Draft Comprehensive Conservation Plan and Environmental Assessment

Des Lacs National Wildlife Refuge
J. Clark Salyer National Wildlife Refuge
Upper Souris National Wildlife Refuge

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Prepared by

U.S. Fish and Wildlife Service

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Abbreviations

Administration Act	National Wildlife Refuge System Administration Act of 1966
ATV	all-terrain vehicle
AUM	animal unit month
CCC	Civilian Conservation Corps
CCP	comprehensive conservation plan
CFR	Code of Federal Regulations
cfs	cubic feet per second
CRP	conservation resource plan
CWCS	“Comprehensive Wildlife Conservation Strategy”
DNC	dense nesting cover
EA	environmental assessment
EO	executive order
EPA	U.S. Environmental Protection Agency
FHWA	Federal Highway Administration
FMP	fire management plan
FONSI	finding of no significant impact
FTE	full-time equivalent
GIS	geographic information system
GPS	global positioning system
GS	general schedule (employment)
HAPET	“Habitat and Population Evaluation Team”
Improvement Act	National Wildlife Refuge System Improvement Act of 1997
NAWMP	North American Waterfowl Management Plan
ND	North Dakota
NDGF	North Dakota Game and Fish Department
NEPA	National Environmental Policy Act
NOI	notice of intent
NRCS	Natural Resources Conservation Service
NWI	“National Wetland Inventory”
NWR	national wildlife refuge
NWRS	National Wildlife Refuge System
PL	public law
PPJV	“Prairie Pothole Joint Venture”
Refuge System	National Wildlife Refuge System
region 6	“Mountain–Prairie Region” of the U.S. Fish and Wildlife Service
RONS	“Refuge Operating Needs System”
SAMMS	“Service Asset Maintenance Management System”
Service	U.S. Fish and Wildlife Service
SUP	special use permit
SWG	“State Wildlife Grant”
Three Affiliated Tribes	Mandan, Hidatsa, and Arikara tribes
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOR	visual obstruction reading
WG	wage grade (employment)
WMD	wetland management district
WUI	wildland–urban interface

Definitions of these and other terms are in the glossary, located after chapter 5.

Summary

North Dakota's Souris River basin is home to three national wildlife refuges, known collectively as the "Souris River basin refuges":

- Des Lacs National Wildlife Refuge (NWR); 19,500 acres—extends south from the Canada border along 28 miles of the Des Lacs River in Burke and Ward counties, North Dakota
- J. Clark Salyer NWR; 58,700 acres—extends southeast from the Canada border along 75 miles of the east arm of the Souris River in Bottineau and McHenry counties, North Dakota
- Upper Souris NWR; 32,092 acres—extends south–southeast along 35 miles of the west arm of the Souris River in Renville and Ward counties, North Dakota

As stated in the executive orders establishing these refuges in 1935, the purpose of each refuge is for a "refuge and breeding ground for migratory birds and other wildlife."

The Souris River basin refuges are located in a critical area of the Central Flyway, providing resting and breeding habitat for migrating and nesting waterfowl. The J. Clark Salyer NWR, in particular, is one of the most important duck production areas in the United States.

The American Bird Conservancy recognizes all three refuges as "Globally Important Bird Areas." In addition, J. Clark Salyer NWR is designated as a regional shorebird site in the "Western Hemisphere Shorebird Reserve Network." Lake Darling at Upper Souris NWR is designated critical habitat for the federally threatened piping plover.

Representing a comprehensive collection of most North Dakota plant communities, these refuges include important remnants of the Drift Plain prairie, which could be considered a threatened resource.

Setting

The Souris River basin extends from North Dakota into the Canadian provinces of Saskatchewan and Manitoba. The Souris River is the main watercourse in the basin and the Des Lacs River is its primary tributary. Until widespread cultivation of prairie soils beginning nearly a century ago, the major ecological community in the basin was northern mixed-grass prairie.

Duane C. Anderson/USFWS

The Souris River basin refuges provide breeding grounds for migratory birds including Canada goose.

The contemporary landscape of the Souris River basin is dominated by annually tilled cropland. Most remnants of the basin's once vast native prairie are substantially invaded by introduced grasses and native shrubs and trees. Several breeding bird species characteristic of northern mixed-grass prairie—such as burrowing owl, ferruginous hawk, and Baird's sparrow—are now uncommon or absent throughout the basin. The Souris River has been significantly modified by drainage, channelization, and construction of numerous low-head dams, such that few natural riverine wetlands remain.

Within this basin, the three national wildlife refuges provide extensive breeding and migration habitat for grassland- and wetland-dependent birds. The refuges have potential for restoration of reasonably intact communities of native plants and animals. In addition, the refuges provide a wide variety of wildlife-dependent recreational opportunities and facilities for visitors including the following:

- Hunting of deer and upland birds
- Wildlife observation and wildlife photography—auto tour routes, hiking trails, viewing and photography blinds
- Interpretive information—kiosks, panels, and headquarters' exhibits

In addition, fishing is offered at J. Clark Salyer NWR and at Upper Souris NWR. A canoe trail and an outdoor classroom can be found at J. Clark Salyer NWR. Des Lacs NWR and Upper Souris NWR also offer canoeing opportunities.

PLANNING PROCESS

The U.S. Fish and Wildlife Service has developed a draft comprehensive conservation plan as the foundation for management and use of the three Souris River basin refuges. The purposes of this plan are as follows:

- to identify the role that the three Souris River basin refuges will play in support of the mission of the National Wildlife Refuge System;
- to provide guidance for managing refuge programs and activities during the next 15 years.

In 2003, a planning team of refuge and other Service staff gathered and began to analyze resource information. The planning process included designing a vision for the three refuges, along with goals to reach the vision. After identifying key issues related to achieving the vision, the team developed management alternatives.

The team invited the public to participate in the planning process and public scoping. A mailing list of about 220 names was created and included private citizens; local, regional, and state government representatives and legislators; other federal agencies; tribal governments, and nonprofit organizations.

VISION AND GOALS

The vision describes what the refuges will be and what the Service hopes to do, and is based primarily on the mission of the National Wildlife Refuge System and specific purpose of the refuges.

Vision

From Paleo-Indians on the tails of the Ice Age—to the Assiniboine and Chippewa, early fur trappers, explorers, and naturalists; eminent bison herds and astoundingly abundant bird life; fires stretching for miles to revitalize treeless prairie; and determined homesteaders and vanquished farms of the Dust Bowl era…

The Souris River basin figures prominently in the cultural and natural history of midcontinent North America's plains and prairies. Three national wildlife refuges of the Souris River basin—Des Lacs, J. Clark Salyer, and Upper Souris—will conserve much of the ecology and natural character of the northern plains region while helping sustain populations of migratory birds and other wildlife native to the landscape.

The refuges will create a sense of awe and wonder by providing an array of wildlife-dependent recreational and educational experiences that enhance visitor awareness of the splendid natural and cultural heritage of the northern plains.

Functioning as integral parts of the ecosystems and human communities to which they belong, the Souris River basin refuges will seek collaborative partnerships to attain common goals.

A diverse and passionate refuge workforce will rely on sound science to understand and restore or emulate natural processes essential to the integrity and perpetuation of major biological communities with which the refuges are entrusted.

The following goals will direct work toward achieving the vision for the refuges.

Drift Prairie Goal

Restore and maintain extensive examples of plant communities dominated by native flora characteristic of the mid-1800s drift prairie. Create the temporally and spatially dynamic habitat conditions that will attract most breeding bird species and other vertebrate fauna characteristic of that era.
(Applies to all three Souris River basin refuges.)

Prairie Slope Goal

Restore representative examples of prairie slopes to preserve some of the most pristine plant communities that remain in the Souris River basin and promote appreciation and stewardship of prairie resources.
(Applies to all three Souris River basin refuges.)

Prairie Parkland Goal

Restore and maintain extensive examples of plant communities characteristic of the mid-1800s prairie parkland. Create the temporally and spatially dynamic habitat conditions that will attract most breeding bird species and other vertebrate fauna characteristic of that era.
(Applies only to J. Clark Salyer NWR.)

Sandhills Goal

Restore and maintain plant communities characteristic of the mid-1800s sandhills within the prairie parkland landscape.
(Applies only to J. Clark Salyer NWR.)

Old Cropland Goal

On high-priority old cropland areas, establish native-dominated, perennial herbaceous cover that, with modest management, resists invasion by introduced cool-season grasses and noxious weeds. This seeded cover will help form extensive, contiguous blocks of structurally diverse, open grassland for grassland-dependent, breeding bird species.
(Applies to all three Souris River basin refuges.)

Coulee Woodland and Coulee Woodland Edge Goal

Acknowledge a nearly irreversible, localized establishment of mature, contiguous woodland and minimally manage these areas as breeding and migration habitat principally for forest-interior, migratory bird species such as veery and ovenbird. Strive to eliminate remaining, noncontiguous, edge-dominated tree and tall shrub cover, particularly near high-priority drift prairie and the largest, most contiguous grassland tracts.
(Applies only to Des Lacs NWR and Upper Souris NWR.)

Riparian Woodland Goal

Maintain the approximate presettlement extent of green ash–American elm riparian woodland within the floodplain of the Souris River to benefit a broad suite of woodland-associated, breeding bird species.
(Applies only to J. Clark Salyer NWR and Upper Souris NWR.)

Meadow Goal

Restore and maintain extensive examples of plant communities dominated by native flora characteristic of seasonally flooded meadows within the Souris River floodplain to attract grassland- and wetland-dependent bird species and other wildlife.
(Applies to all three Souris River basin refuges.)

Wetland Goal

Manage riverine wetlands, including marshes and lakes, to sustain the long-term capacity of riverine wetlands to support diverse plant and wildlife communities. Restore ecological processes that sustain long-term productivity of wetlands.
(Applies to all three Souris River basin refuges.)

Island Goal

Manage islands to attract waterfowl and increase nest survival, especially during drought years when wetland habitat outside of the Souris River basin refuges is limited.
(Applies to all three Souris River basin refuges).

Cultural Resource Goal

Discover and protect cultural resources and interpret sites when the interpretation does not adversely affect habitat management.
(Applies to all three Souris River basin refuges.)

Visitor Service Goal

Provide wildlife-dependent recreational opportunities to a diverse audience when the administration of these programs does not adversely affect wildlife and habitat management.
(Applies to all three Souris River basin refuges.)

Research and Science Goal

Conduct innovative natural resource management using sound science and applied research to advance the understanding of natural resource function and management within the northern Great Plains.
(Applies to all three Souris River basin refuges.)

Operations Goal

Efficiently use funding and staffing for the benefit of all natural and cultural resources, the National Wildlife Refuge System, and present and future generations. Effectively manage visitor service programs that complement habitat management.
(Applies to all three Souris River basin refuges.)

ISSUES

The following key issues were identified during analysis of concerns raised by refuge staffs, along with analysis of 57 public comments collected during scoping.

Habitat and Wildlife Management

Dynamic ecological processes are fundamental to the evolution and maintenance of prairies and wetlands in the northern Great Plains. Processes such as fire, grazing, and drought shaped plant communities of the region. Before Euro-American settlement, the basin was a vast mosaic of prairie and broad, shallow wetlands. Most of this landscape has been drained and cultivated to produce crops. Many plant communities and wildlife populations have been negatively affected—some refuge habitats are so degraded that they may not be restorable.

Trees and tall shrubs have expanded, fragmenting much prairie that provides breeding habitat for grassland birds (most of which are exhibiting continental population declines). Introduced species such as smooth brome and Kentucky bluegrass, and noxious weeds such as leafy spurge and Canada thistle have devalued refuge habitats for wildlife. In addition, programs to control these plants divert important resources from other habitat management.

Refuge staffs suggest that (1) goals and objectives need to emphasize management of vegetation communities as habitat for wildlife, and (2) research and monitoring should be used to predict and validate wildlife response to management.

Too often, biological needs of wildlife and their habitats receive less consideration than socioeconomic and political factors in the decision-making process.

Prescribed fire, haying, and grazing can be controversial management tools, especially when objectives for their use are unclear. Control of predators is controversial—some groups or individuals question the ethics of killing one group of species to increase another group, especially to increase recreational hunting.

Water Quality and Management

The public is mainly interested in having a high-quality water source within the Souris River basin. Pesticides are widely used in the area, especially for oil seed crops, and may enter the rivers along with heavy metals and other contaminants.

Wetland productivity is likely compromised by modifications of the Souris River, as well as by political constraints associated with management of the river such as flood control. Historically, the Souris River had a meandering river channel, characterized by overbank flooding and the development of oxbow ponds. Today, with three major dams and channelization of much of the mid-river section, the river system is more static than dynamic.

A major reservoir, Lake Darling, occurs behind a dam at Upper Souris NWR. Water levels of this reservoir have been regulated for flood control and to support a recreational fishery. However, the timing of water releases from this and upstream reservoirs does not coincide with that of historical spring flood events, with negative implications for nesting by migratory birds downstream. One of the challenges to attain long-term productivity in the entire system is the ability to manage water to promote natural marsh cycles.

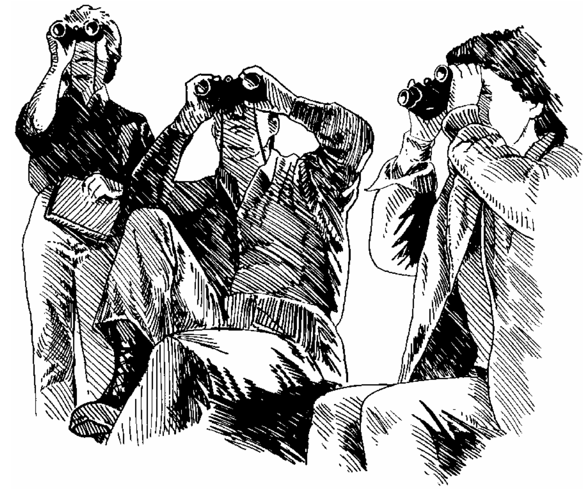
The role of drawdowns (lowering of water levels) to maintain marsh productivity is poorly understood by the public. Some refuge visitors see a dry wetland and conclude that this condition is not beneficial to wildlife.

Public Outreach and Partnerships

Refuge managers and the public underutilize opportunities for the public to understand refuges and their management. Partnerships with local schools, universities, special interest groups, and state and local governments need to be strengthened. Opportunities for outreach and partnerships are constrained by declining rural populations. In addition, relatively few nongovernmental organizations in North Dakota have an interest in wildlife and habitat.

Public Use

America's mobile society is demanding increased use of refuges for uses such as hunting, fishing, wildlife observation, and environmental education. Increased levels of these uses may exceed the capacity at which these services can be provided, unless refuge staffing and budgets increase. Increased public use could enhance awareness of refuge issues and activities.



Refuge Operations

The Souris River basin refuges are currently understaffed and poorly funded relative to the scope and responsibility of management.

ALTERNATIVES

The planning team developed the following four alternatives as management options for addressing the key issues.

Alternative A (Current Management, No Action)

This no-action alternative reflects the current management of the Souris River basin refuges. It provides the baseline against which to compare the other alternatives.

Refuge habitats would continue to be managed on an opportunistic schedule that may maintain—or most likely would result in further decline in—the diversity of vegetation and wildlife species. The Souris River basin refuges would continue to perform only limited research and would monitor only long-term vegetation change.

Outreach, partnerships, and priority public uses (fishing, hunting, wildlife observation, wildlife photography, environmental education, and interpretation) would continue at present minimal levels.

Alternative B (Proposed Action)

Alternative B is the Service's proposed action and basis for the draft comprehensive conservation plan.

This "ecological triage" alternative would prioritize habitats with high probability of restoration for management. Triage is defined here as the assignment of priority order to habitats or habitat types on the basis of where funds and resources can be best used, are most needed, or are most likely to achieve success in meeting stated goals and objectives. Other habitats may only be partially restored or minimally managed. Collaborative research and monitoring would increase and scientific knowledge required to restore upland and wetland plant and animal communities would be shared (with the public and other resource managers).

Some visitor services would be expected to decrease as more staff and funding shifts to habitat restoration. Environmental education would be emphasized, but would rely on volunteers and other groups to contribute more time.

Alternative C

In alternative C, waterfowl habitat management and waterfowl production would be emphasized over other refuge programs. Research and monitoring would focus on actions that enhance waterfowl habitat, increase waterfowl nest densities, and increase nest and brood survival.

Visitor service programs that use or enhance waterfowl-related activities such as hunting, wildlife viewing, or environmental education would be emphasized over other activities.

Alternative D

Management under alternative D would restore, to the fullest extent, ecological processes, vegetation communities, and wildlife characteristic of the presettlement period. Research and monitoring efforts would focus on strategies that enhance native plant and animal communities.

Public uses that are compatible with or that support restoration efforts would be emphasized. Interpretation and environmental education would be expanded, with an emphasis on natural plant and animal communities, ecological processes, and restoration.

1 Introduction

The U.S. Fish and Wildlife Service (Service) has developed this draft comprehensive conservation plan (CCP) to provide a foundation for the management and use of three national wildlife refuges located in the Souris River basin in north-central North Dakota (figure 1). The CCP is intended as a working guide for management programs and actions over the next 15 years for the following national wildlife refuges (known collectively as the "Souris River basin refuges"):

- Des Lacs National Wildlife Refuge (NWR); 19,500 acres—extends south from the Canada border along 28 miles of the Des Lacs River in Burke and Ward counties, North Dakota
- J. Clark Salyer NWR; 58,700 acres—extends southeast from the Canada border along 75 miles of the east arm of the Souris River in Bottineau and McHenry counties, North Dakota
- Upper Souris NWR; 32,092 acres—extends south–southeast along 35 miles of the west arm of the Souris River in Renville and Ward counties, North Dakota

The CCP was developed in compliance with the National Wildlife Refuge System Improvement Act of 1997 (Improvement Act) and Part 602 (National Wildlife Refuge System Planning) of "The Fish and Wildlife Service Manual." The actions described within this CCP also meet the requirements of the National Environmental Policy Act of 1969 (NEPA). Compliance with the NEPA is being achieved through the involvement of the public and the inclusion of an integrated environmental assessment (EA).

The final CCP will specify the necessary actions to achieve the vision and purposes of each refuge. Wildlife is the first priority in refuge management; public use (wildlife-dependent recreation) is allowed and encouraged, as long as it is compatible with the refuge's purpose.

A planning team of representatives from various Service programs and the North Dakota Game and Fish Department (NDGF) has prepared the CCP. In developing this plan, the planning team used input from local citizens and organizations. Public involvement and the planning process are described in "The Planning Process" section of this chapter.

After reviewing a wide range of public comments and management needs, the planning team developed the "proposed action" alternative. This action addresses all substantive issues while determining how best to achieve purpose of each refuge. The proposed action alternative is the Service's recommended course of action for the management of these refuges.


Donna Dewhurst/USFWS

Habitats at the Souris River basin refuges support the gadwall and many other migratory ducks.

NOTE: The Des Lacs NWR Complex includes Des Lacs NWR, Lostwood NWR, Lostwood Wetland Management District (WMD), and Crosby WMD. The J. Clark Salyer NWR Complex includes J. Clark Salyer NWR, Upper Souris NWR, J. Clark Salyer WMD, Wintering River NWR, Cottonwood Lake NWR, Buffalo Lake NWR, Willow Lake NWR, Lords Lake NWR, School Section Lake NWR, and Rabb Lake NWR. This draft CCP and EA addresses management for only Des Lacs NWR, J. Clark Salyer NWR, and Upper Souris NWR and does not include any of the other units within the complexes.

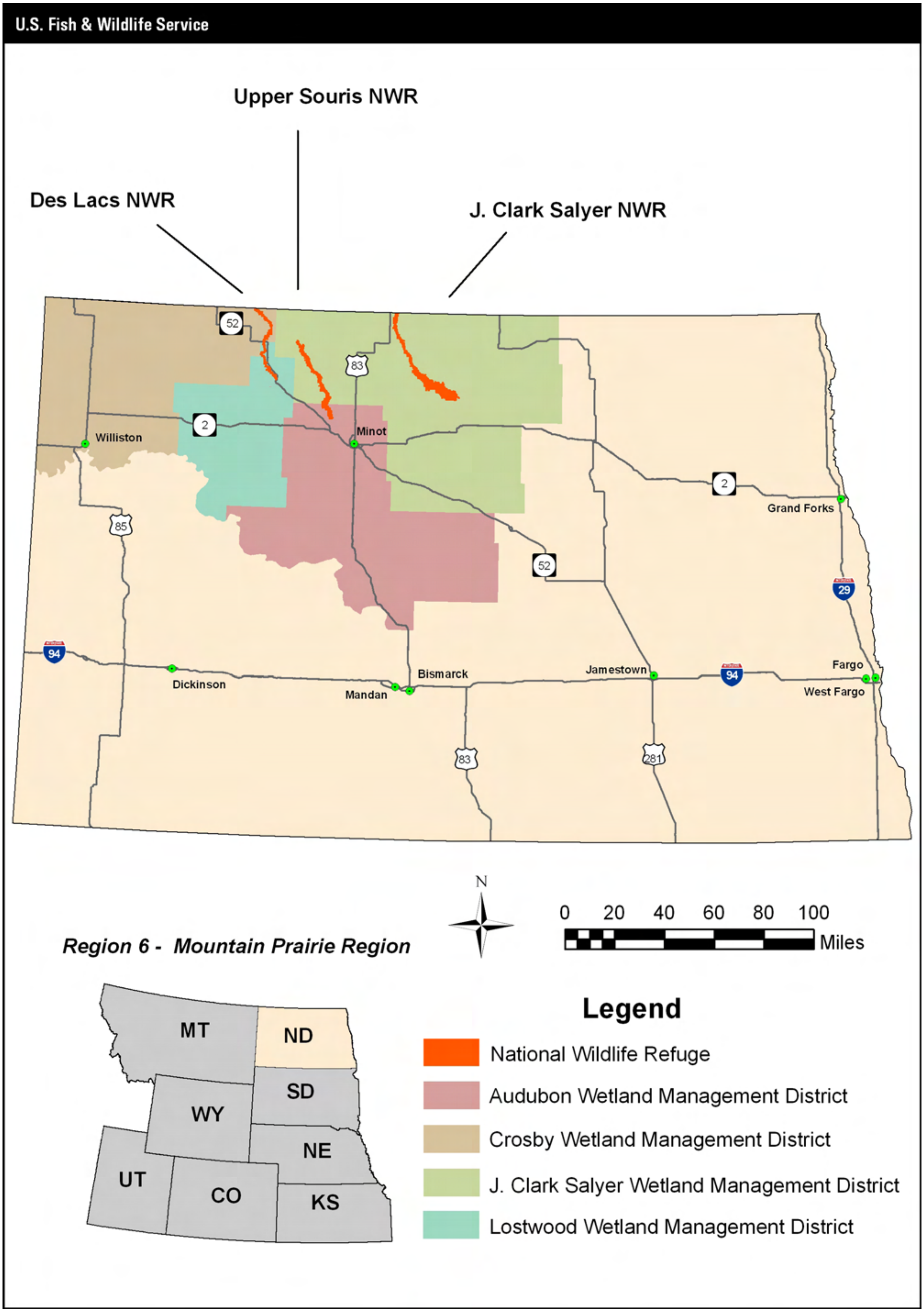


Figure 1. Vicinity map for the Souris River basin refuges, North Dakota.

Purpose of and Need for Plan

The purpose of this draft CCP is to identify the role that the three Souris River basin refuges will play in support of the mission of the National Wildlife Refuge System (Refuge System), and is to provide long-term guidance for managing refuge programs and activities.

The CCP is needed

- to provide a clear statement of direction for the future management of the refuges;
- to ensure that the Service's management actions are consistent with mandates governing management of the Refuge System;
- to ensure that management of these refuges is consistent with federal, state, and county plans;
- to provide a basis for development of budget requests for the refuge's operation, maintenance, and capital improvement needs;
- to provide neighbors, visitors, and government officials with an understanding of the Service's management actions at and around these refuges.

Sustaining the nation's natural resources is a task that can be accomplished only through the combined efforts of governments, businesses, and private citizens

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

The U.S. Fish and Wildlife Service is the principal federal agency responsible for fish, wildlife, and plant conservation. One of the major programs of the Service is the National Wildlife Refuge System.

The U.S. Fish and Wildlife Service

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

About a century ago, America's fish and wildlife resources were declining at an alarming rate. Concerned citizens, scientists, and hunting and angling groups joined together to restore and sustain America's national wildlife heritage. This was the genesis of the Service.

Today, the Service enforces federal wildlife laws, manages migratory bird populations, restores nationally significant fisheries, conserves and restores vital wildlife habitat, protects and recovers endangered species, and helps other governments with conservation efforts. In addition, the Service administers a federal aid program that distributes hundreds of millions of dollars to states for fish and wildlife restoration, boating access, hunter education, and related programs across America.

Service Activities in North Dakota

Service activities in North Dakota contribute to the state's economy, ecosystems, and education programs. The following activities were reported in the 2000 briefing book, "U.S. Fish and Wildlife Service Presence in North Dakota":

- employed 242 people in North Dakota
- 497 volunteers donated more than 17,990 hours to help Service projects
- contributed 13.4 million fingerlings to North Dakota waters
- managed 62 national wildlife refuges encompassing 296,000 acres (0.7% of the state)
- managed 12 wetland management districts
- managed 254,000 acres of fee-title, waterfowl production areas (0.6% of the state)
- hosted more than 478,500 annual visitors to Service-managed lands in North Dakota
- provided education programs for more than 17,000 school children participants
- provided $2.7 million to NDGF for sport fish restoration and $2.1 million for wildlife restoration and hunter education
- helped about 2,500 landowners enhance wildlife habitat on 162,000 acres since 1987
- paid North Dakota counties $427,400 under the Refuge Revenue Sharing Act (funds that are used for schools and roads) in 2000

The National Wildlife Refuge System

In 1903, President Theodore Roosevelt designated the 5.5-acre Pelican Island in Florida as the nation's first wildlife refuge for the protection of brown pelicans and other native nesting birds. This was the first time the federal government set-aside land for the sake of wildlife. This small but significant designation was the beginning of the Refuge System.

One hundred years later, this Refuge System has become the largest collection of lands in the world specifically managed for wildlife, encompassing more than 96 million acres within 545 refuges and more than 3,000 small areas for waterfowl breeding and nesting. Today, there is at least one refuge in every state in the nation including Puerto Rico and the U.S. Virgin Islands.

In 1997, a clear mission was established for the Refuge System through the passage of the Improvement Act.

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.

The Improvement Act further states that each refuge shall be managed

- to fulfill the mission of the Refuge System;
- to fulfill the individual purpose of each refuge;
- to consider the needs of fish and wildlife first;
- to fulfill the requirement of developing a CCP for each unit of the Refuge System and fully involve the public in the preparation of these plans;
- to maintain the biological integrity, diversity, and environmental health of the Refuge System;
- to recognize that wildlife-dependent recreation activities including hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation are legitimate and priority public uses;
- to retain the authority of refuge managers to determine compatible public uses.

In addition to the overall mission for the Refuge System, the wildlife and habitat vision for each national wildlife refuge stresses the following principles:

- Wildlife comes first.
- Ecosystems, biodiversity, and wilderness are vital concepts in refuge management.
- Refuges should ensure biological integrity and environmental health.
- Growth of refuges must be strategic.
- The Refuge System serves as a model for habitat management with broad participation from others.

Following passage of the Improvement Act, the Service immediately began efforts to carry out the direction of the new legislation, including the preparation of CCPs for all refuges. The development of these plans is now ongoing nationally. Consistent with the Improvement Act, all refuge CCPs are being prepared in conjunction with public involvement, and each refuge is required to complete its own CCP within the 15-year schedule (by 2012).

People and the Refuge System

The nation's fish and wildlife heritage contributes to the quality of American lives and is an integral part of the nation's greatness. Wildlife and wild places have always given people special opportunities to have fun, relax, and appreciate the natural world.

Whether through bird watching, fishing, hunting, photography, or other wildlife pursuits, wildlife recreation also contributes millions of dollars to local economies. In 2002, approximately 35.5 million people visited a national wildlife refuge, mostly to observe wildlife in their natural habitats. Visitors are most often accommodated through nature trails, auto tours, interpretive programs, and hunting and fishing opportunities. Significant economic benefits are being generated to the local communities that surround the refuges. Economists have reported that national wildlife refuge visitors contribute more than $792 million annually to local economies.

Ecosystem Description and Threats

The Souris River basin lies near the junction of two ecosystems currently defined by the Service as the Mississippi headwaters/tall-grass prairie and main stem Missouri River ecosystems. However, neither ecosystem, as defined and delineated, includes or adequately describes the Souris River basin area.

The Souris River basin is 15–80 miles north of a continental divide formed by a major moraine, the Missouri Coteau. Drainage of the basin is neither east–southeast toward the Mississippi River nor south toward the Missouri River. Instead, the basin drains north into the Assiniboine River–Red River–Hudson Bay system. Furthermore, the Souris River basin area is mixed-grass prairie, not tall-grass prairie. The area is characterized here more appropriately as the Hudson Bay headwaters/ mixed-grass prairie ecosystem (figure 2).

