground.

goal—Descriptive, open-ended, and often broad statement of desired future conditions that conveys a purpose but does not define measurable units (Draft Service Manual 620 FW 1.5).

GPS—*See* global positioning system.

grassland block—A contiguous area of grassland without fragmentation.

GS—general schedule (pay rate schedule for certain federal positions).

habitat—Suite of existing environmental conditions required by an organism for survival and reproduction; the place where an organism typically lives and grows.

habitat disturbance—Significant alteration of habitat structure or composition; may be natural (e.g., wildland fire) or human-caused events (e.g., timber harvest and disking).

habitat type, *also* **vegetation type, cover type**—A land classification system based on the concept of distinct plant associations.

hydrophytic—Pertaining to a plant that grows in water or in very moist ground.

impoundment—A 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.

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.

introduced species—A species present in an area due to intentional or unintentional escape, release, dissemination, or placement into an ecosystem as a result of human activity.

invasive plant, *also* **noxious weed**—A 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—A place of refuge or protection where animals and birds may not be hunted.

IPM—*See* integrated pest management.

issue—Any unsettled matter that requires a management decision; e.g., 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 Service Manual 602 FW 1.5).

macrophyte—A plant, especially a marine plant, that is large enough to be visible to the naked eye.

maintenance management system (MMS)—A national database which contains the unfunded maintenance needs of each refuge; projects include those required to maintain existing equipment and buildings, correct safety deficiencies for the implementation of approved plans, and meet goals, objectives, and legal mandates.

management alternative—*See* alternative.

migration—Regular extensive, seasonal movements of birds between their breeding regions and their wintering regions (Koford et al. 1994); to pass usually periodically from one region or climate to another for feeding or breeding.

migratory birds—Birds which follow a seasonal movement from their breeding grounds to their wintering grounds. Waterfowl, shorebirds, raptors, and songbirds are all migratory birds.

mission—Succinct statement of purpose and/or reason for being.

mitigation—Measure designed to counteract an environmental impact or to make an impact less severe.

mixed-grass prairie—A transition zone between the tall-grass prairie and the short-grass prairie dominated by grasses of medium height that are approximately 2–4 feet tall. Soils are not as rich as the tall-grass prairie and moisture levels are less.

MMS—*See* maintenance management system.

monitoring—The process of collecting information to track changes of selected parameters over time.

moraine—An irregular mass of glacial drift, usually gravel, sand, and clay.

national wildlife refuge—A designated area of land, water, or an interest in land or water within the National Wildlife Refuge System, but does not include coordination areas; a complete 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—Sets the mission and the administrative policy for all refuges in the National Wildlife Refuge System; defines a unifying mission for the Refuge System; establishes the legitimacy and appropriateness of the six priority public uses (hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation); establishes a formal process for determining appropriateness and compatibility; establish the responsibilities of the Secretary of the Interior for managing and protecting the Refuge System; requires a comprehensive conservation plan for each refuge by the year 2012. This Act amended portions of the Refuge Recreation Act and National Wildlife Refuge System Administration Act of 1966.

native species—A species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem.

NAWMP—North American Waterfowl Management Plan.

Neotropical migrant—A 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—The percentage of nests that successfully hatch one or more eggs of the total number of nests initiated in an area.

nongovernmental organization—Any group that is not composed of federal, state, tribal, county, city, town, local, or other governmental entities.

NOAA—National Oceanic and Atmospheric Administration.

noxious weed, *also* **invasive plant**—Any living stage (including seeds and reproductive parts) of a parasitic or other plant of a kind that is of foreign origin (new to or not widely prevalent in the U.S.) and can directly or indirectly injure crops, other useful plants, livestock, poultry, other interests of agriculture, including irrigation, navigation, fish and wildlife resources, or public health. According to the Federal Noxious Weed Act (PL 93-639), a noxious weed (i.e., invasive plant) is one that causes disease or has adverse effects on humans or the human environment and, therefore, is detrimental to the agriculture and commerce of the U.S. and to public health.

NRCS—Natural Resources Conservation Service of the U.S. Department of Agriculture.

NWR—national wildlife refuge.

objective—An objective is a 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 provide the basis for determining management strategies. Objectives should be attainable and time-specific and should be stated quantitatively to the extent possible. If objectives cannot be stated quantitatively, they may be stated qualitatively (Draft Service Manual 602 FW 1.5).

overwater species—nesting species such as diving ducks and many colonial-nesting birds that build nests within dense stands of water-dependent plants, primarily cattail, or that build floating nests of vegetation that rest on the water.

Partners in Flight (PIF)—A Western Hemisphere program designed to conserve Neotropical migratory birds and officially endorsed by numerous federal and state agencies and nongovernmental organizations; also known as the Neotropical Migratory Bird Conservation Program (Koford et al. 1994).

pass shooting—Hunting waterfowl from a stationary location where waterfowl are expected to fly by.

passerine bird—A bird that typically has feet adapted for perching; belonging to the order Passeriformes.

patch—An area distinct from that around it; an area distinguished from its surroundings by environmental conditions.

perennial—Lasting or active through the year or through many years; a plant species that has a life span of more than 2 years.

photic zone—The area of a water body where light penetration is sufficient for photosynthesis.

PIF—*See* Partners in Flight.

plant community—An assemblage of plant species unique in its composition; occurs in particular locations under particular influences; a 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, i.e., ponderosa pine or bunchgrass.

prescribed fire—The skillful application of fire to natural fuels under conditions such as weather, fuel moisture, and soil moisture that allow 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.

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's purposes. This includes hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation.

proposed action—The alternative proposed to best achieve the purpose, vision, and goals of a refuge (contributes to the Refuge System mission, addresses the significant issues, and is consistent with principles of sound fish and wildlife management).

public—Individuals, organizations, and groups; officials of federal, state, and local government agencies; Indian tribes; and foreign nations. It may include anyone outside the core planning team. It includes those who may or may not have indicated an interest in Service issues and those who do or do not realize that Service decisions may affect them.

public involvement—A 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 of public views is given in shaping decisions for refuge management.

purpose of the refuge—The purpose of a refuge is specified in or derived from the law, proclamation, executive order, agreement, public land order, donation document, or administrative memorandum establishing authorization or expanding a refuge, refuge unit, or refuge subunit (Draft Service Manual 602 FW 1.5).

raptor—A carnivorous bird such as a hawk, a falcon, or a vulture that feeds wholly or chiefly on meat taken by hunting or on carrion (dead carcasses).

refuge operations needs system (RONS)—A national database that contains the unfunded operational needs of each refuge. Projects included are those required to implement 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—Any activity on a refuge, except administrative or law enforcement activity, carried out by or under the direction of an authorized Service employee.

resident species—A species inhabiting a given locality throughout the year; nonmigratory species.

rest—Free from biological, mechanical, or chemical manipulation, in reference to refuge lands.

restoration—Management emphasis designed to move ecosystems to desired conditions and processes, i.e., healthy upland habitats and aquatic systems.

riparian area *or* **riparian zone**—An area or habitat that is transitional from terrestrial to aquatic ecosystems including streams, lakes, wet areas, and adjacent plant communities and their associated soils that have free water at or near the surface; an area whose components are directly or indirectly attributed to the influence of water; of or relating to a river; specifically applied to ecology, "riparian" describes the land immediately adjoining and directly influenced by streams. For example, riparian vegetation includes all plant life growing on the land adjoining a stream and directly influenced by the stream.

RONS—*See* refuge operations needs system.

rough fish—A fish that is neither a sport fish nor an important food fish.

scoping—The process of obtaining information from the public for input into the planning process.

SDGFP—South Dakota Department of Game, Fish and Parks.

seasonally flooded—Surface water is present for extended periods in the growing season, but is absent by the end of the season in most years.

sediment—Material deposited by water, wind, and glaciers.

Service—*See* U.S. Fish and Wildlife Service.

shelterbelts—Single to multiple rows of trees and shrubs planted around cropland or buildings to block or slow down the wind.

shorebird—Any of a suborder (Charadrii) of birds such as a plover or a snipe that frequent the seashore or mud flat areas.

spatial—Relating to, occupying, or having the character of space.

special-status species—Plants or animals that have been identified through federal law, state law, or agency policy as requiring special protection of monitoring. Examples include federally listed endangered, threatened, proposed, or candidate species; state-listed endangered, threatened, candidate, or monitor species; Service's species of management concern; species identified by the Partners in Flight program as being of extreme or moderately high conservation concern.

special-use permit—A permit for special authorization from the refuge manager required for any refuge service, facility, privilege, or product of the soil provided at refuge expense and not usually available to the general public through authorizations in Title 50 CFR or other public regulations (Refuge Manual 5 RM 17.6).

species of concern—Those plant and animal species, while not falling under the definition of special status species, that are of management interest by virtue of being federal trust species such as migratory birds, important game species, or significant keystone species; species that have documented or apparent populations declines, small or restricted populations, or dependence on restricted or vulnerable habitats.

species richness—The absolute number of species in an assemblage or community; the number of species in a given area (Koford et al. 1994).

step-down management plan—A plan that provides the details necessary to implement management strategies identified in the comprehensive conservation plan (Draft Service Manual 602 FW 1.5).

strategy—A specific action, tool, or technique or combination of actions, tools, and techniques used to meet unit objectives (Draft Service Manual 602 FW 1.5).

submergent—A vascular or nonvascular hydrophyte, either rooted or nonrooted, that lies entirely beneath the water surface, except for flowering parts in some species.

tame species—*See* dense nesting cover.

threatened species, federal—Species listed under the Endangered Species Act of 1973, as amended, that are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.

threatened species, state—A plant or animal 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.

travel corridor—A landscape feature that facilitates the biologically effective transport of animals between larger patches of habitat dedicated to conservation functions. Such corridors may facilitate several kinds of traffic including frequent foraging movement, seasonal migration, or the once in a lifetime dispersal of juvenile animals. These are transition habitats and need not contain all the habitat elements required for long-term survival or reproduction of its migrants.

trust species—*See* federal trust species.

USDA—U.S. Department of Agriculture.

U.S. Fish and Wildlife Service (Service, USFWS, FWS)—The 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 93-million-acre National Wildlife Refuge System comprised of more than 530 national wildlife refuges and thousands of waterfowl production areas. It also operates 65 national fish hatcheries and 78 ecological service field stations, the agency 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, and helps foreign governments with their conservation efforts. It also oversees the federal aid program that distributes millions of dollars in excise taxes on fishing and hunting equipment to state wildlife agencies.

USFWS—*See* U.S. Fish and Wildlife Service.

U.S. Geological Survey (USGS)—A federal agency whose mission is to provide reliable scientific information to describe and understand the earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect our quality of life.

USGS—*See* U.S. Geological Survey.

vision statement—A concise statement of the desired future condition of the planning unit, based primarily on the Refuge System mission, specific refuge purposes, and other relevant mandates (Draft Service Manual 602 FW 1.5).

visual obstruction—Pertaining to the density of a plant community; the height of vegetation that blocks the view of predators and conspecifics to a nest.

visual obstruction reading (VOR)—A method of visually quantifying vegetative structure and composition.

VOR—*See* visual obstruction reading.

wading birds—Birds having long legs that enable them to wade in shallow water including egrets, great blue herons, black-crowned night-herons, and bitterns.

warm-season grasses—Grasses that begin growth later in the season (early June). These grasses require warmer soil temperatures to germinate and actively grow when temperatures are warmer. Examples of warm-season grasses are Indiangrass, switchgrass, and big bluestem.

waterfowl—A category of birds that includes ducks, geese, and swans.

watershed—The region draining into a river, a river system, or a body of water.

wetland management district (WMD)—Land that the Refuge System acquires with Federal Duck Stamp funds for restoration and management primarily as prairie wetland habitat critical to waterfowl and other wetland birds.

wetland reserve program—A voluntary program offering landowners the opportunity to protect, restore, and enhance wetlands on their property. The U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) provides technical and financial support to help landowners with their wetland restoration efforts. The NRCS goal is to achieve the greatest wetland functions and values, along with optimum wildlife habitat, on every acre enrolled in the program. This program offers landowners an opportunity to establish long-term conservation and wildlife practices and protection. (www.nrcs.usda.gov/programs/wrp)

WG—wage grade schedule (pay rate schedule for certain federal positions).

WII—Wetland of International Importance.

wildland fire—A free-burning fire requiring a suppression response; all fire other than prescribed fire that occurs on wildlands (Service Manual 621 FW 1.7).

wildlife-dependent recreational use—Use of a refuge involving hunting, fishing, wildlife observation, wildlife photography, environmental education, or interpretation. The National Wildlife Refuge System Improvement Act of 1997 specifies that these are the six priority general public uses of the Refuge System.

WMD—*See* wetland management district.

woodland—Open stands of trees with crowns not usually touching, generally forming 25–60 percent cover.

WPA—waterfowl production area.

WUI—wildland–urban interface.

Appendix A—Key Legislation and Policies

This appendix briefly describes the guidance for the National Wildlife Refuge System and other policies and key legislation that guide the management of Sand Lake National Wildlife Refuge.

National Wildlife Refuge System

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).

Goals

- To fulfill our statutory duty to achieve refuge purpose(s) and further the System mission.
- Conserve, restore where appropriate, and enhance all species of fish, wildlife, and plants that are endangered or threatened with becoming endangered.
- Perpetuate migratory bird, inter-jurisdictional fish, and marine mammal populations.
- Conserve a diversity of fish, wildlife, and plants.
- Conserve and restore, where appropriate, representative ecosystems of the United States, including the ecological processes characteristic of those ecosystems.
- To foster understanding and instill appreciation of fish, wildlife, and plants, and their conservation, by providing the public with safe, high quality, and compatible wildlife-dependent public use. Such use includes hunting, fishing, wildlife observation and photography, and environmental education and interpretation.

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 high 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.

Legal and Policy Guidance

Management actions on national wildlife refuges are circumscribed by many mandates including laws and executive orders, the latest of which is the Volunteer and Community Partnership Enhancement Act of 1998. Regulations that affect refuge management the most are listed below.

American Indian Religious Freedom Act (1978)—Directs agencies to consult with native traditional religious leaders to determine appropriate policy changes necessary to protect and preserve Native American religious cultural rights and practices.

Americans with Disabilities Act (1992)—Prohibits discrimination in public accommodations and services.

Antiquities Act (1906)—Authorizes 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)—Directs the preservation of historic and archaeological data in federal construction projects.

Archaeological Resources Protection Act (1979), as amended—Protects 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)—Requires federally owned, leased, or funded buildings and facilities to be accessible to persons with disabilities.

Clean Water Act (1977)—Requires consultation with the U.S. Army Corps of Engineers (404 permits) for major wetland modifications.

Endangered Species Act (1973)—Requires all federal agencies to carry out programs for the conservation of endangered and threatened species.

Executive Order 7169 (1935)—Establishes Sand Lake National Wildlife Refuge "... as a refuge and breeding ground for migratory birds and other wild life... to effectuate further the purposes of the Migratory Bird Conservation Act...."

Executive Order 11988 (1977)—Requires federal agencies to provide leadership and take action to reduce the risk of flood loss, minimize the impact of floods on human safety, and preserve the natural and beneficial values served by the floodplains.

Executive Order 12996, Management and General Public Use of the National Wildlife Refuge System (1996)—Defines the mission, purpose, and priority public uses of the National Wildlife Refuge System. It also presents four principles to guide management of the Refuge System.

Executive Order 13007, Indian Sacred Sites (1996)—Directs 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, maintain the confidentiality of sacred sites.