In the United States, the Hudson Bay headwaters/ mixed-grass prairie ecosystem includes north-central North Dakota north of the Missouri Coteau and east to the edge of the Red River Valley. In Canada, it includes southern Manitoba and

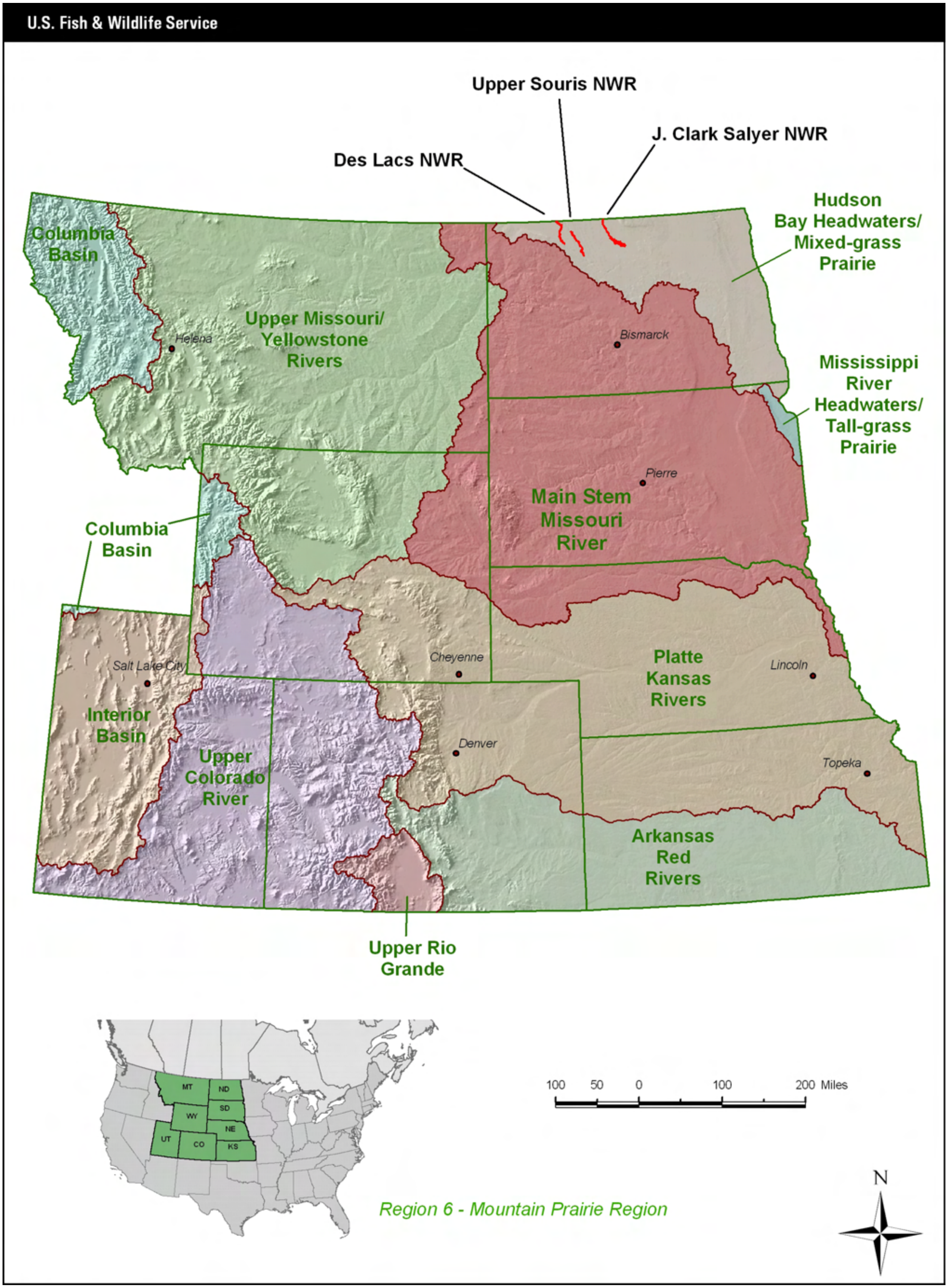


Figure 2. Ecosystem map.

southeastern Saskatchewan. The Souris River basin lies within a major physiographic subregion known as the "Drift Plain," which generally is characterized by flat to gently rolling, moderately deep, loamy soils that originated from glacial till. The basin is at the center of North America's extensive "Prairie Pothole Region," which annually produces 20–25% of the continent's ducks and geese.

Until widespread cultivation of prairie soils beginning nearly a century ago, the major ecological community of the Hudson Bay headwaters/mixed-grass prairie ecosystem was northern mixed-grass prairie. Characteristic plants were grasses, especially needlegrasses, wheatgrasses, and big bluestem. Bur oak and quaking aspen dominated the Turtle Mountains, along the present-day Manitoba border. Woodland also occurred along much of the Souris River; some stunted bur oak and aspen was scattered among sandhills of present-day McHenry County (includes the southern one-third of J. Clark Salyer NWR); patches of trees and shrubs were infrequently encountered at Des Lacs NWR; and woody vegetation was rare elsewhere.

The contemporary landscape of the Souris River basin is dominated by annually tilled cropland (figure 3). Major crops include cereal grains, principally wheat, and various oilseeds. Some cropland areas classified as "highly erodible" have been seeded to perennial, herbaceous cover ("old cropland in seeded herbaceous cover" in figure 3) under the U.S. Department of Agriculture's (USDA) Conservation Reserve Program (CRP). Hay is harvested from seeded upland areas once annually, usually in early to mid-summer. Native meadows along the Souris River also supply annual hay crops. In addition, some seasonally flooded wetland basins supply hay (typically late summer). There is almost no irrigated cropland. Ranching for beef cattle (usually cow–calf operations) is common locally, especially in the hilly, sandy area of McHenry County (the southeastern part of the basin) and along the lower half of the Souris River.

Population growth is not an important issue in the area. Rural towns are small (populations are typically less than 1,000) and widely scattered. Most people are concentrated in the south-central part of the area—in a small city (Minot) and the nearby Minot Air Force base, totaling about 40,000 people.

Major threats to the ecosystem's natural resources mostly are related to agriculture. Before Euro-American settlement, the basin was a vast mosaic of prairie and broad, shallow wetlands. Most of this landscape has been drained and cultivated to produce crops. Elevated levels of wind- and waterborne sediments enter the Souris and Des Lacs rivers via intermittent streams. This sedimentation is a major threat to the ecological function and biodiversity of riverine wetlands. Scientists currently are assessing the magnitude of this threat.

Pesticides are widely used in the area, especially for oil seed crops, and may enter the rivers along with heavy metals and other contaminants.

Invasion by introduced and woody plant species is a major threat to the area. Trees and tall shrubs have expanded, fragmenting most remnant prairie that provides breeding habitat for grassland birds (most of which are exhibiting continental population declines). Leafy spurge has garnered most attention in the area as a noxious weed species of management concern. However, smooth brome (an introduced grass) probably is the most significant, long-term threat to the floristic diversity of remnant native prairies in the area.

The ecological function and productivity of the Souris River is significantly compromised by three major dams along its course. Historically, the Souris River was a broad, temporally dynamic river, heavily braided along much of its course in present-day North Dakota. The meandering main river channel often was indistinct, characterized by overbank flooding and the development of oxbow ponds. Today, the river system is more static than dynamic. A major reservoir occurs behind a dam at Upper Souris NWR. Water levels of this reservoir have been largely regulated for flood control and water storage. However, the timing of water releases from this and upstream reservoirs does not coincide with that of historical spring flood events, with negative implications for nesting by migratory birds downstream. Much of the mid-river section is channelized. Natural processes such as streambed scouring and silt transport are inhibited.

National and Regional Mandates

This section presents highlights of legal mandates, Service policy, and existing resource plans that directly influenced development of this CCP.

Refuges are managed to achieve the mission and goals of the Refuge System and the designated purpose of the refuge unit as described in establishing legislation or executive orders, or other establishing documents. Key concepts and guidance of the Refuge System are provided in the National Wildlife Refuge System Administration Act of 1966 (Administration Act), Title 50 of the "Code of Federal Regulations," "The Fish and Wildlife Service Manual" and most recently through the Refuge System Improvement Act of 1997.

The Improvement Act amends the Administration Act by providing a unifying mission for the Refuge System, a new process for determining compatible public uses at refuges and a requirement that each refuge will be managed under a CCP. The Improvement Act states that wildlife conservation

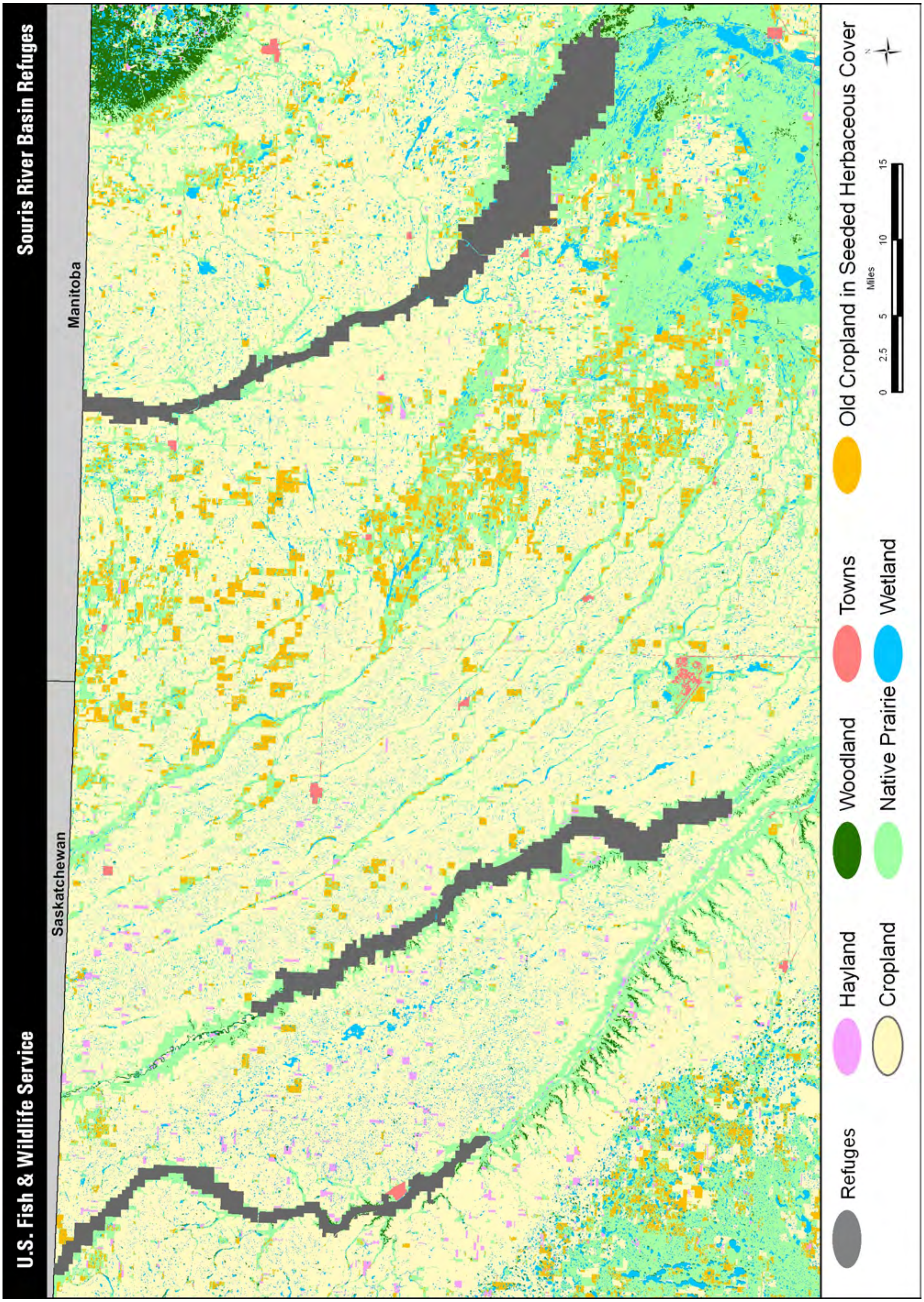


Figure 3. Landscape of the Souris River basin in north-central North Dakota (Des Lacs NWR, Upper Souris NWR, and J. Clark Salyer NWR are represented west to east by long, gray polygons).

is the priority of Refuge System lands and that the Secretary of the Interior will ensure that the biological integrity, diversity, and environmental health of refuge lands are maintained. Each refuge must be managed to fulfill the Refuge System mission and the specific purposes for which it was established. The Improvement Act requires the Service to monitor the status and trends of fish, wildlife, and plants at each refuge.

The Improvement Act declares that compatible wildlife-dependent recreational uses are legitimate and appropriate, priority public uses of the Refuge System. Six uses (hunting, fishing, wildlife observation and photography, and environmental education and interpretation) are to receive special consideration, in planning and management, more than all other general public uses of the Refuge System.

A detailed list of these and other laws and executive orders that may affect the Souris River basin refuges' CCP or the Service's implementation of the CCP is provided in appendix A.

Service policies providing guidance on planning and the day-to-day management of a refuge are contained within the "National Wildlife Refuge System Manual" and "The Fish and Wildlife Service Manual."

Refuge Contributions to National and Regional Plans

The Souris River basin refuges contribute to the conservation efforts described here.

Fulfilling the Promise

A 1999 report, "Fulfilling the Promise, The National Wildlife Refuge System" (U.S. Fish and Wildlife Service [USFWS] 1999), is the culmination of a year-long process by teams of Service employees to evaluate the Refuge System nationwide. This report was the focus of the first national Refuge System conference (in 1998)—attended by refuge managers, other Service employees, and representatives from leading conservation organizations.

The report contains 42 recommendations packaged with three vision statements dealing with wildlife and habitat, people, and leadership. This CCP deals with all three of these major topics, and the planning team looked to the recommendations in the document for guidance throughout the plan.

Partners in Flight, Conservation of the Land Birds of the United States: Northern Mixed-grass Prairie

The "Partners in Flight Program" began in 1990 with the recognition of declining population levels of many migratory bird species. The challenge, according to the program, is managing human population growth while maintaining functional natural ecosystems. To meet this challenge, Partners in Flight worked to identify priority, land bird species and habitat types. Partners in Flight activity has resulted in 52 bird conservation plans covering the continental United States.

The primary goal of Partners in Flight is to provide for the long-term health of the bird life 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 priority is to "keep common birds common."

There are 58 physiographic areas, defined by similar physical geographic features, wholly or partially contained within the contiguous United States and several others wholly or partially in Alaska. The Souris River basin refuges lie within the northern mixed-grass prairie, which is physiographic area 37 (figure 4).

The area includes almost the entire eastern half of South Dakota and central North Dakota, from the Red River Valley on the east, to the Missouri River and Montana border on the south and west. In Canada, it includes a small portion of southern Manitoba and a swath that crosses Saskatchewan and extends into Alberta. The southern edge of this physiographic area is the terminus of a glacial moraine parallel to the course of the nearby Missouri River. To the north, prairie gives way to aspen parkland.

Precipitation declines and evaporation rates increase from east to west across the northern mixed-grass prairie, resulting in differences in the height of dominant grasses. To the east, the mixed grass begins as topography rises out of the tall-grass prairie of the Red River Valley. Grass height gradually decreases toward the western boundary of this physiographic area.

Because of the glacial history of the northern mixed-grass prairie and the relationship between precipitation and evapotranspiration, the area is dotted with thousands of depressions that range from permanently to periodically wet. This area is known as the Prairie Pothole Region. Internally, the various moraines are particularly rugged and marked by potholes.

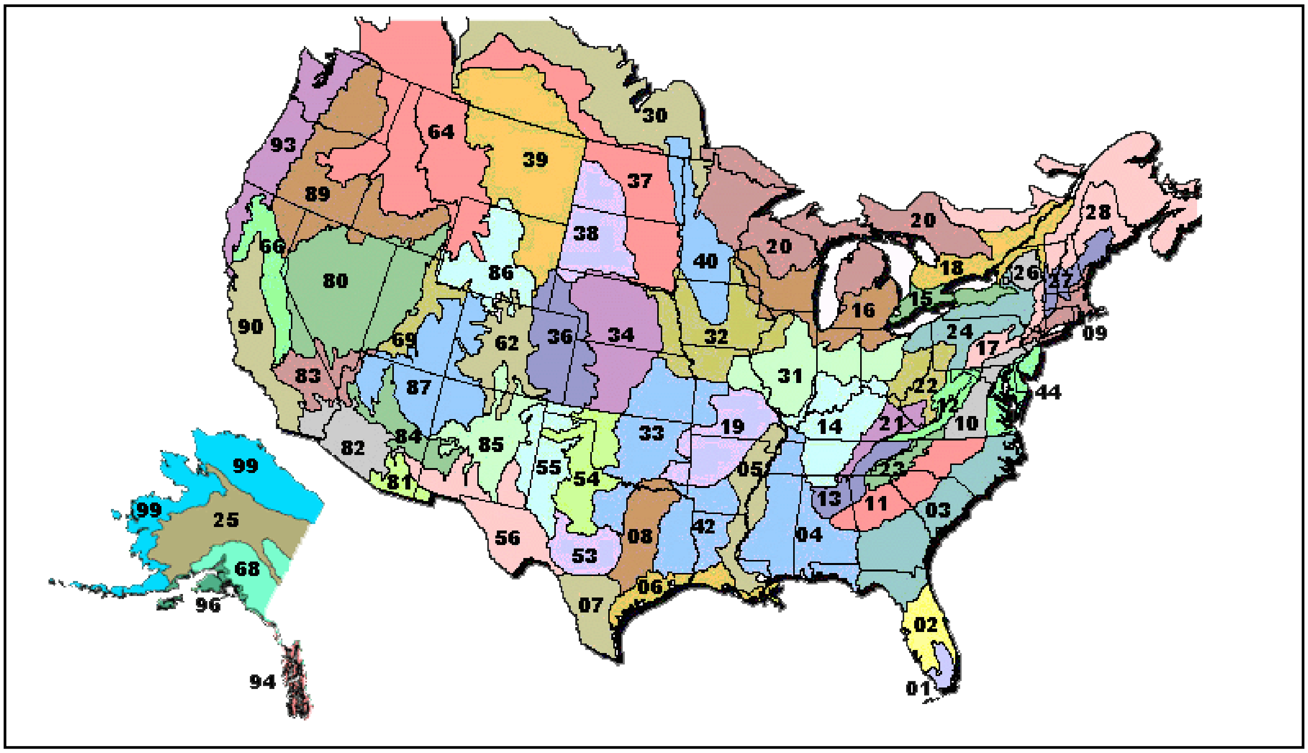


Figure 4. Physiographic areas of the United States.

Priority bird species and habitats of the northern mixed-grass prairie include the following:

Grassland

Baird's sparrow
greater prairie-chicken
McCown's longspur
Sprague's pipit
Le Conte's sparrow

Wetland

yellow rail
Nelson's sharp-tailed sparrow
marbled godwit

Riparian Woodland

Bell's vireo

River Sandbars

piping plover
waterfowl
shorebirds

Several high-priority species of shorebirds breed in the northern mixed-grass prairie, and huge numbers of more northerly breeding bird species pass through during migration. This includes most of the global population of very high-priority species such as buff-breasted sandpiper and Hudsonian godwit.

Lee Karney/USFWS

Marbled Godwit

Maintenance of large, unfragmented, grassland ecosystems is the conservation objective for areas such as the Missouri Coteau where agriculture is not dominant. On the drift prairie and other agricultural areas, conservation of discrete blocks of grassland–wetland complexes is recommended.

North American Waterfowl Management Plan

The "North American Waterfowl Management Plan" (NAWMP) was originally written in 1986. The plan envisioned a 15-year effort to achieve landscape conditions that could sustain waterfowl populations. Specific NAWMP objectives are to increase and restore duck populations to the average levels of the 1970s—62 million breeding ducks and a fall flight of 100 million birds.

By 1985, waterfowl populations had plummeted to record lows. Habitat that waterfowl depend on was disappearing at a rate of 60 acres per hour. Recognizing the importance of waterfowl and wetlands to North Americans and the need for international cooperation to help in the recovery of a shared resource, the United States and Canadian governments developed a strategy to restore waterfowl populations through habitat protection, restoration, and enhancement. Mexico became a signatory to the plan in 1994.

The plan is innovative because its international scope, plus its implementation at the regional level. Its success depends on the strength of partnerships called "joint ventures," involving federal, state, provincial, tribal, and local governments; businesses; conservation organizations; and individual citizens.

Joint ventures are regionally based, self-directed partnerships that carry out science-based conservation through a wide array of community participation. Joint ventures develop implementation plans focusing on areas of concern identified in the plan.

To date, the NAWMP contains 12 habitat joint ventures and 2 species joint ventures with a wide variety of public and private partners. As of the end of 2003, plan partners have invested more than $3.2 billion to protect, restore, or enhance more than 13.1 million acres of habitat. The Souris River basin refuges lie within the "Prairie Pothole Joint Venture" (PPJV).

Prairie Pothole Joint Venture Implementation Plan

The Prairie Pothole Region remains the most important waterfowl-producing region on the continent, generating more than half of North America's ducks. Nearly 15% of the continental waterfowl population comes from the PPJV region (Montana, the Dakotas, Minnesota, and Iowa). As many as 10 million ducks and 2 million geese use this region during migration or for nesting. The wetlands and associated grassland in the PPJV region provide breeding habitat to more than 200 species of migratory birds.

The PPJV implementation plan was prepared in 2005, and outlined a mission, vision, goals, objectives, and strategies for joint venture activities. Individual state action groups and steering committees prepared state action plans that "stepped down" joint venture activities to the state and local level.

The goal of the PPJV is to increase waterfowl populations through habitat conservation projects that improve natural diversity across the prairie pothole landscape of the United States. The joint venture attempts to carry out landscape-level habitat projects so that waterfowl populations increase during the wet years and stabilize under moderate wetland conditions. Since little can be done to stabilize breeding populations across the Prairie Pothole Region during extended drought, joint venture strategies are designed to carry out actions that take advantage of years when precipitation is at least normal.

Wetland Protection Objective
Protect in perpetuity 1.4 million acres of high-priority wetlands at risk, including 1.2 million acres through perpetual easements and 200,000 acres through fee-title acquisitions.

Grassland Protection Objective
Protect in perpetuity 10.4 million acres of priority (over 55 acres in size) native prairie, including 10 million acres through perpetual easements and 400,000 acres through fee-title acquisitions.

Wetland Restoration Objective
Restore wetlands sufficient to carry an additional 492,000 total breeding duck pairs over the capacities identified in table 1 of the "Prairie Pothole Joint Venture 2005 Implementation Plan, Section II—Waterfowl Plan."

Grassland Restoration Objective
Restore 393,000 acres of grasslands associated with high-density wetland communities.

Recovery Plans for Federally Listed Threatened or Endangered Species

Where federally listed threatened or endangered species occur at the Souris River basin refuges, management goals and strategies in their respective recovery plans will be followed. The list of threatened or endangered species that occur on the refuges will change as species are listed or delisted, or as listed species are discovered on refuge lands.

At the time of plan approval, Upper Souris NWR is following the draft recovery plan for piping plovers in the northern Great Plains (USFWS 1994). Lake Darling at Upper Souris NWR is within the area as designated critical habitat for the federally listed piping plover.

Edward Henry/USFWS

Piping Plover

State Wildlife Grants Program

Over the past several decades, documented declines of wildlife populations have occurred nationwide. The

State Wildlife Grant (SWG) program was created by Congress in 2001. This program provides states and territories with federal dollars to support conservation aimed at preventing wildlife from becoming endangered and in need of protection under the Endangered Species Act. The SWG program represents an ambitious endeavor to take an active hand in keeping species from becoming threatened or endangered in the future.

According to the SWG program, each state, territory, and the District of Columbia must complete a comprehensive wildlife conservation strategy (CWCS) by October 1, 2005 to receive future funding.

These strategies will help define an integrated approach to the stewardship of all wildlife species, with additional emphasis on species of concern and habitats at risk. The goal is to shift focus from single species management and highly specialized individual efforts to a geographically based, landscape-oriented, fish and wildlife conservation effort. The Service approves CWCSs and administers SWG program funding.

The State of North Dakota CWCS was reviewed and information was used during development of the CCP. The goals and objectives of the State of North Dakota CWCS are supported by the CCP through implementation of habitat goals and objectives.

The Planning Process

This draft CCP and EA for the three Souris River basin refuges are intended to comply with the Improvement Act, the NEPA, and the implementing regulations of the acts. The Service's policy establishes requirements and guidance for Refuge System planning, including CCPs and step-down management plans to ensure that planning efforts comply with the Improvement Act. The planning policy identifies several steps of the CCP and EA process (also see figure 5):

- Form a planning team and conduct preplanning.
- Initiate public involvement and scoping.
- Draft the vision statement and goals.
- Develop and analyze alternatives, including the proposed action.
- Prepare the draft CCP and EA.
- Prepare and adopt the final CCP and EA and issue a "finding of no significant impact" (FONSI) or determine if an environmental impact statement is needed.
- Implement the CCP; monitor and evaluate.
- Review the CCP every 5 years and revise it every 15 years.

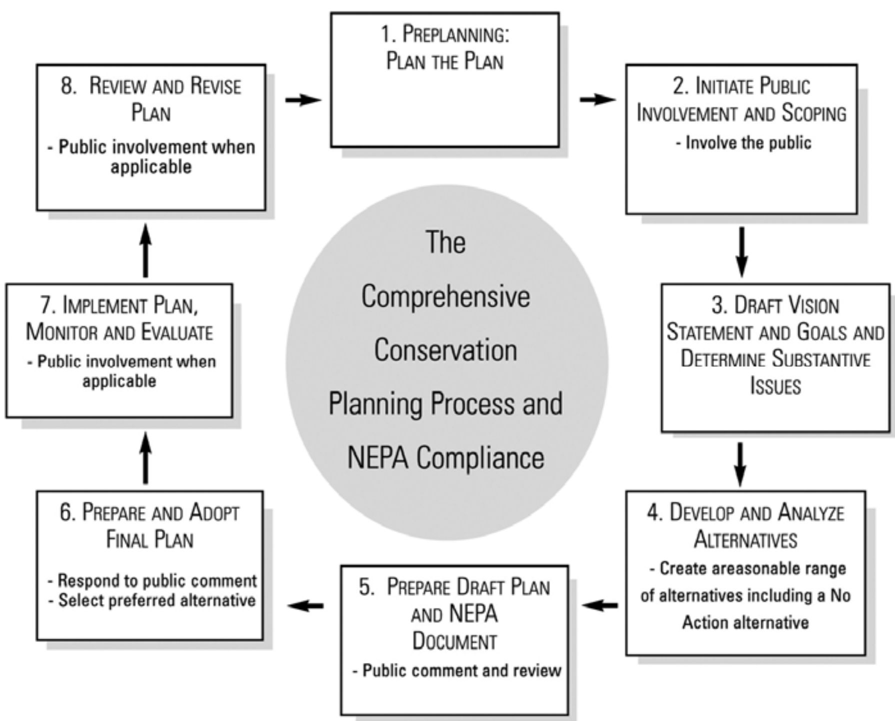


Figure 5. The planning process.

Table 1 displays the details of the planning process to date for this draft CCP and EA. The Service began the preplanning process for the refuges in June 2002. A planning team was developed shortly after an initial kickoff meeting, which included the following team members:

- Service personnel from the refuges and division of refuge planning (region 6, Lakewood, Colorado)
- personnel from NDGF
- personnel from the U.S. Geographical Survey's (USGS) biological resources division

A list of planning team members and other major contributors to development of this document are found in appendix B. Several items were addressed during preplanning including the development of a mailing list, planning schedule, and public involvement plan. Internal scoping was conducted by identifying refuge qualities and issues over a course of several meetings.

Table 1. Planning process summary for the Souris River basin refuges, North Dakota.

Date	*Event*	*Outcome*
June 3–6, 2002	CCP kickoff meeting	Toured refuges. Kickoff meeting (CCP overview; establishment of planning team; identified purpose of the refuges, history, and establishing authority; developed planning schedule).
January 2003	NOI (to prepare the CCP) published in "Federal Register"	Notified the public of the upcoming preparation of the CCP.
January 14–15, 2003	Vision and goals workshop	Conducted internal scoping by developing initial issues and qualities lists. Developed a vision statement and goals.
March 18–20, 2003	News releases for public meetings sent to local newspapers, and radio and television stations	Notified public of opportunities for involvement in the CCP process.
March 24, 2003	Public open house in Mohall, ND	Opportunity for public to learn about the CCP.
March 25, 2003	Public open house in Bowbells, ND	Opportunity for public to learn about the CCP.
March 26, 2003	Public open houses in Bottineau and Kenmare, ND	Opportunity for public to learn about the CCP.
March 27, 2003	Public open houses in Towner and Minot, ND	Opportunity for public to learn about the CCP.
March 2003	Site visit to refuges by USGS–Northern Prairie Wildlife Research Center	Toured refuges. Met with refuge staff. Collected data for assessment of wetland conditions at the refuges.
April 2003	Site visit to refuges by Fort Collins Science Center, policy analysis science assistance branch	USGS researchers met with refuge staff to understand refuge needs, visitation, and management issues to design a public use survey.
August 2003–August 2004	Survey distributed to refuge visitors	Conducted research to assess (1) visitor experience, perceptions, and preferences, and (2) visitor spending in relation to recreation.

Table 1. Planning process summary for the Souris River basin refuges, North Dakota.

Date	*Event*	*Outcome*
September 2–4, 2003	Wetlands biological workshop; field assessment	Planning team toured refuges with representatives from Northern Prairie Wildlife Research Center and discussed wetland conditions.
December 2003	Assessment of wetland conditions	Report issued by USGS–Northern Prairie Wildlife Research Center: "A Biological Assessment of Wetland Conditions on the Souris River National Wildlife Refuges."
January 25–26, 2005	Alternatives workshop	Developed a range of alternatives for the refuges.
March 15–16, 2005	Environmental consequences workshop and identification of the proposed action	Reviewed the anticipated environmental consequences. Identified alternative B as the proposed action.
May 26, 2005	Objectives workshop	Reviewed the proposed objectives, strategies, and rationale for implementation of the proposed action (draft CCP).
June 2006	Internal review of draft CCP and EA	Received comments on the draft CCP and EA.
Summer 2006	Release of draft CCP and EA for public review	Received comments on the revised draft CCP and EA.
Summer 2006	Public open houses	Increased public understanding of the draft CCP and EA. Received public comments about the draft CCP and EA.

Coordination with the Public

Public scoping began January 17, 2003, with publication in the "Federal Register" of the notice of intent (NOI) to prepare CCPs and associated environmental documents for the three refuges.

A mailing list of more than 220 names was created and includes private citizens; local, regional, and state government representatives and legislators; other federal agencies; and nonprofit organizations (see appendix C).

In March 2003, a planning update was sent to each individual on the mailing list. Information was provided on the history of the Refuge System and the CCP process, along with a schedule of and invitation to upcoming open houses. Open houses were announced in local newspapers, on radio stations, and on television stations. Flyers were posted at local businesses throughout the region. Announcements were made at local organizations including, Minot City Council, Bottineau County Wildlife Club, and Rotary Club meetings.

Six open houses were held March 24–27, 2003. At each meeting, the CCP planner or refuge personnel gave a presentation on the history of the program along with an overview of the CCP and NEPA processes. Attendees were encouraged to ask questions and offer comments. Attendees were invited to submit additional thoughts or questions in writing and each was given a two-page comment form to complete. The turnout was mixed, from a few attendees to 18 individuals at a single-refuge meeting.

In addition to scoping meetings, postage-paid comment forms were sent to everyone on the mailing list with an April 30, 2003 response deadline.

A second planning update (with comment form) was sent to each individual on the mailing list in November 2003. This update provided information on the ongoing public involvement effort and a summary of the public comments received during the open houses.

Input obtained from open houses and planning updates was considered in developing this draft CCP and EA.

State Coordination

In July 2002, an invitation letter to participate in the CCP process was sent by the Service's regional director (region 6), to the director of the NDGF. Local NDGF wildlife managers and refuge staff maintain excellent and ongoing working relations that precede the start of the CCP process. An NDGF representative is part of the core CCP planning team and has been a participant in each workshop. The NDGF's mission is to "protect, conserve, and enhance fish and wildlife populations and their habitats for sustained public consumptive and nonconsumptive uses." The NDGF is responsible for managing natural resource lands owned by the state, in addition to enforcement responsibilities for the state's fish, wildlife, and endangered species. The state currently manages about 78,000 acres in support of wildlife, recreation, and fisheries.

In November 2002, an invitation letter to participate in the CCP process was sent by the regional director to the state engineer of the North Dakota State Water Commission. A commission representative is part of the CCP planning team, but has not been a participant in the planning workshops. The commission will provide input through review of the CCP documents.

The refuge managers initially contacted elected officials in January 2003. They were contacted again via two planning updates that provided information on the CCP process, outlined the public meeting schedule, and included a summary of public comments received.

Coordination with other Federal Agencies

In July 2002, an invitation letter to participate in the CCP process was sent by the Service's regional director to the colonel of the St. Paul District of the U.S. Army Corps of Engineers (USACE). A representative was assigned to the core planning team. Input has been provided to the CCP through attendance at planning workshops and review of planning documents.

Tribal Coordination

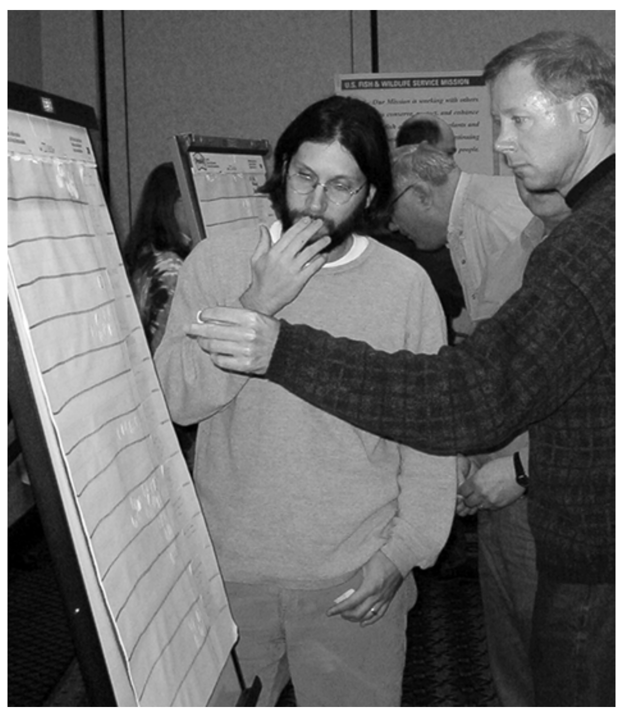
On July 26, 2002, six Native American tribal governments in North Dakota and South Dakota (Sisseton–Wahpeton Sioux, Spirit Lake Tribal Council, Standing Rock Sioux, Three Affiliated Tribes [Mandan, Hidatsa, and Arikara], Fort Peck Tribal Executive Board, and the Turtle Mountain Band of Chippewa) were contacted through a letter from the Service's regional director. The letter provided information about the upcoming CCP and invited recipients to serve on the core planning team. Responses were as follows:

- The Service received a response from the chair of the Turtle Mountain Band of Chippewas and a tribal representative was assigned to the planning team. Tribal input has been obtained through the review of CCP documents.
- The Service also received a response from the Three Affiliated Tribes and two tribal representatives were assigned to the planning team. A tribal representative attended the vision and goals workshop. Additional input was obtained through review of CCP documents.

Results of Scoping

Comments collected from scoping meetings and correspondence were used to help develop key issues. The planning team determined which alternatives could most appropriately address these issues.

The proposed action alternative formed the basis for the draft CCP, with its objectives and strategies to achieve the goals developed by the planning team. This process ensures that key issues are resolved or given priority over the life of this CCP. Chapter 2 provides a summary of these issues and the associated resource ramifications.


USFWS

The Service received 57 comments during scoping.

Decision to be Made

The decision to be made by the Service's regional director is the selection of an alternative that will be carried out as the CCP for the Souris River basin refuges. This decision will be made in recognition of the environmental effects of each alternative considered. The decision will be disclosed in a FONSI included in the final CCP. Implementation of the CCP will begin on signature and publication of the final CCP.

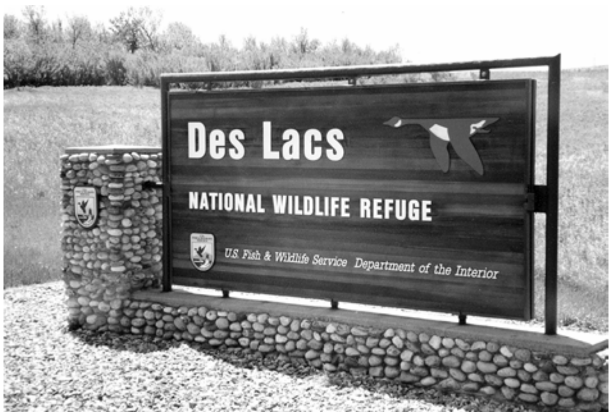
The CCP

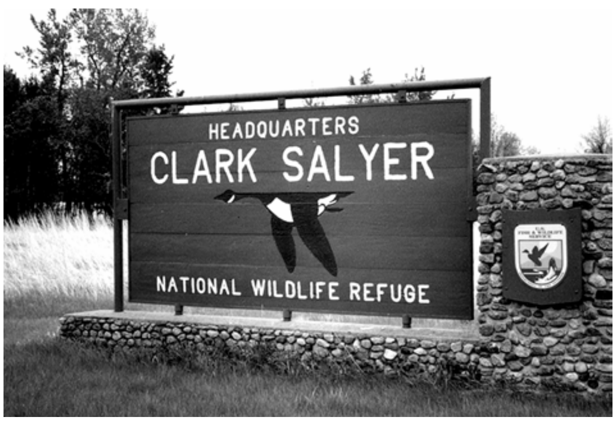
- provides long-term guidance for management decisions;
- sets forth goals, objectives, and strategies needed to accomplish the purpose of the refuges;
- identifies the Service's best estimate of future needs.

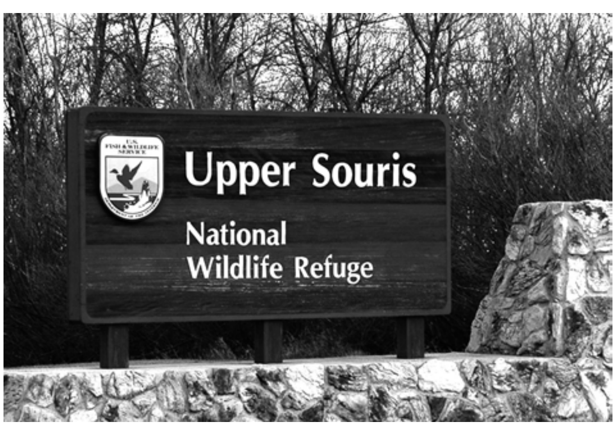
The draft CCP details program-planning levels that are sometimes substantially above current budget allocations and, as such, are primarily for Service strategic planning purposes. This CCP does not constitute a commitment for staffing increases, operational and maintenance increases, or funding for future land acquisition.

2 The Refuges

The three Souris River basin refuges were established by executive order in 1935.







The Des Lacs Migratory Waterfowl Refuge (later renamed "Des Lacs National Wildlife Refuge") was established by Executive Order (EO) 7154-A (figure 6).

> *By virtue of and pursuant to the authority vested in me as President of the United States, and in order to further the purposes of Migratory Bird Conservation Act (45 Stat. 1222), it is ordered that the following-described lands, acquired or to be acquired by the United States, in Burke and Ward Counties, North Dakota, consisting of 24,100 acres, more or less, be, and they are hereby, reserved and set apart for the use of the Department of Agriculture, subject to valid existing rights, as a refuge and breeding ground for migratory birds and other wildlife: Provided, that any private lands within the areas described shall become a part of the refuge hereby established upon the acquisition of title or lease thereto by the United States: (legal description of land) … This refuge shall be known as the Des Lacs Migratory Waterfowl Refuge.*
>
> —Franklin D. Roosevelt, August 22, 1935

The Lower Souris Migratory Waterfowl Refuge (later renamed "J. Clark Salyer National Wildlife Refuge") was established by EO 7170 (figure 7).

> *By virtue of and pursuant to the authority vested in me as President of the United States, and in order to further the purposes of Migratory Bird Conservation Act (45 Stat. 1222), it is ordered that the following-described lands, acquired or to be acquired by the United States, in Bottineau and McHenry Counties, North Dakota, consisting of 40,000 acres, more or less, be, and they are hereby, reserved and set apart for the use of the Department of Agriculture, subject to valid existing rights, as a refuge and breeding ground for migratory birds and other wildlife: Provided, that any private lands within the areas described shall become a part of the refuge hereby established upon the acquisition of title or lease thereto by the United States: (legal description of land) … This refuge shall be known as the Lower Souris Migratory Waterfowl Refuge.*
>
> —Franklin D. Roosevelt, September 4, 1935

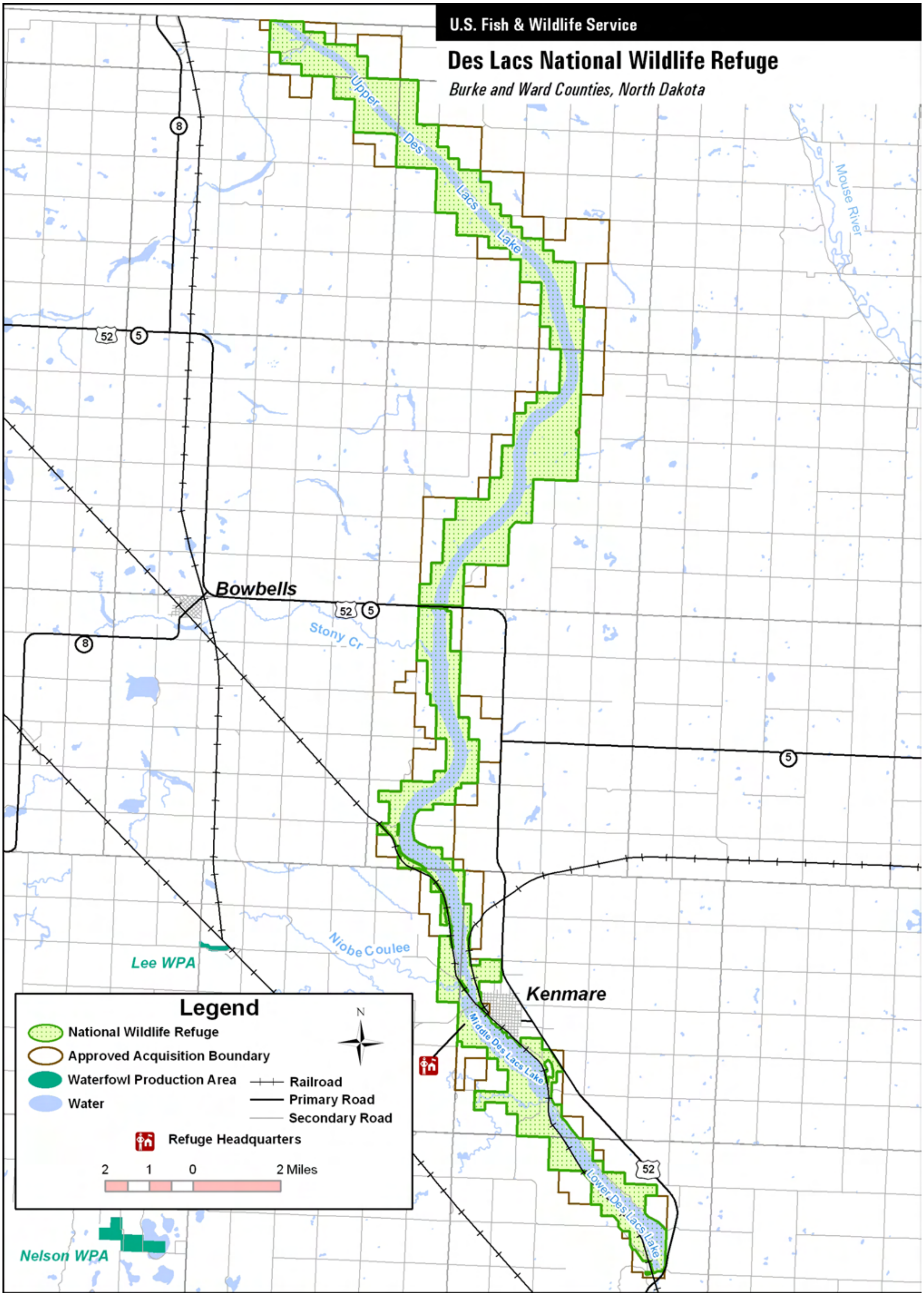


Figure 6. Base map for Des Lacs NWR, North Dakota.

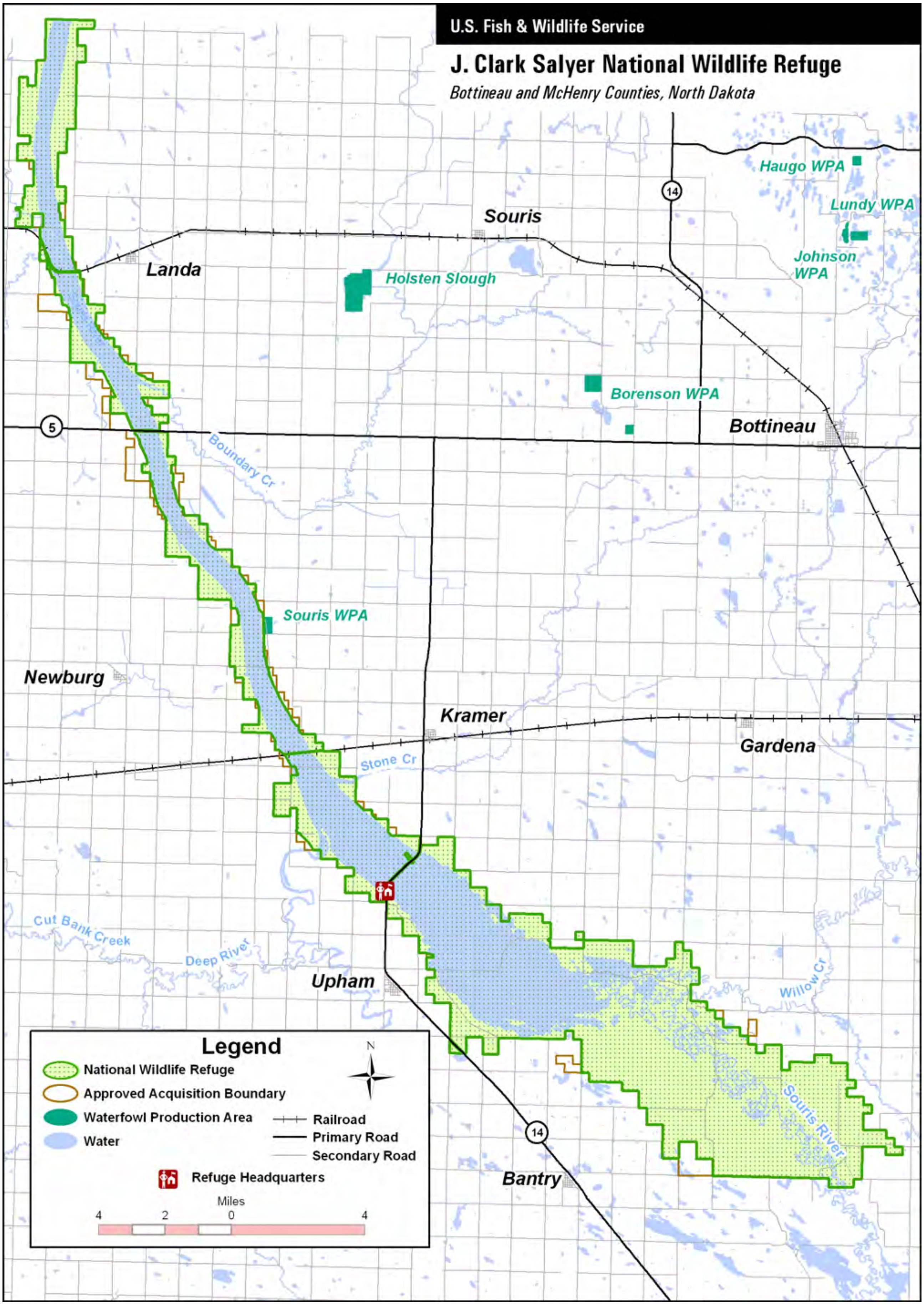


Figure 7. Base map for J. Clark Salyer NWR, North Dakota.

The Upper Souris Migratory Waterfowl Refuge (later renamed "Upper Souris National Wildlife Refuge") was established by EO 7161 (figure 8).

> *By virtue of and pursuant to the authority vested in me as President of the United States, and in order to further the purposes of Migratory Bird Conservation Act (45 Stat. 1222), it is ordered that the following-described lands, acquired or to be acquired by the United States, in Renville and Ward Counties, North Dakota, consisting of 40,000 acres, more or less, be, and they are hereby, reserved and set apart for the use of the Department of Agriculture, subject to valid existing rights, as a refuge and breeding ground for migratory birds and other wildlife: Provided, that any private lands within the areas described shall become a part of the refuge hereby established upon the acquisition of title or lease thereto by the United States: (legal description of land) … This refuge shall be known as the Upper Souris Migratory Waterfowl Refuge.*
>
> —Franklin D. Roosevelt, August 27, 1935

PURPOSE

Refuge System lands have been acquired under a variety of legislative acts and administrative orders. The transfer and acquisition authorities used to obtain the lands usually have one or more purposes for which land can be transferred or acquired. Over time, an individual refuge may contain lands that have been acquired under a variety of transfer and acquisition authorities with different purposes.

As stated in the executive orders, the purpose of all three Souris River basin refuges is for a "refuge and breeding ground for migratory birds and other wildlife."

VISION AND GOALS

During the early stages of the planning process, the planning team developed a vision statement for the refuges. The vision describes what the refuges will be, or what the Service hopes to do, and is based primarily on the Refuge System mission and specific purpose of each refuge.

The vision statement was presented to the public during open houses. The vision is a future-oriented statement designed to be achieved through refuge management by the end of the 15-year CCP planning horizon.

Vision

> *From Paleo-Indians on the tails of the Ice Age—to the Assiniboine and Chippewa, early fur trappers, explorers, and naturalists; eminent bison herds and astoundingly abundant bird life; fires stretching for miles to revitalize treeless prairie; and determined homesteaders and vanquished farms of the Dust Bowl era…*
>
> *The Souris River basin figures prominently in the cultural and natural history of midcontinent North America's plains and prairies. Three national wildlife refuges of the Souris River basin—Des Lacs, J. Clark Salyer, and Upper Souris—will conserve much of the ecology and natural character of the northern plains region while helping sustain populations of migratory birds and other wildlife native to the landscape.*
>
> *The refuges will create a sense of awe and wonder by providing an array of wildlife-dependent recreational and educational experiences that enhance visitor awareness of the splendid natural and cultural heritage of the northern plains.*
>
> *Functioning as integral parts of the ecosystems and human communities to which they belong, the Souris River basin refuges will seek collaborative partnerships to attain common goals.*
>
> *A diverse and passionate refuge workforce will rely on sound science to understand and restore or emulate natural processes essential to the integrity and perpetuation of major biological communities with which the refuges are entrusted.*

The planning team developed a set of goals for the refuges based on the Improvement Act and information developed during project planning. The goals direct work toward achieving the vision and purpose of the refuges, and outline approaches for managing resources. Some goals apply to all three refuges, while other goals apply to only one or two of the three refuges based on occurrence of habitat types.

Drift Prairie Goal

Restore and maintain extensive examples of plant communities dominated by native flora characteristic of the mid-1800s drift prairie. Create the temporally and spatially dynamic habitat conditions that will attract most breeding bird species and other vertebrate fauna characteristic of that era. *(Applies to all three Souris River basin refuges.)*

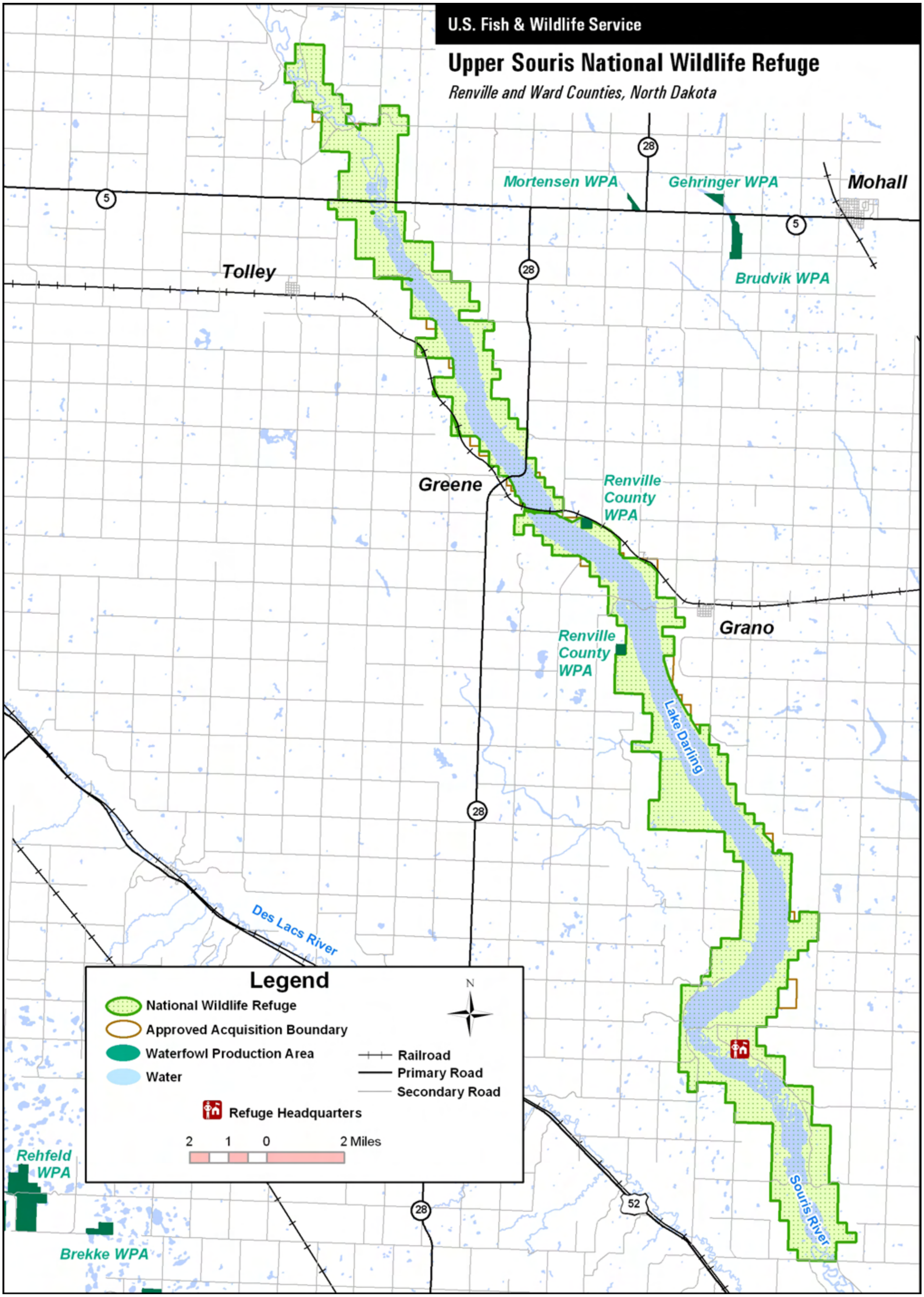


Figure 8. Base map for Upper Souris NWR, North Dakota.

Prairie Slope Goal

Restore representative examples of prairie slopes to preserve some of the most pristine plant communities that remain in the Souris River basin and promote appreciation and stewardship of prairie resources.
(Applies to all three Souris River basin refuges.)

Prairie Parkland Goal

Restore and maintain extensive examples of plant communities characteristic of the mid-1800s prairie parkland. Create the temporally and spatially dynamic habitat conditions that will attract most breeding bird species and other vertebrate fauna characteristic of that era.
(Applies only to J. Clark Salyer NWR.)

Sandhills Goal

Restore and maintain plant communities characteristic of the mid-1800s sandhills within the prairie parkland landscape.
(Applies only to J. Clark Salyer NWR.)

Old Cropland Goal

On high-priority old cropland areas, establish native-dominated, perennial herbaceous cover that, with modest management, resists invasion by introduced cool-season grasses and noxious weeds. This seeded cover will help form extensive, contiguous blocks of structurally diverse, open grassland for grassland-dependent, breeding bird species.
(Applies to all three Souris River basin refuges.)

Coulee Woodland and Coulee Woodland Edge Goal

Acknowledge a nearly irreversible, localized establishment of mature, contiguous woodland and minimally manage these areas as breeding and migration habitat principally for forest-interior, migratory bird species such as veery and ovenbird. Strive to eliminate remaining, noncontiguous, edge-dominated tree and tall shrub cover, particularly near high-priority drift prairie and the largest, most contiguous grassland tracts.
(Applies only to Des Lacs NWR and Upper Souris NWR.)

Riparian Woodland Goal

Maintain the approximate presettlement extent of green ash–American elm riparian woodland within the floodplain of the Souris River to benefit a broad suite of woodland-associated, breeding bird species.
(Applies only to J. Clark Salyer NWR and Upper Souris NWR.)

Meadow Goal

Restore and maintain extensive examples of plant communities dominated by native flora characteristic of seasonally flooded meadows within the Souris River floodplain to attract grassland- and wetland-dependent bird species and other wildlife.
(Applies to all three Souris River basin refuges.)

Wetland Goal

Manage riverine wetlands, including marshes and lakes, to sustain the long-term capacity of riverine wetlands to support diverse plant and wildlife communities. Restore ecological processes that sustain long-term productivity of wetlands.
(Applies to all three Souris River basin refuges.)

Island Goal

Manage islands to attract waterfowl and increase nest survival, especially during drought years when wetland habitat outside of the Souris River basin refuges is limited.
(Applies to all three Souris River basin refuges).

Cultural Resource Goal

Discover and protect cultural resources and interpret sites when the interpretation does not adversely affect habitat management.
(Applies to all three Souris River basin refuges.)

Visitor Service Goal

Provide wildlife-dependent recreational opportunities to a diverse audience when the administration of these programs does not adversely affect wildlife and habitat management.
(Applies to all three Souris River basin refuges.)

Research and Science Goal

Conduct innovative natural resource management using sound science and applied research to advance the understanding of natural resource function and management within the northern Great Plains.
(Applies to all three Souris River basin refuges.)

Operations Goal

Efficiently use funding and staffing for the benefit of all natural and cultural resources, the National Wildlife Refuge System, and present and future generations. Effectively manage visitor service programs that complement habitat management.
(Applies to all three Souris River basin refuges.)

Special Values

During the vision and goals workshop, the planning team identified the outstanding qualities of the refuges. Qualities are the characteristics and features that make the areas special and worthy of refuge status.

The Souris River basin refuges

- preserve a large component of the natural environment totaling 110,220 acres;
- provide breeding habitat for five bird species that are endemic to the northern mixed-grass prairie region (an endemic species is one with a distribution that is limited to a specific, relatively small, geographic area);
- represent a comprehensive collection of most North Dakota plant communities;
- have some of the only remaining representative tracts of native prairie on the Drift Plain, a declining and threatened type of prairie habitat;
- are associated with rivers and serve as sediment traps for the Hudson Bay drainage;
- are a critical area of the Central Flyway and provide resting and breeding habitat for migratory birds;
- are in an area that has been a gathering spot for people and wildlife through time;
- occur in an area with a rich history of paleohistory, early exploration, and settlement;
- were originally developed in part by the Civilian Conservation Corps (CCC);
- have potential for a broad range of partnerships that are integral to every aspect of refuge management (hunting, fishing, research, and education).


Gary Eslinger/USFWS

Stiff Sunflower

Planning Issues

Several key issues were identified following the analysis of comments collected from refuge staffs and the public, and a review of the requirements of the Improvement Act and the NEPA. Substantive comments (those that could be addressed within the authority and management capabilities of the Service) were considered during formulation of the alternatives for future management. These key issues are summarized below.

Habitat and Wildlife Management

Complex ecological processes and disturbance regimes are fundamental to the evolution and maintenance of prairie and wetland habitat in the northern Great Plains. These dynamic phenomena have been drastically impaired, however, since Euro-American settlement of the region a century ago. Processes such as fire, grazing, and drought shaped plant communities of the region. When these important processes change (for example, decrease in the frequency of fire), native plant communities and wildlife populations are negatively affected.

Refuge management decisions are often based on economic and political factors rather than on ecological principles or biological needs of wildlife species and their habitats entrusted to the Service's care. Biology should guide management decisions for the Refuge System. Too often, however, biological needs of wildlife and their habitats receive less consideration than socioeconomic and political factors in the decision-making process.

Some refuge habitats are so badly degraded that they may no longer have potential to be restored. Beyond some biological threshold, many plant communities or habitats are unlikely to be restored regardless of effort expended. Invasive species—namely woody plants, introduced cool-season grasses (for example, smooth brome and Kentucky bluegrass), and noxious weeds (for example, leafy spurge and Canada thistle)—compromise the integrity of refuge habitats and devalue the areas for wildlife. Programs to control these plants divert important resources from other habitat management initiatives.

Prescribed fire, haying, and grazing can be controversial management tools, especially when goals and objectives that direct their use are unclear or poorly understood by the public. The public often is either strongly supportive or adamantly opposed to use of these tools. Use of fire and grazing can be controversial simply because their use in other regions is highly controversial (for example, grazing is extremely controversial in arid western states).

Personnel of the three refuges suggest that (1) goals and objectives should emphasize management of plant communities as habitat for wildlife, and (2) research and monitoring should be used to predict wildlife response to management. Most factors that influence the dynamics of wildlife populations, especially those of migratory birds, may not be directly influenced at the individual refuge level; but can be influenced indirectly through appropriate or inappropriate management of habitat.

Direct control of mammalian and avian nest predators (mainly predators of waterfowl nests) is controversial with the public and within the scientific community. Some groups and individuals question the ethics of killing one group of species to benefit another group, especially to increase recreational hunting. Predator control is known to increase the survival of duck nests in northern prairies, but its indirect effects on other grassland bird and nontarget mammal species are poorly understood.

Current and future effects of emerging wildlife diseases, especially West Nile virus, avian influenza, and chronic wasting disease are unknown. Efficacy of methods to contain and control avian botulism remains a concern. Real and perceived threats of wildlife to human transmission of some diseases are a concern with the public.

Water Quality and Management

Wetland management practices, especially lowering water levels ("drawdowns"), can be controversial with the public. The role of drawdowns in maintaining long-term marsh productivity is poorly understood by the public. Refuge visitors see a dry wetland and conclude that this condition is not beneficial to wildlife. Refuges can do a better job of educating the public on the need and benefits of manipulating water levels.