Federal Noxious Weed Act (1990)—Requires 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)—Requires the preservation of evidence of the government's organization, functions, policies, decisions, operations, and activities, as well as basic historical and other information.

Fish and Wildlife Coordination Act (1958)—Allows the U.S. Fish and Wildlife Service to enter into agreements with private landowners for wildlife management purposes.

Migratory Bird Conservation Act (1929)—Establishes 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)—Authorizes the opening of part of a refuge to waterfowl hunting.

Migratory Bird Treaty Act (1918)—Designates the protection of migratory birds as a federal responsibility; and enables the setting of seasons and other regulations, including the closing of areas, federal or nonfederal, to the hunting of migratory birds.

National Environmental Policy Act (1969)—Requires all agencies, including the Service, to examine the environmental impacts of their actions, incorporate environmental information, and use public participation in the planning and implementation of all actions. Federal agencies must integrate this Act with other planning requirements, and prepare appropriate documents to facilitate better environmental decision making. [From the Code of Federal Regulations (CFR), 40 CFR 1500]

National Historic Preservation Act (1966), as amended—Establishes as 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)—Defines the National Wildlife Refuge System and authorizes the Secretary of the Interior to permit 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—Sets the mission and administrative policy for all refuges in the National Wildlife Refuge System; mandates comprehensive conservation planning for all units of the Refuge System.

Native American Graves Protection and Repatriation Act (1990)—Requires federal agencies and museums to inventory, determine ownership of, and repatriate cultural items under their control or possession.

Refuge Recreation Act (1962)—Allows the use of refuges for recreation when such uses are compatible with the refuge's primary purposes and when sufficient funds are available to manage the uses.

Rehabilitation Act (1973)—Requires programmatic accessibility in addition to physical accessibility for all facilities and programs funded by the federal government to ensure that any person can participate in any program.

Rivers and Harbors Act (1899)—Section 10 of this Act requires the authorization of U.S. Army Corps of Engineers prior to any work in, on, over, or under navigable waters of the United States.

Volunteer and Community Partnership Enhancement Act (1998)—Encourages the use of volunteers to assist in the management of refuges within the Refuge System; facilitates partnerships between the Refuge System and nonfederal entities to promote public awareness of the resources of the Refuge System and public participation in the conservation of the resources; and encourages donations and other contributions.

Appendix B—Compatibility Determinations

Refuge Name

Sand Lake National Wildlife Refuge

Establishing and Acquisition Authority

The Sand Lake National Wildlife Refuge was established by Executive Order 7169, dated September 4, 1935.

Refuge Purposes

"... as a refuge and breeding ground for migratory birds and other wildlife"

"...for use as an inviolate sanctuary, or for any other management purpose for migratory birds"

"... suitable for (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species..."

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.

1. Description of Proposed Use: Farming, Grazing, and Haying

Continue upland management activities such as farming, grazing, and haying that are conducted under cooperative farming or special-use permit by private individuals. Currently these economic uses are used as tools to manage habitat for wildlife.

Farming currently averages 1,200 acres per year, including fields and grassland restoration activities. Cattle grazing is used as a management tool and it averages about 400 acres per year. Haying is used to improve grassland conditions and control invasive plant species.

This CCP proposes to reduce the base acreage farmed for resident wildlife to 800 acres per year. Farming will be used on 200–600 acres per year as a management tool to restore grasslands. Cooperative farming activities are compatible only on areas that are not native prairie.

Cropland is planted to establish seedbeds free of invasive plants—for the establishment of grassland, to provide winter food for resident wildlife, and to control invasive plants or nonnative plant species. The farming rotation is based on a diversified crop rotation to control invasive plants and insects, and to provide for soil fertility. The crops that may be used in the rotation include, but are not limited to, corn, soybeans, spring wheat, barley, alfalfa, and sweetclover.

The Service's policy is to restrict pesticide use on national wildlife refuges. All cooperative farming permits do not allow insecticides and restrict the use of herbicides to those least toxic and persistent in the environment.

Availability of Resources

The needed staff time for development and administration of cooperative farming, haying, and grazing programs is stretched thin to maintain existing programs. If additional staff support were available, these programs could be expanded to use these tools more effectively and additional monitoring could be accomplished.

Additional staff is identified in appendix L. These positions will be needed to fully accomplish the goals of this CCP and improve existing programs.

Anticipated Impacts of the Use

Current management affects approximately 15 percent of the uplands annually. Under this CCP, management will place increased emphasis on managing refuge habitats for migratory birds and maintain less cropland as winter food for resident wildlife.

Without management, general habitat conditions would gradually deteriorate due to long periods of rest. While some habitat disturbance does occur with these activities, the benefits to wildlife outweigh these disturbances.

No cultural resources will be impacted. No impact to endangered species should occur.

Determination

The use of haying, grazing, and farming as habitat management tools is compatible.

Stipulations Necessary to Ensure Compatibility

- Monitor vegetation and wildlife to assess the effects of the management tool.

- Require general and special conditions for each permit to ensure consistency with management objectives.
- Restrict farming permittees to a list of approved chemicals that are less detrimental to wildlife and the environment.
- Restrict haying to after August 1 to avoid disturbance to nesting birds unless the refuge manager deems it necessary to hay earlier to control invasive plants or restore grasslands.
- Hire an additional refuge operations specialist to help administer, and a biologist to monitor grassland habitats.

Justification

To maintain and enhance the habitat for migratory birds and other wildlife, some habitat manipulation needs to occur. Upland habitat conditions would deteriorate without the use of a full range of upland management tools. Migratory bird production and ecological diversity would decrease as habitat suitability for these species declines. Exotic and invasive plant species would increase and habitat diversity would decrease.

Farming provides a useful tool to control invasive plants, restore grasslands, and improve habitat conditions for the production of migratory birds. Farming also benefits resident wildlife by providing a source of food during the winter. Farming facilitates wildlife observation, photography, and environmental education by attracting and concentrating wildlife in areas where they are highly visible.

Mandatory 15-year Reevaluation Date: 2020

2. Description of Proposed Use: Environmental Education and Interpretation

Provide opportunities for environmental education and interpretation.

Environmental education consists of activities conducted by refuge complex staff, volunteers, and teachers. Interpretation occurs in less formal activities with refuge complex staff and volunteers or through exhibits, educational trunks, signs, and brochures.

Currently, environmental education and interpretation activities are conducted at the refuge complex office. Programs and activities are also conducted at the headquarters nature trail and the Columbia Day Use Area. Additional programs are conducted at schools and other locations as personnel are available.

This CCP proposes an education center to be located near the refuge complex office. The facility will provide enough room, displays, and educational materials to maximize the public's learning experience while visiting the refuge. The remainder of the refuge will provide excellent opportunities for environmental learning. These uses occur year-round, with peak use in the spring and fall when local schools bring students to the refuge.

This CCP proposes to continue with the above uses and add the following to improve environmental education and interpretation opportunities for all visitors:

- Construct an education center on site.
- Update and improve refuge signs.
- Update existing brochures to the Service graphic standards.
- Pave the access roads and parking areas for the headquarters and education center with asphalt.
- Expand and enhance environmental education through various initiatives such as educational displays, presentations, and websites that feature purposes, programs, and wildlife of the refuge.

Availability of Resources

Currently all environmental education and interpretation are conducted using available resources. Implementing new programs, activities, and facilities outlined in this CCP is tied to funding requests in the form of RONS and MMS projects (appendices L and M).

Anticipated Impacts of Use

Minimal disturbances to wildlife and wildlife habitat will result from these uses at the current and proposed levels. Adverse impacts are minimized through careful timing and placement of activities. Some disturbance to wildlife will occur in areas frequented by visitors. There will be some minor damage to vegetation, littering, and increased maintenance. Location and time limitations placed on environmental education and interpretation activities will ensure that this activity will have only minor impacts on wildlife and will not detract from the primary purposes of the refuge.

No cultural resources will be impacted. No impact to endangered species should occur. Some short-term disturbance to wildlife will occur during construction.

Determination

Environmental education and interpretation are compatible.

Stipulations Necessary to Ensure Compatibility

- Allow environmental education and interpretation only in designated areas or under the guidance of refuge complex staff, a volunteer, or a trained

teacher to ensure minimal disturbance to wildlife, minimal damage to vegetation, and minimal conflicts between groups.

- Annually review environmental education and interpretation activities to ensure these activities are compatible.

Justification

Based on biological impacts described in the EA and the draft CCP, it is determined that environmental education and interpretation within the Sand Lake National Wildlife Refuge will not materially interfere with or detract from the purposes for which this refuge was established.

Environmental education and interpretation are priority public uses listed in the National Wildlife Refuge System Improvement Act of 1997. By facilitation of environmental education, refuge visitors will gain knowledge and an appreciation of fish, wildlife, and their habitats, which will lead to increased public awareness and stewardship of natural resources. Increased appreciation for natural resources will support and complement the Service's actions in achieving the purposes of the refuge and the mission of the National Wildlife Refuge System.

Mandatory 15-year Reevaluation Date: 2020

3. Description of Proposed Use: Wildlife Observation and Wildlife Photography

Provide opportunities that support wildlife-dependent recreation.

Wildlife observation and wildlife photography are facilitated by an auto tour route, two hiking trails, and two wildlife observation pullouts (one with an observation platform).

This CCP proposes to continue the above uses and add the following to improve wildlife observation and wildlife photography:

- Update and improve refuge signs.
- Construct a fully accessible, wildlife photography blind.
- Update existing brochures to the Service's graphic standards.
- Pave the Columbia Day Use Area access road and parking lot with asphalt.
- Hire a full-time law enforcement officer to enforce wildlife laws.

Availability of Resources

Currently, the programs for wildlife observation and wildlife photography are administered using available resources. Implementing new programs, activities, and facilities outlined in this CCP is tied to funding requests in the form of RONS and MMS projects (appendices L and M).

Anticipated Impacts of Use

Anticipated impacts from visitors engaged in wildlife observation and wildlife photography include minor damage to vegetation, littering, increased maintenance activity, potential conflicts with other visitors, and minor disturbances to wildlife. These activities will have only minor impacts on wildlife and do not detract from the primary purposes of the refuge. All other potential impacts are considered minor.

Determination

Wildlife observation and wildlife photography are compatible.

Stipulations Necessary to Ensure Compatibility

- Restrict vehicles to designated roads and trails.
- Monitor use, regulate access, and maintain necessary facilities to prevent habitat degradation and minimize wildlife disturbance.

Justification

Based on the anticipated biological impacts above and in the EA, it is determined that wildlife observation and wildlife photography on the Sand Lake National Wildlife Refuge will not interfere with the habitat goals and objectives or purposes for which it was established.

Wildlife observation and wildlife photography are priority public uses listed in the National Wildlife Refuge System Improvement Act of 1997. By facilitating these uses, visitors will gain knowledge and an appreciation of fish and wildlife, which will lead to increased public stewardship of wildlife and their habitats. Increased public stewardship will support and complement the Service's actions in achieving the purposes of the refuge and the mission of the National Wildlife Refuge System.

Mandatory 15-year Reevaluation Date: 2020

4. Description of Use: Recreational Fishing

Continue to provide for recreational fishing at five designated fishing areas in accordance with state regulations.

The primary game fish are walleye and northern pike. The designated fishing areas are located off of road rights-of-way at bridges where the fishing opportunity is the greatest. Anglers park within the road right-of-way or designated parking areas if available. Boating is not allowed and fishing is restricted to the fishing areas to minimize impacts to migratory birds.

Fishing visitations and success fluctuate according to water conditions in the James River. The James River has a marginal fishery due to its seasonal flows and common fish winterkills. During the prairie's wet cycles, high flows in the James River promote fish spawning and winter survival. Fish populations can flourish until the next drought period or winterkill during a severe winter.

Availability of Resources

The current fishing program is administered using available resources. Implementing new programs, activities, and facilities outlined in this CCP is tied to funding requests in the form of RONS and MMS projects (appendices L and M).

Anticipated Impacts of Use

Fishing and other human activities cause disturbance to wildlife. Fishing near water control structures and bridges may displace migratory birds that may gather in these locations to feed on fish. Restricting fishing access to the designated fishing areas will minimize the disturbance to migratory birds and other wildlife and will not affect other programs.

Determination

Recreational fishing is compatible.

Stipulations Necessary to Ensure Compatibility

- Require that fishing follow state regulations.
- Confine fishing to designated fishing areas.
- Monitor existing use to ensure that facilities are adequate and disturbance to wildlife continues to be minimal.
- Limit icehouses to day use only at designated fishing areas.
- Hire a full-time law enforcement officer to enforce wildlife laws.

Justification

Based on the biological impacts addressed above and in the EA, it is determined recreational fishing will not materially interfere with the habitat goals and objectives or purposes for refuge establishment.

Fishing is a priority public use as listed in the National Wildlife Refuge System Improvement Act of 1997.

Mandatory 15-year Reevaluation Date: 2020

5. Description of Use: Recreational Hunting

Continue recreational hunting of deer, waterfowl, and upland game birds.

Waterfowl hunting opportunities are limited to a system of spaced hunting blinds inside the perimeter of the refuge that offer hunters a place to pass-shoot waterfowl. Archery and firearm deer seasons help maintain deer populations within management goals and objectives. A December season for upland game birds is held annually for ring-necked pheasant, sharp-tailed grouse, and Hungarian partridge.

Availability of Resources

The current administration of hunting programs is conducted using available resources. Implementing new programs, activities, and facilities outlined in this CCP is tied to funding requests in the form of RONS and MMS projects (appendices L and M).

Anticipated Impacts of Use

Hunting has shown no detrimental environmental impacts to habitats or wildlife. Hunting helps maintain the white-tailed deer population at a level that does not interfere with meeting management goals and reduces impacts to adjacent private property.

Hunting harvests a small percentage of the populations of waterfowl and upland game species, which is in accordance with wildlife objectives and principles.

Restricting vehicle use to designated purposes, times, and established roads, trails, and parking lots protects habitats from damage and minimizes disturbance to wildlife. Closed areas have been established at refuge headquarters, Columbia Day Use Area, around residences on the refuge, and near residences on adjacent private property to provide safety zones and reduce conflicts between hunters and visitors.

Determination

Recreational hunting is compatible.

Stipulations Necessary to Ensure Compatibility

- Require the use of nontoxic shot, in accordance with current regulations for upland game and waterfowl hunting.
- Limit use of motorized vehicles to designated parking areas, access trails, and public roads for deer retrieval during specified times.
- Prohibit all-terrain vehicles (ATVs).
- Prohibit camping, overnight use, and fires.
- Require that hunting be in accordance with federal and state regulations.
- Promote sound hunting practices for hunter safety and quality experiences.
- Hire a full-time law enforcement officer to enforce wildlife laws.

Justification

Hunting on national wildlife refuges has been identified as a priority public use in the National

Wildlife Refuge System Improvement Act of 1997. Hunting is a legitimate wildlife management tool that can be used to manage populations.

Deer hunting seasons are necessary to ensure that populations are controlled to reduce impacts to refuge habitats and damage to adjacent landowners' property. Hunting harvests a small percentage of the renewable resources, which is in accordance with wildlife objectives and principles.

Based on the biological impacts anticipated above and in the EA, it is determined that recreational hunting at Sand Lake National Wildlife Refuge will not materially interfere with or detract from the purposes for which this refuge was established or its habitat goals and objectives.

Mandatory 15-year Reevaluation Date: 2020

6. Description of Proposed Public Use: Trapping for Refuge Management Purposes

Conduct spring predator trapping at specific sites to improve the nesting success of upland-nesting birds. In addition, trapping will be conducted for animals that are damaging facilities such as roadbeds, dikes, and water control structures.