Sustained long-term productivity of riverine marshes in the Souris River basin is likely compromised by physical modifications of the Souris River (for example, dams, channelization, and sedimentation) and by political constraints associated with management of the river (for example, flood control and altered hydroperiod).

Sedimentation and nonpoint source pollution affect water quality and long-term management potential of refuge wetlands. The public is interested in having a high-quality water source within the Souris River basin. Refuge staff is also concerned that highly variable water supplies (timing and duration of river flows), coupled with increased sediment loads associated with flooding and wetland drainage within the Souris River basin, may hinder wetland management and restoration.

Public Outreach and Partnerships

Opportunities are often missed for the public to learn about refuges and their management. Communication could be enhanced regarding topics such as public use opportunities, habitat management, water management, and the economic benefits of the refuges.

Partnerships with local schools, universities, special interest groups, and state and local governments should be strengthened to further education, especially experiential learning.

Opportunities for outreach and partnerships are constrained by declining rural populations, especially by outmigration of people to urban centers outside North Dakota. In addition, few nongovernmental organizations exist in North Dakota that have an interest in wildlife and habitat.

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Environmental Education at Des Lacs NWR

Visitor Service Programs

Today's increasingly mobile society is demanding greater use of refuges for uses such as hunting, fishing, wildlife observation, and environmental education. Increased levels of these uses may exceed the capacity at which services can be provided, unless refuge staff and budgets also increase. However, increased visitor service can elevate the profile and awareness of refuge-related issues and activities. Some requested activities are not allowed because they are incompatible with the purpose of the refuges (for example, all-terrain vehicle [ATV] and snowmobile use). At Upper Souris NWR, facilities may be inadequate to accommodate all who wish to participate in refuge activities.

Refuges are probably underused for nonconsumptive recreation such as wildlife observation and wildlife photography. These opportunities may increase as refuge habitat and wildlife management are enhanced.

Refuge Operations

The refuges are currently understaffed and poorly funded relative to the scope and responsibility of management. Service personnel at national wildlife refuges in North Dakota manage more land with fewer people than other refuges in the Refuge System.

3 Affected Environment

Gary Eslinger/USFWS

Native Prairie Clover and Coneflowers

The three refuges lie within the Souris River basin, which extends from north-central North Dakota to southeastern Saskatchewan and southwestern Manitoba.

The J. Clark Salyer NWR is the largest of the three refuges, at 58,700 acres. Upper Souris NWR covers 32,092 acres and Des Lacs NWR covers 19,500 acres. The Souris River basin is in the eastern, mesic (moist) subregion of the northern mixed-grass prairie, principally within the *Agropyron–Andropogon–Stipa* (needlegrass–bluestem–wheatgrass) vegetation association (Kuchler 1964, Coupland 1992, Bragg 1995). However, the contemporary landscape is dominated by annually tilled cropland (figure 3).

In the late 1880s and early 1890s, Government Land Office officials surveyed the basin's vast prairie to guide forthcoming settlement by Euro-American homesteaders. The surveyors may have unknowingly encountered one of North America's most botanically diverse native grasslands, encompassing more than 750 plant species. Although characterized by cool-season, mid-height grasses, the prairie was mixed grass, because it also included widespread tall-grass and short-grass prairie elements. These mainly were big bluestem communities on low, moist sites and blue grama–threadleaf sedge communities on higher, relatively dry sites such as sandy or elevated ridges and southwest-facing slopes.

Like other northern mixed-grass prairie, the prairie in the Souris River basin evolved with interacting grazing and fire disturbances (Higgins 1986), as well as marked climatic variability (Bragg 1995). Through the mid-1800s, the Souris River basin was a significant, year-round range for bison (Hanson 1984) and experienced roughly a 5-year fire return interval characteristic of the region (Bragg 1995). These major, frequent disturbances ended by the early 1900s. Bison had been extirpated, and Euro-American homesteaders who settled in the basin suppressed fires (Grant and Murphy 2005). Before settlement, trees mainly had been restricted to green ash–American elm woodland along the Souris River and on some steep north slopes of adjoining major coulees (ravines). Bur oak and quaking aspen brush had occurred on steep, fire-protected scarps in the sandhills of present-day J. Clark Salyer NWR. However, without frequent fire and grazing disturbances, tree and shrub cover significantly increased throughout much of the area (Grant and Murphy 2005).

The Souris and Des Lacs rivers are perennial, exhibiting many old oxbows, meander scars, and channel relicts. Prior to settlement, numerous riverine and palustrine (nonflowing, such as ponds and marshes) wetlands were maintained by periodic overbank flooding. With settlement of the region, the Souris and Des Lacs rivers were significantly modified (1) by drainage and channelization, and (2) by construction of many low-head dams along the river to regulate flooding and restore wetlands or augment wetland management on the three refuges. Because of these changes, few natural riverine wetlands remain on the Souris River basin refuges.

Environments and natural resources of the Souris River basin refuges are described in the following sections:

- physical attributes
- biological attributes
- cultural resources
- special management areas
- visitor services
- socioeconomic environment

PHYSICAL ATTRIBUTES

This section describes the climate, physiography, geology, soils, and water resources of the Souris River basin refuges.

Climate

Area climate is semi-arid to subhumid continental, with average monthly temperatures ranging from 5°F in January to 68°F in July (USFWS, unpublished data). There are significant daily and annual temperature fluctuations and precipitation is erratic. Average annual precipitation (1898–2002) is 16–17 inches, most falling as rain during April–September.

The National Climate Data Center has entered into a long-term agreement with the Service to install and operate one of the National Oceanic and Atmospheric Administration's U.S. Climate Reference Network meteorological stations at the Des Lacs NWR. The station will provide data on long-term climate change in the northern Great Plains, as one of a series of meteorological stations. The station will be located at the northwest end of the refuge, 2.2 miles south of Canada and will operate by 2006.

Physiography, Geology, and Soils

The physiography (mainly soils and topography) of each refuge was uniquely shaped by ice flow associated with the Wisconsin lobe of the Laurentide Ice Sheet during the end of the Pleistocene Epoch (Bluemle 1991).

The Des Lacs River and upstream portion of the Souris River (encompassing Des Lacs and Upper Souris NWRs) were formed by catastrophic meltwater release from two large glacial lakes about 10,000 years ago. River channels at Des Lacs NWR and Upper Souris NWR were spillways from these glacial lakes and thus the refuges (especially Des Lacs NWR) are characterized by steep, high-relief valleys roughly 0.7 mile wide and 165 feet deep (Lord and Kehew 1990). Soils at Des Lacs NWR and Upper Souris NWR are mostly well drained, level to steep loams formed in glacial till.

The Souris Lake Plain characterizes the downstream portion of the Souris River drainage (east of Minot, North Dakota, including J. Clark Salyer NWR), and is the remnant of Glacial Lake Souris (Lord and Kehew 1990). The contemporary Souris Lake Plain is a flat, deltaic outwash plain, bordered to the south and east by sandhills formed from wind and wave action of historic Glacial Lake Souris. Soils are mostly well drained, level to hilly sandy loams.

Water Resources

All three refuges are within the Souris River basin, an area encompassing about 24,600 square miles, of which 5,500 square miles are in the United States (adapted from Laubhan et al. 2003). The United States portion of the basin is located within the "Central Lowland Province" and is bounded by the Souris River (east) and the Missouri Coteau (south and west).

The Souris River, the main watercourse in the basin, originates near Weyburn in southeastern Saskatchewan and enters the United States in the northwest corner of Renville County, North Dakota. It flows southeast to Velva, North Dakota, then turns north and enters Manitoba northeast of Westhope in Bottineau County, North Dakota. The river, which is perennial, discharges into the Assiniboine River, which discharges into the Red River at Winnipeg. The Des Lacs River, a perennial stream that originates in southeastern Saskatchewan about 2 miles north of the international boundary, is the primary tributary of the Souris River.

Prior to settlement, the Souris River valley supported numerous riverine and palustrine wetlands. The Souris River in many areas was broad and deep with a gentle current, according to a review by

Laubhan et al. (2003). The riverine system apparently was very dynamic, characterized as sinuous and prone to overbank flooding, a view supported by current aerial photos and satellite imagery that reveal numerous relict meander scars, oxbows, and abandoned channels within the valley.

Darla Leslie/USFWS

Ducks settle in a wetland at Upper Souris NWR.

With settlement by Euro-Americans, the Souris and Des Lacs rivers were significantly modified by drainage and channelization; this was most evident at J. Clark Salyer NWR, where major stretches of the river were dredged and channelized to promote cultivation. River flows were unregulated until the 1930s, when numerous low-head dams were constructed to regulate flooding or to increase wetland management capability at the three refuges.

Biological Attributes

This section describes the environment, vegetation, and characteristic wildlife of the following contemporary habitats of the Souris River basin refuges:

- drift prairie
- prairie slope
- prairie parkland
- sandhills
- old cropland
- coulee woodland and coulee woodland edge
- riparian woodland
- meadow
- wetland
- islands

Acreages of these habitats at the refuges are displayed in figure 9, and their general spatial distributions are shown on habitat maps for Des Lacs NWR (figure 10), J. Clark Salyer NWR (figure 11), and Upper Souris NWR (figure 12).

Detailed information about biological resources of the Souris River basin refuges are found in several appendixes:

- plants (appendix D)
- plant group types (appendix E)
- birds (appendix F)
- birds of conservation concern (appendix G)
- mammals (appendix H)
- reptiles and amphibians (appendix I)
- fishes (appendix J)

Drift Prairie

The upland habitat type most commonly shared by the Souris River basin refuges is drift prairie, collectively comprising about 12% of these refuges (figure 9). Due to its level, relatively rich loams, drift prairie has been destroyed through conversion to agriculture more than other northern prairie types, and remnant tracts appear to be particularly vulnerable to invasion by smooth brome and Kentucky bluegrass (Murphy and Grant 2005). As such, drift prairie could be considered an endangered resource.

Physical Environment

Drift prairie is defined as native ("unbroken") sod in relatively deep (5- to 6-inch surface, 10- to 12-inch subsurface), level to gently rolling (<5% slope), loam soils typical of the extensive Drift Plain physiographic region (Bluemle 1991).

There are roughly 3,300–9,500 acres of drift prairie per refuge (figure 9). Drift prairie on Des Lacs NWR and on J. Clark Salyer NWR consist of 15- to 20-mile long, 0.2- to 1.2-mile wide tracts along the east and west sides of impoundments of the Des Lacs or Souris rivers (figures 10 and 11). Compared to these extensive, relatively flat tracts, drift prairie at Upper Souris NWR typically occurs in isolated, gradually sloping patches, interspersed with extensive prairie slope and coulee woodland habitat. Drift prairie tracts on all three refuges are (1) bordered by cropland (dryland farming for small grains and oil seeds); (2) annually grazed, privately owned drift prairie (40–640 acres); and (3) former cropland seeded to varied mixtures of native and introduced grasses and forbs, both on and off the refuges.

Drift prairie tracts at Des Lacs NWR and J. Clark Salyer NWR have similar management histories (Murphy and Grant 2005):

- From refuge establishment in the mid-1930s through the late 1960s, drift prairie at both refuges typically was grazed season-long by cattle at light- to moderate-stocking rates of 0.3–0.7 animal unit months (AUMs) per acre.

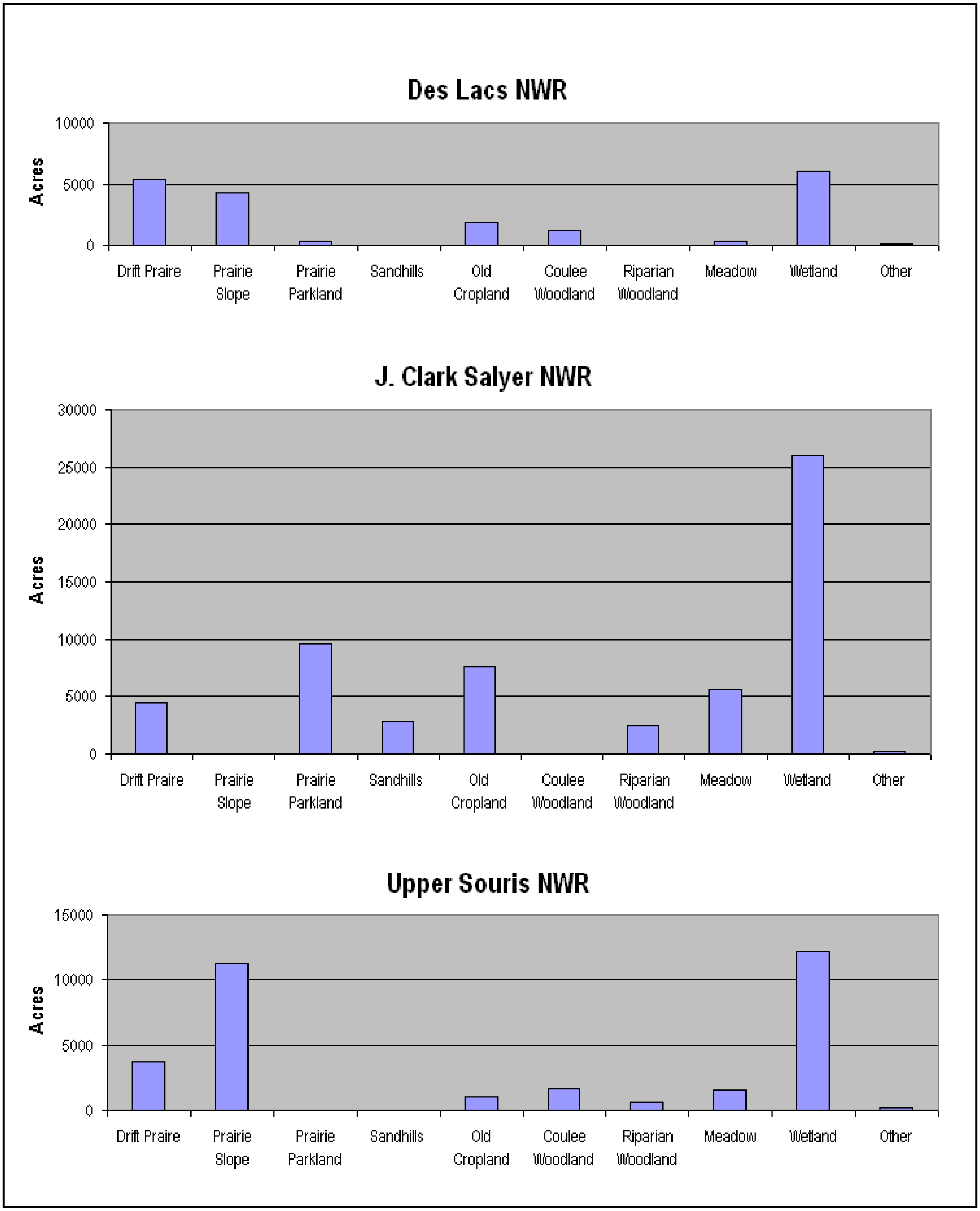

Figure 9. Contemporary habitat coverage for the Souris River basin refuges, North Dakota.

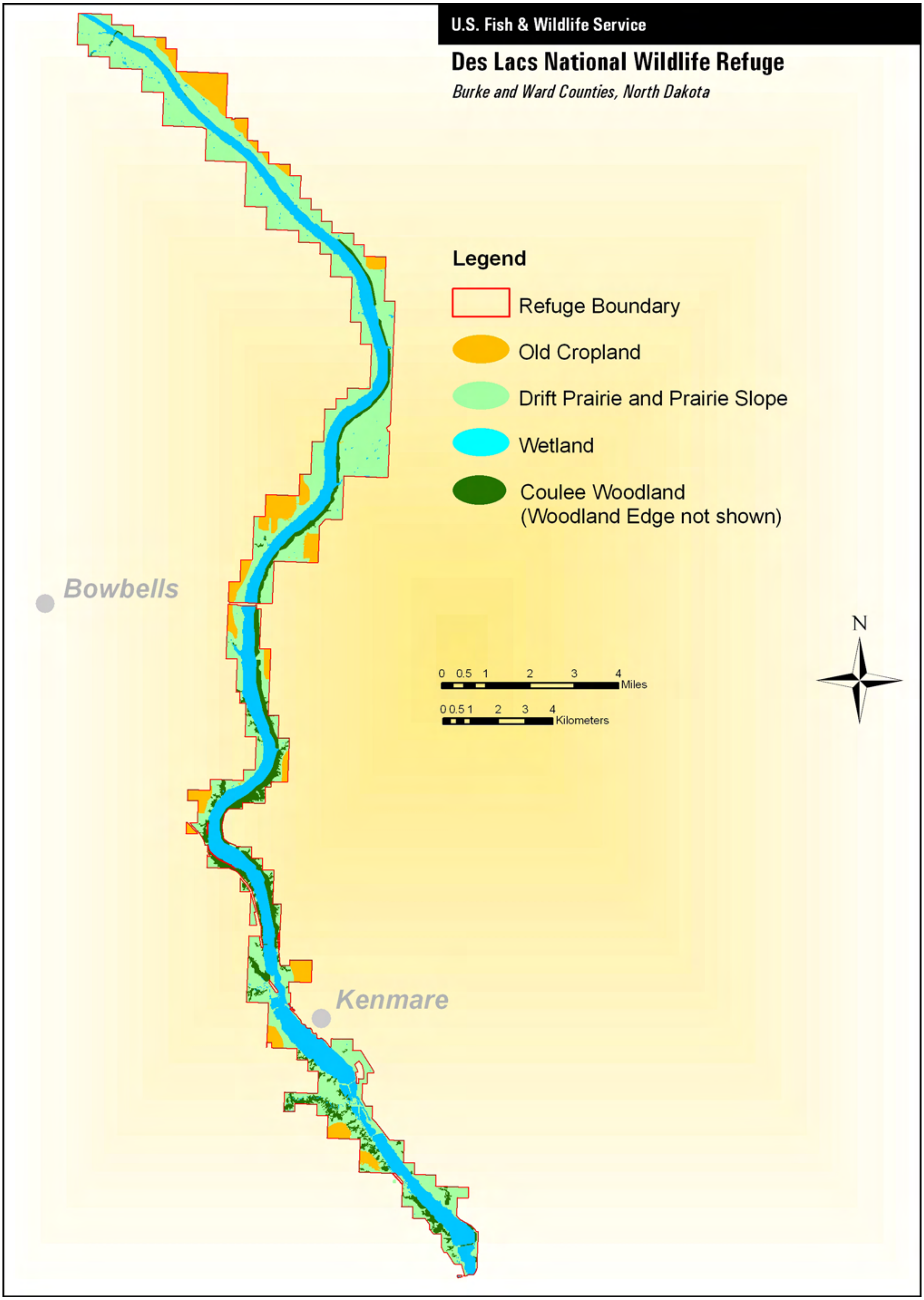

Figure 10. Habitats at Des Lacs NWR, North Dakota.

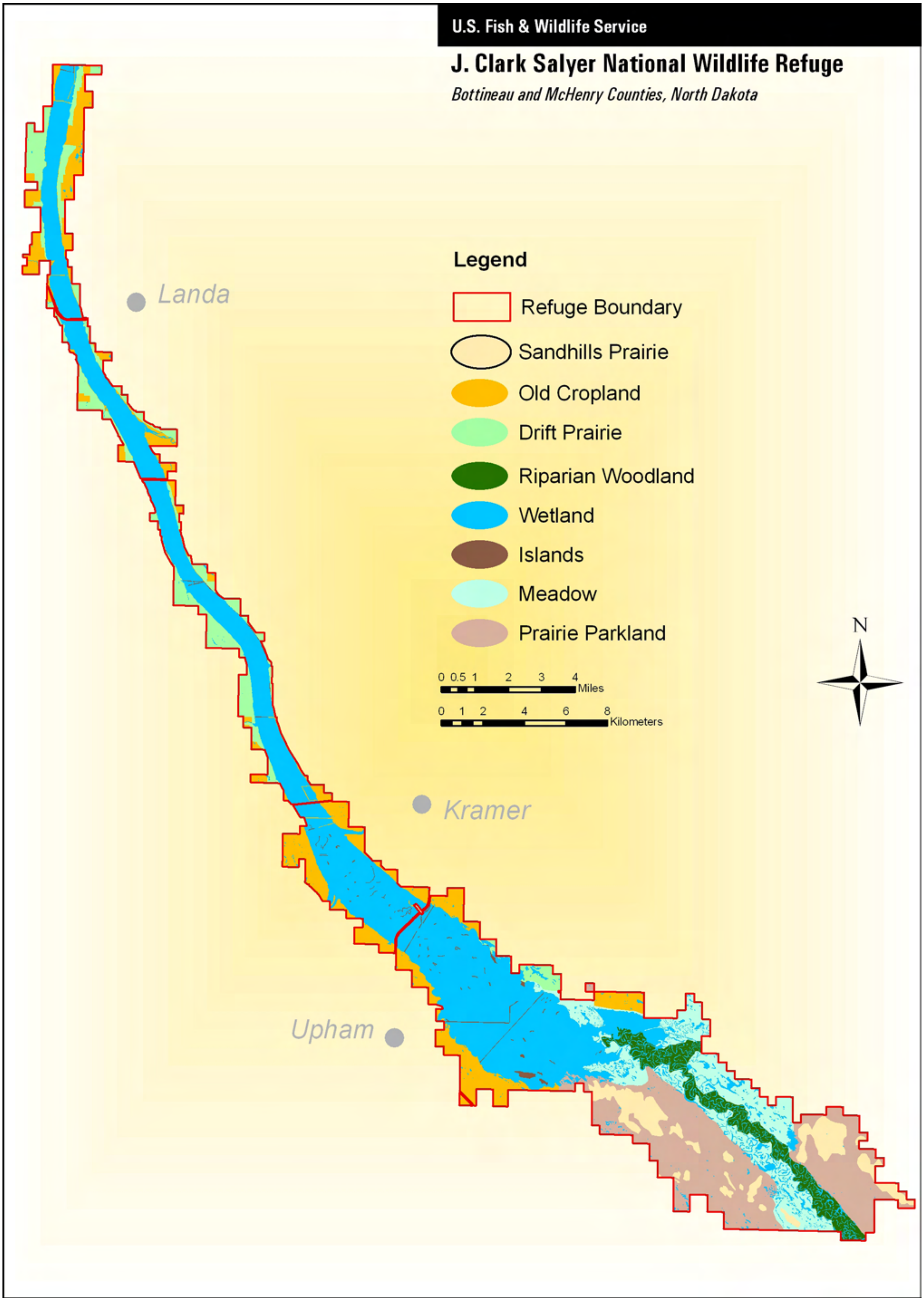

Figure 11. Habitats at J. Clark Salyer NWR, North Dakota.

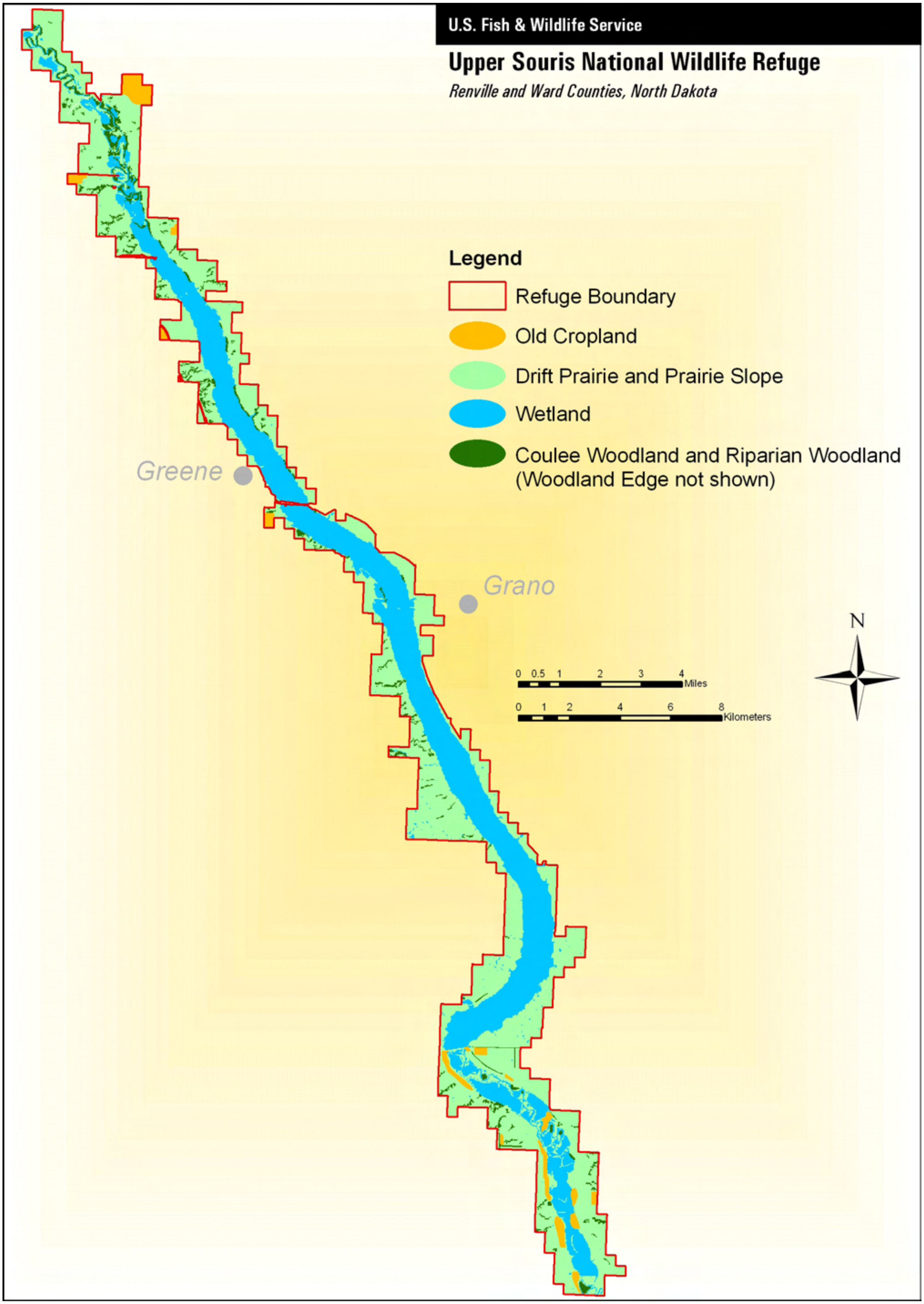

Figure 12. Habitats at Upper Souris NWR, North Dakota.

However, at Des Lacs NWR, years of grazing often alternated with years of rest. During the early 1970s to early 1990s, drift prairie at both refuges was rested with increasing frequency to emphasize dense, undisturbed nesting cover for prairie ducks. About one-third of the prairie at Des Lacs NWR was grazed at moderate stocking rates under rotation prescriptions during an average of two May–September seasons. At J. Clark Salyer NWR, grazing was limited to few drift prairie tracts.

- Tracts totaling roughly two-thirds of the drift prairie at each refuge were prescribe burned (spring or late summer), usually just once, during this 20-year period. Only since the early 1990s has prescribed fire been used widely and frequently, especially at Des Lacs NWR, where nearly all drift prairie management units have received multiple (two to four) burn treatments.

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The management history of drift prairie at Upper Souris NWR is vaguely similar to that at Des Lacs NWR and J. Clark Salyer NWR through the 1960s, but not afterward, as follows:

- Drift prairie at Upper Souris NWR was idle from the late 1930s through the mid-1940s, and then grazed heavily through the mid-1950s. Light, season-long grazing and rest prevailed through the early 1970s. This was followed by rest-rotation grazing, then twice-over rotation grazing (late spring and fall grazing periods) through the mid-1980s. Since then, a once-over grazing treatment with moderate stocking rates and grazing periods has been applied annually to each upland management unit.
- Almost no prescribed burning has occurred on drift prairie at Upper Souris NWR. Since the mid-1990s, an average of only about 800 acres of upland habitats of all types has been burned annually.

Characteristic Vegetation

Parallels in management of the drift prairie at Des Lacs NWR and J. Clark Salyer NWR through the early 1990s are reflected by strikingly similar patterns in composition of the contemporary vegetation (Murphy and Grant 2005):

- The drift prairie flora at both refuges is badly degraded by introduced plant species, especially the widespread invasion by smooth brome and Kentucky bluegrass, although this varies among management units. Vegetation dominated by introduced species occurs frequently (average frequency of occurrence is >60%), while intact assemblages of native vegetation occur infrequently (3–6%).
- Smooth brome-dominated types occur almost twice as frequently as Kentucky bluegrass-dominated types (at Des Lacs NWR, 40% versus 22%; at J. Clark Salyer NWR, 32% versus 18%). Vegetation dominated by introduced, weedy forb species occurs less frequently (2% at Des Lacs NWR; 12% at J. Clark Salyer NWR). Such vegetation includes leafy spurge (about 80% of weedy forb types), sweetclover (10%), and Canada thistle (10%).
- Vegetation dominated by low shrubs, principally western snowberry, occurs fairly frequently (22% at Des Lacs NWR; 17% at J. Clark Salyer NWR), probably greater than it did under a natural, historical disturbance regime; for example, an estimated 5% low shrub cover occurred on pristine mixed-grass prairie in northwestern and north-central North Dakota (U.S. Soil Conservation Service 1975). Snowberry probably was more prevalent on the refuge drift prairie 20–30 years ago (U.S. Fish and Wildlife Service [USFWS], unpublished refuge narrative reports), but has been largely replaced by smooth brome. The relatively cool, moist sites typically occupied by snowberry appear most vulnerable to smooth brome invasion (Romo et al. 1990).
- Smooth brome poses a particularly serious management problem on the drift prairie. Because it seems more difficult to control than other introduced cool-season grasses (Murphy and Grant 2005), smooth brome more significantly alters the quality and structure of a prairie (Blankespoor 1987), and can alter the soil environment to further its own invasion (Jordan et al., unpublished data).

The plant community of Upper Souris NWR's drift prairie is also badly invaded by introduced plant species and low shrub cover. Intact native, herbaceous vegetation occurs as infrequently as on the drift prairie at the other two refuges. However, differences in makeup of plant species that are invading the drift prairie at Upper Souris NWR predictably reflect the refuge's longer grazing history and relative lack of fire, as follows:

- Intact assemblages of native herbaceous vegetation compose <5% of the prairie, similar to the other two refuges.
- Kentucky bluegrass-dominated types occur much more frequently (42% frequency) than smooth brome-dominated types (13%), versus greater frequency of brome than bluegrass types at the other two refuges.
- Low shrub-dominated types are more prevalent (27% frequency) than on drift prairie at Des Lacs NWR and J. Clark Salyer NWR.
- Vegetation dominated by introduced, weedy forb species occurs infrequently (<1%) on drift prairie at Upper Souris NWR. Leafy spurge accounts for 90% of this cover.

Characteristic Wildlife

The degraded condition of the drift prairie vegetation has important implications for grassland-dependent bird species. Populations of grassland birds are experiencing the most rapid declines of any group of bird species in North America (Peterjohn and Sauer 1999). Refuges in the northern Great Plains potentially serve an important role in maintaining representative, grassland bird communities. However, the diversity of grassland-breeding birds is significantly diminished on refuge drift prairie (Murphy and Sondreal 2003; Grant et al. in press).

Species characteristic of the contemporary drift prairie are Savannah sparrow, clay-colored sparrow, and bobolink; less common are sharp-tailed grouse, grasshopper sparrow, and (in relatively wet years) Le Conte's sparrow (figure 13).

Most bird species characteristic of northern mixed-grass prairie are uncommon or absent, for example, marbled godwit, horned lark, western meadowlark, Sprague's pipit, chestnut-collared longspur, and Baird's sparrow (Stewart 1975). The latter three species, which are endemic to the northern Great Plains, were considered the most common breeding birds across the North Dakota–Canada border of the Souris River basin in the 1870s (Coues 1878). Burrowing owl and ferruginous hawk also were characteristic of this northern mixed-grass prairie, but have not been recorded as breeding at the refuges for decades.

The communities of grassland bird species that are uncommon to absent on the refuges' drift prairie require shorter, sparser, more herbaceous prairie vegetation than that available. In particular, Sprague's pipit is associated with native bunchgrasses and avoids broad-leaved, introduced grasses such as smooth brome (Wilson and Belcher 1989, Madden et al. 2000, Nenneman 2003a, Grant et al. 2004a).

The Savannah sparrow is a common species at the refuges.

Losses of plant and bird species diversity are not the only consequences when introduced plants invade northern prairie. Nutrient pools, energy flows, soil invertebrate and mycorrhizal relationships, and the water cycle also can be altered significantly (Bragg and Steuter 1995, Christian and Wilson 1999, Seastedt 1995, Wilson 2002). Regardless of vegetation conditions, some species such as northern harrier may avoid narrow tracts of drift prairie bordered by cropland simply because they need broader grassland tracts (Johnson and Igl 2001). For example, territories of the harrier may cover 250–500 acres (Bildstein and Gollop 1988).

In an adjacent, rolling to hilly region of northern mixed-grass prairie known as the "Missouri Coteau," habitat and species diversity of grassland birds has been largely restored by applying multiple prescribed burns (Madden et al. 1999). A recent study of relationships between bird species abundances and fire history at Des Lacs NWR suggests, however, that habitat and birds may not respond similarly to reintroduction of fire to drift prairie (Ludwick and Murphy 2006). The three endemic, historically common, songbird species (Baird's sparrow, chestnut-collared longspur, and Sprague's pipit) continue to be rare or absent on drift prairie at Des Lacs NWR regardless of fire history. Abundances of common bird species appear uninfluenced by fire, perhaps because smooth brome is so pervasive and has a pronounced influence on habitat structure for at least several bird species. Greater treatment frequency and integration of alternate tools, chiefly livestock grazing, could possibly improve the structure to attract a broader mix of grassland songbirds, including endemic species.

Still, the quality of grassland habitat for grassland birds is not necessarily reflected simply by bird abundance. Often there are tradeoffs to consider when reintroducing major habitat disturbances such as fire and grazing; short-term losses should be weighed against net gains over longer periods. For example, management treatments might influence the survival of grassland bird nests, directly through

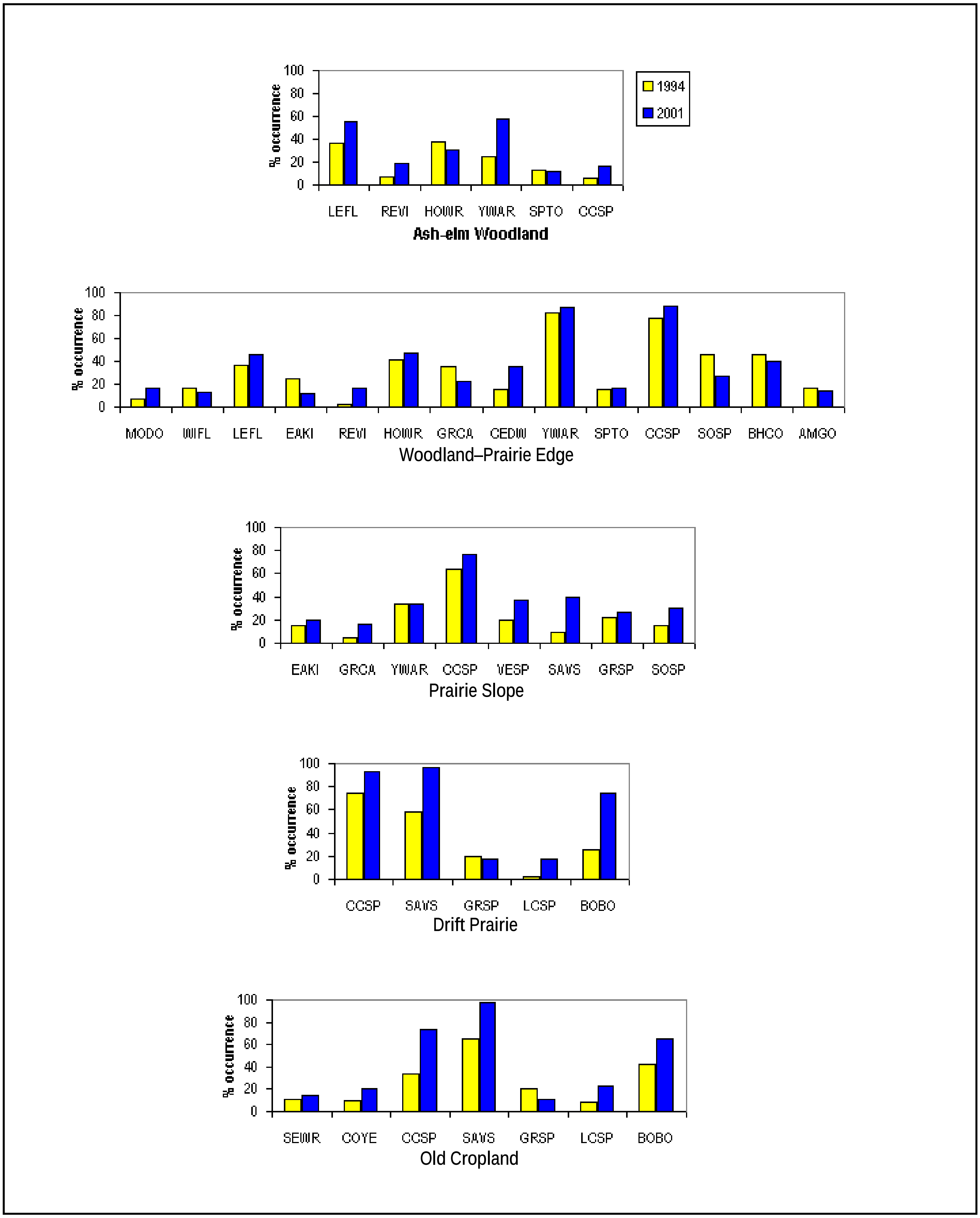

Figure 13. Frequency of occurrence of common breeding bird species in major upland habitats at Des Lacs NWR, North Dakota, following several dry years (1994; yellow bars**) and wet years (2001;** blue bars**).**

Species include: American goldfinch (AMGO), bobolink (BOBO), brown-headed cowbird (BHCO), cedar waxwing (CEDW), clay-colored sparrow (CCSP), common yellowthroat (COYE), eastern kingbird (EAKI), grasshopper sparrow (GRSP), gray catbird (GRCA), house wren (HOWR), least flycatcher (LEFL), Le Conte's sparrow (LCSP), mourning dove (MODO), red-eyed vireo (REVI), Savannah sparrow (SAVS), sedge wren (SEWR), song sparrow (SOSP), spotted towhee (SPTO), vesper sparrow (VESP), willow flycatcher (WIFL), and yellow warbler (YEWA). Modified from Murphy and Sondreal (2003).

livestock trampling, or indirectly via increased predation or brood parasitism rates, when nest site vegetation is modified by fire or grazing. These potential management influences have been assessed recently on drift prairie on the refuges. The density of songbird nests declines during the first growing season following a prescribed fire. However, no strong relationship was detected between the survival of nests of three grassland songbird species and the time since the last fire (1, 2, 3, or >4 years) at J. Clark Salyer NWR, except that parasitism of nests by brown-headed cowbirds was greater during the first growing season following a fire for Savannah sparrows and may have decreased nest survival (Grant et al., in review). The probability of Savannah sparrow nests surviving at Des Lacs NWR declined when cattle were present at moderate stocking densities, but no such relationship was evident for clay-colored sparrow nests in the same management units (Kerns 2005). Cattle trampling accounted for only 1% and 3% of all nest failures for the two species, respectively.

The quality of drift prairie as habitat for grassland birds also may be influenced by occurrences of trees and tall shrubs. Historically, the drift prairie landscape of the Souris River basin was open and treeless, but trees appeared and increased across much of the area during the 1900s (Grant and Murphy 2005). Trees and tall shrubs effectively fragment this landscape, rendering it unsuitable for most grassland bird species (Grant et al. 2004a).

There are almost no trees or tall shrubs on the contemporary drift prairie at J. Clark Salyer NWR. Most drift prairie at Des Lacs NWR and Upper Souris NWR has either (1) widely scattered, stunted trees or tall shrubs, or (2) borders of natural woodland or planted tree and shrub shelterbelts. Some drift prairie tracts in the northern half of Des Lacs NWR also have one to several groves of quaking aspen and are more aptly classified as aspen parkland habitat. Much of the tall, woody cover at Des Lacs NWR currently is being reduced by prescribed fire, however. An analysis of recent data from the refuge suggests that the survival of clay-colored sparrow nests declines with increasing amounts of surrounding tree and tall shrub cover, but survival of Savannah sparrow nests appears unaffected (Murphy et al., unpublished data). Tall woody cover on the drift prairie at Upper Souris NWR—where prescribed fire has not been applied frequently or extensively and trees and tall shrubsare much more widespread—is likely to reduce the occurrence and productivity of at least some grassland songbird species.

Many duck species use drift prairie at the refuges as nesting cover. For example, blue-winged teal, gadwall, mallard, northern shoveler, and northern pintail nests composed 95% (in decreasing order) of duck nests discovered at J. Clark Salyer NWR during 1998–2003. Nesting density and nest success varies among years and among the refuges. Ducks nest at greater densities on the drift prairie at J. Clark Salyer NWR than on drift prairie at the other refuges. Regardless, the density and fate of duck nests in northern prairie may be affected by grassland management practices such as prescribed fire and grazing (for example, Kruse and Bowen 1996). On drift prairie at J. Clark Salyer NWR during 1998–2003, duck nest densities were reduced during the first growing season following a fire, but recovered 2–3 years postfire. Nest survival for mallard and gadwall was greater during the first post-fire growing season than in subsequent years, but was unaffected by fire for other duck species regardless of how recently fire had occurred (Grant et al., unpublished data). The density and survival of nests of prairie ducks are believed to be greatest on rested grasslands (Naugle et al. 2000).

Beginning in 1970, rest (nondisturbance: no grazing, haying, or fire) was emphasized as a management approach to increase densities of duck nests in uplands at the Souris River basin refuges. In the short term (2–20 years), greater vertical structure may be maintained in northern grasslands that are rested. The structure of such idle vegetation is believed to be more important than plant species composition when the management goal is waterfowl production (Schranck 1972, Naugle et al. 2000). However, management that emphasizes rest has long-term implications for prairie duck nesting habitat that often are overlooked in short-term management studies, because continuous idling without periodic defoliation disturbance fails to promote long-term grassland health (Naugle et al. 2000). With extended rest, introduced grasses, especially smooth brome and Kentucky bluegrass, may more rapidly displace native vegetation (Murphy and Grant 2005). Of particular concern is replacement of western snowberry communities (see previous) by smooth brome, which is less attractive to ducks, short-eared owls, northern harrier, and grassland songbirds. Monotypic stands of smooth brome and Kentucky bluegrass are less attractive to upland-nesting ducks than other types of grass–forb cover (Kemner and Higgins 1993, Nenneman 2003a). Duck nest survival, although highly variable among years, can decrease for grasslands idled >5 years (Miller 1971).

Conspicuously absent from the refuges' drift prairie is the Richardson's ground squirrel, which typically occupies open, heavily grazed grasslands. Historically, its colonies extended across the northern Great Plains north and east of the Missouri River (Jones et al. 1983). Burrows created by Richardson's ground squirrel continue to be key nest site habitat for burrowing owls in most of North Dakota, a state where the owl's breeding population is declining (Murphy et al. 2001). The ground squirrel occurs on some annually grazed, privately owned drift prairie tracts adjacent to the refuges and could colonize the refuge drift prairie where the height of vegetation was reduced by burning and frequent grazing.

Other vertebrate fauna characteristic of the contemporary refuge drift prairie include chorus frog, plains garter snake, masked shrew, meadow vole, thirteen-lined ground squirrel, deer mouse, and meadow jumping mouse (Eddingsaas et al., unpublished data). Coyote, white-tailed jackrabbit, and northern pocket gopher are less common.

Thirteen-lined Ground Squirrel
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Prairie Slope

Prairie slope occurs at Des Lacs NWR, at Upper Souris NWR, and minimally at J. Clark Salyer NWR. Prairie slope, especially the southwest-facing slopes, supports some of the most pristine native flora in the Souris River basin and is thus a highly valued resource.

Physical Environment

Prairie slope is defined as native sod hillside that covers at least a 25-foot elevation gain and generally is characterized by a 25–60% slope. Such slopes typify the transition from the level Drift Plain down to the valley floor at Des Lacs NWR and at Upper Souris NWR. At J. Clark Salyer NWR, prairie slope is poorly developed, and the transition from drift prairie to valley floor instead is represented by very short hillsides.

Prairie slope accounts for 22% of the total area of Des Lacs NWR (figure 9). Slopes on the southern half of the refuge cover a 100- to 170-foot rise; slopes on the northern half are shorter, covering only a 50- to 70-foot rise from the valley floor to the Drift Plain. Soils on the refuge's slopes are thin ("A" horizon, 1–4 inches deep), well-drained loams formed in glacial till. For at least 60 years, prairie slope at Des Lacs NWR had been managed mainly by rest—there had been occasional light grazing by cattle and perhaps a single prescribed fire, a history identical to that of the adjoining, level drift prairie (Murphy and Grant 2005).

At Upper Souris NWR, prairie slope is the most widespread upland habitat, comprising 35% of the refuge (figure 9). Physical characteristics of prairie slope at the refuge are roughly similar to those of this habitat at Des Lacs NWR, except that slopes are more gradual at Upper Souris NWR. Since the mid-1900s, prairie slope at Upper Souris NWR generally has been managed along with adjoining drift prairie by light grazing interspersed with long periods of rest and little or no fire.

Characteristic Vegetation

Slope aspect (the direction toward which it is oriented) can have significant implications for plant species composition. At Des Lacs NWR, it is important to distinguish between southwest-facing prairie slope and northwest- to southeast-facing prairie slope (aspect, 180–270° versus 280–170°). Southwest-facing prairie slope at the refuge supports some of the most pristine native flora in the Souris River basin and thus is a highly valued resource. The steep southwest aspect fosters a hot, arid, sunlight-rich environment for plant growth. This favors many xerophytic (dry-site loving), native plant species, but is hostile to most introduced plant species such as smooth brome. Competition is fierce among individual plants for crucial resources in the thin soils, especially for moisture. Compared to the refuges' drift prairie, litter apparently accumulates slowly on southwest-facing prairie slope, and the native-dominated plant community may remain relatively stable over decades with little management intervention. Native, warm-season grasses are far better represented among the flora of southwest-facing prairie slopes at Des Lacs NWR than they are in northwest- to southeast-facing slopes and drift prairie. This provides a broader overall plant phenology and thus more effective competition against introduced cool-season grasses.

More intact assemblages of native plant species, especially grasses, sedges, and forbs, characterize prairie slope at Des Lacs NWR. For example, an average of about two-thirds of the southwest-facing prairie slope is noninvaded, native herbaceous vegetation, compared to only 6% on the adjoining drift prairie (Murphy, Whipp, and Muscha; unpublished data). Dominant grasses and sedges of southwest-facing slopes in the refuge include the following species (from upper to lower slopes):

- blue grama
- threadleaf sedge
- plains muhly
- needle and thread
- prairie sandreed
- prairie Junegrass
- native bluegrasses (two species)
- green needlegrass

- native wheatgrasses (several species)
- sideoats grama
- little bluestem
- porcupine grass
- Kentucky bluegrass
- big bluestem
- smooth brome

Tall shrubs and trees occur infrequently on southwest-facing slopes; these mostly are chokecherry, Saskatoon serviceberry, and stunted green ash trees.

Northwest- to southeast-facing slopes at Des Lacs NWR are relatively cooler, darker, and moister than southwest-facing slopes. These areas tend to be more successfully invaded by introduced plants (for example, smooth brome) and native woody plant species (Murphy, Whipp, and Muscha; unpublished data). Much of this slope is woodland edge habitat, distributed mainly along the west side of the river valley (described and discussed in more detail under "Coulee Woodland and Coulee Woodland Edge" habitat).

Prairie slope at Upper Souris NWR are less pristine than those at Des Lacs NWR. This is probably due in part to subtle contrasts in their general management history, but also to differences in the steepness of slopes at the two refuges. Frequent light grazing by cattle, interspersed with long periods of rest and little fire, tend to further the spread of introduced cool-season grasses (especially Kentucky bluegrass), plus hasten invasion by low shrubs, tall shrubs, and trees. The average frequency of vegetation dominated by Kentucky bluegrass and woody plants is 32% and 28% respectively, versus about 20% for each plant group type at Des Lacs NWR.

Regardless, native herbaceous vegetation is more intact on prairie slope than on adjoining drift prairie at Upper Souris NWR (13–15% pristine native vegetation on prairie slopes versus <5% on drift prairie).

In contrast with Des Lacs NWR, plant species composition on southwest-facing slopes at Upper Souris NWR appears to be quite similar to that on the refuge's northwest- to southeast-facing slopes. This may be partly because Kentucky bluegrass is a significant invader of upland native prairie at Upper Souris NWR regardless of aspect. For example, plant communities characterized solely by native herbaceous vegetation make up 15% and 13% respectively, of southwest-facing and northwest- to southeast-facing slopes; vegetation dominated by Kentucky bluegrass makes up 33% and 31%. During sampling of prairie slope vegetation, scattered patches of tall woody vegetation (such as chokecherry, Saskatoon serviceberry, northern hawthorn, and green ash saplings and trees) generally were avoided, such that woody cover probably is much more prevalent on northwest- to southeast-facing slopes at Upper Souris NWR than conveyed here.

Characteristic Wildlife

Several more songbird species are commonly found on prairie slope than are found on drift prairie (figure 13), although the overall density of songbirds probably is less on prairie slope. At Des Lacs NWR, southwest-facing prairie slope is the most important habitat for vesper sparrow and grasshopper sparrow. Upper slopes are about the only place on the refuge where the endemic Sprague's pipit currently occurs, albeit uncommonly. Most common bird species on southwest-facing prairie slope (such as vesper sparrow and song sparrow) are associated with the sparse, widely scattered, tall woody vegetation.

No corresponding data are summarized for the breeding bird community of prairie slope at Upper Souris NWR, but the general makeup of the bird community probably is similar to that on prairie slope at Des Lacs NWR. There likely is potential for a significant amount of breeding habitat for Sprague's pipit if upper prairie slopes are restored at Upper Souris NWR.

Prairie Parkland

Prairie parkland occurs only at J. Clark Salyer NWR, occupying about 16% of the refuge (figure 9).

Physical Environment

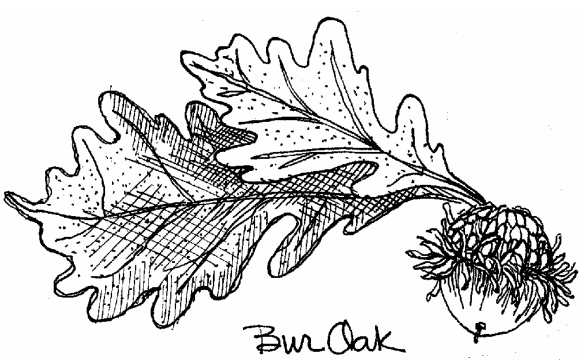
Prairie parkland is an island of mixed-grass prairie and woodland habitat occurring within the Souris Lake Plain physiographic subregion (Bottineau, McHenry, and Pierce counties). The Souris Lake Plain is a flat, deltaic outwash plain, bordered to the south and east by sandhills formed from wind and wave action of historic Glacial Lake Souris (Bluemle 1991). Soils are mostly sand, gravel, and clay; water drainage is good in sandy soils but poor near the Souris River. The water table is close to the surface in sandy soils, especially during years of above average precipitation.

Lands in and adjacent to J. Clark Salyer NWR constitute one of the largest, contiguous patches of northern mixed-grass prairie remaining in North America (about 1 million acres). The refuge is bordered to the south mainly by native rangeland. Some cropland (dryland farming for small grains), hay land (seeded alfalfa and native meadows), and Conservation Reserve Program (CRP) lands seeded to grasses and forbs border the refuge to the west and east.

Characteristic Vegetation

Aspen–oak woodland accounts for 38% of the contemporary prairie parkland. Low shrubs and tall shrubs collectively account for about 10% cover, with the remainder (52%) occurring as grasses, upland sedges, and forbs. About 15% of these grass–forb communities are in pristine condition; 28% are partially degraded (where native plants occur codominant with introduced plants), and 33% are badly degraded by invasive plants, being dominated by introduced species of grasses and forbs. Kentucky bluegrass is the dominant invasive plant, accounting for about 28% of the grass–forb cover. Other, introduced plant species include smooth brome (3% cover), leafy spurge (<2% cover), yellow sweetclover (<1% cover), and crested wheatgrass (<1% cover).

Native prairie is a mix of warm- and cool-season grasses and forbs. Dominant cool-season grasses include prairie Junegrass, western wheatgrass, porcupine grass, green needlegrass, and various species of upland sedges. Warm-season grasses include sand bluestem, little bluestem, blue grama, prairie sandreed, and sand dropseed. Grasslands are interspersed with low (<3 feet) shrub dominated by western snowberry and meadowsweet, plus tall (>3 feet) shrub dominated by chokecherry and willow. Quaking aspen and bur oak are the dominant tree species in woodland. Woodland understory shrubs include western snowberry, chokecherry, Saskatoon serviceberry, and redosier dogwood. Ground cover is dominated by poison ivy, wild sarsaparilla, false Solomon's seal, and various species of grasses and sedges.



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Expansion of aspen–oak woodland into native prairie remains the most serious threat to the prairie parkland. Prior to settlement, the extent of this woodland was limited, occurring as stunted groves of quaking aspen and bur oak along fire-protected scarps of sandhills or near wetland margins. The extent of aspen–oak woodland has doubled since 1938 and now account for almost 40% of the prairie parkland landscape (Grant and Murphy 2005). Aspen–oak woodland initially increased due to fire suppression, extirpation of bison and elk, and annual cattle grazing at low to moderate stocking rates (reviewed in Grant and Murphy 2005). Long-term rest (that is, limited grazing and burning) is implicated in more recent expansion of this woodland.

Kentucky bluegrass is the most widespread introduced grass in the prairie parkland, occurring codominant with native grasses and forbs. Kentucky bluegrass increases under prolonged rest or with grazing in northern prairie, but generally decreases with fire (reviewed in Murphy and Grant 2005). From 1890 to 1960, the prairie parkland was annually grazed, season-long, at light to moderate stocking rates (0.3–0.7 AUM/acre). Beginning in 1970, the extent, frequency, and intensity of grazing were reduced to emphasize nesting cover for waterfowl and sharp-tailed grouse. Since 1890, natural fires were suppressed; cultivation and road building helped limit the spread of fires. Prescribed fire was used opportunistically from 1960 until 1990, with one or two burns applied on a few prairie parkland management units. Since 1992, prescribed fire has been used with greater frequency; one to four burns have been applied to control woody vegetation and Kentucky bluegrass at each of several units ranging from 300 to 1,200 acres.

Leafy spurge, an introduced forb, is an aggressive invader of prairie on sandy soils and poses a significant long-term threat to prairie parkland. Leafy spurge spreads into prairie parkland mainly from sandhills, where it is a more serious problem. Biological control with flea beetles (*Apthona* spp.) has not been effective on sandy soils characteristic of the prairie parkland.

Characteristic Wildlife

Changes in vegetation of the prairie parkland since the 1870s have implications for the diversity and abundance of breeding birds, especially grassland-dependent species. These species were historically the most important bird guild in the region (Coues 1878). Grassland species characteristic of the contemporary prairie parkland include sharp-tailed grouse, vesper sparrow, clay-colored sparrow, Sprague's pipit, upland sandpiper, and grasshopper sparrow (Grant et al. 2004a, in press). Less common are blue-winged teal, mallard, northern pintail, horned lark, eastern kingbird, common nighthawk, and (in wet years) bobolink. Several species characteristic of the region are rare or absent, for example, Savannah sparrow, chestnut-collared longspur, western meadowlark, and Baird's sparrow.

Invasion of prairie by aspen woodland profoundly changes the breeding bird community of the prairie parkland. As woodland expands, edge and woodland bird species displace grassland birds (figure 14).

- Occurrence decreases markedly for 11 of 15 grassland bird species (including three species endemic to the northern Great Plains—Baird's sparrow, chestnut-collared longspur, and Sprague's pipit) as percent woodland, tall shrub, or brush cover increases (Grant et al. 2004a).

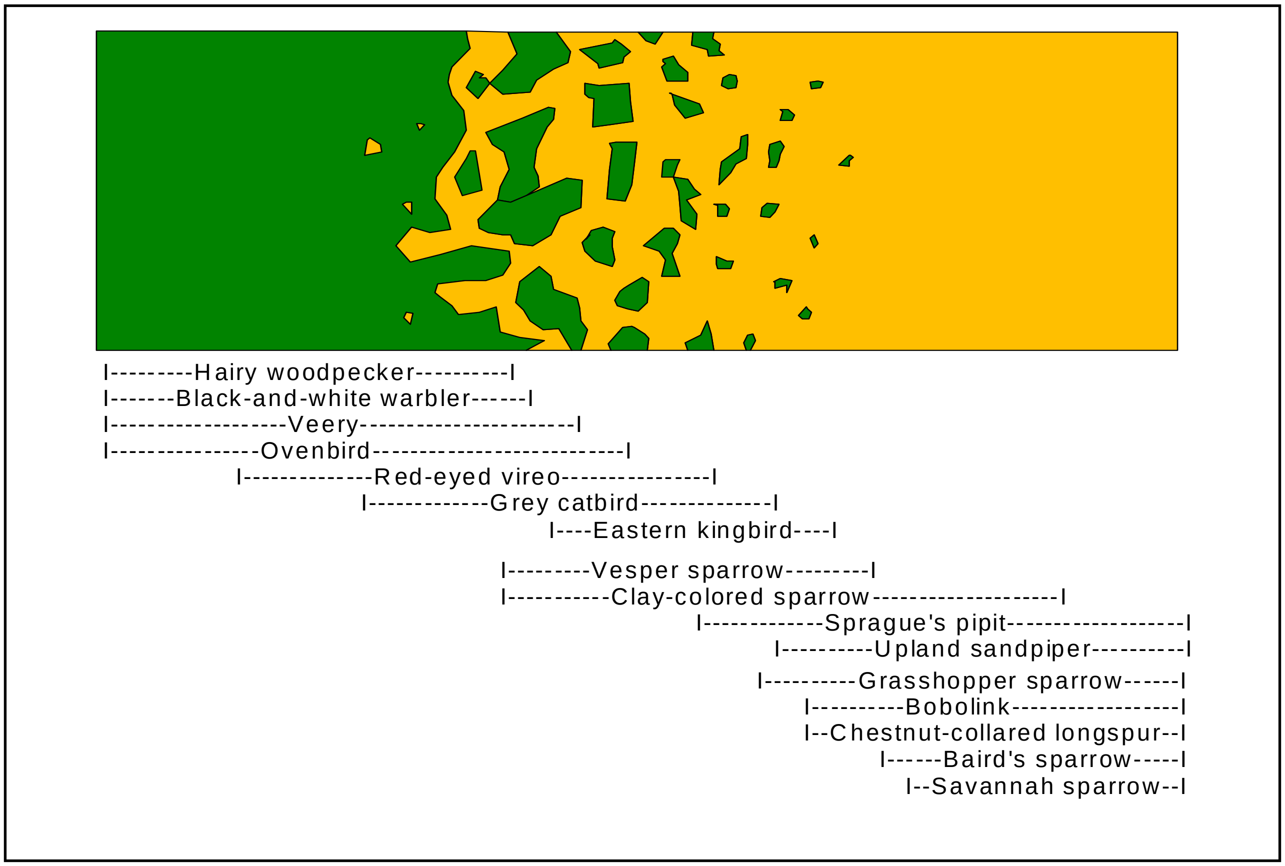

Figure 14. Distribution of breeding songbird species in relationship to the proportion of woodland (in green) **and grassland** (in yellow) **within prairie parkland at J. Clark Salyer NWR, North Dakota.** (Large aspen–oak woodland patches are represented at the far left and large, treeless grasslands are represented at the far right.)

Effects are intensified as the height of woody plants increases from low shrubs to tall shrubs to trees. Prairie parkland becomes largely unsuitable for nine grassland bird species as woodland cover exceeds 25%.

- Except for clay-colored sparrow, vesper sparrow, Sprague's pipit, and upland sandpiper, few grassland bird species nest in prairie parkland (Grant et al., in press). Contrary to expectations, nest predation and brood parasitism rates are lower near woodland edges than for nests placed far from woodland, at least for clay-colored and vesper sparrows (Grant et al., in press).
- Sharp-tailed grouse also use prairie parkland habitat for nesting and brood rearing and for winter food and cover. However, when woodland cover increases above a certain threshold, grouse will abandon lek sites (spring dancing grounds) where males gather to display to and breed with females (Berger and Baydack 1992, Hanowski et al. 2000). At least 10–12 historical leks have been abandoned at J. Clark Salyer NWR since 1950 because of woodland expansion (Grant and Hammond, unpublished data).
- Several grassland bird species (for example, chestnut-collared longspur, horned lark, and Sprague's pipit) are particularly sensitive to the quality of remaining prairie. Their occurrence declines when nonnative plants, especially smooth brome, replace native grasses and forbs (Wilson and Belcher 1989, Madden et al. 2000, Grant et al. 2004a).