Availability of Resources

In the past, there was insufficient funding and staffing to develop an EA for a refuge-wide trapping program of spring predators. Currently, the refuge

is in the process of developing that EA. The spring trapping program will be enhanced through additional law enforcement and biological staff for monitoring and meeting the administrative requirements of the program. Both positions are listed in the RONS list (appendix L).

Anticipated Impacts of the Use

Spring predator trapping is conducted on the refuge in the fenced predator exclosure and on Mud Lake Island when water levels are sufficient to provide a natural barrier to predators. Trapping removes individual animals from wildlife populations, temporarily reducing predator populations before and during the nesting season. Spring trapping can increase nesting success of upland-nesting birds.

There will be direct mortality of target animals, minor damage to vegetation, and a slight increase in general wildlife disturbance. There is the possibility of injury to nontarget wildlife that are caught in traps. Domestic dogs and feral cats will be year-round nontarget species. Muskrats and weasels will be nontarget species in the spring because they do not depredate upland nests.

Determination

Trapping for management purposes is compatible.

Stipulations Necessary to Ensure Compatibility

- Conduct trapping in a manner removes only targeted species or species removed for public health and safety concerns.
- Maintain detailed trapping records for all trapping activities.
- Prohibit trapping in areas of high public use and near refuge residences.
- Monitor nest success in areas targeted for predator removal to determine effectiveness of management activities.
- Hire a full-time law enforcement officer to enforce wildlife laws.

Justification

Spring predator trapping will benefit upland nesting birds when predator populations are reduced during the nesting season. Long-term negative effects to predator populations will not take place because trapping activities are for short periods in the spring and in relatively small management areas. Trapping to protect facilities will be confined to specified areas and will not conflict with other uses.

Mandatory 15-year Reevaluation Date: 2020

Signature

Eugene Williams 9-7-05
Gene Williams Date
Project Leader
Sand Lake National Wildlife Refuge, SD

Rodney F. Krey 9/15/05
Rod Krey Date
Refuge Supervisor (ND, SD)
U.S. Fish and Wildlife Service, Region 6, CO

Concurrence

Richard A Coleman 9/16/05
Richard A. Coleman, Ph.D. Date
Assistant Regional Director
National Wildlife Refuge System
U.S. Fish and Wildlife Service, Region 6, CO

Appendix C—Species List

This appendix presents the list of resident and breeding wildlife species at Sand Lake National Wildlife Refuge (Meeks and Higgins 1998), as well as a list of plant species mentioned in this document.

This list includes all of the resident and breeding vertebrates documented during the past two decades. This comprehensive list includes 5 classes, 32 orders, 160 genera, and 202 species of which 6 are amphibian, 5 reptile, 127 bird, 34 mammal, and 30 fish species. Taxonomic order and names follow Banks et al. (1987).

WILDLIFE

CLASS AMPHIBIA

Order Caudata

Mudpuppy *(Necturus maculosus)*
Tiger salamander *(Ambystoma tigrinum)*

Order Anura

Great Plains toad *(Bufo cognatus)*
Canadian toad *(B. hemiophrys)*
Western chorus frog *(Pseudacris triseriata)*
Northern leopard frog *(Rana pipiens)*

CLASS REPTILIA

Order Testudines

Snapping turtle *(Chelydra serpentina)*
Western painted turtle *(Chrysemys picta)*

Order Squamata

Northern prairie skink *(Eumeces septentrionalis)*
Northern red-bellied snake *(Storeria occipitomaculata)*
Plains garter snake *(Thamnophis radix)*

CLASS AVES

Order Podicepidiformes

Western grebe *(Aechmophorus occidentalis)*
Clark's grebe *(A. clarkii)*
Eared grebe *(Podiceps nigricollis)*
Pied-billed grebe *(Podylimbus podiceps)*

Order Pelicaniformes

American white pelican *(Pelecanus erythrocephalus)*
Double-crested cormorant *(Phalacrocorax auritus)*

Order Ciconiformes

Great blue heron *(Ardea herodias)*
Great egret *(A. alba)*
American bittern *(Botaurus lentiginosus)*
Cattle egret *(Bubulcus ibis)*
Green-backed heron *(Boturides striatus)*
Little blue heron *(Egretta caerulea)*
Snowy egret *(E. thula)*
Least bittern *(Ixobrychus exilis)*
Black-crowned night-heron *(Nycticorax nycticorax)*
White-faced ibis *(Plegadis chihi)*

Order Anseriformes

Wood duck *(Aix sponsa)*
Northern pintail *(Anas acuta)*
American wigeon *(A. americana)*
Northern shoveler *(A. clypeata)*
Green-winged teal *(A. crecca)*
Blue-winged teal *(A. discors)*
Mallard *(A. platyrhyncos)*
American black duck *(A. rubripes)*
Gadwall *(A. strepera)*
Lesser scaup *(Aythya affinis)*
Redhead *(A. americana)*
Canvasback *(A. valisineria)*
Canada goose *(Branta canadensis)*
Bufflehead *(Bucephala albeola)*
Hooded merganser *(Lophodytes cucullatus)*
Ruddy duck *(Oxyura jamaicensis)*

Order Falconiformes

Cooper's hawk *(Accipiter cooperii)*
Sharp-shinned hawk *(A. striatus)*
Red-tailed hawk *(Buteo jamaicensis)*
Swainson's hawk *(B. swainsoni)*
Northern harrier *(Circus cyaneus)*
American kestrel *(Falco sparverius)*

Order Galliformes

Ring-necked pheasant *(Phasianus colchicus)*
Sharp-tailed grouse *(Tympanuchus phasianellus)*
Gray partridge *(Perdix perdix)*

Order Gruiformes

American coot *(Fulica americana)*
Common moorhen *(Gallinula chloropus)*
Sora *(Porzana carolina)*
Virginia rail *(Rallus limicola)*

Order Charadriifomes

Killdeer *(Charadrius vociferus)*
Upland sandpiper *(Bartramia longicauda)*
Spotted sandpiper *(Actitis macularia)*
Willet *(Catoptrophorus semipalmatus)*
Marbled godwit *(Limosa fedoa)*
American avocet *(Recurvirostra americana)*
Wilson's phalarope *(Phalaropus tricolor)*
Ring-billed gull *(Larus delawarensis)*
Franklin's gull *(L. pipixcan)*
Black tern *(Chlidonias niger)*
Forster's tern *(Sterna forsteri)*
Common tern *(S. hirundo)*

Order Columbiformes

Rock dove *(Columba livia)*
Mourning dove *(Zenaida macroura)*

Order Cuculiformes

Yellow-billed cuckoo *(Coccyzus americanus)*
Black-billed cuckoo *(C. erythropthalmus)*

Order Strigiformes

Long-eared owl *(Asio otus)*
Short-eared owl *(A. flammeus)*
Eastern screech owl *(Otus asio)*
Great horned owl *(Bubo virginianus)*

Order Caprimulgiformes

Common nighthawk *(Chordeiles minor)*

Order Apodiformes

Chimney swift *(Chaetura pelagica)*

Order Coraciiformes

Belted kingfisher *(Ceryle alycon)*

Order Piciformes

Northern flicker *(Colaptes auratus)*
Red-headed woodpecker *(Melanerpes erythrocephalus)*
Downy woodpecker *(Picoides pubescens)*
Hairy woodpecker *(P. villosus)*

Order Passeriformes

Eastern wood-pewee *(Contopus virens)*
Least flycatcher *(Empidonax minimus)*
Willow flycatcher *(E. traillii)*
Eastern phoebe *(Sayornis phoebe)*
Eastern kingbird *(Tyrannus tyrannus)*
Western kingbird *(T. vericalis)*
Horned lark *(Eremophila alpestris)*
Cliff swallow *(Hirundo pyrrhonota)*
Barn swallow *(H. rustica)*
Purple martin *(Progne subis)*
Bank swallow *(Riparia riparia)*
Northern rough-winged swallow *(Stelgidopteryx serripennis)*
Tree swallow *(Tachycineta bicolor)*
American crow *(Corvus brachyrhynchos)*
Blue jay *(Cyanocitta cristata)*
Black-capped chickadee *(Parus atricapillus)*
White-breasted nuthatch *(Sitta carolinensis)*
Marsh wren *(Cistothorus palustris)*
Sedge wren *(C. platensis)*
House wren *(Troglodytes aedon)*
American robin *(Turdus migratorius)*
Eastern bluebird *(Sialia sialis)*
Gray catbird *(Dumetella carolinensis)*
Brown thrasher *(Toxostoma rufum)*
Cedar waxwing *(Bombycilla cedrorum)*
Loggerhead shrike *(Lanius ludovicianus)*
European starling *(Sturnus vulgaris)*
Warbling vireo *(Vireo gilvus)*
Red-eyed vireo *(V. olivaceous)*
Yellow warbler *(Dendroica petechia)*
Common yellowthroat *(Geothlypis trichas)*
Dickcissel *(Spiza americana)*
Sharp-tailed sparrow *(Ammodramus caudacutus)*
LeConte's sparrow *(A. leconteii)*
Grasshopper sparrow *(A. savannarum)*
Chestnut-collared longspur *(Calcarius ornatus)*
Lark sparrow *(Chondestes grammacus)*
Swamp sparrow *(Melospiza georgiana)*
Song sparrow *(M. melodia)*
Savannah sparrow *(Passerculus sandwichensis)*
Vesper sparrow *(Pooecetes gramineus)*
Clay-colored sparrow *(Spizella pallida)*
Field sparrow *(S. pusilla)*
Red-winged blackbird *(Agelaius phoeniceus)*
Bobolink *(Dolichonyx oryzivorus)*
Brewer's blackbird *(Euphagus cyanocephalus)*
Northern oriole *(Icterus galbula)*
Orchard oriole *(I. spurius)*
Brown-headed cowbird *(Molothrus ater)*
Common grackle *(Quiscalus quiscula)*
Western meadowlark *(Sturnella neglecta)*
Yellow-headed blackbird *(Xanthocephalus xanthocephalus)*
American goldfinch *(Carduelis tristis)*
House finch *(Carpodacus mexicanus)*
House sparrow *(Passer domesticus)*

Class Mammalia

Order Marsupialia

Virginia opossum *(Didelphis virginianus)*

Order Insectivora

Northern short-tailed shrew *(Blarina brevicauda)*
Masked shrew *(Sorex cinereus)*

Order Chiroptera

Hoary bat *(Lasiurus cinereus)*

Order Carnivora

Coyote *(Canis latrans)*
Red fox *(Vulpes vulpes)*
Raccoon *(Procyon lotor)*
Long-tailed weasel *(Mustela frenata)*
Least weasel *(M. nivalis)*
Mink *(M. vison)*
Badger *(Taxidea taxus)*

Striped skunk *(Mephitis mephitis)*
Spotted skunk *(Spilogale putorius)*

Order Artiodactyla

White-tailed deer *(Odocoileus virginianus)*

Order Rodentia

Woodchuck *(Marmota monax)*
Fox squirrel *(Sciurus niger)*
Franklin's ground squirrel *(Spermophilus franklinii)*
Richardson's ground squirrel *(S. richardsonii)*
Thirteen-lined ground squirrel *(S. tridecemlineatus)*
Plains pocket gopher *(Geomys bursarius)*
Northern pocket gopher *(Thomomys talpoides)*
Plains pocket mouse *(Perognathus flavescens)*
Beaver *(Castor canadensis)*
Northern grasshopper mouse *(Onychomys leucogaster)*
White-footed mouse *(Peromyscus leucopus)*
Deer mouse *(P. maniculatus)*
Western harvest mouse *(Reithrodontomys megalotis)*
Meadow vole *(Microtus pennsylvanicus)*
Muskrat *(Ondatra zibethicus)*
House mouse *(Mus musculus)*
Norway rat *(Rattus norvegicus)*
Meadow jumping mouse *(Zapus hudsonius)*
White-tailed jackrabbit *(Lepus townsendii)*
Eastern cottontail *(Sylvilagus floridanus)*

Class Osteichthyes

Order Lepisosteiformes

Shortnose gar *(Lepisosteus platostomus)*

Order Salmoniformes

Northern pike *(Esox lucius)*

Order Cypriniformes

Common carp *(Cyprinus carpio)*
Brassy minnow *(Hybognathus hankinsoni)*
Golden shiner *(Notemigonus crysoleucas)*
Common shiner *(Luxilus cornutus)*
Spottail shiner *(Notropis hudsonius)*
Red shiner *(Cyprinella lutrensis)*
Sand shiner *(Notropis stramineus)*
Fathead minnow *(Pimephales promelas)*
Creek chub *(Semotilus atromaculatus)*
River carpsucker *(Carpiodes carpio)*
White sucker *(Catostomus commersoni)*
Bigmouth buffalo *(Ictiobus cyprinellus)*

Order Siluriformes

Black bullhead *(Ameiurus melas)*
Channel catfish *(Ictalurus punctatus)*
Tadpole madtom *(Noturus gyrinus)*

Order Gasterosteiformes

Brook stickleback *(Culaea inconstans)*

Order Perciformes

Green sunfish *(Lepomis cyanellus)*
Pumpkinseed *(L. gibbosus)*
Orangespotted sunfish *(L. humilis)*
Bluegill *(L. macrochirus)*
Smallmouth bass *(Micropterus dolomieu)*
Largemouth bass *(M. salmoides)*
White crappie *(Pomoxis annularis)*
Black crappie *(P. nigromaculatus)*
Iowa darter *(Etheostoma exile)*
Johnny darter *(E. nigrum)*
Yellow perch *(Perca flavescens)*
Walleye *(Stizostedion vitreum)*

Plants

Alfalfa *(Medicago* spp.*)*
American elm *(Ulmus americana)*
Barley *(Hordeum* spp.*)*
Big bluestem *(Andropogon gerardii)*
Boxelder *(Acer negundo)*
Canada thistle *(Cirsium arvense)*
Cattail *(Typha* spp.*)*
Chinese elm *(Ulmus parvifolia)*
Common reed *(Phragmites australis)*
Coon's tail *(Ceratophyllum demersum)*
Corn *(Zea mays)*
Green ash *(Fraxinus pennsylvanica)*
Green needlegrass *(Nassella viridula)*
Hardstem bulrush *(Schoenoplectus acutus)*
Indiangrass *(Sorghastrum* spp.*)*
Intermediate wheatgrass *(Agropyron intermedium)*
Kentucky bluegrass *(Poa pratensis)*
Leafy spurge *(Euphorbia esula)*
Little bluestem *(Schizachyrium* spp.*)*
Needle and thread *(Hesperostipa comata)*
Prairie cordgrass *(Spartina pectinata)*
Prairie dropseed *(Sporobolus heterolepis)*
Purple loosestrife *(Lythrum salicaria)*
Quackgrass *(Elymus repens)*
Rush *(Juncus* spp.*)*
Russian olive *(Elaeagnus angustifolia)*
Sago pondweed *(Potamogeton pectinatus)*
Sedge *(Carex* spp.*)*
Sideoats grama *(Bouteloua curtipendula)*
Smooth brome *(Bromus inermis)*
Soybean *(Glycine* spp.*)*
Spotted knapweed *(Centaurea biebersteinii)*
Spring wheat *(Triticum* spp.*)*
Sweetclover *(Melilotus officinalis)*
Switchgrass *(Panicum virgatum)*
Western wheatgrass *(Agropyron smithii)*
Willow *(Salix* spp.*)*
Wormwood sage *(Artemisia absinthium)*

Appendix D—Landscape-level Goals and Objectives

This appendix summarizes landscape-level plans that are relevant to management of Sand Lake National Wildlife Refuge.