At least 50 breeding bird species are associated with aspen–oak woodland at J. Clark Salyer NWR (Grant and Berkey 1999). Large woodland patches support more diverse bird communities than smaller or more isolated woodlands, especially area-sensitive, forest-interior species. Large contiguous patches of aspen woodland account for a significant portion of the contemporary prairie parkland landscape; restoration of these heavily invaded sites (former grasslands) is no longer feasible.

Woodland contributes to local avian diversity and may provide habitat for forest species that have shown regional or continental population declines such as red-eyed vireo, rose-breasted grosbeak, veery, and ovenbird. Large (40- to 500-acre) woodlands provide suitable habitat for area-sensitive woodland bird species, while also meeting the requirements of habitat generalists such as brown thrasher, catbird, yellow warbler, and American goldfinch. The converse is not true; small woodland patches do not support the high number or diversity of bird species that large woodland patches do. Of the more than 50 bird species recorded in aspen–oak woodland, none appears restricted to small patches and most use the edges of larger woodland patches. These findings suggest that small woodland patches may be removed (for example, for grassland restoration) without adversely affecting overall use of woodland by forest birds. Meanwhile, removal of the small patches significantly improves availability of habitat for several species of grassland songbirds (Grant and Berkey 1999).

The species makeup of mammal communities also changes with the transition from open grassland to the grassland–woodland edge to woodland interior habitats. The meadow vole, thirteen-lined ground squirrel, plains pocket mouse, short-tailed shrew, western jumping mouse, masked shrew, arctic shrew, and pygmy shrew prefer open prairie habitat, while the deer mouse, red-backed vole, fox squirrel, snowshoe hare, red squirrel, and raccoon prefer woodland and woodland edge habitat (Kadrmas 2005). The relative abundance of small mammal species can fluctuate significantly from year to year, even from month to month (for example, increased juvenile dispersal during late summer), or following a disturbance such as fire.

Gary Eslinger/USFWS

White-tailed Deer

Large mammals such as moose, white-tailed deer, coyote, and red fox are more flexible in their selection of habitats and can range widely, rarely restricted to a certain habitat type. Other important vertebrates include chorus frog, wood frog, and plains garter snake.

Sandhills

The sandhills cover about 5% of J. Clark Salyer NWR (figure 9).

Physical Environment

The sandhills occur within flat sandy plains occupied by more extensive prairie parkland. Embedded in this plain are a series of northeast- to southwest-oriented sand ridges with relief of 50–80 feet. These ridges were formed from wind and waves acting on sediments deposited on the floor of Glacial Lake Souris (Bluemle 1991). Soils are mostly sand and gravel. Management history and surrounding land use are similar to descriptions for the prairie parkland.

Characteristic Vegetation

The sandhills' prairies are a mix of warm- and cool-season grasses and forbs. Dominant cool-season plants include prairie Junegrass, green needlegrass, and various species of upland sedges. Warm-season grasses include sand bluestem, little bluestem, blue grama, prairie sandreed, and sand dropseed. Grasslands are interspersed with low (<3 feet) shrub dominated by western snowberry and Woods' rose, and tall (>3 feet) shrub dominated by chokecherry, hawthorn, and Saskatoon serviceberry.

North and east aspects of sand ridges are often dominated by bur oak. Aspen woodland has invaded the transition from oak to prairie at the toe of these slopes and occurs as stunted or widely scattered woodland patches. Woodland and tall shrub cover is extensive in some areas.

The contemporary composition of the sandhills is woodland (20% cover), tall shrub (12% cover), and low shrub (8% cover), with the remainder occurring as grasses and forbs. The extent of aspen woodland has increased since refuge establishment and is now twice that of bur oak woodland (13% versus 7%). Some of the best representative examples of northern mixed-grass prairie are found growing on sandy soils and harsh sandhill aspects. About 35% of the grass–forb cover is in pristine condition (having no introduced species and relatively little native, woody vegetation). However, about 20% of the grass–forb cover has been replaced by invasive, introduced plants, primarily leafy spurge and to a lesser extent, Kentucky bluegrass. Only 5% of the grass–forb vegetation is partially degraded by invasive plants. This suggests that once invasion has occurred, especially by leafy spurge, native grasses and forbs are quickly and completely displaced.

Less than 1% of the sandhills are unvegetated. Early descriptions and aerial photographs from 1938 suggest that sand blowouts were more common than today. Heavy disturbance by grazing and wallowing bison, and later by cattle, likely maintained many of these blowouts, especially on south- and west-facing aspects.

As in the prairie parkland, encroachment by trees and tall shrubs poses a serious threat to the sandhills. Changes in the extent of aspen–oak woodland and rationale for these changes are similar to descriptions for the prairie parkland.

Leafy spurge is the most serious long-term threat to the integrity of the sandhills. Leafy spurge currently dominates 17% of the nonwoodland cover. Biological control using flea beetles (*Apthona* spp.) has yet to be effective on sandy soils characteristic of the sandhills. Furthermore, vehicle access to the sandhills is limited, rendering efforts to control leafy spurge using chemicals unrealistic. Soil disturbance by cattle and fire can hasten the expansion of leafy spurge, potentially limiting the use of these tools to control expansions of woody vegetation and Kentucky bluegrass.


Gary Eslinger/USFWS

Sandhills in Fall


Gary Eslinger/USFWS

Black-billed Magpie

Characteristic Wildlife

The contemporary bird community of the sandhills includes grassland species that tolerate trees and tall shrubs. Important species include clay-colored sparrow, vesper sparrow, and Sprague's pipit. Conversely, other grassland bird species such as upland sandpiper and grasshopper sparrow are intolerant of tall, woody vegetation and thus avoid much sandhill habitat on the refuge (Grant and Berkey 1999).

Woodland edge and shrubland species include black-billed magpie, black-billed cuckoo, brown thrasher, and lark sparrow. Black-and-white warbler and orange-crowned warbler have an affinity for bur oak and are commonly found in closed-canopy stands on the northeast aspect of sand ridges (Grant and Berkey 1999). Resident forest species (such as hairy woodpecker and black-capped chickadee) and Neotropical migrant forest species (such as red-eyed vireo, rose-breasted grosbeak, veery, and ovenbird) use larger woodland patches.

Important small and mid-sized mammals of the sandhills include masked shrew, pygmy shrew, red-backed vole, meadow vole, deer mouse, Franklin's ground squirrel, thirteen-lined ground squirrel, northern pocket gopher, porcupine, and North American badger (Kadrmas 2005).

Old Cropland

Old cropland occurs at all three Souris River basin refuges, roughly covering 10%, 13%, and 5% respectively of Des Lacs NWR, J. Clark Salyer NWR, and Upper Souris NWR.

Physical Environment and Characteristic Vegetation

Old cropland includes areas cultivated before refuge establishment, usually on the Drift Plain, into which perennial grasses and forbs have been seeded to provide relatively tall, dense cover mainly for nesting by mallards and other ducks. The general term "seeded herbaceous cover" includes old cropland areas into which dense nesting cover or native grass mixtures were known to have been seeded at least once during the past 25 years.

Old cropland also includes previously cultivated tracts allowed to revert to herbaceous cover ("go-back" prairie). These reverted areas of old cropland are particularly extensive at J. Clark Salyer NWR. However, distinguishing go-back prairie from badly degraded drift prairie can be difficult based on plant species composition. Signs of soil surface disturbance or other physical evidence of tillage often are subtle. Definitive inventories generally have not been completed.

Typically, introduced species of grasses and forbs are used to reseed old cropland—intermediate wheatgrass, tall wheatgrass, and alfalfa or sweetclover or both (Duebbert et al. 1981, Higgins and Barker 1982). This seed mixture commonly is referred to as "dense nesting cover" (DNC). DNC is relatively inexpensive to establish, but has a limited lifespan—providing cover attractive to nesting ducks for perhaps only 6–8 years after seeding (Higgins and Barker 1982). Stand structure and vigor often can be rejuvenated and the life of the stand extended several years through periodic hay harvest, prescribed burning, or grazing. Regardless, stands of DNC respond less favorably to management treatment about 12–15 years after establishment. Typically, these areas are then cultivated and farmed for 2–3 years, then reseeded. For this reason, stands of introduced cover are considered semipermanent (Higgins and Barker 1982).

Nearly all old cropland at Des Lacs NWR is under the typical DNC rotation of seeding–managing–farming–seeding. Roughly one-half of old cropland identified on the Drift Plain at J. Clark Salyer NWR has been seeded during the past 25 years into DNC, or (more recently) native grasses, or both. Most old cropland at Upper Souris NWR was seeded into DNC 15–25 years ago. During the same time, other old cropland on the refuge was seeded into native grasses. Regardless of whether native grasses were "interseeded" or seeded into cultivated seedbeds, old cropland at Upper Souris NWR now is covered by invasive, introduced grasses and native grass species are no longer evident.

Stands of native grasses are expensive to establish in old cropland, mainly due to seed costs, but they have the advantage of being permanent if successfully established. In the early 1980s, native grasses were seeded into some old cropland areas at Upper Souris NWR, and were "interseeded" into several DNC areas at the refuge. Regardless of seeding history, native grass species are no longer evident on these areas. In recent years at J. Clark Salyer NWR, warm- and cool-season native grasses sometimes have been seeded into old cropland instead of introduced plant species typically used in DNC.

On the Souris River basin refuges, seeded herbaceous cover, whether composed of DNC or native species, tends to be rapidly degraded by undesirable, introduced plant species (especially smooth brome, quackgrass, Canada thistle, and leafy spurge). Smooth brome, in particular, becomes pervasive and significantly compromises stand structure. Management treatments that discourage undesirable, introduced cool-season plants (such as smooth brome) also tend to discourage the desirable, seeded, introduced cool-season grasses due to closely overlapping phenology. Application of herbicides to control noxious weeds (for example, leafy spurge and Canada thistle) can significantly reduce cover of alfalfa and sweetclover. Seeded stands dominated by warm-season grasses, typically big bluestem, switchgrass, and Indiangrass, may provide considerably broader latitude for control of undesirable cool-season plants. For example, prescribed fire ineffectively controls smooth brome in cool-season-dominated grasslands when few (<20% cover) warm-season plants are available to compete (Willson and Stubbendieck 2000). When warm-season plants are more common, however, smooth brome can be reduced by late spring burning when brome is most actively growing.

Characteristic Wildlife

Cover provided by plants seeded in old cropland generally is taller and denser than that on native sod at the Souris River basin refuges. However, this cover may not necessarily provide more secure nest site habitat for prairie ducks. At Des Lacs NWR during 2001–2003, the average annual success of duck nests discovered in DNC was similar to that in drift prairie (annual range 12–20% versus 12–34% [Mayfield estimate; Johnson 1979]).

Survival of nests in DNC at Des Lacs NWR was within an estimated 15–20% considered necessary to maintain stable duck populations in the region (Cowardin et al. 1985). The variety of duck species that nest in DNC was less than in drift prairie, however; an average of five and seven species were represented annually in the two habitats at Des Lacs NWR. Mallard nests composed most nests found in the seeded cover (annual average 60%) and other species were uncommon (<15% each). During the same years, nests of three species were common in drift prairie: mallard, gadwall, and blue-winged teal (35%, 23%, and 20% respectively of all nests discovered).

Savannah sparrow, clay-colored sparrow, and bobolink are abundant breeding birds in DNC and probably in all seeded herbaceous cover in old cropland at the refuges, similar to characteristic breeding birds of the contemporary drift prairie (Murphy and Sondreal 2003; Grant, et al.; unpublished data). DNC at the refuges also is important breeding habitat for sedge wren, Le Conte's sparrow, and Nelson's sharp-tailed sparrow; the relatively rank, dense cover apparently imitates the native wet meadow vegetation that attracts these species (Murphy and Sondreal 2003). DNC and other seeded herbaceous cover at the refuges may be a preferred nesting site and foraging habitat of the short-eared owl and northern harrier; their main prey, the meadow vole, appears to be common to abundant in this habitat most years.

Herbaceous cover seeded in old cropland can increase grassland habitat diversity at the refuges by providing a unique tall-grass prairie component. This may be increasingly important as vegetation height and density are reduced on much of the drift prairie. This reduction occurs through more frequent and intensive management treatments to effectively restore that prairie and address needs of a broader suite of grassland birds. Establishment of stands of native warm-season plants in old cropland should provide more flexibility for managing invasive plant species, better complement the Refuge System's goals for biological diversity and ecological integrity, and reduce erosion potential and sources of introduced plant species invasion (for example, by sweetclover) into native sod.

Coulee Woodland and Coulee Woodland Edge

Coulee woodland and coulee woodland edge occurs only at Des Lacs NWR and Upper Souris NWR (about 9% and 6% respectively; figure 9).

Physical Environment and Characteristic Vegetation

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Coulee woodland and coulee woodland edge includes partially to mostly wooded drainages of intermittent stream tributaries. It also includes any partially to mostly wooded, east- to north-facing , native sod hillside of the river valleys. In coulee woodland, the uppermost vegetation strata is dominated (>50% canopy cover) by trees, primarily green ash. Woodland edge is coulee that is sparsely wooded with trees, mostly green ash (5–50% canopy cover, usually <20%), plus associated chokecherry and other tall shrub. Coulee woodland and coulee woodland edge are characteristic of the west sides of steep-walled valleys, especially the southern half of Des Lacs NWR and most of Upper Souris NWR. Slopes at these sites at Des Lacs NWR typically are 25–60% and are less steep at Upper Souris NWR.

Coulee woodland at Des Lacs NWR occurs as a narrow (<300 feet wide), relatively linear habitat, typically with about 250–350 trees per acre and 55–60% canopy cover (from 1995 random plot data in Nenneman et al. 2003). Stands generally are 65–80 years old. Green ash is the overwhelmingly dominant overstory tree (Nenneman and Murphy, unpublished data). Historically, American elm codominated this woodland in the Souris River basin (Grant and Murphy 2005). However, elm occurred on only 56% of coulee woodland plots sampled at Des Lacs NWR in 1995, and these trees were dead and dying, apparently from Dutch elm disease. Ten years later, no viable mature elm remains and almost no young elm is found in the understory. With the change to dominance by a single-tree species, structure of coulee woodland will be further simplified and value of the habitat for some species of woodland-breeding birds may be altered. Other coulee woodland trees include boxelder and quaking aspen (28% and 3% frequency, respectively). No bur oak occurs at Des Lacs NWR even though it is common about 25 miles downstream near the confluence with the Souris River. Bur oak occurs infrequently at nearby Upper Souris NWR.

Principle understory shrubs in Des Lacs NWR woodland include chokecherry, Saskatoon serviceberry, and green ash saplings (>75% frequency each; Nenneman and Murphy, unpublished data). Shrub density typically is 600–1,000 stems per acre. Frequency of occurrence for the introduced tall shrub, common buckthorn, was 25% in 1995 (Nenneman and Murphy, unpublished data) and appears to have increased markedly since (Robert Murphy, wildlife biologist, Des Lacs NWR, personal observation). Left unchecked, this aggressive, weedy shrub may pose a serious threat to the native plant diversity and wildlife habitat value of coulee woodland, just as it has degraded native woodland, pasture, fens (alkaline bogs), and prairie in many midwestern states (Grace et al. 2001).

Ground cover averages 90% in coulee woodland at Des Lacs NWR and is dominated by native woodland sedges, Kentucky bluegrass, smooth brome, wild sarsaparilla, and western snowberry (Nenneman and Murphy, unpublished data). Leafy spurge rarely occurs.

Woodland edge at Des Lacs NWR is not just the broken-canopy transition between woodland and open prairie. More often, it is broad, grassy slopes of moderate to steep grade. Vegetation is scattered patches of tall shrub and young or stunted trees that emanate from subtly low, relatively moist areas and shallow drainages. This woody cover can sometimes spread into adjoining drift prairie. Tree canopy typically covers only 8–15% of woodland edge areas (Murphy et al., unpublished data). Typical tree and shrub densities are 40–70 stems per acre and 1,100–2,000 stems per acre, respectively. Green ash trees and snags (dead, tall woody stems) usually occur (69% frequency for each).

Shrubs common in woodland edge at Des Lacs NWR include green ash saplings, chokecherry, Saskatoon serviceberry, and round-leaved hawthorn (25–56% frequency). Each of four species of introduced tall shrub—common buckthorn, Tartarian honeysuckle, Russian olive, and caragana—occur infrequently (4–8% frequency). Woodland edge vegetation is otherwise badly degraded; invasive grasses, mainly smooth brome and Kentucky bluegrass (30% frequency) and low shrubs (27% frequency) account for most cover. Leafy spurge occurs more than twice as commonly in woodland edge (10% frequency) than in other habitats. Intact assemblages of native vegetation rarely occur (3%).

Equivalent descriptive data for coulee woodland habitat at Upper Souris NWR have been collected recently but are not summarized. Distribution (site type), species composition, and structure of coulee woodland on the refuge appear generally similar to the respective attributes of coulee woodland at Des Lacs NWR. Coulee woodland edge is similarly pervasive on northwest- to southeast-facing slopes at Upper Souris NWR but also remains unquantified except for the herbaceous and low-shrub stratum. In this layer, vegetation dominated by native low shrub, especially western snowberry, is prevalent (30% frequency), just as at Des Lacs NWR. Unlike at Des Lacs NWR, however, this layer is otherwise composed chiefly of native-dominated and Kentucky bluegrass-dominated vegetation (24% and 31% respectively at Upper Souris NWR), rather than smooth brome-dominated vegetation (12%).

Characteristic Wildlife

The breeding bird community of coulee woodland at Des Lacs NWR is characterized by least flycatcher, house wren, and yellow warbler, which are abundant (figure 13). Red-eyed vireo, spotted towhee, and clay-colored sparrow are common. Two forest-interior species, veery and ovenbird, are found in the most mature stands. Cooper's hawks are common, with a nest area occurring about every mile along the southern half of the refuge (Nenneman et al. 2002). Northern goshawk and pine grosbeak are among migrant bird species that often overwinter in coulee woodland (Des Lacs NWR Christmas bird count, 1939–2004 data).

Characteristic small mammals of coulee woodland at Des Lacs NWR are deer mouse and red-backed vole (Eddingsaas et al., unpublished data). Eastern cottontail and moose are uncommon and local in distribution, while the white-tailed deer is common and widespread.

Lee Karney/USFWS

Song Sparrow

Because of its structural diversity, it is unsurprising that woodland edge provides habitat for more breeding bird species than other habitats at Des Lacs NWR (figure 13). Woodland edge is the most important habitat at Des Lacs NWR for willow flycatcher, song sparrow, and brown-headed cowbird; the cowbird occurs more than twice as frequently here than in any other habitat (Murphy and Sondreal 2003). Besides brown-headed cowbird, however, the only other grassland bird species common in this habitat is clay-colored sparrow.

Almost no woodland cover existed at present-day Des Lacs NWR in the 1800s, but woodland had developed by the time the refuge was established (Grant and Murphy 2005). The area covered by woodland increased significantly through the late 1960s but appears to have nearly reached its potential extent.

Today, most areas covered by coulee woodland at Des Lacs NWR may be overwhelmingly difficult to restore back to prairie. However, these areas probably could continue to provide modest habitat for forest-interior bird species without hindering widespread improvement in grassland bird habitat elsewhere at the refuge (Grant and Berkey 1999). In contrast, coulee woodland edge is a widespread habitat type at the refuge that, in the absence of fire, would continue to fragment drift prairie and some prairie slope. None of the breeding bird species that are common in this edge habitat is of management concern, whereas 11 grassland bird species that occur or used to occur at Des Lacs NWR are species of concern.

Conversion of woodland edge habitat to open prairie at Des Lacs NWR could be done through repeated prescribed fire. This conversion would negligibly influence continental population trends of woodland bird species, while helping reverse population declines of grassland bird species (Murphy and Sondreal 2003). Reduction of woodland edge may also help reduce cowbird parasitism rates among grassland bird nests.

The breeding bird community of coulee woodland at Upper Souris NWR likely is similar to that in the same habitat type at Des Lacs NWR. However, the bird community at Upper Souris NWR could be more diverse because some of its coulee woodlands at the refuge are broader, which may provide habitat for additional forest-interior species (for example, great crested flycatcher). Data on abundance of breeding birds and of other vertebrate species specific to coulee woodland and to coulee woodland edge at the refuge are available but not summarized. Unlike Des Lacs NWR, coulee woodland was evident in the 1800s along the river valley of present-day Upper Souris NWR, although its extent has increased markedly since (Grant and Murphy 2005).

Riparian Woodland

Riparian woodland occurs only at J.Clark Salyer NWR and at Upper Souris NWR (5% and 2% of refuge area, respectively; figure 9).

Physical Environment

Riparian woodland occurs within about 0.5 mile of the Souris River and is most extensive on the southern one-half of J. Clark Salyer NWR and the upper one-third of Upper Souris NWR. Woodlands extend downstream from Upper Souris NWR and terminate 1 mile west of Willow Creek at J. Clark Salyer NWR. These woodlands are associated with the meandering river, its numerous oxbows, and abandoned channels.

At least 1,000 acres of riparian woodland at Upper Souris NWR were permanently lost in the late 1930s when water was impounded behind Lake Darling dam. Riparian woodland is periodically inundated by overbank flooding of the Souris River. Soils are alluvial, mainly silty clay loams that are poorly drained.

Characteristic Vegetation

Riparian woodland has not been extensively inventoried at J. Clark Salyer NWR; quantitative and qualitative data are derived from less than 10 survey plots variously located in the riparian zone (Nenneman et al., unpublished data). Extensive inventories have been recently completed at Upper Souris NWR but the data have not been summarized.

Green ash is the dominant tree species of riparian woodland. American elm was once codominant with green ash, but Dutch elm disease has all but eliminated elm from riparian woodland. Furthermore, recent flooding (1997–2001) significantly reduced the density of large elm snags. Bur oak, boxelder, eastern cottonwood, and balsam poplar also occur. Understory shrubs include redosier dogwood, chokecherry, and various willow species. Ground cover comprises various forb, grass, and sedge species. Woodland cover is mostly continuous, with the forest canopy broken only by the meandering river channel and its numerous oxbows.

An extended hydroperiod associated with construction and operation of numerous dams along the Souris River has likely contributed to observed changes in extent and composition of wet meadow and riparian vegetation at the refuges. Green ash and American elm mortality occurred north of Lake Darling when the maximum operating elevation of the lake was raised 1 foot to 1,597.0 feet above mean sea level. Loss of these species is linked to increases in depth and duration of surface flooding (Fredrickson 1979, Fredrickson and Batema 1992).

Characteristic Wildlife

Breeding birds have not been inventoried in riparian woodland at J. Clark Salyer NWR. Inventories have been recently completed at Upper Souris NWR, but the data have not been summarized. Based on qualitative observations and data from related systems, riparian woodland is important for forest-interior migratory birds such as northern waterthrush, ovenbird, veery, red-eyed vireo, and American redstart (Rumble et al. 1998, Grant and Berkey 1999, Murphy and Sondreal 2003).

Gary Kramer/USFWS

Black-crowned night-heron (above) and great blue heron colonies are found in riparian woodland.

Other characteristic vertebrates include red squirrel, red-backed vole, masked shrew, raccoon, moose, wood frog, chorus frog, and leopard frog.

Meadow

Meadow is a transitional habitat on the Souris River basin refuges, where it supports some water-loving plants and is sometimes temporarily flooded. In addition, meadow supports vegetation characteristic of relatively moist areas of uplands. Meadow on the refuges generally is not classified as wetland in broad inventories based on remote imagery (for example, Habitat and Population Evaluation Team [HAPET]; Cowardin et al. 1979); this may partly be an artifact of the particular imagery used and its interpretation.

Meadow occurs at all three refuges but is uncommon at Des Lacs NWR (<1% of area versus 9% of J. Clark Salyer NWR and 6% of Upper Souris NWR; figure 9).

Physical Environment

The Souris River is "under-fit" relative to the size of the river valley (1–2 miles wide at J. Clark Salyer NWR). The river is sinuous and meandering, with numerous oxbows and abandoned channels. Prior to settlement, the Souris River valley supported numerous riverine and palustrine marshes maintained by periodic overbank flooding of the river. Extensive meadows that occurred on the northern one-half of J. Clark Salyer NWR and much of Upper Souris NWR have been lost—initially during the early 1900s due to extensive drainage and channelization, and later during the 1930s as water was impounded in several large reservoirs following refuge establishment.

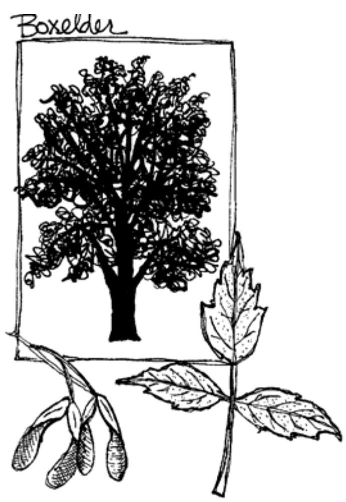
Contemporary meadows at J. Clark Salyer NWR and Upper Souris NWR occur along both banks of the river within a seasonally inundated zone that includes riparian woodland habitat. This zone is bounded by prairie parkland at J. Clark Salyer NWR and by drift prairie and prairie slope at Upper Souris NWR. Soils are alluvial, silty clay loams that are poorly drained. Meadows extend south and west of J. Clark Salyer NWR in McHenry County and are especially extensive around Towner, North Dakota. Meadows in private ownership are used for winter livestock forage (hay land) and are bordered mainly by native rangeland.

Meadow is limited in area at Des Lacs NWR, occurring in small (<40-acre), isolated, often long, narrow patches. Meadow occurs at the mouths of major coulees or on the periphery of riverine wetland units along the southern one-third of the refuge. Meadow is uncommon on the refuge because of the valley's relatively narrow, steep profile.

Characteristic Vegetation

A variety of native sedges, rushes, and grasses dominate meadow sites including the following principal species: slim sedge, wooly sedge, and fescue sedge, prairie cordgrass, northern reedgrass, Baltic rush, common spikerush, and fowl bluegrass.

Oxbows, meander scars, and old channels support wetland plants tolerant of deeper water such as cattail, three-square bulrush, giant bur-reed, slough sedge, and American mannagrass.



Low shrubs include western snowberry, meadowsweet, and Woods' rose. Tall shrubs include several willow species and aspen. Near the river channel, meadow includes edges of riparian woodland where dominant species are green ash, American elm, bur oak, boxelder, and balsam poplar.

Willow shrubland and aspen woodland have expanded significantly since 1900 and now occupy 15–20% of the meadow zone (Grant and Murphy 2005). The herbaceous component of the contemporary meadow vegetation is composed of pristine native assemblages (37%), partially degraded native assemblages where native plants occur codominant with introduced plants (10%), and assemblages that are severely degraded (mostly by quackgrass [18% of all cover], reed canarygrass [8% cover], Kentucky bluegrass [7% cover], Canada thistle [<4% cover], or leafy spurge [<1% cover]).

Expansion of tall shrubs and trees is the most significant threat to meadows. The open, herbaceous character of meadows was historically maintained by fire, periodic spring flooding, and year-round grazing by bison and elk (Hanson 1984). During the 15-year interim between the extirpation of bison and beginning of settlement (about 1875–1890), early ranchers used meadows for open range and as hay land for winter livestock forage. Beginning in 1890, Euro-American settlers suppressed natural fires, and extensive cultivation and road building limited the spread of fires once started. On poorly drained soils, willow and aspen can quickly invade sedges and grasses in the absence of fire or grazing (Ewing 1924, Buell and Buell 1959, Coupland 1961).

Since 1900, the hydroperiod and hydrograph of the Souris River have been altered, first by drainage and channelization, and later by construction of dams along the entire river. Changes in the peak and duration of spring river flows have likely affected historical soil moisture levels in meadows, which could have affected establishment and expansion of tall shrubs and trees (Laubhan et al. 2003).

Beginning in the 1880s, annual clipping (haying) largely replaced fire and grazing as the principal defoliation disturbance. Recurrent clipping of woody sprouts appears effective in limiting the expansion of willow and aspen into meadows.

Rapid invasion of meadow by trees and shrubs during the 1960s and 1970s appears to correspond with several years of high to extreme flooding (1956, 1960, 1969, and 1974–76), as the Souris River overflowed its banks and inundated adjacent meadows. Access to meadows was limited for several consecutive years, allowing woody plants to expand beyond control through use of conventional haying equipment. (Grant and Murphy 2005.)

Characteristic Wildlife

Use of meadows by breeding songbirds, waterfowl, or other waterbirds has not been systematically assessed. Qualitative observations suggest that meadows are important to upland nesting ducks (mallard, blue-winged teal, gadwall, and northern shoveler), shorebirds (willet and Wilson's phalarope), and grassland songbirds (bobolink, Nelson's sharp-tailed sparrow, Le Conte's sparrow, Savannah sparrow, and sedge wren), especially during dry years. Use shifts to wetland-associated bird species during years when meadows are flooded during much of the summer (for example, sandhill crane, sora rail, yellow rail, Wilson's snipe, marsh wren, red-winged blackbird, and redhead).

Based on data collected for birds breeding in drift prairie and prairie parkland, the occurrence of important open-meadow bird species, such as Savannah sparrow, Le Conte's sparrow, bobolink, and sedge wren will decline as trees and shrubs expand (Grant et al. 2004a). Conversely, extensive stands of willow and aspen are used by yellow warbler, common yellowthroat, alder flycatcher, willow flycatcher, clay-colored sparrow, and gray catbird.


Dave Menke/USFWS

Common Yellowthroat

Other characteristic vertebrates include beaver, muskrat, red-backed vole, meadow vole, deer mouse, masked shrew, raccoon, moose, wood frog, chorus frog, leopard frog, and tiger salamander.

Wetland

Few natural riverine wetlands remain at the Souris River basin refuges. This section focuses on the contemporary riverine lakes and marshes, which account for 35–40% of collective habitat acres of the refuges (figure 9).

International Agreements

All of the Souris River basin refuges have certain physical and legal constraints affecting their water management capabilities. All three refuges hold state-based water rights, administered by the state of North Dakota.

Des Lacs NWR holds a declaration of filing dated September 1, 1934. The water rights filed with the North Dakota State Engineer on August 25, 1937 claimed a total of 65,000 acre-feet. The primary water management constraints on Des Lacs are physical: the low gradient of the Des Lacs River and the small size and inconsistent elevations of the water control structures limits water management capability. Currently, senior water right holders do not directly impact Des Lacs NWR.