North American Waterfowl Management Plan

Signed in 1986, the North American Waterfowl Management Plan (NAWMP) is broad policy framework that describes the overall scope of requirements for management of waterfowl in the United States, Canada, and Mexico.

The NAWMP also serves as a guide for the participation of various private organizations and the public in the conservation and management of waterfowl. The goal of the NAWMP is to restore waterfowl populations to the levels recorded during the 1970s, a benchmark decade for waterfowl. The NAWMP is designed to reach its objectives through key joint venture areas, species joint ventures, and state implementation plans within these joint ventures.

The "North American Waterfowl Management Plan, 1998 Update, Expanding the Vision" reflects on the legacy established by the NAWMP and presents three visions to advance waterfowl conservation in the future:

- Plan partners enhance the capability of landscapes to support waterfowl and other wetland-associated species by ensuring that plan implementation is guided by biologically based planning, which in turn is refined through ongoing evaluation.
- Plan partners define the landscape conditions needed to sustain waterfowl, benefit other wetland-associated species, and participate in the development of conservation, economic, management, and social policies and programs that most affect the ecological health of these landscapes.
- Plan partners collaborate with other conservation efforts, particularly migratory bird initiatives, and reach out to other sectors and communities to forge broader alliances in a collective search for sustainable uses of landscapes.

Partners in Flight

Nationally and internationally, several nongame bird initiatives are in the planning stage and implementation is expected to begin in the near future. Partners in Flight (PIF) is developing bird conservation plans, primarily for land birds, in numerous physiographic areas. The plans include priority species lists, associated habitats, and management strategies.

The primary goal of PIF is to provide for the long-term health of the avifauna of this continent.

- The first priority is to prevent the rarest species from going extinct.
- The second priority is to prevent uncommon species from descending into threatened status.
- The third goal is to keep common birds common.

PIF's general recommendations for the mixed-grass prairie are:

> "Although agriculture has taken over much of the mixed-grass, significant areas of native prairie remain, most notably in the glacial coteau of the Dakotas and the sandhills of Nebraska.
>
> These great reservoirs for grassland birds must be retained through easements, protection, and strengthening of ranching economies.
>
> The interests of land birds extensively overlap with those of waterfowl and shorebirds in the wetter portions of this ecosystem."

U.S. Shorebird Conservation Plan

The shorebird plan is designed to complement the existing landscape-scale conservation efforts of the North American Waterfowl Management Plan, Partners in Flight, and the North American Colonial Waterbird Conservation Plan. The plan has three major goals at different scales.

At a regional scale, the goal of the plan is to ensure that adequate quantity and quality of habitat is identified and maintained to support the different shorebirds that breed in, winter in, and migrate through each region (Brown et al. 2001).

There are eleven regional working groups formed in this planning process. The Sand Lake National Wildlife Refuge is in the northern plains/prairie–potholes region. Three major shorebird issues have been identified for this region:

- endangered and threatened species, declining species, and species of special concern

- habitat loss, including fragmentation and degradation
- the need for additional information to evaluate potential threats, such as contaminants, depredation, and invasion of exotic plants, to migrating and breeding shorebirds

The regional goals are:

- maintain biotic integrity and persistence of breeding shorebird populations in the northern plains/prairie–potholes region
- ensure that adequate stopover resources exist to support populations of migrating shorebirds
- identify and fill information gaps, including the development of tools to use within the context of dynamic ecosystem processes
- coordinate with other conservation efforts in a cross-border landscape

North American Waterbird Conservation Plan

Volume 1: Seabirds and Colonial Waterbirds, Review Draft II

The goal of this plan is ensure that the distribution, diversity, and abundance of waterbird populations and habitats (breeding, nonbreeding, and migratory) is sustained or restored throughout North America (Kushlan et al. 2002).

Species and population goal—Have sustainable distributions, diversity and abundance of priority species for conservation and those in decline.

Habitat goal—Secure, maintain, and enhance sufficient high quality habitat throughout the year to achieve and maintain sustainable populations of waterbirds throughout North America.

Area goal—Identify, protect, maintain, and enhance important areas needed to maintain sustainable populations and habitats of waterbirds throughout their ranges in North America.

Education goal—Ensure that information for the conservation of waterbirds is widely available to decision makers, the public, and all those whose actions affect seabird and colonial waterbird populations.

Nongame Migratory Birds Conservation Plan, Region 6

This plan outlines the conservation of nongame bird species in Region 6 (Mountain–Prairie Region) of the U.S. Fish and Wildlife Service. Information concerning nongame species in the region is scarce and research is ongoing.

The goal of the nongame migratory bird program is to protect and maintain all native, nongame species at viable population levels and protect their habitats. An important part of this goal is to prevent any avian species from becoming listed as threatened or endangered, or from becoming extirpated from Region 6.

Appendix E—Ecosystem Goals and Objectives

This appendix summarizes information and includes excerpts from the "Ecosystem Plan, Mainstem Missouri River; North Dakota, South Dakota and East Montana" (USFWS 2001).The U.S. Fish and Wildlife Service has adopted an ecosystem approach to conservation to enable it to fulfill its federal trust resource responsibility with greater efficiency and effectiveness. Through this holistic approach to resource conservation, the Service can accomplish its mission to conserve, protect, and enhance the Nation's fish and wildlife and their habitats for the continuing benefit of the American people.

An ecosystem approach to fish and wildlife conservation means protecting or restoring functions, structure, and species composition of an ecosystem, while providing for its sustainable socioeconomic use. Key to implementing this approach is recognizing that partnerships are an essential part of a diverse management to accomplish ecosystem health.

The Service has adopted watersheds as the basic building blocks for implementing ecosystem conservation. The Sand Lake National Wildlife Refuge is located in the Mainstem Missouri River ecosystem, which includes the Dakotas and northeastern Montana. The refuge contains three of the four focus areas for the ecosystem: wetlands, riparian areas, and prairie grasslands.

WETLANDS

The glaciated prairies of North and South Dakota and northeastern Montana cover approximately 60 million acres. Once a myriad of prairie–pothole wetlands in a sea of native prairie, the area is now intensively farmed and is the breadbasket of the country.

Drainage, largely for agricultural purposes, has reduced 7.2 million acres of wetlands by more than 40 percent, to 3.9 million acres. Native prairie, consisting mostly of mid-grass prairie, has been reduced by 75 percent to 14.9 million acres. Much of the remainder is overgrazed by livestock.

The area is rich in wildlife. Prairie potholes are the lifeblood for waterfowl and other migratory waterbirds. As an example of the importance of the prairie, ducks banded in North Dakota have been recovered in 46 states and 23 other countries. Grassland-nesting, Neotropical migrants have been declining faster than woodland Neotropical migrants or prairie-nesting ducks. Several endangered, threatened, and candidate species, including the ferruginous hawk, black tern, and Baird's sparrow, breed in the prairie and wetland habitats of this focus area.

Agriculture is the dominant economic activity and force on prairie wetlands and grasslands. No other activity in the focus area affects habitats and wildlife population to the extent that agriculture does. The USDA and various federal farm programs have more influence on natural resources and wildlife than the Service, all the state wildlife agencies, and all the conservation organizations combined.

The Service has been involved in prairie and wetland resources since the early 1900s. The Service has 69 national wildlife refuges (380,000 acres) and 19 wetland management districts in the focus area. Since 1961, the Service's small wetland acquisition program has acquired 448,000 acres in fee title and 1.9 million acres in perpetual easement.

The following vision, goals, and objectives are shown as described in the ecosystem plan.

WETLANDS VISION—Diverse wetland habitats and watersheds that provide an abundance and diversity of native flora and fauna in the ecosystem for the benefit of the American public.

Goal 1: Increase recognition of wetland values by the various publics (communities, conservation organizations, communication people, congressional delegations and staff, and corporate entities) to develop a wetland advocacy.

Objective A: Over the next 3 years, develop and implement an information and outreach plan in North and South Dakota and northeastern Montana.

Goal 2: Conserve, restore, and enhance wetlands and wetland habitats and functions for trust species and species of concern.

Objective A: As a minimum, annually protect 15,000 acres of wetlands through fee and easement over the next 10 years in the ecosystem.

Objective B: Assist partners and other agencies in protecting, creating, restoring, managing, and enhancing 10,000 acres of wetlands and associated uplands annually.

Goal 3: Protect the water supply and property interests of wetlands on Service lands and easements.

Objective A: File for and secure water rights on eligible Service properties and easements over the next 10 years.

Riparian Areas

Riparian areas make up a very small portion of the habitat in the ecosystem. However, riparian and riverine wetland habitats are very important to fish and wildlife resources including migratory birds, threatened and endangered species, native fish, rare and declining fisheries, amphibians, and many mammals.

Many vertebrates, including species of nongame wildlife and Neotropical migrants, are dependent on riparian and adjacent aquatic zones for reproduction or foraging. Riparian habitats provide for much of the biodiversity in the ecosystem. Many of the species currently occurring in the ecosystem would be eliminated without healthy riparian habitats.

Riparian habitats are important even to the species that mainly occur in the adjacent upland areas. Many rare and declining Neotropical grassland species need to nest within a short distance from water and will use riparian areas during juvenile dispersal and as critical sites of migratory stopovers.

Many additional wildlife species use these zones as migratory corridors. Riparian habitats are important for stabilizing river banks, reducing sedimentation, and providing woody debris and organic material for invertebrates, thus enhancing fishery habitat.

Many resident wildlife species also use riparian areas for winter survival. These species leave the upland areas, using the riparian areas for food and cover during the winter.

National wildlife refuges have been established along the Souris, James, and Des Lacs rivers and tributaries of the Red River. These refuges include sites of internationally significant Prairie Pothole Joint Venture projects that are critical to the success of the North American Waterfowl Management Plan.

The following vision, goals, and objectives are shown as described in the ecosystem plan.

Riparian Areas Vision—Healthy riparian and floodplain ecosystems that provide an abundance and diversity of indigenous flora and fauna.

Goal 1: Reduce the conversion of riparian habitats and maintain, restore, or enhance riparian habitats, quality and functions on priority rivers and tributaries.

Objective A: Inventory and determine the quality of riparian habitats and associated wildlife populations within the ecosystem by 2004 to provide baseline information.

Objective B: Implement an informational program in the ecosystem by 2004 to promote a public appreciation and understanding of the benefits and the threats to riparian habitats.

Objective C: Support and assist in locating and control of invasive species in the ecosystem by 2006 to maintain or improve the quality of the riparian habitat and protect national wildlife refuges and other important habitats.

Objective D: Use existing programs and opportunities in the ecosystem by 2009 to improve critical riparian habitats.

Goal 2: Conserve and recover threatened and endangered species and species of management concern.

Objective A: Inventory threatened and endangered species and species of concern along riparian corridors in the ecosystem by 2004 to provide baseline information.

Objective B: Develop and implement strategies for conserving and recovering threatened and endangered species and species of concern along riparian habitat in the ecosystem by 2004 and preclude the need to list any further species.

Goal 3: Conserve, restore, and create habitat resources in watersheds to enhance the quality and quantity of water flowing into rivers and streams.

Objective A: Use existing oversight, coordination, and technical assistance by 2006 to promote sound management on critical watersheds in the ecosystem.

Objective B: Use existing programs and opportunities in the ecosystem by 2006 to conserve, enhance, or restore grasslands and wetlands to provide quality water runoff.

Prairie Grasslands

Prairie habitats in the Mainstem Missouri River ecosystem consist of tall-grass, mid-grass, and short-grass prairies from the eastern Dakotas to the west. Although the plant and wildlife species differ across the gradation from tall to short grass, the threats and issues remain the same; conversion of prairie to other uses. Habitat losses have been the most severe in the tall-grass prairie and least severe in the western reaches of the Dakotas and northeastern Montana.

The tall-grass prairie once spanned millions of acres along the eastern border of North and South Dakota. The focus area is characterized by the dominant vegetation of the tall-grass prairie, including big bluestem, switchgrass, Indiangrass, and prairie dropseed. In North Dakota, this is found mainly in the Agassiz Lake plain, but transitionally can be found along the state's eastern border in a strip two

to three counties wide. Similarly, in South Dakota, the zone follows the eastern border at a similar width, broadening to the Missouri River at the southern end of the state and extending into northeastern Nebraska. Vast acreage of the habitat has been converted to agriculture. The remaining prairie sites are found in small, fragmented parcels scattered throughout and are crucial to maintaining and restoring the ecosystem. These sites are threatened by conversion to cropland, invasion of exotics, invasive plants, woody plants, pesticides, and heavy grazing pressure.

The remaining prairie sites support a wide assemblage of plant and animal species including many federal and state rare species. Sites in North Dakota have the largest population of the western prairie fringed orchid, a federally listed threatened plant found in lowland swales within the tall-grass community. The regal fritillary and Dakota skipper are butterflies that are federally classified as candidates for endangered or threatened status. The powesheik skipper is a butterfly of high concern.

Eighteen state-classified rare plants occur in the tall-grass prairie of North Dakota. This prairie also provides primary and secondary breeding habitat for declining Neotropical migrants such as upland sandpiper, bobolink, common yellowthroat, grasshopper sparrow, and clay-colored sparrow. Candidate bird species include Baird's sparrow and loggerhead shrike.

Long-term survival of these small, isolated prairies depends on establishing prairie networks and connecting these prairies and nearby habitats to ward off extinctions and integrating prairies with their surroundings to reduce harm from improper management on surrounding lands. The following vision, goals, and objectives are shown as described in the ecosystem plan.

PRAIRIE GRASSLANDS VISION—Protect, restore, and maintain ecosystem native prairie and other grasslands to ensure its diversity and abundance of indigenous flora and fauna

Goal 1: Prevent degradation and conversion of native prairie grassland.

Objective A: Locate, categorize, evaluate, and map native prairie within the ecosystem for baseline information by 2003.

Objective B: Protect native prairie by U.S. Fish and Wildlife Service (FWS) easement on a minimum of 100,000 acres per year for the next 10 years.

Objective C: By the year 2003, develop and implement informational programs to promote awareness and advocacy for native prairie.

Objective D: Develop partnerships to protect 1,000,000 acres of native prairie by 2010.

Objective E: Develop partnerships to reduce the extent and curtail the impact of invasive species in native prairie by 2010.

Objective F: Strive to work with partners to reduce fragmentation effects to flora and fauna in native prairie communities.

Objective G: Identify contaminant issues affecting native prairie and the adverse impact each may be on native prairie and associated wildlife species.

Objective H: Develop a plan on how to prevent and/or reduce further contaminants from entering native prairie.

Goal 2: Maintain and establish networks of native prairie and planted grasslands on public and private lands.

Objective A: Promote and implement prescribed burning and rotational grazing on a minimum of 20 percent of private lands per year to enhance and maintain healthy native prairie.

Objective B: By the year 2003, develop informational materials on the importance of proper grazing management of native prairie.

Objective C: By the year 2002, identify the key areas in the ecosystem to restore perennial grasslands, maintain and/or increase planted grassland with an emphasis on native species restoration.

Objective D: Strive to treat a minimum of 20 percent of FWS-administered grasslands annually using prescribed fire, prescribed grazing, invasive species control, or other recognized management practice.

Goal 3: Protect and enhance habitat for trust species and species of special concern.

Objective A: Identify grassland species that are in decline by the year 2006.

Objective B: Develop information programs on why grassland species in decline are important, approaches to be taken to reverse decline, and the public's role in prairie conservation.