The 1909 Boundary Waters Treaty Act governs the apportionment of waters between the United States and Canada. This act generally specifies that Canada is entitled to 50% of the water originating in the Canadian portion of a river basin, and that the United States is entitled to 50% of the natural flow that would have occurred at the border. The Souris River is unique in that it arises in Saskatchewan and North Dakota (Long Creek), flows through Saskatchewan, enters North Dakota, and then flows north into Manitoba. In 1959, an interim operating agreement was adopted by the respective countries giving Saskatchewan the right to store and use 50% of the flows originating in Canada, and apportioning the remainder to North Dakota. In addition, North Dakota had to supply a minimum of 20 cubic feet per second (cfs) to Manitoba from June 1 through October 31, unless certain drought conditions existed. The International Souris River Board of Control oversaw the apportionment.

The governments of the United States and Canada entered into the "Agreement between the Government of Canada and the Government of the United States of America for Water Supply and Flood Control in the Souris River Basin" (referred to as the "International Agreement") on October 26, 1989 (the complete agreement is in appendix K). To offset evaporation from two large reservoirs constructed in Saskatchewan, Saskatchewan's apportionment would now be 60% of the natural flow, depending on the elevation of Lake Darling on October 1 of a given year. This language was modified in 2001. The current language gives the United States 50% of the first 40,500 acre-feet (50,000 cubic decameters) that occurs prior to May 1, and then there is a 50:50 or a 60:40 split between the countries depending on the elevation of Lake Darling on June 1 of each year.

The operation of the Lake Darling Dam is under the control of the Service for runoff events with less than a 10-year exceedance probability. For flood events with greater than a 10-year exceedance probability, the USACE assumes operational responsibility for Lake Darling. The Service operates the dam at the direction of the USACE. Saskatchewan Watershed Authority operates the dams in Canada and coordinates dam operation with the Service, the USACE, and the North Dakota State Water Commission.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Lake Darling

In addition to the flood control project, there are senior water right holders in North Dakota, and an agreement with the Eaton Irrigation Project for water supply. Management at Upper Souris NWR must accommodate senior water right holders and the Eaton Irrigation District. These operations are coordinated with the North Dakota State Water Commission. The Service and the Eaton Irrigation District have applied for prescriptive water rights through a state process; none of these water right applications has been finalized. The disposition of the water right claims has the potential to impact water management on the Des Lacs NWR and Upper Souris NWR.

The water resources division of region 6 of the Service helps fund gauging stations on the Souris River that are used in determining apportionment, meeting water quality mandates set by the International Agreement, and helping in water management. In addition, Service employees of the water resources division have a role on the International Souris River Board and participate in subcommittees of the board. The water resources division is also working with the North Dakota State Water Commission on the processing of the prescriptive water right applications. Changes in refuge operations that might have water right implications or be affected by the International Agreement are coordinated through refuge staff consultation with the division of water resources.

Physical Environment

Almost all wetlands occur as riverine lake and marsh units that are impounded behind low-head dams and, thus, have potential for water level management. The degree to which these can be successfully managed differs markedly among and within refuges.

Natural wetlands not impounded by dikes and dams occur within other habitat types (for example, drift prairie, parkland, and meadows), especially at J. Clark Salyer NWR. These natural wetlands are generally managed in concert with the surrounding upland matrix in which they occur. Constructed ponds such as dugouts (cattle water sources) and wetlands created by damming intermittent streams compose a small component (<200 collective acres) of the Souris River basin refuges (figure 15).

Much of this section is adapted from a recent biological assessment of the Souris River basin refuges by Laubhan et al. (2003). The Souris River basin encompasses about 24,600 square miles, of which 5,500 square miles are in the United States.

The Souris River is perennial and originates in Saskatchewan. The river flows south to Velva, North Dakota, and then turns north, entering southern Manitoba northeast of Westhope, North Dakota. The Des Lacs River is a major tributary, entering the Souris River northwest and west of Minot. Des Lacs NWR and Upper Souris NWR are contained within steep, high-relief (0.7 mile wide and 165 feet deep) river valleys (Lord and Kehew 1990), with numerous intermittent drainages extending several miles from the respective rivers.

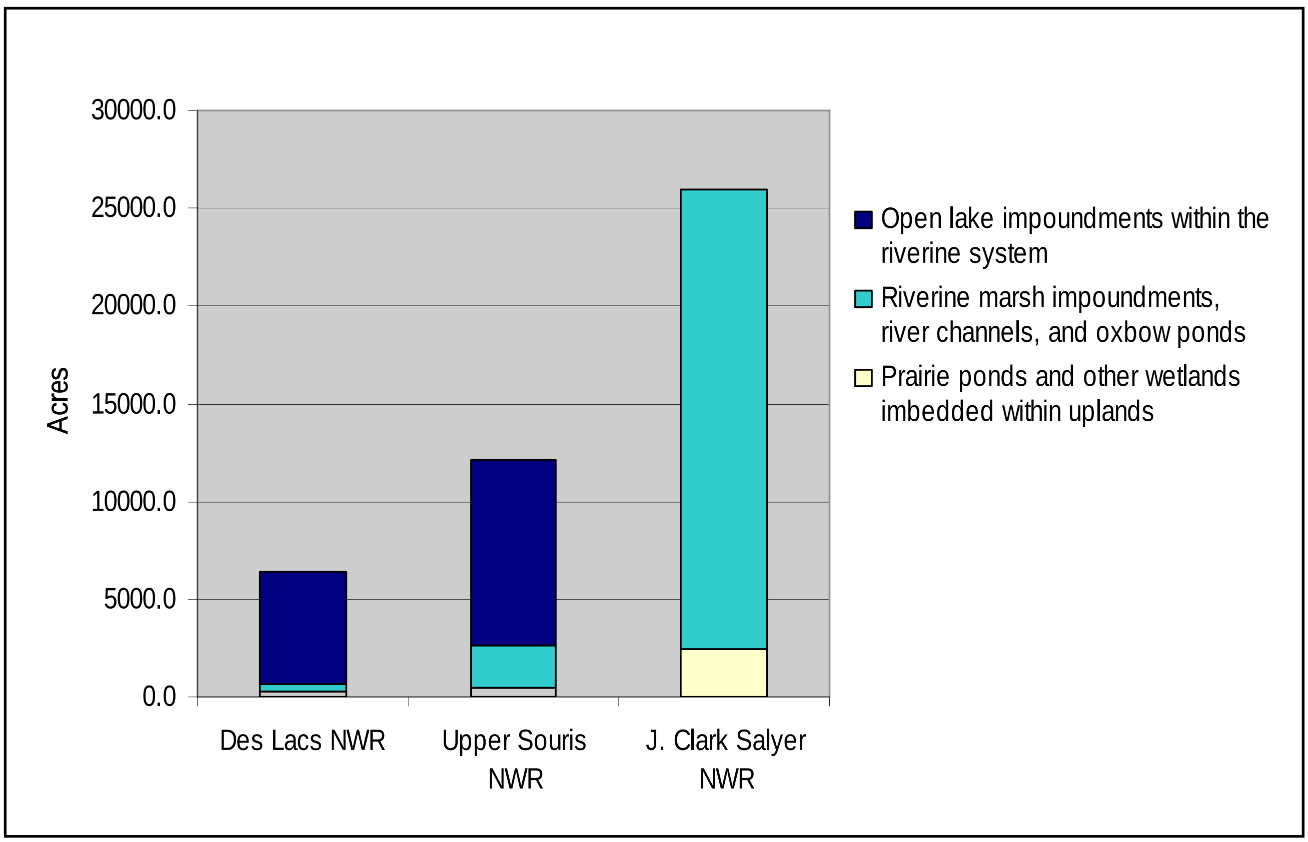

Figure 15. Extent of three wetland types at each of the Souris River basin refuges, North Dakota.

The downstream portion of the Souris River drainage, including J. Clark Salyer NWR, lies within the Souris Lake Plain physiographic subregion, a flat, deltaic outwash plain, bordered to the south and east by a series of sandhills. The Souris River is “under-fit” relative to the width of the valley floor, which exhibits many old oxbows, meander scars, and channel relicts.

Prior to settlement, the Souris River valley contained numerous riverine and palustrine marshes, maintained by periodic overbank flooding of the Souris River. With Euro-American settlement of the region, drainage significantly modified the Souris and Des Lacs rivers. This was most evident at J. Clark Salyer NWR, where stretches of the river were dredged and channelized to promote cultivation. River flows were unregulated until the 1930s. At this time, numerous low-head dams were constructed along the river to regulate flooding and carry out wetland management to benefit waterfowl at the three refuges. Because of these changes, few natural riverine wetlands remain at the Souris River basin refuges (excepting meadows on the southern one-half of J. Clark Salyer NWR).

Wetlands of Des Lacs NWR

Des Lacs NWR extends from the Canada border to 8 miles south of Kenmare, North Dakota. The refuge includes 5,695 acres of open water and 350 acres of emergent marsh along a 28-mile reach of the Des Lacs River (figure 15). The river’s name was derived from the French, “Riviere des Lacs,” literally, a “river of lakes.” The floodplain of the present-day refuge historically included a series of three large basins that functioned at times like dynamic prairie lakes. At other times, it functioned like a broad, slow-moving river, overflowing into adjoining and downstream marshes and meadows.

Dikes were constructed in the 1930s to create eight impoundments. Maximum water depths in impoundments range from 5 to 12 feet; maximum storage capacity of all impoundments is 53,879 acre-feet. Each dike is equipped with water control structures to permit water level manipulations. However, control is limited for several reasons, as follows:

- The source of water is unregulated runoff from the surrounding watershed (350 square miles of which only 43% contributes runoff to the river). Water enters different refuge impoundments via five primary coulees on the west side of the refuge valley. Most runoff occurs during March and April, but severe summer thunderstorms also can contribute large volumes of water to refuge impoundments.
- Although the timing and amount of runoff received are not controlled, the construction of railroads on both sides of the floodplain has altered surface inputs to the impoundments. Historically, surface water transported by coulees to the river was unobstructed and entered the floodplain at various sites and velocities. In contrast, water from coulees obstructed by the railroad grade must now pass through ditches and culverts, which function to stabilize the location and restrict the velocity of water entering impoundments.
- Dikes were constructed perpendicular to the floodplain; thus, upstream impoundments can only be dewatered by transferring water through downstream impoundments. This challenge has been alleviated to some extent by constructing bypass channels around some impoundments (for example, impoundments 6 and 7). Finally, water movement is restricted by an area of higher elevation (1,777.6 feet above mean sea level) in the middle impoundment (impoundment 4, also known as Middle Des Lacs Lake) that creates a hump or “hinge-point” in the system. Surface water inputs from coulees north of this hump flow north, whereas surface inputs from coulees south of the hump flow south. Consequently, drainage of northern impoundments 1, 2, and 3 is difficult. Changing the elevation of the dikes is not possible due to potential damage to the railroad grade. Therefore, refuge personnel have attempted to achieve more control by constructing a new structure that prevents water in impoundment 4 from flowing north.


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Aerial View of Unit 6 (upper third of photograph) at Des Lacs NWR

The local water board has proposed altering flood control protocols to evacuate water from the Des Lacs River to the Souris River in spring. Although this may improve the ability of refuge staff to achieve water levels more desirable for plant production, it may imply that an additional purpose of the refuge is flood protection.

Wetlands of J. Clark Salyer NWR

J. Clark Salyer NWR extends from Canada south for about 50 miles along the Souris River in Bottineau and McHenry counties, North Dakota. The refuge includes 23,525 acres of impounded riverine marshes and 2,474 acres of river, oxbows, and prairie marshes (figure 15). The watershed contributing to the refuge covers about 9,000 square miles, of which only 40% contributes runoff to the river.

During the early 1900s, attempts to farm and harvest hay from the area that is now the refuge were difficult due to frequent flooding. Therefore, previous landowners dredged channels to improve drainage. Following purchase by the Refuge System in 1935, the Service completed additional earthwork. This included construction of levees across the Souris River floodplain to retain water in five major impoundments, mainly to increase waterfowl production.

During the 1950s, and again in 1991–92, the heights of original levees were increased up to 2 feet to improve wetland management and as a mitigation measure for the Souris River Flood Control Project. Each dike was equipped with control structures to enable management of water levels. The addition of heated radial gates (around 1990) has provided more flexibility in discharging water from impoundments during winter. Flows exceeding 3,000–3,500 cubic feet per second are discharged over spillways constructed as part of the levee design. Maximum water depths in pools vary, but range from 4–6 feet.

Gary Eslinger/USFWS

Dam 1 at J. Clark Salyer NWR

The types of prior land modifications at J. Clark Salyer are similar to those already mentioned for Des Lacs NWR and Upper Souris NWR. In general, the construction of levees to impound and manage water has converted a dynamic lotic (flowing) system to a less dynamic lentic (nonflowing) system. The ability to manage this altered system is constrained by the existing physical infrastructure. During periods of high river flows, the river often transports a large volume of water. These flows must pass through refuge impoundments, but the channel capacity often is not sufficient to transport the water quickly or efficiently. Thus, marsh habitat within impoundments often becomes flooded for extended periods. Although this occurred naturally, upstream disturbances and increased runoff from wetland drainage have significantly altered the time and duration of these flows.

Another potential long-term change occurring in marshes at the refuge is increased deposition of sediment. Although the river potentially can transport large sediment loads into the marshes, drainage of numerous wetlands in surrounding agricultural land may elevate sediment loads (for example, Brander drain, Boundary Creek drain, Oak Creek drain, and White Spur–Stone Creek drain). A determination of sediment accretion rates is currently being made, but results are not available for inclusion in this draft CCP and EA. Based on qualitative sampling in 2003–2004 and on data collected for Sand Lake NWR, South Dakota (Gleason et al. 2003), it seems likely that accumulated sediments have significantly degraded the long-term productivity of refuge marshes and may continue to do so.

Wetlands of Upper Souris NWR

Upper Souris NWR follows a 35-mile reach of the Souris River in Renville and Ward counties, North Dakota. Wetland habitats total about 12,175 acres (figure 15), including the following:

- 9,575-acre reservoir, Lake Darling
- 58 acres of river
- 2,127 acres of riverine marshes with riparian woodlands
- 472 acres of dugouts, ponds, oxbows, and prairie marshes

The watershed for Lake Darling is 9,450 square miles, of which only 35% contributes runoff to the lake. The primary management objective for Lake Darling is to provide water, particularly during drier years, to marshes at J. Clark Salyer NWR located 237 river miles downstream. However, the reservoir also provides the water supply for downstream marshes at Upper Souris NWR. In addition, the reservoir provides 100-year flood protection for Minot, North Dakota (population 33,000).

In addition to Lake Darling, there have been numerous smaller impoundments created both above and below the reservoir by constructing earthen dikes equipped with water control structures. Some of these impoundments (pools A, B, C, 87A, 96A, and 96B) are located adjacent to the Souris River and pump stations are used to supply water. The Souris River runs through the remaining impoundments (Pools 41, 87, and 96). Water management capability varies among impoundments. Pools A, B, C, 87A, 87B, 96A, and 96B are isolated from the river and can be effectively managed. Many pools require that in-stream pools be lowered before they can be drained.

Sanford Rostad/USFWS

Pool C at Upper Souris NWR

Lake Darling is part of the Souris River Flood Control Project, which includes three dams in Saskatchewan. Collectively, these structures provide 100-year flood protection for Minot, North Dakota. An international agreement and an agreement with USACE stipulates that the Service will control discharges from Lake Darling dam unless the magnitude of the flood exceeds a 10-year event. In addition, drawdowns of Lake Darling are mandatory, to prepare for floods up to a 100-year event.

The construction of Lake Darling Dam and other dams on the river have resulted in numerous effects on natural resources, both positive and negative. Compared to pre-dam conditions, flows in the river have been greatly altered. Peak flows have been lowered, whereas the duration of low and moderate flows has increased. Flow releases to benefit different natural resource components often conflict, particularly during periods of extreme or extended drought and flood, as follows:

- Although the international agreement states that flood control dams are to be operated in a manner that mimics natural conditions to the extent possible, the timing of flow releases from upstream dams in Saskatchewan is often later than historical river flows.
- Management of Lake Darling is further constrained by an agreement to supply irrigation water (10,000 acre-feet) to the Eaton Irrigation District, and by minimum flow requirements at the international boundary near Westhope, North Dakota.
- Additionally, the capacity of the channel and structures in Minot to readily pass high flows complicates releases of water from Lake Darling. Subsequently, the water level in Lake Darling can fluctuate above desired levels.

Siltation rates probably vary among refuge wetlands. All drainages except the 12-mile-long Mackabee Coulee are short (<2 miles long). Much incoming silt carried by the Souris River appears to be trapped in pool 41 above Lake Darling. Lake Darling appears to receive some siltation from erosion of high banks surrounding the reservoir that occurs from wave action when the lake is high.

The Wetland Cycle

There have been no formal surveys of marsh vegetation at the Souris River basin refuges since the 1940s and 1950s, except for a recent study of sago pondweed at Des Lacs NWR (Euliss et al. 2003).

The impact of altered river flows has influenced sediment distribution, water quality, and plant community dynamics. The purpose of levee construction at all three refuges was to restore and enhance previously degraded wetlands. At the time of refuge establishment in the 1930s, lack of water was considered the primary limiting factor (Henry 1939, Steenis 1939). This is not surprising given this was the Dust Bowl era and human developments and agriculture had disrupted floodplain functions.

Installation of water control structures indicate that the need for water removal was necessary, but engineers of the original structures may not have considered the need for complete dewatering of refuge impoundments. Although successful in providing resources for wildlife, the construction of in-stream obstructions in the floodplains of both rivers, coupled with human disruptions to the floodplain, started to change fundamental wetland processes. The frequency and magnitude of different flow events changed (for example, minimum flows increased and peak flows decreased) and the channels of both rivers started to become laterally stabilized and entrenched. As a result, the frequency, duration, and extent of flooding were altered and likely became less dynamic. For example, compared to historical conditions, the areas impounded by levees obviously were designed to flood with greater frequency and for longer durations. In addition, changes in runoff and flow impacted sediment transport and deposition. In combination, these two factors are important in the creation and loss of riverine wetlands.

The levees constructed at each refuge created new, permanent areas of high- and low-flow velocities. This often has numerous impacts that affect long-term productivity of riverine systems. For example, the rate and number of new wetlands that are formed is reduced because scouring and deposition occurs repeatedly in the same areas. The creation of new wetlands is important because initially they tend to support annual plants and invertebrates capable of rapid colonization. Thus, they are important in providing wetland diversity needed for survival of many wetland-dependent species such as amphibians, reptiles, and birds. In addition, the location of sediment accumulation tends to become more stationary. As sediment depth increases, numerous factors critical to proper wetland function often are impacted, including soil properties, nutrient cycling, invertebrate egg banks, seed banks, and plant community composition. Eventually, wetlands that are sediment traps tend to become dominated by a reduced diversity of plants and invertebrates capable of tolerating a rather constant set of abiotic conditions.

Data collected at J. Clark Salyer NWR between 1940 and 1960 suggest that many of the above changes started to create new management challenges as the drought ended and a wet period began. In a report covering the period 1946–56, it is stated that “annual floods prevented the attainment of complete plant succession from marsh to dry-land species which had been desired at higher elevations” (Hammond, no date). This report further states that areas (primarily sloughs and oxbows) at elevations below 1,415 (elevation datum not provided) were never exposed during this period and that most had “silted in greatly” during the years of high water levels.

In 1951, a refuge report on marsh and waterfowl management at Lower Souris NWR (later renamed J. Clark Salyer NWR) states that “sediment accumulation in open water bay sloughs, channels, borrow pits, and all open water areas not covered by sod, or exposed to periodic drying or wave action, had developed a deep muck bottom” (Hammond [no date]). This report also mentions that periodic drawdowns were being conducted, but implies that success was dependent on time and magnitude of river flows. Other conditions that had developed by this time included concern regarding the extensive expansion of cattail, river bulrush, and common reed (anonymous 1962), as well as relationships between algal blooms, pondweed production, and botulism (Hammond 1961, 1962). Similar records were not located for Des Lacs NWR and Upper Souris NWR. However, many of the same challenges likely occurred at all three refuges, because a river flows through impoundments at each refuge and individual impoundments cannot be independently flooded or dewatered.

Since the 1950s, there have been numerous, additional disturbances within the Souris River basin that have further altered the dynamic flow regimes once characteristic of the Souris and Des Lacs rivers. This includes additional dams and an international agreement that regulates river flows and water quality, along with continued human development. An example of an altered flow regime is where the average annual runoff at Sherwood, North Dakota, was 73,170 acre-feet between 1929 and 1968, but increased to more than 208,000 acre-feet (184%) between 1969 and 1975 (Ulrich and Pfeifer 1976). Although such increases are due in part to precipitation cycles, another cause has been major land use changes in the watershed (Ulrich and Pfeifer 1976). For example, wetland drainage and conversion of grasslands to cultivated cropland has likely increased runoff contributed by watersheds.

Given the history of changes and current conditions within the Souris River and Des Lacs River watersheds, one of the challenges that must be addressed if management goals are to sustain long-term productivity is the ability to manage water to promote natural marsh cycles. Short- and long-term hydrologic conditions affect many abiotic factors. Water fluxes affect nutrient cycling by determining the type and quantity of nutrients that enter and exit wetlands and influencing decomposition rates (Livingston and Loucks 1979). Hydroperiod affects water quality and soil conditions (Mitsch and Gosselink 2000). These abiotic conditions in turn influence biotic components including the composition, distribution, and productivity of wetland vegetation (van der Valk and Welling 1988, Squires and van der Valk 1992) and invertebrate community composition and structure (Kadlec 1982). Ultimately, vertebrate use of wetlands is directly and indirectly affected by hydrology (Weller and Spatcher 1965, Weller and Fredrickson 1974, Laubhan and Roelle 2001).

Currently, refuges have difficulty removing water from impoundments and drying soils sufficiently to (1) promote establishment of annual vegetation, or (2) control the encroachment rate of perennial vegetation such as cattail and bulrush. Therefore, vegetation tends to cycle rapidly between open water and dense stands of perennial emergents. The root of this problem may be the inability to reliably dewater impoundments during the growing season because of the following:

- The volume of water entering the refuge is frequently outside the control of the refuges.
- Water entering the refuge cannot be diverted from marshes because the river flows through each impoundment.
- Management actions such as drawdown of one impoundment constrains management options at other impoundments.

All three refuges have attempted to dewater impoundments and, when accomplished, the seed bank responds in large portions of many impoundments. This suggests that the seed bank is still viable. However, the ability to reliably conduct complete drawdowns at the correct time is limited. Consequently, maximum productivity potential of impoundments is often not attained. Upper Souris NWR appears to have the greatest capability to control water during the growing season, but only in a few impoundments (collectively <2,000 wetland acres). In contrast, J. Clark Salyer NWR and Des Lacs NWR often attempt to dewater select impoundments, but success is hindered by the inability to move flows through impoundments without unintended flooding of marsh substrates.

The importance of dewatering and drying soils described above is based on an important paper describing a model of wetland plant succession that was developed by van der Valk (1981). According to this model, wetland plants can be divided into groups based on life span (annual, perennial with limited life, or perennial with unlimited life), propagule longevity (short or long), and requirements for propagule establishment (drawdown, surface water). Annual plants generally have long-lived propagules that are contained in the seed bank and, following a drawdown, production of seeds can be large. However, if the wetland remains saturated or flooded for more than a year, the abundance of annuals typically decreases because they are incapable of germinating in water. In contrast, perennial vegetation tends to increase because these species can propagate by rhizomes as well as seeds, and can tolerate deeper water. Through time, particularly under stable water regimes, perennial plants capable of reproducing by rootstocks (such as cattail and bulrush) will begin to dominate the wetland plant community. In many cases (such as the Souris River basin refuges), dense, monotypic stands of robust vegetation develop throughout the basin and a decline in productivity eventually occurs.

In northern temperate wetlands, the feeding and house-building activities of herbivores such as muskrats and beaver are extremely important at this stage in the cycle. These activities, in conjunction with water level fluctuations, function to create openings in the marsh and facilitate the production of annuals when the next drawdown occurs. At the Souris River basin refuges, however, the inability to conduct complete drawdowns appears to create conditions that either facilitate the creation of large open water bodies or cause rapid recolonization of perennial vegetation. Thus, marshes often do not exhibit the critical dry portion of the marsh cycle that facilitates oxidation of soil and stimulates annuals to germinate.

Characteristic Wildlife

The importance of the Souris River basin refuges for waterbirds has been widely recognized since acquisition of the areas. For example, following impoundment development in the 1930s, the waterfowl response at J. Clark Salyer NWR was tremendous. During the first 3 years of management, nests of 22 species were documented for the first time at the refuge. By 1939, a total of 112 nesting species had been documented (Henry 1939).

Currently, the refuges provide food and breeding habitat for thousands of migrating and nesting waterfowl. J. Clark Salyer NWR, in particular, has developed into one of the most important duck production areas in the United States. The refuge also provides habitat for numerous other bird species including shorebirds, grebes (five species), and wading birds. Based on the most recent bird list available, the refuge has documented 160 nesting species.


Donna Dewhurst/USFWS

Green-winged Teal

The American Bird Conservancy recognizes all three refuges as "Globally Important Bird Areas." In addition, J. Clark Salyer NWR has been designated as a regional shorebird site in the "Western Hemisphere Shorebird Reserve Network." Lake Darling is designated critical habitat for the federally threatened piping plover.

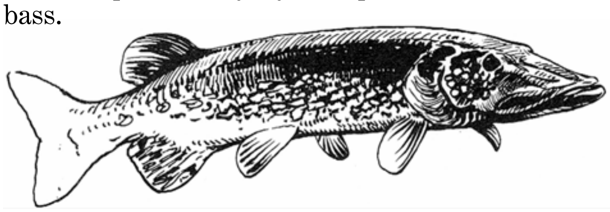
The Souris River basin refuges support high densities of dabbling and diving duck species, especially during years with favorable wetland conditions. J. Clark Salyer NWR and the upper end of Lake Darling at Upper Souris NWR are especially important as a molting refuge for dabbling ducks. The Souris River basin is within the core breeding range of most dabbling duck and several diving duck species, including mallard, northern pintail, gadwall, American wigeon, green-winged teal, blue-winged teal, northern shoveler, redhead, canvasback, lesser scaup, and ruddy duck.

The Souris River basin provides significant breeding and migration habitat for more than 200 other bird species. Important wetland species that breed in the area include Franklin's gull, yellow rail, piping plover, Wilson's phalarope, marbled godwit, American avocet, American bittern, and five species of grebes.

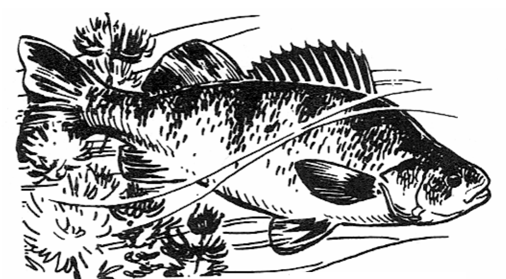
Wetlands in the region also provide important migration habitat for the following:

- waterfowl such as tundra swan and snow goose
- waterbirds including sandhill crane
- shorebirds such as Hudsonian godwit, American golden-plover, white-rumped sandpiper, and buff-breasted sandpiper

Other important vertebrates include muskrat, mink, painted turtle, snapping turtle, chorus frog, and tiger salamander. In addition, Lake Darling at Upper Souris NWR supports a fishery that includes northern pike, walleye, yellow perch, and smallmouth bass.



Northern Pike
Bob Hines/USFWS



Yellow Perch
Bob Hines/USFWS

Islands

All three Souris River basin refuges have islands.

Physical Environment

Construction of artificial islands is a management technique used in the Prairie Pothole Region to overcome the loss of upland nesting habitat.

Eight 0.5-acre islands were created in the early 1990s at Des Lacs NWR (four in each of 115-acre impoundment 6 and 400-acre impoundment 7 [lower Des Lacs Lake]). The latter were improperly designed and became mostly to completely submerged during reflooding of the pool in the mid-1990s.

At J. Clark Salyer NWR, more than 50 nesting islands, ranging in size from 0.6 to 3.0 acres, were constructed in the 1930s, 1950s, and 1970s. Islands were constructed in four large (4,000- to 5,000-acre) impoundments (pools 320, 326, 332, and 341) and in hay meadows east of the Rubble Masonry Unit. Additionally, a 7-acre natural island (Ding Island) is located in pool 320. All islands were constructed using a dragline or bulldozer or both to borrow fill adjacent to the site. Many islands were rehabilitated in the 1990s and were riprapped with fieldstone to reduce erosion.

At Upper Souris NWR, 28 islands have been constructed. Islands average about 0.6 acre each and are found in six impoundments (41, C, 87A, 87B, 96, and 96B). The two largest islands (2 acres each) are located in pools C and 96.

Characteristic Vegetation

The makeup and density of plant cover varies significantly among islands. The average cover on islands at J. Clark Salyer NWR follows:

- 18% low shrubs (western snowberry and Woods' rose)
- 38% introduced grasses (mainly smooth brome and Kentucky bluegrass)
- 23% tall, weedy forbs (stinging nettle, mustard, Canada thistle, and absinth wormwood)
- 9% leafy spurge
- the remainder is bare ground, rock, or emergent vegetation such as common reed and cattail

Low shrubs attractive to ducks as nest sites have been hand-planted and may need to be periodically replanted because of flooding or due to clipping by meadow voles during winter. Planted stands of DNC (wheatgrasses, alfalfa, and sweetclover) are short-lived (7–10 years), and often invaded by smooth brome, Kentucky bluegrass, and weedy forbs. Over time, grazing by Canada geese can shift island cover from grasses to weedy forbs.

The makeup and density of plant cover on islands at Des Lacs NWR and Upper Souris NWR is roughly similar and as variable.

Wildlife Use of Islands

Waterfowl use of nesting islands at J. Clark Salyer NWR has been intensively studied (Hammond and Mann 1956, Duebbert 1966, Aufforth et al. 1990, Willms and Crawford 1989). However, most of these studies were conducted over 2 years on a subset of islands. In 1992–94, a more comprehensive study was conducted on 30 nesting islands located in impoundments 320, 326, and 332 and under variable water levels (Grant and Shaffer, unpublished data). Gadwall was the most common nesting duck, accounting for 50–60% of nests. Gadwall, mallard, and blue-winged teal accounted for 90% of all waterfowl nests in this and previous island studies at J. Clark Salyer NWR. Less common were Canada goose, northern pintail, northern shoveler, lesser scaup, American wigeon, redhead, canvasback, and ruddy duck. Double-crested cormorant, American avocet, and ring-billed gull nest on islands occasionally.

Nests on islands at Des Lacs NWR are mostly of mallard, gadwall, and Canada goose. Canada geese have been observed nesting on islands at Upper Souris NWR.