Objective C: Develop statewide partnerships to get people involved in species management.

Objective D: Develop criteria and identify the most biologically significant grasslands by 2003.

Objective E: Over the next 10 years, develop partnerships to enhance and manage native prairie including invasion by nonnative species.

Objective F: Develop management strategies to enhance species of concern on priority grasslands.

Appendix F—List of Preparers, Consultation, and Coordination

This document is the result of the extensive, collaborative, and enthusiastic efforts by the members of the planning team shown below.

Team Member	*Position*	*Work Unit*
Sean Fields	Biologist, GIS specialist	U.S. Fish and Wildlife Service (USFWS), Region 6, Lakewood, CO
Bridgette Flanders-Wanner	Wildlife biologist	Sand Lake National Wildlife Refuge, Columbia, SD
John Jave	Refuge manager	Sand Lake National Wildlife Refuge, Columbia, SD
Linda Kelly	Chief of comprehensive conservation planning branch, planning team leader	USFWS, Region 6, Lakewood, CO
John Koerner	*Former* project leader	Sand Lake National Wildlife Refuge, Columbia, SD
Rhoda Lewis	*Former* regional archaeologist	USFWS, Region 6, Lakewood, CO
Kathleen Linder	Fish and wildlife biologist, *former* planning team leader	USFWS, Region 6, Lakewood, CO
Adam Misztal	Fish and wildlife biologist, *former* planning team leader	USFWS, Region 6, Lakewood, CO
Deb Parker	Writer-editor	USFWS, Region 6, Lakewood, CO
William Schultze	Wildlife biologist	Sand Lake National Wildlife Refuge, Columbia, SD
Cindy Souders	Outdoor recreation planner	USFWS, Region 6, Lakewood, CO
Beth Ullenberg	Outdoor recreation planner	Sand Lake National Wildlife Refuge, Columbia, SD
Gene Williams	Project leader	Sand Lake National Wildlife Refuge, Columbia, SD
Cheryl Williss	Chief of division of water resources	USFWS, Region 6, Lakewood, CO

Valuable support to the planning team was provided by the individuals listed on the next page.

Name	*Position*	*Work Unit*
Ned (Chip) H. Euliss, Jr.	Research wildlife biologist	USGS Northern Prairie Wildlife Research Center, Jamestown, ND
Doug Johnson	Supervisory statistician	USGS Northern Prairie Wildlife Research Center, Jamestown, ND
Marcia Haaland	Administrative officer	USGS Northern Prairie Wildlife Research Center, Jamestown, ND
Lynne Koontz	Economist	USGS, science center, Fort Collins, CO
Murray Laubhan	Special assistant to the director	USGS Northern Prairie Wildlife Research Center, Jamestown, ND
Rachel Laubhan	Wildlife biologist	USFWS, Region 6
Jay Lincoln	Engineer	U.S. Army Corps of Engineers, Jamestown and Pipestem project, Jamestown, ND
Will Morlock	Regional wildlife manager	South Dakota Department of Game, Fish and Parks (SDGFP), Watertown, SD
Dave Mushet	Wildlife biologist	USGS Northern Prairie Wildlife Research Center, Jamestown, ND
Tim Temeyer	Chief of water quality and water control section	U.S. Army Corps of Engineers, hydrology branch, NE
Spencer Vaa	State waterfowl biologist	SDGFP, Brookings, SD

Additionally, the following staffs of Region 6 of the Service were of enormous help through their review and input on the drafts of this document:

- Bob Barrett, deputy refuge supervisor (ND, SD)
- Rick Coleman, assistant regional director
- Shane Delgrosso, fire management officer
- John Esperance, chief of land protection planning branch
- Sheri Fetherman, chief of education and visitor services
- Bernardo Garza, refuge planner
- Galen Green, fire ecologist
- Toni Griffin, refuge planner
- Laura King, refuge planner
- Wayne King, biologist
- Rod Krey, refuge supervisor (ND, SD)
- Ralph D. Morgenweck, regional director
- Michael Spratt, chief of division of refuge planning
- Harvey Wittmier, chief of division of realty

Appendix G—Environmental Compliance

Environmental Action Statement

U.S. Fish and Wildlife Service, Region 6
Lakewood, Colorado

Within the spirit and intent of the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act and other statutes, orders, and policies that protect fish and wildlife resources, I have established the following administrative record.

I have determined that the action of implementing the *Comprehensive Conservation Plan for Sand Lake National Wildlife Refuge* is found not to have significant environmental effects, as determined by the attached Finding of No Significant Impact and the environmental assessment as found with the draft comprehensive conservation plan.

Mary G. Henry

for Ralph O. Morgenweck
Regional Director
U.S. Fish and Wildlife Service, Region 6
Lakewood, CO

9/19/05
Date

Richard A. Coleman

Richard A. Coleman, Ph.D.
Assistant Regional Director
National Wildlife Refuge System
U.S. Fish and Wildlife Service, Region 6
Lakewood, CO

9/16/05
Date

Rodney F. Krey

Rod Krey
Refuge Program Supervisor (ND, SD)
U.S. Fish and Wildlife Service, Region 6
Lakewood, CO

9/15/05
Date

Eugene Williams

Gene Williams
Project Leader
Sand Lake National Wildlife Refuge
Columbia, SD

9-7-05
Date

Finding of No Significant Impact

U.S. Fish and Wildlife Service, Region 6
Lakewood, Colorado

Fulfill the Comprehensive Conservation Plan for Sand Lake National Wildlife Refuge

Three management alternatives for the Sand Lake National Wildlife Refuge were assessed as to their effectiveness in achieving the refuge purposes and their impact on the human environment. Alternative 1, the "no-action" alternative, would continue current management of the refuge. Alternative 2, to optimize biological potential, would place management emphasis on grassland-nesting birds through intense management of upland habitat for nesting migratory birds and less emphasis on resident species.

Alternative 3, integrated management (the proposed action), would take an integrated approach with management practices that would serve to improve the biological potential of the refuge for all migratory birds. Based on this assessment and comments received, I have selected alternative 3 for implementation.

The preferred alternative was selected because it best meets the purposes for which the Sand Lake National Wildlife Refuge was established and is preferable to the "no-action" alternative in light of physical, biological, economic, and social factors. The preferred alternative will continue to provide public access for wildlife-dependent recreation, environmental education, and interpretation.

I find that the preferred alternative is not a major federal action that would significantly affect the quality of the human environment within the meaning of Section 102(2)(C) of the National Environmental Policy Act of 1969. Accordingly, the preparation of an environmental impact statement on the proposed action is not required.

The following is a summary of anticipated environmental effects from implementation of the preferred alternative:

- The preferred alternative will not adversely impact endangered or threatened species or their habitat.
- The preferred alternative will not adversely impact archaeological or historical resources.
- The preferred alternative will not adversely impact wetlands nor does the plan call for structures that could be damaged by or that would significantly influence the movement of floodwater.
- The preferred alternative will not have a disproportionately high or adverse human health or environmental effect on minority or low-income populations.
- The state of South Dakota has been notified and given the opportunity to review the comprehensive conservation plan and associated environmental assessment.

Marya. Henry — 9/26/05

for Ralph Morgenweck — Date
Regional Director
U.S. Fish and Wildlife Service
Region 6
Lakewood, CO

Appendix H—Public Involvement

Public scoping was initiated for the Sand Lake National Wildlife Refuge in a "Notice of Intent" dated August 1, 2001, announcing the availability of an issue workbook and dates for open houses to be held for public input on refuge management and the development of a CCP for the refuge.

Public Involvement

An issues booklet was made available to the public, beginning in August 2001, through mailings to interested parties and public meetings.

The first public involvement meeting was scheduled for Hecla, South Dakota on September 11, 2001, with two more to follow that week. The refuge had sent out news releases and flyers during the last two weeks of August advertising the meetings and a "reminder" news release during the first week of September. Given the circumstances surrounding the events of September 11, 2001, the refuge sent out a news release canceling these meetings.

News releases and flyers were distributed the last week of September 2001 and first week of October 2001. A media contact list was compiled and invitations sent. The refuge had a link on their website for information and the issues workbook. Three scoping meetings were held in October 2001 to gather input from the public.

- October 9, 2001 in Hecla, SD
- October 10, 2001 in Columbia, SD
- October 11, 2001 in Aberdeen, SD

Sixty-two people attended these meetings and approximately 35 written comments were received during the open comment period. Comments received identified biological, social, and economic concerns regarding management.

Many of the public comments were general comments for all units of the refuge complex—Sand Lake National Wildlife Refuge, Sand Lake WMD, and associated waterfowl production areas). They are included for the refuge as well.

Public Comments

The following issues, concerns, and comments are a compilation and summary of those expressed during the June–July 2005 comment period for the draft CCP and EA. Comments were provided by the public, federal and state agencies, local and county governments, private organizations, and individuals concerned about the natural resources and public use of Sand Lake National Wildlife Refuge.

This section is organized by topics. The issues, comments, concerns, or questions within each topic category are summarized. Some editorial comments were addressed by changes within this final CCP document and are not addressed below.

Wildlife Management

Deer Depredation, Croplands, and Haying

Comment: Increased farming on the refuge would support deer herds in the summer and winter.

Response: The region is experiencing a growing deer herd. The problems associated with that cannot be met by simply feeding them. The refuge will continue to farm approximately 800 acres. Wildlife comes first on a national wildlife refuge. The purposes of the refuge are "as a refuge and breeding ground for migratory birds" and for "other wildlife and for use as an inviolate sanctuary or for any other management purpose for migratory birds." Feeding an ever-growing regional deer herd does not meet the refuge's purposes.

Comment: Opportunities for haying on the refuge need to be available to adjacent landowners at a price reflecting who "feeds" the deer.

Response: As a public entity, the Service needs to be fair to everyone and consistent with our policies on how permittees for haying are selected.

Waterfowl

Comment: Geese are no longer stopping at the refuge during migration.

Response: Goose use of the refuge has changed as a result of changing farming practices in the entire flyway.

Comment: The refuge needs to be kept the same to support waterfowl hunting.

Response: New Congressional mandates dictate that the refuge refocus and do more for nongame migratory birds. These changes will not impact waterfowl hunters.

Comment: Could livestock water developments be designed to have increased waterfowl values?

Response: Dugouts are designed to hold maximum volume with minimum surface area to minimize evaporation. This is not consistent with the needs of ducks.

Comment: The refuge needs to incorporate some management for pintail ducks, which seem to

need help. Shorter vegetation and temporary wetlands would be the assist they need.

Response: Pintails have specific habitat needs in shallow wetlands and short-grass prairie. Their preferred habitat is in the counties west of the refuge in the Missouri Coteau.

Resident Wildlife

Comment: The management strategies for woody plants for resident wildlife over the long term should convert linear strips to block areas. This would maintain deer and upland game, food for deer, and nongame species habitat.

Response: The Service agrees. Many of the old shelterbelts will be removed over the next several years. Block areas will remain.

Ground-nesting Migratory Birds

Comment: Providing habitat for the production, maintenance, and basic life requirements of ground-nesting migratory birds should be addressed outside the refuge in the WMD.

Response: The refuge is predominantly wetland and riparian in nature. The refuge is still obligated to do more for ground-nesting migratory birds.

Vegetation

Comment: Techniques to convert DNC-type cover for selected vegetation in 1 year should include a combination of knockdown, Roundup®, and no-till drill. This may work even where invasive plant species are present, and could be the best way.

Response: These techniques are currently in use on the refuge—no-till farming with "Roundup® ready" crops provides for resident game needs and is the predominant practice.

Canada Thistle

Comment: Canada thistle cannot compete with tall warm-season native grasses.

Response: Canada thistle is a fierce competitor that gains a stronger foothold every year in South Dakota.

Comment: State law requires the refuge to control Canada thistle and do what is necessary to control it without concern about other species.

Response: Significant time and funds are dedicated to invasive plant control on the refuge. It becomes problematic along the James River's riparian lands, where seasonal flooding is conducive to invasive plants.

Hunting

Comment: Should South Dakota go to half-day hunting, hunter take could be increased. This would also have a significant positive economic impact on the area. Hunters were successful in the past due to different hunting practices, the location of heavily used goose hunting blinds, and waterfowl flight patterns in the late 1940s and early 1950s. Half-day hunting has unequivocally been demonstrated to increase hunter take. It is unfortunate that the early half-day trial was set up to take place before the bulk of the geese arrived.

Response: Migratory goose migration and use patterns in the Central Flyway have changed radically, primarily due to the conversion of pasture to row crops in southern Canada. Greater food availability has created a wider distribution of geese, reducing the concentration of birds on the refuge. The geese no longer have a reason to show up early in the season and stay until freeze-up. Restructuring the goose hunt will not influence goose use of the refuge.

Comment: The refuge needs to provide and maintain all of the waterfowl-hunting blinds.

Response: Blinds will remain in areas that offer reasonable hunting opportunities. Where the blinds have been removed, the adjacent county road and township rights-of-way have been legalized to allow waterfowl and upland bird hunting. This strategy will likely be applied in the case of any future removal of blinds.

Land Acquisition

Comment: Acquisition of any additional lands to the refuge could have effects, especially as it could potentially impact the tax base for the school district.

Response: In an era of escalating land values, it is highly unlikely the federal government can compete with the private sector. It has been more than a decade since the refuge acquired any acreage inside the executive order boundary.

MAILING LIST

The following mailing list was developed for this CCP.

FEDERAL OFFICIALS

U.S. Representative Stephanie Herseth, Washington DC; Scott Herreid, area director, Aberdeen, SD

U.S. Senator Tim Johnson, Washington DC; Sharon Stroschein, Aberdeen, SD

U.S. Senator John Thune, Washington DC; Judy Vrchota, area directory, Aberdeen, SD

Federal Agencies

Bureau of Reclamation, Dakotas Area Office, Bismarck, ND

U.S. Army Corps of Engineers, Omaha, NE

U.S. Department of Agriculture (USDA), Farm Service Agency, Brown County, SD

USDA, Natural Resources Conservation Service, Aberdeen and Burke, SD

U.S. Fish and Wildlife Service, ND—Arrowwood National Wildlife Refuge (NWR) Complex, Kulm Wetland Management District (WMD), Valley City WMD

U.S. Fish and Wildlife Service, SD—Brookings Wildlife Habitat Office, Ecological Services, Huron WMD, Lacreek NWR, Lake Andes NWR Complex, Madison WMD, Waubay NWR

U.S. Geological Survey, Huron, SD

U.S. National Ramsar Committee, Arlington, VA

South Dakota State Officials

Representative Paul Dennert, Columbia

Representative Burt Elliott, Aberdeen

Representative Larry Frost, Aberdeen

Representative Jim Hundstad, Bath

Representative Al Novstrup, Aberdeen

Governor Mike Rounds, Pierre

Senator Duane Sutton, Aberdeen

South Dakota State Agencies

Department of Agriculture, Pierre

Department of Emergency Management, Pierre

Department of Environment and Natural Resources, Pierre

Department of Game, Fish and Parks; Aberdeen, Brookings, Pierre, and Watertown

Division of Forestry, Aberdeen

Division of Water Rights, Pierre

Farm Bureau Federation, Huron

State Conservationist, Huron

State Historic Preservation Officer, Pierre

Local Agencies and Officials

Aberdeen Parks, Recreation and Forestry

Aberdeen School District

Beadle County Commission, Huron

Britton School District

Brown County Auditor

Brown County Commission, Aberdeen

Brown County Emergency Manager, Aberdeen

Brown County Extension Service, Aberdeen

Brown County Highway Department, Aberdeen

Brown County Sheriff, Aberdeen

Brown/Day Conservation District, Webster

Brown/Marshall Conservation District, Hecla

Columbia Fire Department

Conde Public School

Davison County Commission, Mitchell

Elm Valley School District, Barnard

Groton School District

Hanson County Commission, Alexandria

Hecla Volunteer Firefighters

Hecla-Houghton School District, Hecla

Hutchinson County Commission, Olivet

James River Water Development District, Huron

Lower Crow Creek Watershed District, Claremont

Mayor, Aberdeen

Mayor, Claremont

Mayor, Columbia

Mayor, Frederick

Mayor, Groton

Mayor, Hecla

Mayor, Westport

Northeast Council of Governments, Aberdeen

Redfield School District

Richmond Lake/Mina Recreation Area, Aberdeen

Roncalli School District, Aberdeen

Sanborn County Commission, Woonsocket

Spink County Commission, Redfield

Yankton County Commission

State Colleges and Universities

Northern State University, Aberdeen

Presentation College, Aberdeen

South Dakota Fish and Wildlife Cooperative Research Unit, Brookings

South Dakota State University, Brookings

North Dakota Agencies and Officials

Dickey-Sargent Irrigation District, Oakes

Garrison Diversion Conservancy District, Oakes

Mayor, Ellendale

Mayor, Oakes

Media

Krause Publications, Iola, WI

Organizations, Business, and Civic Groups

Aberdeen Bird Club, SD

American Bird Conservancy, Washington DC

Aberdeen Chamber of Commerce, SD

Aberdeen Convention and Visitors Bureau, SD

American Fisheries Society–Dakota Chapter, Brookings, SD

American Rivers, Lincoln, NE

Boy Scouts–Sioux Council, Sioux Falls, SD

Dacotah Prairie Museum, Aberdeen, SD

Defenders of Wildlife, Washington DC

Ducks Unlimited; Aberdeen, SD and Memphis, TN

Farmers Union State Office, Huron, SD

Girl Scouts–Nyoda Council, Huron, SD

Glacial Lakes and Prairies Tourism, Watertown, SD

Izaak Walton League, Gaithersburg, MD

Manomet Center for Conservation Sciences, Manomet, MA

National Audubon Society, NY

National Wildlife Federation, Reston, VA

National Wildlife Refuge Association, Washington DC

Northeast South Dakota Walleye Club, Aberdeen, SD

Pheasants Forever, Aberdeen, SD

Rocky Mountain Elk Foundation, Warner, SD

Sierra Club, San Francisco, CA

South Dakota Bowhunters Association, Hot Springs, SD

South Dakota Ornithological Union, Sioux Falls, SD

South Dakota Resources Coalition, Brookings, SD

South Dakota Wildlife Federation, Pierre, SD

Sportsmen's Club of Brown County, Aberdeen, SD

The Nature Conservancy–Northern Tall-Grass Prairie Ecoregion, Clear Lake, SD

The Nature Conservancy–Samuel H. Ordway Prairie, Leola, SD

The Nature Conservancy–South Dakota Chapter, Sioux Falls

The Wildlife Society–South Dakota Chapter, Brookings

Whitetail Bowmen, Aberdeen, SD

Whitetails Unlimited, Groton, SD

Wild Turkey Federation, Aberdeen, SD

Wildlife Management Institute, Washington DC

Individuals

128 persons

Appendix I—Economic Analysis

Regional Economic Effects of Current and Proposed Management Alternatives for Sand Lake National Wildlife Refuge

Lynne Koontz, U.S. Geological Survey, Biological Resources Division, Fort Collins, CO 80526

Heather Lambert, U.S. Geological Survey, Biological Resources Division, Fort Collins, CO 80526

Introduction

The National Wildlife Refuge System Improvement Act of 1997 requires all units of the National Wildlife Refuge System to be managed under a Comprehensive Conservation Plan (CCP). The CCP must describe the desired future conditions of a Refuge and provide long range guidance and management direction to achieve Refuge purposes. Sand Lake National Wildlife Refuge (NWR), located 27 miles northeast of Aberdeen, South Dakota, is in the process of developing a range of management goals, objectives, and strategies for the CCP. The CCP for Sand Lake NWR must contain an analysis of expected effects associated with current and proposed Refuge management strategies.

Special interest groups and local residents often criticize a change in Refuge management, especially if there is a perceived negative impact to the local economy. Having objective data on income and employment impacts may show that these economic fears are drastically overstated. Quite often, residents do not realize the extent of economic benefits a Refuge provides to a local community; yet at the same time overestimate the impact of negative changes. Spending associated with Refuge recreational activities such as wildlife viewing and hunting can generate considerable tourism activity for the regional economy. Refuge personnel typically spend considerable amounts of money purchasing supplies in the local lumber and hardware stores, repairing equipment and purchasing fuel at the local service stations, as well as reside and spend their salaries in the community.

The purpose of this study was to provide the economic analysis needed for the Sand Lake NWR CCP by evaluating the regional economic impacts associated with the Sand Lake NWR Draft CCP management strategies. For Refuge CCP planning, an economic impact analysis describes how current (No Action Alternative) and proposed management activities (alternatives) affect the local economy. This type of analysis provides two critical pieces of information: 1) it illustrates a refuge's contribution to the local community; and 2) it can help in determining whether local economic effects are or are not a real concern in choosing among management alternatives.

Sand Lake NWR is currently managed to improve and maintain habitat for nesting and resting waterfowl and other migratory birds, such as diving and puddle ducks, geese, grebes, herons, egrets, gulls, and terns. There are three alternatives evaluated in the draft CCP. Alternative 1, the No Action alternative, would continue Refuge management at current levels and would not involve extensive restoration of cropland, grassland, and wetland habitat or improvements to roads, interpretive, and administrative facilities. No new funding or staff levels would occur and programs would follow the same direction, emphasis, and intensity as they do at present. Alternative 2 would maximize the

biological potential of the refuge for species of grassland-nesting birds. This would be accomplished through intense management of upland habitat for nesting migratory birds, minimal management for resident species, and minimization of public use that may interfere with migratory bird production. The third alternative takes an integrated approach, with management practices that would serve to maximize the biological potential of Sand Lake for migratory birds.

This report first provides a description of the local community and economy near the Refuge. An analysis of current and proposed management strategies that could affect the local economy is then presented. The Refuge management activities of economic concern in this analysis are Refuge personnel staffing and Refuge spending within the local community, and spending in the local community by Refuge visitors.

Regional Economic Setting

Sand Lake NWR is located in Brown County, northeast of Aberdeen, South Dakota. Brown County is part of the Glacial Lakes and Prairies Region of South Dakota and is sometimes called the heart of the Prairie-Pothole Region of North America. The County offers such attractions as the Dacotah Prairie Museum, Centennial Village, Pari-Mutual Horse Racing, Brown County Fair, and the Richmond Lake Youth Camp (Brown County, SD 2004). Brown County has a total area of 1,713 square miles (1,096,320 acres). Aberdeen, the third largest city in South Dakota, is the county seat and the center of commerce for the region.

Aberdeen was nicknamed the "Hub City" because it served as an important intersection for many busy railroad lines. Today's "Hub City" has grown into a diverse, regional trade center with service and manufacturing industries, attractive retail shopping opportunities, convention facilities, a private college, a state university and two large medical centers (Aberdeen Area Chamber of Commerce 2004). 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 local area is included as stimulating the changes in economic activity. The size of the region influences both the amount of spending captured and the multiplier effects. Based on the relative self-containment in terms of retail trade and distance to other communities, Brown County was assumed to comprise the economic region for this analysis.

Population, Employment, and Income

The 2000 Census estimated Brown County's population at 35,460 persons (US Census Bureau). Approximately 70% of the County's residents reside in Aberdeen (Discover Aberdeen, SD 2004). While the state of South Dakota experienced a 7.8% population increase from 1990 to 2000, Brown County's population decreased 0.4% over the same time frame (U.S. Census Bureau). In 2000, Brown County averaged 21 persons per square mile, the state average was 10 persons per square mile.

The 2000 Census reported 0.7% of the county population consisting of persons of Hispanic or Latino origin, 95.1% of white persons not of Hispanic/Latino origin, 0.3% of Black or African American persons, 2.7% of American Indian and Alaska Native Persons, and 0.4% of Asian persons. Approximately, 86% of the county population 25 years and older were high school graduates, and 24% were college graduates (US Census Bureau). There are two colleges in Aberdeen, Northern State University and Presentation College.

According to the Discover Aberdeen website, the major employers in Aberdeen are hospital/health service, education, manufacturing, hotel reservations, agriculture, higher education, call center, and support services. South Dakota's major exports include computers & electronic production, machinery

manufactures, processed foods, and crop production (U.S. Department of Commerce 2002). Local and state employment is shown in Table 1. In 2000, 83.5% of County jobs were in private wage and salary employment (people who work for someone else) as compared to 79.2% for the State of South Dakota.

Table 1. Industry Breakdown of Full Time and Part Time Employment for 2000.

Industry	**Brown County**		**State of South Dakota**	
	# Jobs	% of County Total	# Jobs	% of State Total
Total farm	1,205	4.5%	37,659	7.2%
Total nonfarm	25,650	95.5%	483,677	92.8%
Private	22,431	83.5%	412,957	79.2%
Ag. Services, forestry, & fishing	282	1.1%	7,705	1.5%
Mining	(L)	---	1,552	0.3%
Construction	1,416	5.3%	27,956	5.4%
Manufacturing	2,483	9.2%	52,030	10.0%
Transport/utilities	939	3.5%	22,727	4.4%
Wholesale trade	1,393	5.2%	21,652	4.2%
Retail trade	5,148	19.2%	89,412	17.2%
Insurance/real estate	1,897	7.1%	42,523	8.2%
Services	8,868	33.0%	147,400	28.3%
Government	3,219	12.0%	70,720	13.6%
Total full-time and part time employment	**26,855**		**521,336**	

Source: U.S. Dept. of commerce, Bureau of Economic Analysis, Regional Economic Information System, 2002. *(L) less than 10 jobs, but the estimates for this item are included in the totals.

Hunting, fishing, camping, boating, cross-country skiing, bird watching, biking, and snowmobiling are important tourism activities in Brown County. Most jobs pertaining to the recreation and tourism industry are found in the retail trade (spending on supplies, souvenirs, restaurants, and grocery stores) and service (spending on hotels, gas stations, amusement, and recreation activities) sectors in an economy. As shown in Table 1, service and retail trade industries account for 33% and 19% of total County employment respectively.

As shown in Table 2, County per capita personal income was $28,421 in 2000, which was $2,606 higher than the state average (U.S. Dept. of Commerce 2002). Total personal income was just over 1.0 billion for Brown County in 2000 (Table 2). In 2000, non farm personal income for Brown County totaled almost $960 million which accounted for 5.2% of total statewide non farm personal income, while Brown County farm related income accounted for 4.5% of total statewide farm income.

Table 2. Personal Income for Brown County and South Dakota, 2000.

	Brown County	State of South Dakota
Personal Income	$1,005,276,000	$19,510,589,000
Nonfarm personal income	$958,962,000	$18,475,437,000
Farm Income	$46,314,000	$1,035,152,000
Per capita personal income	$28,421	$25,815

Source: U.S. Dept. of Commerce, Bureau of Economic Analysis, Regional Economic Information System, 2002.

Economic Impacts of Current and Proposed Management Activities

Economic impacts are typically measured in terms of number of jobs lost or gained, and the associated result on income. Economic input-output models are commonly used to determine how economic sectors will and will not be affected by demographic, economic, and policy changes. The economic impacts of the management alternatives for Sand Lake NWR were estimated using IMPLAN, a regional input-output modeling system developed by the USDA Forest Service (Minnesota IMPLAN Group 2002).

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 as many as 528 sectors (Olson and Lindall, 1996). The year 2000 Brown County IMPLAN data profile was used in this study. IMPLAN estimates for employment include both full time and part time workers which are measured in total jobs. The IMPLAN county level employment data estimates were comparable to the US Department of Commerce, Bureau of Economic Analysis, Regional Economic Information System data at the 1 digit Standard Industrial Code level for the year 2000.

Refuge Staffing and Budgeting

For the current conditions, (Alternative 1) staffing at the Refuge consists of thirteen permanent and four temporary/seasonal employees. The current staff accounted for an annual payroll (including salaries and benefits) of $910,600 in 2003. In addition to providing salaries and benefits, the Refuge purchased goods and services totaling $165,200 in 2003, approximately 65% of which was spent locally in the Brown County economy.

For Alternative 2, the anticipated staffing and non salary expenditures are the same as current conditions. Under Alternative 3 staffing needs are expected to increase by six permanent employees and one permanent half time employee. Including salaries and benefits, annual funding needed for the proposed personnel/staffing for Alternative 3 is anticipated to cost $1,171,250 (which is $260,650 more than Alternative 1). Annual non salary expenditures for Alternative 3 are anticipated to cost $398,600 annually (which is $233,400 more than Alternative 1). For each alternative, it is assumed that approximately 65% of non salary expenditures will still be spent locally in the Brown County economy. Table 3 summarizes the anticipated annual expenditures by management alternative.

Because of the way industries interact in an economy, a change in the activity of one industry affects activity levels in several other industries. For example, an increase in funding could allow the Refuge to start new projects or hire additional staff members. This added revenue will directly flow to the

Table 3. Refuge Staffing and Budgeting Expenditures by Management Alternative

	Annual Expenditures by Alternative		
	Alt 1	Alt 2	Alt 3
Salary	$910,600	$910,600	$1,171,250
Non-salary	$165,200	$165,200	$398,600
Total	$1,075,800	$1,075,800	$1,569,850

businesses from which the Refuge purchases goods and services and to the new Refuge employees. As additional supplies are purchased or as new staff members spend their salaries within the community, local businesses will purchase extra labor and supplies to meet the increase in demand for additional services. The income and employment resulting from Refuge purchases and Refuge employees' spending of salaries locally represents the *direct* effects of Refuge management activities within Brown County. In order to increase supplies to local businesses, input suppliers must also increase their purchases of inputs from other industries. The income and employment resulting from these secondary purchases by input suppliers are the *indirect* effects of Refuge management activities within the county (Stynes 1998). The input supplier's new employees use their incomes to purchase goods and services. The resulting increased economic activity from new employee income is the *induced* effect of visitor spending. The sums of the direct, indirect and induced effects describe the total economic effect of Refuge management activities in Brown County.

Table 4 shows the economic impacts associated with current and proposed management staffing. IMPLAN estimates for employment include both full time and part time workers which are measured in total jobs. The current level (Alternative 1) of Refuge personnel directly accounts for 14.6 jobs and almost $584,000 in personal income. The associated indirect and induced effects generate an additional 7.6 jobs and $174,000 in personal income throughout the Brown County economy for a total economic impact of 22.2 jobs and almost $758,000 associated with the current level of Refuge personnel. For Alternative 2, the staffing levels and economic impacts are the same as for Alternative 1. Due to the increased staffing levels for Alternative 3 (Table 3), the associated economic effects generate more jobs and income than Alternative 1 and 2.

Table 5 shows the economic impacts associated with current and proposed management non salary spending in Brown County. For each alternative, it is assumed that 65% of the non salary expenditures reported in Table 3 are spent locally in the Brown County economy. The current level (Alternative 1) of Refuge non salary expenditures directly accounts for 4.1 jobs and almost $51,000 in personal income. The associated indirect and induced effects generate an additional 1.3 jobs and almost $32,000 in personal income throughout the Brown County economy for a total economic impact of 5.4 jobs and almost $83,000 in personal income associated with the current level of Refuge non salary spending in the local economy. For Alternative 2, the non salary spending levels and economic impacts are the same as for Alternative 1. Due to the increased non salary spending levels for Alternative 3 (Table 3), the associated economic effects generate more jobs and income than Alternative 1 and 2.

Table 4. Local Economic Impacts of Refuge Staffing Expenditures

Brown County	Alternative 1	Alternative 2	Alternative 3
Salary Impacts *(excludes benefits)*			
Direct Effects *(Federal Government Sector)*			
Income ($/year)	$583,596	$583,596	$770,398
Jobs	14.6	14.6	19.3
Indirect and Induced Effects *(in Brown County Economy)*			
Income ($/year)	$174,181	$174,181	$229,935
Jobs	7.6	7.6	10.0
Total Effects			
Income ($/year)	**$757,777**	**$757,777**	**$1,000,333**
Jobs	**22.2**	**22.2**	**29.2**

Table 5. Economic Impacts of Refuge Non Salary Expenditures in Brown County

Brown County	Alternative 1	Alternative 2	Alternative 3
Non Salary Impacts *(65% of total non salary expenditures spent locally)*			
Direct Effects			
Income ($/year)	$50,882	$50,882	$122,771
Jobs	4.1	4.1	9.8
Indirect and Induced Effects *(in Brown County Economy)*			
Income ($/year)	$31,738	$31,738	$76,577
Jobs	1.3	1.3	3.1
Total Effects			
Income ($/year)	**$82,620**	**$82,620**	**$199,348**
Jobs	**5.4**	**5.4**	**12.9**

Table 6 presents the combined economic impacts associated with refuge staffing and non salary spending in Brown County. Refuge management activities currently generate 27.6 jobs and over $840,000 in personal income in Brown County. This accounts for less than one-tenth of one percent (0.1%) of total employment in Brown County. Refuge management activities associated with Alternative 2 would generate the same as Alternative 1. The higher staffing and spending levels associated with Alternative 3 would generate more jobs and income than Alternative 1.

Table 6. Combined Refuge Staffing and Non Salary Expenditures in Brown County

Brown County	Alternative 1	Alternative 2	Alternative 3
Total Refuge Staffing and Budgeting Impacts *(salary and non-salary)*			
Direct Effects			
Income ($/year)	$634,478	$634,478	$893,169
Jobs	18.7	18.7	29.1
Indirect and Induced Effects *(in Brown County Economy)*			
Income ($/year)	$205,919	$205,919	$306,512
Jobs	8.9	8.9	13.1
Total Effects			
Income ($/year)	**$840,397**	**$840,397**	**$1,199,681**
Jobs	**27.6**	**27.6**	**41.2**
% of Total County Income	*0.08%*	*0.08%*	*0.12%*
% of Total County Jobs	*0.10%*	*0.10%*	*0.15%*

Recreation Activities

The Refuge offers a wide variety of year round accessible recreational opportunities that are wildlife compatible. Wildlife observation, bird watching, education, photography, hunting and fishing are all popular activities. The Refuge is a nationally recognized wildlife sanctuary and offers opportunities for the big game hunter, upland game hunters, and waterfowl hunters. Pheasant hunting draws outdoorsmen from across the country each fall, and duck and goose hunters set decoys on the many small lakes and marshes that dot the prairie pothole country. Fishing is allowed year round at five locations on the Refuge.

Major visitor expenditure categories include lodging, food, and supplies. To determine the local economic impacts of visitor spending, only spending by persons living outside the local area (Brown County) are included in the analysis. The rational for excluding local visitor spending is two fold. First, money flowing into Brown County from visitors living outside is considered new money injected into the Brown County economy. Second, if Brown County residents visit Sand Lake NWR more or less due to the management changes, they will correspondingly change their spending of their money elsewhere in Brown County, resulting in no net change to the local economy. These are standard assumptions made in most regional economic analyses at the local level.

In order to accurately estimate the amount of spending associated with Refuge visitation, visitors must be divided by type of activity and place of residence (local County residents, non local South Dakota residents, and nonresidents). Sand Lake NWR annual visitation was estimated based on the 2003 Refuge annual visitation estimates. The Refuge bases visitation estimates on visitors entering the Visitor Center/Office and general observation. Estimates on the percentage of visitors by place of residence were provided by Refuge personnel. Table 7 summarizes estimated Refuge visitation by type of visitor activity and percentage of visitors by place of residence.

Table 7. Estimated Annual Refuge Visitation by Visitor Activity and Place of Residence.

	Total # of Visitors	Percentage of Local Brown County Visitors	Percentage of Non Local South Dakota Visitors	Percentage of Nonresident Visitors (live outside of South Dakota)
Total Estimated Visitors	43,281			
Non-Consumptive Users				
Interpretation/ Observation	32,140	50%	25%	25%
Environmental Education	3,862	80%	10%	10%
Hunting				
Migratory Bird	3,200	40%	30%	15%
Upland Game	3,600	50%	45%	20%
Big Game	4,100	60%	30%	10%
Fishing	2,900	90%	9%	1%

A key step in estimating total visitor spending is the development of visitor spending profiles. Average daily travel related expenditure profiles for various recreation activities derived from the 1996 National Survey of Hunting, Fishing and Wildlife Related Recreation (U.S. Dept. of Interior 1996) by the U.S. Forest Service (Niccolucci and Winter 2002) were used in this analysis. For each type of visitor activity, the Survey reports trip related spending of state residents and non residents for several different recreational activities. State resident and nonresident spending profiles for big game hunting, small game hunting, migratory bird hunting, and fresh water fishing were used for the Sand Lake NWR hunting and fishing related visitor activities. The state resident and nonresident spending profiles for non-consumptive wildlife recreation (observing, feeding, or photographing fish and wildlife) were used for interpretation/observation and environmental education visitors at Sand Lake NWR. For each visitor activity, spending is reported in the categories of lodging, food & drink, transportation, and other expenses. Total spending per day for state residents and nonresidents by visitor activity is reported in Table 8.

Table 8. Time Spent on the Refuge and Spending per Day for Each Visitor Activity.

	Average State Resident Spending per Day	Average Nonresident Spending per Day
Interpretation/Observation and Environmental Education	$7	$104
Waterfowl Hunting	$17	$23
Upland Game Hunting	$18	$208
Big Game Hunting	$20	$31
Fishing	$25	$44

Source: Niccolucci and Winter 2002

Visitor spending is typically estimated on an average per day (eight hours) or average per trip basis. In order to properly account for the amount of spending associated with each type of refuge visitor, it is important to determine the average length of trip. Refuge personnel estimate that visitors participating in interpretation/observation and environmental education activities typically spend 4 hours on the Refuge, visitors participating in fishing activities spend 3 hours, waterfowl hunters usually spend a half day (4 hours), upland game hunters spend 6 hours, and big game hunters spend a day (8 hours) on the Refuge. Because the visitor spending profiles are for an 8 hour visitor day, the number of 8 hour state resident and nonresident visitor days for each visitor activity must be calculated. The current number of visitor days per activity is shown in Table 9.

Table 9. Annual Number of Non Local Visitor Days per Activity for Alternative 1.

	Number of Non Local South Dakota Visitors	Number of Non-resident Visitors	Estimated time spent at Sand Lake NWR	Number of Non Local South Dakota Resident Visitor Days (1 day = 8 hours)	Number of Non-resident Visitor Days (1 day = 8 hours)
Interpretation/ Observation	8,035	8,035	4 hours	4,018	4,018
Environmental Education	386	386	4 hours	193	193
Waterfowl Hunting	960	480	4 hours	480	240
Upland Game Hunting	1,620	720	6 hours	1,215	540
Big Game Hunting	1,230	410	8 hours	1,230	410
Fishing	261	29	3 hours	98	11
Total				**7,233**	**5,411**

Total visitor spending is determined by multiplying the total spending per day (Table 8) by the number of non local visitor days for each visitor activity (Table 9). Current Refuge visitors spend about $655,500 annually in the Brown County economy. Table 10 shows the economic impacts associated with current visitation and anticipated changes in visitation by management alternative. The current level (Alternative 1) of visitor spending directly generates over $152,000 in personal income and 9.4 jobs for local businesses accommodating visitors (hotels, restaurants, supply stores, and gas stations).

The associated indirect and induced effects generate an additional 4.3 jobs and over $102,000 in personal income throughout the Brown County economy for a total economic impact of 13.7 jobs and over $254,000 in personal income associated with the current level of Refuge visitation. For Alternative 2, Refuge personnel estimate visitation declining by 30% as compared to Alternative 1. For Alternative 3, visitation is anticipated to increase by 25% as compared to Alternative 1. The resulting economic impacts associated with Refuge visitation for Alternatives 2 and 3 are presented in Table 10.

As shown in Table 10, the economic impacts associated with current Refuge visitation are limited in terms of contributing to the overall county income and employment. Any decrease in visitation associated with a change in Refuge management will not have a significant economic effect. An increase in the amount of time current visitors spend on the Refuge will increase the amount of daily spending that can be attributed to visiting the Refuge. An increase in both the length of stay on the

Refuge (and in the local economy) and the number of people visiting the Refuge could have a considerable impact on increasing the role Refuge visitors play in the local economy.

Table 10. Economic Impacts of Sand Lake NWR Visitor Spending by Alternative.

Brown County	Alternative 1	Alternative 2	Alternative 3
		Visitor Spending Impacts	
Direct Effects			
Income ($/year)	$152,076	$106,453	$190,095
Jobs	9.4	6.6	11.8
Indirect and Induced Effects *(in Brown County Economy)*			
Income ($/year)	$102,263	$71,584	$127,829
Jobs	4.3	3.0	5.4
Total Effects			
Income ($/year)	**$254,339**	**$178,037**	**$317,924**
Jobs	**13.7**	**9.6**	**17.1**
% of Total County Income	*0.03%*	*0.02%*	*0.03%*
% of Total County Jobs	*0.05%*	*0.04%*	*0.06%*

Summary and Conclusions

Table 11 summarizes the direct and total economic impacts for all Refuge management activities for each management alternative. Under current Refuge management (Alternative 1), economic activity directly related to all Refuge operations would generate an estimated 28.1 jobs and over $786,500 in personal income in Brown County. Including direct, indirect, and induced effects, all Refuge activities would account for 41.3 jobs and $1.09 million in personal income in Brown County (Table 11). Current Refuge management activities account for 0.15% of total County employment and 0.11% of County income.

Table 12 summarizes the economic effects associated with management changes from Alternative 1. Alternative 2 will slightly decrease employment by 4.1 jobs and personal income by $76,000 in Brown County because of anticipated decreases in Refuge visitation. Alternative 3 will increase employment by 17 jobs and personal income by over $422,000 in Brown County because of proposed increases in staffing, non salary expenditures and Refuge visitation.

Table 11. Summary of all Refuge Management Activities by Alternative.

Brown County	Alternative 1	Alternative 2	Alternative 3
Total Refuge Staffing and Budgeting Impacts			
Direct Effects			
Income ($/year)	$634,478	$634,478	$893,169
Jobs	18.7	18.7	29.1
Total Effects			
Income ($/year)	$840,397	$840,397	$1,199,681
Jobs	27.6	27.6	41.2
Recreation Activities			
Direct Effects			
Income ($/year)	$152,076	$106,453	$190,095
Jobs	9.4	6.6	11.8
Total Effects			
Income ($/year)	$254,339	$178,037	$317,924
Jobs	13.7	9.6	17.1
Aggregate Impacts			
Direct Effects			
Income ($/year)	$786,554	$740,931	$1,083,264
Jobs	28.1	25.3	40.9
Total Effects			
Income ($/year)	$1,094,736	$1,018,434	$1,517,605
Jobs	41.3	37.2	58.3
% of Total County Income	*0.11%*	*0.10%*	*0.15%*
% of Total County Employment	*0.15%*	*0.14%*	*0.22%*

Table 12. Economic Effects Associated with Changing from Alternative 1.

Brown County	Alternative 2	Alternative 3
Total Refuge Staffing and Budgeting Impacts		
Direct Effects		
Income ($/year)	$0	+$258,691
Jobs	0	+10.4
Total Effects		
Income ($/year)	$0	+$359,284
Jobs	0	+13.6
Recreation Activities		
Direct Effects		
Income ($/year)	-$45,623	+$38,019
Jobs	-2.8	+2.4
Total Effects		
Income ($/year)	-$76,302	+$63,585
Jobs	-4.1	+3.4
Aggregate Impacts		
Direct Effects		
Income ($/year)	-$45,623	+$296,710
Jobs	-2.8	+12.8
Total Effects		
Income ($/year)	-$76,302	+$422,869
Jobs	-4.1	+17.0

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Appendix J—Fire Management Program

Sand Lake National Wildlife Refuge consists of 21,498 acres, lying astride the James River in north-central Brown County, South Dakota. Refuge objectives focus primarily on migratory bird habitat.

Fire—A Critical Natural Process

Historically, natural fire has played an important role in many ecosystems by removing fuel accumulations, decreasing the impacts insects and diseases, simulating regeneration, cycling critical nutrients, and providing a diversity of habitats for plant species and wildlife.

When fire is excluded on a broad scale, the unnatural accumulation of living and dead fuels that occurs can contribute to degraded plant communities and wildlife habitats. These fuel accumulations often change fire regime characteristics, and have created a potential in many areas across the country for uncharacteristically severe wildland fires. These catastrophic wildland fires often pose risks to public and firefighter safety. In addition, they threaten property and resource values such as wildlife habitat, grazing opportunities, timber, soils, and water quality.

In the grassland species of the northern Great Plains, vegetation has evolved under periodic disturbance and defoliation from bison and fire. This periodic disturbance is what made the prairie healthy and a place of enormous diversity for thousands of years. Return of fire in most ecosystems is essential for healthy vegetation in grasslands, wetlands, and some woodlands, for wildlife habitat.

When integrated back into an ecosystem, fire can help restore and maintain healthy systems and reduce the risk of wildland fires. To facilitate fire's natural role in the environment, fire must be integrated into land and resource management plans and activities on a broad scale. Reintroduced fire:

- Can improve wetlands and riparian areas by reducing the density of vegetation, thereby increasing the amount of available water;
- Can improve deer and elk habitat, especially in areas with shortages such as winter habitat and on the spring and fall transitional ranges;
- Can sustain biological diversity;
- Can improve access in woodlands and shrublands;
- Can improve soil fertility;
- Can improve the quality and amount of livestock forage;
- Can improve growth in immature woodlands by reducing density;
- Can reduce susceptibility of plants to insects and disease caused by moisture and nutrient stress;
- Can improve water yield for off-site activities and communities dependent on wildlands for their water supply.

Wildland Fire Management Policy and Guidance

In 2001, an update of the 1995 Federal Fire Policy was completed and approved by the Secretaries of Interior and Agriculture. The 2001 Federal Wildland Fire Management Policy directs federal agencies to achieve a balance between fire suppression to protect life, property, and resources and fire use to regulate fuels and maintain healthy ecosystems. In addition, it directs agencies to use the appropriate management response for all wildland fires regardless of the ignition source. This policy provides nine guiding principles that are fundamental to the success of the fire management program:

- Firefighter and public safety is the first priority in every fire management activity.
- The role of wildland fire as an essential ecological process and natural change agent will be incorporated into the planning process.
- Fire management plans (FMPs), programs, and activities support land and resource management plans and their implementation.
- Sound risk management is a foundation for all fire management activities.
- Fire management programs and activities are economically viable, based upon values to be protected, costs, and land and resource management objectives.
- FMPs and activities are based upon the best available science.
- FMPs and activities incorporate public health and environmental quality considerations. Federal, state, tribal, local, interagency, and international coordination and cooperation are essential.
- Standardization of policies and procedures among federal agencies is an ongoing objective.

It is essential to have written fire management in the land use resources plans (e.g., the comprehensive conservation plans). FMPs are step-down processes from the land use plans and habitat plans, with more

detail on fire suppression, fire use, and fire management activities.

Management Direction

Fire management will be used to protect life, property and other resources from wildland fires by safely suppressing all wildfires on the Sand Lake National Wildlife Refuge and Sand Lake Wetland Management District. Prescribed fire will be used in an ecosystem management context for habitat management and to protect both federal and private property. Fuel reduction activities will be applied where needed, especially in areas with a higher proportion of residences that may be considered "wildland–urban interface" (WUI) areas.

All fire management programs will be conducted in a manner consistent with applicable laws, policies, and regulations. Maintain an FMP; implement the plan to accomplish resource management objectives. Prescribed fire will be applied in a scientific way under selected weather and environmental conditions on approximately 2,500 acres of grasslands and approximately 100 acres of wetlands annually to accomplish habitat management objectives.

Fire Management Objective

Fire is an important grassland management tool that can be used to accomplish habitat management objectives. Fire is also a tool that can quickly destroy equipment, buildings and property, and hurt or kill those that work with it. Prescribed fire and WUI treatments will be used to reduce hazardous fuels on refuge lands to reduce the intensity and favorable conditions for wildland fires.

Strategies

Strategies and tactics that consider public and firefighter safety and values at risk will be used. A more detailed fire plan for information on wildland fire suppression and prescribed fire methods, timing, and monitoring will be found in a step-down FMP.

All management actions will use prescribed fire to control nonnative vegetation and the spread of woody vegetation in grassland habitats.

The prescribed fire program will be outlined in the FMP for the refuge. This plan describes the following:

- the year's burn units and their predominant vegetation
- the primary objectives of the units and the fires
- the acceptable range of results
- site preparation requirements
- weather requirements
- safety considerations and measures to protect sensitive features
- burn-day activities
- communications and coordination for burns
- ignition techniques
- smoke management procedures
- post-burn monitoring

Air Quality

Prescribed fire temporarily reduces air quality by reducing visibility and releasing several components through combustion. The four major components are carbon monoxide, carbon dioxide, hydrocarbons, and particulates. Varying amounts of particulate content are generated in different types of burns (e.g., wildlife habitat improvement burns vs. fuel-reduction burns). Clean Air Act standards will be met during all prescribed fire under all fire management actions.

Visibility and clean air are primary natural resource values. The protection of these resources must be given full consideration in fire management planning and operations. Additionally, smoke can have serious health and safety effects that must be considered. The management of smoke will be incorporated into the planning of prescribed fires and, to the extent possible, in the suppression of wildland fire. The state of South Dakota does not have a permit system for air quality, but does have regulations concerning agricultural burning.

Appendix K—Section 7 Biological Evaluation

Intra-Service Section 7 Biological Evaluation

Origination Person: William A. Schultze, Wildlife Biologist
Telephone Number: (605) 885-6320
Date: July 27, 2004

Region: Region 6, Mountain-Prairie Region

Service Activity: Sand Lake National Wildlife Refuge - Comprehensive Conservation Plan

Pertinent Species and Habitat:

Listed species and/or their critical habitat within the action area:

Bald Eagle (*Haliaeetus leucocephalus*) - threatened
There is no federally designated critical habitat in the action area. Bald eagles migrate through Sand Lake NWR due to the presence of prey, such as waterfowl and snow geese during the spring and fall migration (September-November and February-April). Winter-killed fish, primarily carp, are available in the spring (February-May). No bald eagles are nesting on Sand Lake NWR, but 5 known breeding pairs nest in Brown County.

Eskimo Curlew (*Numenius borealis*) - endangered
There is no federally designated critical habitat in the action area. The eskimo curlew was once considered to be a common spring migrant through eastern South Dakota. It is extremely rare and may be extinct.

Topeka Shiner (*Notropis topeka*) - endangered
There is no federally designated critical habitat in the action area. The Topeka shiner has never been found in the James River, which flows through Sand Lake NWR. Topeka shiners are known to exist in parts of the Elm River, which flows into the James River approximately four miles south of Sand Lake NWR.

Western Prairie Fringed Orchid (*Platanthera praeclara*) - threatened
Brown County has the potential for the western prairie fringed orchid, but there are no known populations of this species in South Dakota.

Proposed species and/or proposed critical habitat within the action area:

None

Candidate species within the action area:

Dakota Skipper (*Hesperia dacotae*)
The Dakota skipper is known to exist in Brown County, but Sand Lake NWR provides very little of the native habitat suitable for it.

Station Name and Action:

The proposed action is to implement the preferred alternative(Alternative 3) of the Comprehensive Conservation Plan for Sand Lake National Wildlife Refuge(Attachment 1). The actions will occur on Sand Lake National Wildlife Refuge.

Location:

Sand Lake National Wildlife Refuge is located in the Upper James River Watershed of the Mainstem Missouri River Ecosystem, in northern South Dakota (Brown County). (Attachment 2, 3, & 4) Sand Lake NWR headquarters is 7.5 miles north of Columbia, South Dakota.

Description of Proposed Action:

The proposed action is the implementation of a Comprehensive Conservation Plan (CCP) for Sand Lake NWR over the next 15 years. Briefly, the preferred alternative(alternative 3) within the CCP takes an integrated approach through better management planning and monitoring to provide the best management practices for production of migratory birds, while maintaining a balance with socio-political considerations, such as management of resident species and providing public use on Sand Lake NWR. This is necessary if Sand Lake NWR continues to participate in the large array of resource issues currently facing wildlife on the James River. For a detailed description of the proposed management objectives and strategies, please refer to the Proposed Alternative #3: Integrated Management(Attachment 1).

The process will continue to determine if current goals are appropriate. In the case of habitat goals, information will continue to be gathered on:

1) impact of habitat management practices
2) current needs of migratory birds and the Refuge's best role in providing habitat
3) how to better control noxious weeds and prevent their spread

Determination of Effects:

Bald Eagle (*Haliaeetus leucocephalus*)

The management described in alternative #3 and changes proposed may affect, but are not likely to adversely affect bald eagles using the refuge. Most of the upland and wetland management techniques currently used will not change, only "how intensely" the habitats are managed and monitored. The current management techniques provide excellent habitat and foraging opportunities for migrating eagles. Only Russian olives or smaller, isolated trees will be removed, and these have little value for eagle perches or nesting.

Large trees that have the potential for eagles to nest in will not be removed. If eagles do initiate nests on the refuge, measures will be undertaken to minimize disturbance from ongoing refuge activities and refuge visitors.

Eskimo Curlew (*Numenius borealis*)

The eskimo curlew is extremely rare or extinct, and has never been documented at Sand Lake NWR. The actions in alternative 3 will have no effect on this species.

Topeka Shiner (*Notropis topeka*)

The James River flows through Mud Lake and Sand Lake, which are the two main pools on Sand Lake NWR. The management of these pools has little effect on the overall flows of the James River and fish passage currently occurs through the existing control structures. The structures that retain water in these pools are also overtopped by higher flows on the James River on a fairly regular basis which also facilitates fish passage. The Topeka shiner has not been documented in the James River, but has been found in a section of the Elm River, which enters the James River about four miles south of Sand Lake NWR. Additionally, this species has not been documented in North Dakota. Management proposed in alternative 3 may affect, but is not likely to adversely affect on the Topeka shiner.

Western Prairie Fringed Orchid (*Platanthera praeclara*)

This plant has not been documented on Sand Lake NWR, and there are currently no known populations of this species in South Dakota. The actions in alternative 3 will have no effect on this species.

Dakota Skipper (*Hesperia dacotae*)

The Dakota skipper is known to exist in Brown County, but has not been found on Sand Lake NWR. Sand Lake has very little native grassland, which is needed by the skipper. The actions in alternative 3 will have no effect on this species.

Effect determination and response requested: (* = optional)

Listed species/designated critical habitat:

Determination	Response requested
no effect/no adverse modification (species: eskimo curlew, western prairie fringed orchid)	✓ *Concurrence
may affect, but is not likely to adversely affect species/adversely modify critical habitat (species: bald eagle, Topeka shiner)	✓ Concurrence
may affect, and is likely to adversely affect species/adversely modify critical habitat (species: _____)	____Formal Consultation

Proposed species/proposed critical habitat:

Determination	Response requested
no effect on proposed species/no adverse modification of proposed critical habitat (species: _____)	____*Concurrence
is likely to jeopardize proposed species/ adversely modify proposed critical habitat (species: _____)	____Conference

Candidate species:

Determination	Response requested
no effect (species: Dakota skipper)	✓ *Concurrence
is likely to jeopardize candidate species (species: _____)	____Conference

Eugene Williams 7-28-04

Gene Williams, Project Leader
Sand Lake NWR

Date

Reviewing ESO Evaluation:

Concurrrence X Nonconcurrence_____

Formal Consultation Required:_____

Conference Required:_____

Informal Conference Required:_____

Remarks:

Acting For Scott Larson 8/2/04

Donald Gober, Field Supervisor
South Dakota Ecological Services Field Office

Date

Appendix L—Refuge Operations Needs System Projects

RONS[1] *Number*	*Project Description*	*First-Year Need ($1,000s)*	*Recurring Annual Need ($1,000s)*	*Personnel FTE*[2]
R–01003	Increase habitat management capability (refuge manager)	139.0	74	1.0
R–97015	Provide station administrative assistance (administrative clerk)	110.0	45	1.0
R–03001	Expand the station's law enforcement program (law enforcement officer)	136.0	71	1.0
R–97016	Expand the station's law enforcement program (law enforcement officer)	65.5	32	0.5
R–97011	Evaluate and monitor wildlife response to applied management using GIS technology (resource specialist)	139.0	74	1.0
R–98001	Reestablish area and capacity data for Sand Lake National Wildlife Refuge	249.0	0	—
R–00004	Design and update all refuge brochures into the Service's graphic standards format	32.0	4	—

[1] *RONS=refuge operations needs system*
[2] *FTE=full-time equivalent*

Appendix M—Maintenance Management System Projects

*MMS Number**	*Description*	*Cost ($1,000s)*
	Deferred Maintenance	
R–90034	Replace outdated educational and interpretive signs and aerial photos	26
R–92003	Replace garages	79
R–99003	Replace Mud Lake water control structure	419
R–00004	Replace station two-way radio system with narrow-band system	151
R–01043	Replace 1,000-gallon, aboveground, Convault storage tank	34
R–01044	Replace 2 bay, 1,000-gallon, aboveground, Convault storage tanks	34
	Large Construction	
R–99002	Construct education center—Centennial Legacy Project (design and construction)	1,036
	Heavy Equipment	
R–01013	Replace 1978 John Deere front-end loader	121
R–01019	Replace worn-out 1980 GMC equipment truck	66
R–01035	Replace 1980 auto car, 6x4 diesel tractor (semitruck)	91
R–01037	Replace 1995 Ford 6x4 truck tractor	81
R–01070	Replace 1980 IHC 684 farm tractor	35
R–01046	Replace 1978 John Deere 4440 agricultural tractor	66
R–01047	Replace 1979 IHC TD15 tracked crawler-tractor	152
R–01048	Replace 1992 John Deere 2555 agricultural tractor with front-end loader	40
R–01049	Replace 1996 John Deere 7400 agricultural tractor with loader	66
R–01068	Replace 1999 John Deere tracked excavator	152
R–02003	Replace grader	113
R–02005	Replace 2002 Ford dump truck	80
R–02006	Replace loader, backhoe	55
R–95008	Replace worn-out 1989 Chevrolet extended-cab pickup	28
R–00003	Replace Bobcat loader	48
R–93004	Replace worn-out lowboy trailer	58
R–00005	Replace worn-out 1993 pickup	29
R–01002	Replace worn-out 4-wheel ATV	6
R–01003	Replace worn-out 4-wheel ATV	6
R–01006	Replace 1997 Honda 4-wheel ATV	6
R–01009	Replace 1979 John Deere disc	12
R–01010	Replace 1987 native grass drill	22
R–01011	Replace 1965 Clark forklift	15
R–01012	Replace 1985 disc harrow	17
R–01014	Replace worn-out 1999 Dodge Ram 4x4 pickup	30
R–01017	Replace worn-out 1997 John Deere 48-inch deck mower	9
R–01018	Replace worn-out 1989 Chevrolet diesel 4x4 pickup	32

**MMS=maintenance management system*

MMS Number	*Description*	*Cost ($1,000s)*
	Heavy Equipment	
R–01021	Replace 1999 Dodge ¾-ton, 4x4 pickup	30
R–01022	Replace 1999 Dodge ½-ton, 4x4 pickup	30
R–01023	Replace 1999 Chevrolet ¾-ton, 4x4 pickup	30
R–01025	Replace 1992 Dodge Dakotah 4x2 pickup	25
R–01026	Replace 1991 Chevrolet 4x4 dual pickup	30
R–01030	Replace 1993 Chevrolet 4x4 pickup	30
R–01032	Replace 1995 Ford 4x4 pickup	30
R–01034	Replace 1995 Ford 4x4 pickup	30
R–01038	Replace 1999 Chevrolet Suburban	32
R–01039	Replace 300-gallon Western fire pumper	15
R–01040	Replace 1988 300-gallon Wajax Pacific fire pumper	15
R–01041	Replace 1997 Arctic Cat snowmobile	5
R–01042	Replace 1991 300-gallon Wajax Pacific fire pumper	15
	Small Equipment	
R–01050	Replace 1990 Trail Eze tilt-bed implement trailer	51
R–01052	Replace 1999 Honda 4-wheel ATV	6
R–01053	Replace 1999 Honda 4-wheel ATV	6
R–01054	Replace 1999 Honda 4-wheel ATV	6
R–01055	Replace 2000 Wildcat snow blower	9
R–01056	Replace 1999 Blumhardt weed sprayer	6
R–01057	Replace 2000 forward hydraulic hoist	10
R–01058	Replace 2000 Honda 4-wheel ATV	6
R–01059	Replace 2000 Honda 4-wheel ATV	6
R–01060	Replace 2000 Blumhardt weed sprayer	6
R–01061	Replace 2000 John Deere riding lawn mower	8
R–01062	Replace 2000 John Deere riding lawn mower	9
R–01063	Replace 2000 Chevrolet Tahoe	33
R–01065	Replace 1999 Dodge ¾-ton, 4x4 pickup	30
R–01067	Replace 2001 Chevrolet ¾-ton, 4x4 pickup	30
R–01069	Replace 1999 Truax grass drill	25
R–02007	Replace Canon Image Runner 330 Copier	13
R–02001	Replace 2002 Chevrolet pickup	20
R–02004	Replace 2002 Ford fire truck and tank	41
	Road Rehabilitation	
R–91009	Preliminary engineering (route 12,101;18 miles)	400
R–02002	Preliminary engineering and construction (Sand Lake Recreation Area Road and three parking lots (route 100, 901-03; 18 miles)	340
R–99003	Preliminary engineering and construction (route 010, 0.49 mile, parking lot 900)	283
R–03001	Construction (route 12, 101; 18 miles)	4,000
R–03002	Construction (route 11, 14.9 miles)	4,000
R–03003	Preliminary engineering (route 11, 14.9 miles)	400

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