Nest densities are higher on islands that have (1) predators controlled; (2) a large, surrounding, open-water barrier; and (3) extensive cover of low shrubs or leafy spurge (Grant and Shaffer, unpublished data). Nest survival can be greater than 75% (apparent survival), especially following winter drawdowns in conjunction with predator removal. Deep water and an extensive unvegetated barrier around an island discourage mammalian predators from reaching islands. Mink are a significant predator of island-nesting ducks and can seriously impact nest and hen survival (Grant and Shaffer, unpublished data). Once nesting begins, mink are especially difficult to remove by trapping. Striped skunk, raccoon, and red fox also cause nest losses but are more readily controlled. Gulls occasionally prey on eggs and ducklings.

Islands are expensive to build ($30,000 per acre) and maintain. Long-term maintenance costs were not factored into original construction; island repairs and rehabilitation have significantly inflated the cost-to-benefit ratio of island construction. Many islands that were built at J. Clark Salyer NWR in the 1930s during impoundment construction are rarely used by nesting waterfowl because they fail to deter predators that come from the mainland. These islands are perennially surrounded by dense stands of emergent vegetation, occur in shallow water, or are too close to the mainland.

CULTURAL RESOURCES

The Service is responsible for managing archaeological and historical sites found on refuge lands.

Prehistoric Background

Because of the limited nature of the archaeological work that has been conducted to date, much of the understanding of the area's prehistory is drawn by inference from surrounding areas. This document gives details of the various cultural traditions and complexes that are present or potentially present within the Souris River basin, particularly that portion of the Souris River valley in North Dakota upstream of the city of Minot.

Artifactual evidence exists for the presence of prehistoric peoples in and near the Souris River valley in North Dakota from Paleo-Indian times (9500–5500 BC) to early historic times. The Paleo-Indian tradition is characterized by a variety of hunting and gathering adaptive strategies, each with a strong focus on big game. Due to the limited amount of archaeological excavations in this area however, evidence for the presence of particular cultural complexes and traditions comes primarily


Rhoda Lewis/USFWS

Remains of a Prehistoric Campground in the Souris River Basin

from a small number of surface-collected diagnostic artifacts.

Ethnographic (descriptive of cultures) accounts indicate that the Assiniboine, Sioux, Mandan, Hidatsa, Plains Ojibwa, and Atsina peoples all made use of the Souris River region of North Dakota for hunting or trade route purposes. Although the area has a rich cultural heritage, few sites have been formally identified.

The Souris River basin refuges are within a relatively unresearched archeological area in northwestern North Dakota. The closest site to be excavated is about 40 miles west of the northern boundary of Des Lacs NWR at Long Creek near Estevan, Saskatchewan, in Canada. Excavation at Long Creek was sponsored by the Saskatchewan Museum of Natural History in 1957 and was reported in 1960 (Wettlaufer and Mayer-Oakes 1960). The Long Creek site revealed occupation by as many as nine separate cultures dating back to 3043 BC ±125 years. Because of the near proximity of the Long Creek site and the then-interconnecting of the Souris and Des Lacs rivers and the Long Creek flowage, it is reasonably safe to assume that at one time or another all of the nine cultures were present in the Des Lacs River valley.

Historical records indicate that the last inhabitants of the Des Lacs River valley, before Euro-American settlement, were the southern Assiniboine tribes, who now reside in Canada. Many known sites exist at the Des Lacs NWR where Native Americans occupied the area either in permanent or transient camps and more may be present but undiscovered. Sites commonly contain tipi rings and one site contains several turtle effigies with what are apparently rock-lined fire pits in the center. During drought years when water levels in the Upper Des Lacs Lake recede, large quantities of bison bones are visible on the beaches and shoreline adjacent to one site.

Early Exploration

Among the earliest accounts located for the Souris River region is an article that recounts a journey by Alexander Henry in the summer (June 14–August 9) of 1806 (Billeck 1990). Gough (1988) bases the article on a transcription of Henry's 1,642-page journal. The general route traveled was from the confluence of the Assiniboine and Souris rivers to near the confluence of the Knife and Missouri rivers. On the outbound portion of the trip, Henry headed southeast and crossed the Souris River valley to near present-day Minot, North Dakota. On the return portion of the trip, the Souris River was crossed near present-day Verendrye and again at Willow Creek.

Billeck (1990) indicated that at least part of the Souris River area was a buffer zone, which is a contested area between Native American tribes. In this case, the buffer zone separated the Assiniboine and Sioux. Buffer zones are characterized as supporting higher game populations because the area was not settled and was exploited only by hunting parties at high risk (Hickerson 1965). Henry's journal frequently mentions the abundance of game. For example, on August 1, 1806, Henry describes "thousands of buffalo [American bison]" while overlooking the Souris River valley from the Missouri Coteau. On August 3, 1806, Henry crossed the Souris near Verendrye and reported the river was "well stocked with red deer, moose, deer, antelope [pronghorn], and buffalo."

The first accounts of Euro-American contact with Native Americans occurred in 1738 when Verendrye traveled between Fort LaReine on the Assiniboine River to the Missouri River (probably near either present-day Bismarck or Minot, North Dakota) (Robinson 1966, Schweigert 1990). Organized fur companies such as North West Company, Hudson's Bay Company, and American Fur Company and independent trappers traded with Native American tribes between 1780 and 1850. However, major trading posts apparently were never established in the middle Souris River region of North Dakota (Schweigert 1990). Similarly, between the 1850s and 1880s, there were several military and civilian expeditions through the area, but again settlements were not mentioned (Schweigert 1990).

Although speculative, the journal kept by settler Henry A. Boller suggests that he and his party crossed the Des Lacs River at a point south of the southern end of Middle Des Lacs Lake and camped at the Assiniboine encampment approximately 5 miles east of the river valley. Whatever the case may have been, it is certain that Boller traveled through the Des Lacs River valley in 1858, several decades before the rapid and widespread settling of the area by Euro-Americans.

Boller's accounts of his journey to the Des Lacs River valley paints a picture of a vast and continuous landscape devoid of trees, but alive with life. Shortly after departing Fort Atkinson, Boller characterizes their route as "uninteresting ... high rolling prairie, totally destitute of timber." Again, making reference to an unforested landscape, Boller notes that out of necessity of "there being no wood within miles," he and his party were "busied in collecting dry buffalo chips" to provide fuel for their evening campfires.

Although Boller continued to characterize his route to the Des Lacs River valley as "a most barren and uninteresting country," the wildlife seemed to be overly abundant. Boller notes that the "buffalo were plenty ... wild fowl were present in countless numbers ... plenty of ducks could be obtained with but little trouble ... [wolf] forms could everywhere be seen sneaking over the adjacent hills." Again, in reference to the abundance of bison in the area, Boller noted that the country "abounded in innumerable lakes or ponds of stagnant water, and all more or less highly flavored with buffalo urine." Boller also made special mention of a grizzly bear that was sighted "a short distance from the line of march."

Boller's first and only reference to the presence of trees came on his party's approach to the Des Lacs River. It seems, however, that these trees did not make a big impression on Boller as they were not mentioned again in his journal. Boller described the trees as "a dark line" that "marked [their] approach to a running stream, the River of Lakes." From his brief description, the trees appeared to be no more than in a narrow line along the river edge. Boller also enthusiastically mentions that the river "had a hard rocky bottom, making a very good crossing," which according to Boller was "a wonder in this part of the country."

After crossing the river and "toiling up the steep and stony bluffs on the opposite shore ... reach[ing] a broad plateau", Boller's party was "strung out over the prairie" with "the conical skin lodges [of the Assiniboines] ... now plainly in sight, not more than five miles off." Boller describes the Assiniboines encampment as "in the middle of an open plain without a stick of timber in sight ... large bands of buffalos were in plain sight from the encampment ... the whole country seemed fairly alive with moving herds ... the proximity of the herds and the abundance of meat in the camp [made] the [Assiniboines] dainty in their selections."

Alexander Henry's 1806 journey from Fort Souris across the Souris River valley and Missouri Coteau to villages on the Upper Missouri River brought him into the vicinity of the Des Lacs River valley, thus providing another invaluable early description of the area's landscape. On reaching the Des Lacs

River valley, most likely near the confluence of Des Lacs and Souris rivers, Henry described a landscape of “steep hills ... covered with huge stones” and “low valleys in continual succession ... there [was] no wood of any kind” (Coues 1897). After continuing his trek across the valley, Henry and his party soon spotted a “cluster of wood at the N. extremity ... of a long lake running N. and S.” (Coues 1897). According to Henry, this came as a surprise to his guide, “who said he never knew of any wooded lake in this plain” (Coues 1897). Henry also noted the “thousands of buffalo which covered the plains” (Gough 1988).

Early Settlement

The first settlements began to appear in the early 1880s. The town of Scripton (near Velva) was established in 1882 and settlement of the Souris Valley upstream from Minot occurred in 1883. These initial settlers were ranchers that claimed lands in the Souris and Des Lacs river valleys for exclusive use by cattle and forage production (Stammen 1978).

A lignite mine was established near Burlington at the mouth of the Des Lacs River; by 1883, 12,000 pounds of lignite had been excavated. The 1885 Census of Dakota Territory listed 31, 257, and 800 people living in what would become Renville, Ward, and McHenry counties, respectively (Schweigert 1990). In Ward County, 600 head of cattle and 1,093 acres were planted to crops in 1884, and census records indicate there were 280 farms in McHenry County.

In 1886, extension of the Great Northern Railway from Devils Lake to Minot (Robinson 1966) was initiated. Following completion, the area was more accessible for settlers and both the Souris and Des Lacs river valleys filled with people. In 1893, the Soo Line was established from Minot north to Portal at the Canada border, part of which runs through present-day Des Lacs NWR for 12.6 miles. The Great Northern Railway extended a track that ran parallel to the Souris River from Granville to Sherwood. In 1905, the Soo Line constructed a rail from Oslo, Minnesota, to Kenmare that crossed the Souris River south of Greene (Schweigert 1990). Towns developed at regular intervals along these lines and, by 1905, nearly every quarter section (160 acres) of land in north-central North Dakota had been claimed. At this time, Minot had a population of about 10,000.

The Des Lacs River area was part of a vast cattle range that extended from Texas to the Canada border. Thousands of acres were ranched, as the lush prairie grasses of the area provided excellent pasture for finishing of cattle. In 1894, more than 125,000 head of cattle were trailed overland from the Chinook and Malta, Montana, area for shipment at Spiral, a major cattle-shipping center located a few miles northwest of the Des Lacs NWR headquarters along the Soo Line. Sheep were grazed in the hills and coulees in the areas to the west and southwest.

The first major influx of Euro-Americans into the Des Lacs River area began in the early 1890s near the present city of Kenmare. However, evidence indicates that a rancher settled the area in 1864 and the first lignite coal mine opened in 1880. Accounts left by one early rancher, Andrew McBride, relates that in 1892 there were only three other settlers within a 20-mile radius of his homestead, located at the southern end of Middle Des Lacs Lake. The coming of the railroad in 1893, however, opened up the area to settlement, although the development of town sites and the arrival of immigrants did not begin until after 1896.

The land in Kenmare was first opened to homesteaders in July 1896 and was incorporated as a village in 1901. In 1897, Kenmare took on the appearance of a booming frontier town with 1,200 cars of settlers arriving and the establishment of livery stables, restaurants, saloons, and other area businesses. The area was also a trade center for grain shipping and the terminal point for a short-lived river barge business. Navigation of the Upper Des Lacs Lake was begun in 1903 in a sternwheeler; barges were used to ship grain to a point near Kenmare to be unloaded and shipped via the Soo Line railroad. In 1904, records show that A.A. Robinson hauled about 200,000 bushels of grain on the boat to a site near Kenmare and loaded it onto the Soo Line Railroad.

The 1890s marked the beginning of a major transformation of the landscape in the Des Lacs River valley. Decades of activities associated with Euro-American settlement has resulted in dramatic changes in the composition and abundance of the area’s native fauna (for example, bison were extirpated) and flora (for example, increases in woody and brushy vegetation). Fortunately, detailed records were taken of the vegetation and wildlife of the Des Lacs River valley, particularly near Kenmare, in the early years of settlement.

George K. Dike came to the Des Lacs River valley area in September 1895. Dike’s survey notes described a prairie country, although noting the occurrence of trees and brush in coulees and along lakeshores. The photographs of E.H. Gross corroborate Dike's surveys and provide convincing evidence of the scarcity of trees in the Des Lacs River valley, especially near Kenmare, in the early 20th century. Vernon Bailey's field reports (1913) of the flora and fauna of the Kenmare and Des Lacs River valley area from July 1913 also suggested a prairie landscape, but included areas of dense woodland. According to Bailey (1913), the Kenmare area in 1913 was "rolling prairie ... [with] numerous coulees ... many of [which were] densely wooded or full of brush." He also noted the deliberate planting by farmers of trees such as boxelder and willow as windbreaks (Bailey 1913).

Although the landscape was being rapidly modified by agricultural and mining activities during the early 1900s, the bird fauna still appeared to be thriving in the Des Lacs River valley. According to Bailey's field notes, ducks, especially northern pintail, mallard, blue-winged teal, and northern shoveler, were abundant, as well as many other waterbird and shorebird species (Bailey 1913). More importantly, however, were Bailey's numerous accounts of species sensitive to woody growth and other invasive vegetation. This suggests that the grasslands surrounding the Des Lacs River valley in the early 1900s were of higher quality than those of today. The prairie-adapted species documented by Bailey (1913) included the northern harrier (common), Swainson's hawk (common), ferruginous hawk, greater prairie chicken (common), upland sandpiper, burrowing owl, short-eared owl (common), Baird's sparrow (common), and grasshopper sparrow (common). Conversely, certain species that were not very common during Bailey's survey in 1913 (such as the ring-billed gull, double-crested cormorant, and American white pelican) are currently common and abundant at the refuge.

Civilian Conservation Corps and Works Progress Administration

The election of Franklin Roosevelt as president in 1932 unleashed a host of programs aimed at stemming the Great Depression cycle. These programs were meant to build the nation's infrastructure to support the failing economy and to overhaul the methods that had lead to the disastrous conditions.

Roosevelt was a strong advocate for conserving natural resources and felt strongly that the federal government should take an active role in the nation's economy. His somewhat romantic sentiment was turned into several broad-brush executive orders to create work programs with a strong central conservation ethic. Five days after taking the oath of office, President Roosevelt called a conference with the secretaries of Agriculture, Interior, and War. The president discussed his ideas for recruiting 500,000 men to work in the nation's forests and eroded farmland.

The CCC was legislated, followed several months later with an executive order setting up the development of the Works Projects Administration (later renamed Works Progress Administration). Both programs contributed to the Depression-era development of the Souris River basin refuges. The men labored for months and years to build the headquarters, roads, dams, and recreation facilities that survive today and are an integral part of the refuges.

Camp Des Lacs was located at Kenmare, North Dakota. The camp was part of the 797th Company of the CCC; its official army name was Camp Sam G. Anderson. Camp Des Lacs was one of four CCC camps operating under the U.S. Bureau of Biological Survey, in the restoration and development of four migratory waterfowl refuges in the northwestern part of North Dakota. The camp was established to carry on the restoration and development of the Des Lacs and Lostwood migratory waterfowl refuges.

The CCC built almost all the present-day patrol roads, dams, and spillways at Des Lacs NWR. Several structures still remain including the cinderblock residence, cold storage building, well house, Tasker's Coulee picnic shelter, and Northgate rubble dam. In addition, the CCC built fences, planted trees, and transplanted emergent vegetation.

The 796th Company of the CCC was assigned to Camp BF-1 (known as Camp Maurek, located at Upper Souris NWR) and Camp BF-5 (known as Camp Heintzelman, located at Mohall). The camps operated from May 1935 to October 1941. A Works Project Administration workforce was employed at the Upper Souris NWR from December 1936 to November 1939, and for a short time in 1940.

At Upper Souris NWR, the CCC laborers helped build miles of truck roads, diversion ditches, spillways, waterfowl-nesting islands, and fish-spawning habitat. Crews from the CCC and Works Progress Administration cleared the area to be flooded by Lake Darling of fence materials, farm buildings, and trees that lined the river channel. Contractors built dams 83 (Lake Darling), 87, and 96. The CCC crews assisted by building spillways, culverts, bridges, and water control structures using quality masonry in which local fieldstones were incorporated. (Speulda and Lewis 2003).

The 766th Company of the CCC was assigned to Camp BF-4; after temporarily locating near Bottineau, the company was moved to a location west of Kramer. The camp was commonly known as Camp Ding, after J. Ding Darling. The CCC were stationed at the refuge from 1935 to 1942.

At J. Clark Salyer NWR, the company built dikes and miles of roads and fences; collected wildflower, grass, tree, and shrub seeds; planted trees; and installed many other wildlife habitat facilities. A Works Progress Administration workforce was also employed at the refuge from 1936 to 1941 and assisted the CCC with their projects.

Historical Sites

There are a limited number of sites at J. Clark Salyer NWR eligible for listing in the Register of Historical Sites. They are dams 1, 320, 326, 332, 341, and 357. There are many farmstead sites at the refuge but the exact locations are unknown at this time.

Special Management Areas

There are several, officially designated, special management areas in the Souris River basin refuges:

- The American Bird Conservancy recognizes each of the three refuges as a globally important bird area. The important bird area program, initiated by BirdLife International in Europe during the mid-1980s, was developed to recognize and support sites significant to bird populations. Based on the criteria developed by BirdLife International, an important bird area must maintain and support one or more of the following: (1) species of concern (for example, threatened and endangered); (2) restricted-range species; (3) species vulnerable because of population concentration; and (4) species vulnerable because they occur at high densities due to their congregative behavior.
- The auto tour route at the Des Lacs NWR is designated as a national scenic backway. The route starts at the south end of the refuge on the east side of the lake and proceeds north 6.5 miles to a point just south of Kenmare. The route then proceeds through Kenmare for 2.2 miles. The backway starts again on the south end of Boat Dock Road, 1 mile north of Kenmare. The route then proceeds north 5 miles on the west side of Upper Des Lacs Lake, until it exits the refuge and joins into Ward County Road 1.
- The Munch's Coulee Hiking Trail at Des Lacs NWR was designated as a national recreation trail in June 2005. The trail is located adjacent to the Lower Des Lacs Lake, situated just off the national scenic backway. The trail has an accessible hard-surfaced lower section that is 0.25 mile long. The foot trail is a loop on top of the bluffs overlooking the river valley.
- J. Clark Salyer NWR has been designated as a regional shorebird site in the Western Hemisphere Shorebird Reserve Network.

USFWS

Munch's Coulee Hiking Trail at Des Lacs NWR

- Lake Darling at Upper Souris NWR is designated critical habitat for the piping plover, a shorebird listed by the Service as threatened in the northern Great Plains.

Visitor Services

Each of the Souris River basin refuges supports a variety of the priority public uses identified in the Improvement Act.

Des Lacs NWR

The Des Lacs NWR provides visitors opportunities for five of the six priority public uses identified in the Improvement Act. Fishing is not allowed as there is no sustainable fishery population. Most activity centers on hunting and wildlife observation. Yearly visitation is approximately 11,000.

Hunting

The hunting program provides opportunity to hunt deer, turkey, pheasant, gray partridge, sharp-tailed grouse, cottontail, snowshoe hare, and fox. Many hunters request waterfowl hunting and are referred to other public lands or to private lands, as waterfowl hunting is not permitted at the refuge. A hunting "tear sheet" provides information, regulations, and a map for a variety of game seasons. Some aspects of the hunting program follow:

- Turkeys are hunted in the spring and fall.
- Upland game is permitted in late-November to early January annually, after deer rifle season closes and waterfowl have generally migrated out of the area.
- Deer hunting is permitted for archery, rifle, and muzzleloader hunters in accordance with state seasons. Archery season opens in early September, rifle season in early November, and muzzleloader season in early December. No special regulations exist except to have a unit tag. Youth deer hunting is allowed and

encouraged at the refuge during the September season.

- The Canada Goose Trail, White-tailed Deer Trail, and Boat Dock Road to Highway 52 are open for game retrieval access with vehicles during rifle deer season. Deer hunters are able to retrieve game during designated times posted at these locations, to encourage hunters to walk to access more remote areas of the refuge.
- Requests for accessible hunting permits (to shoot from vehicles) are evaluated for hunters with disabilities and are generally allowed.
- The use of dogs is permitted for upland game hunting only.
- No field trials or shooting ranges are permitted at the refuge.

Fishing

Fishing does not occur at the refuge.

Wildlife Observation and Wildlife Photography

An auto tour route is part of a system of North Dakota's scenic backways and byways. The route traverses 14 miles along Upper Des Lacs, Middle Des Lacs, and Lower Des Lacs lakes and includes driving through Kenmare. Thirteen interpretive panels are located along the auto tour route and overlooks are available at Middle Des Lacs and Lower Des Lacs lakes. The direction of travel is two-way and the route is generally open from April through November. The auto tour route is not maintained during winter months. The refuge, Ward County, and Kenmare Park Board rotate summer road maintenance annually, as agreed upon through a memorandum of understanding.

Four nature trails are available at the refuge:

- Canada Goose Trail—7.5-mile nature trail is open to hiking and bicycling, and one-way vehicle traffic for 17 days in mid-September annually
- Munch's Coulee Hiking Trail—1-mile nature trail loop is open to hiking with an accessible section
- White-tailed Deer Trail—1-mile nature trail is open to hiking
- Tasker's Coulee has informal mowed nature trails

A viewing and photography blind to observe displaying sharp-tailed grouse is available in the spring. Spotting scopes and binoculars are available for visitors. An all-weather binocular is mounted on the observation deck at headquarters and provides visitors with an excellent view of the Middle Des Lacs Lake and wildlife. A paved overlook with interpretive panels is located adjacent to the headquarters area.

Tasker's Coulee has tables, a CCC-era covered shelter, accessible restrooms, and informal mowed trails. The boat dock day use area has a boat ramp, tables, and vault toilets. Nonmotorized boats are allowed.

Environmental Education and Interpretation

Videos and trunks are available for loan. Binoculars, dip nets, spotting scopes, and microscopes are available for use. Refuge staff have developed a curricula on fire ecology of the northern Great Plains, which is available for use in schools. Small-group environmental education programs are provided on request to Boy Scouts, Cub Scouts, and other groups. Environmental education duties are currently shared among the staff.

Visitor exhibits are available at refuge headquarters and focus on early history of the area, habitats and waterfowl production, grassland birds, grebes, sharp-tailed grouse, and butterflies.

Gary Eslinger/USFWS

Monarch Butterfly on Switchgrass

A general brochure is available and provides information about refuge wildlife and habitats and visitor opportunities. The Souris River basin refuges' bird list and the brochure for the auto tour route describe refuge wildlife.

The refuge staff hosts a variety of special events:

- "Green Wing Day" promotes youth hunting safety and conservation
- National Wildlife Refuge Week
- "Eco-Ed Days" promotes conservation and resource management for fifth- and sixth-grade students
- "Haunted Hayride"

The refuge also assists with the annual Kenmare Goosefest celebration in October.

A number of community groups and individuals (including Natural Resource Conservation Service [NRCS], Ducks Unlimited, and Kenmare Association of Commerce) participate in the planning and implementation of special events. Other community groups have donated equipment and personnel for various special events.

J. Clark Salyer NWR

J. Clark Salyer NWR provides visitors wildlife-dependent activities including hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation. Yearly visitation is approximately 15,000.

Hunting

The refuge is open for the hunting of waterfowl, white-tailed deer, turkey, sharp-tailed grouse, gray partridge, ring-necked pheasant, and fox. A hunting brochure provides information, regulations, and a map for a variety of game seasons. Some aspects of the hunting program follow:

- There are nine designated public hunting areas that are open for the hunting of waterfowl and upland game birds, which follow the state-designated hunting seasons.
- Most of the refuge, with exception of specific closed areas, is open to deer hunting with archery, muzzleloader, and rifle equipment following state seasons.
- Late-season hunting for upland game bird and for fox is allowed after the close of the deer firearm season.
- The portion of the refuge south of the Upham–Willow City Road is open for hunting turkey, grouse, and partridge during state seasons.

Fishing

Fourteen public fishing areas cover the entire length of the refuge. All of these locations are open to bank fishing and several allow limited nonmotorized boat fishing. Fishing is allowed along the entire length of Souris River Canoe Trail. All areas are open to winter ice fishing following state regulations.

Wildlife Observation and Wildlife Photography

There are numerous opportunities for these activities, many opportunistic and some formalized. The self-guided Scenic Trail, Grassland Trail, and Souris River Canoe Trail cover prairie, forest, wetland, and hardwood bottomland habitats. Wildflowers, songbirds, waterfowl, and waterbirds are seasonally abundant.

A photography blind is placed near a sharp-tailed grouse dancing ground each spring and visitors can reserve its use.

Environmental Education

The refuge conducts an extensive operation for the banding of waterfowl each autumn. The project requires a lot of time and staff to accomplish the banding of 4,000–5,000 ducks. Volunteers from universities and local schools provide a substantial amount of time toward this operation. Their assistance with collecting, handling, marking, and releasing thousands of birds could not be accomplished without their help. This activity not only provides the refuge with adequate staff to get the work done, but it provides a wonderful outdoor classroom for students from elementary school to college to learn about national wildlife refuges and wildlife resources.

In addition to the above activity, minimal opportunities are provided to educate the public because of the lack of funding and trained staff. There are more than 60,000 residents and more than a dozen schools within commuting distance of the refuge. Videos and trunks are available for loan as well as binoculars, dip nets, and spotting scopes for specific groups and organizations.

Interpretation

Two interpreted auto tour routes are open to the public:

- The 22-mile Scenic Trail begins at the refuge headquarters and traverses wetland, grassland, and woodland habitat from pool 326 to the south boundary and back to Highway 14. A brochure provides interpretation of eighteen stops along the route. The brochure includes information on wildlife, habitat, management techniques, and history. The direction of travel is two-way. The route is generally open from April through November, but is not maintained during winter months.
- The 5-mile Grassland Trail is located along the northern shoreline of pool 341 on the west side of the refuge. It moves through mixed-grass prairie habitat and meanders down to the shoreline of the marsh. The trail is interpreted through a leaflet that provides information on seven stops along its route. This unimproved one-way trail begins off the Newberg Road and exits at the Shevelo Road; it is open from April to November.

The Souris River Canoe Trail is designated as a national recreation trail. The canoe trail traverses bottomland hardwood forest habitat within the Souris River floodplain. It can be paddled as a 5½- or 13-mile trip. The 5½-mile route travels from Johnson Bridge to Thompson Well and takes 2–3 hours to complete. The 13-mile route travels from Johnson Bridge to dam 1 and takes 5–7 hours to float. Numbered markers are located at each mile along the river. An interpretive brochure provides a map and information about the habitat and wildlife a visitor will encounter.

Thompson Well is an historical stop along the Scenic Trail that has drinking water from a hand-pumped well, a shelter, accessible restrooms, and a portable dock for access to the Souris River Canoe Trail. The Sandhills Walk, also along the Scenic Trail, is an area designated for hiking into the unique sandhills, containing bur oak forest with shrub and grassland understory.

A two-tiered viewing platform and an accessible observation deck provides visitors with an excellent view of marsh habitat and associated wildlife at pool 326. A paved walkway with interpretive panels leads to the observation point located adjacent to the headquarters area. Spotting scopes and binoculars are available for visitors.

A viewing and photography blind to observe displaying sharp-tailed grouse is available in the spring.

Visitor exhibits at refuge headquarters focus on early history of the area, habitats, and wildlife. Brochures are available and provide information about wildlife, habitats, and visitor opportunities.

Upper Souris NWR

Upper Souris NWR provides visitors with a full complement of wildlife-dependent activities including hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation.

Yearly visitation is approximately 60,000–70,000 with a peak of 150,000 visitors. In 2004, the following percentages of visitation were estimated for each wildlife-dependent activity:

- 3% of visitors participated in hunting
- 78% of visitors participated in fishing
- 9% of visitors participated in wildlife observation and wildlife photography
- less than 1% of visitors participated in environmental education activities
- 8% of visitors participated in interpretive activities

Hunting

Hunting, particularly for white-tailed deer, is very popular. Deer hunting with archery equipment begins in early September, followed by rifle and muzzleloader seasons.

Several areas are open to hunting sharp-tailed grouse, gray partridge, and ring-necked pheasant. To reduce waterfowl disturbance, upland bird hunting is open during different times of the fall and at different areas of the refuge.

A hunting brochure is available that provides information, regulations, and a map.

Bob Savannah/USFWS

Fishing

Fishing is allowed year-round, with visitors permitted to drive on the ice covering Lake Darling to fish. Lake Darling is a magnet for anglers looking to catch walleye, northern pike, perch, and smallmouth bass.

There are 2 boat-fishing areas at Lake Darling and 13 bank-fishing areas scattered along the lake and the Souris River. There are four boat-launching facilities. Boat fishing is allowed from May 1 through September 30.

A fishing brochure containing information, rules, and a map is available.

Wildlife Observation and Wildlife Photography

There are numerous opportunities for these activities—many are opportunistic and some are formalized.

The Prairie–Marsh Scenic Drive is open to vehicles during the summer and early fall. Numbered signs along the drive correspond to points of interest that are described in the tour brochure available at the beginning of the drive. Visitors are welcome to walk around the coulees, roads and prairie-covered hills in the immediate vicinity of the scenic drive. This is an excellent place to observe wetland and grassland animals and plants—the area has spectacular summer-long blooms of native wildflowers.

Photography blinds are placed at three sharp-tailed grouse dancing grounds (leks) each spring and visitors can reserve the use of these blinds at no charge. The peak time for active dancing occurs at sunrise. Another blind placed at the end of Pelican Nature Trail is available year-round. Visitors are welcome to hide in this blind and let the wildlife come to them.

Five nature trails beckon visitors to get out of their vehicles and explore the refuge. All trails present opportunities for observation and photography. These trails are for walking and are less than 2 miles long. One trail is almost flat and is hard-surfaced, making it wheelchair-accessible. Other trails require some stamina to climb up and down the hills. Some trails have interpreted stops and benches for relaxing.

Canoes are permitted on two Souris River canoe trails and on Lake Darling from May 1 through September 30. Canoeing can be a very quiet way to sneak up to wildlife such as the colorful wood duck and capture an unforgettable picture. It is a convenient way to view a beaver lodge and get a closer look at its inhabitants.

Environmental Education

There is a growing need for environmental education as people move from rural to urban areas and lose their connection to the land. There are more than 60,000 residents and more than a dozen schools within commuting distance of the refuge. One of the largest potential audiences is the Minot Air Force Base (12 miles east of refuge headquarters).

The refuge has a diversity of habitats and wildlife that can be used to teach environmental education. However, only minimal opportunities can be made available yearly because of a lack of trained and available staff.

In the past, the refuge has sponsored "Migratory Bird Day," "Zoo Day," "Special Fishing Day," wildlife refuge week activities, and "Envirothon." The latter is a national scholastic competition among high school students that also teaches environmental principles. Teams compete and broaden their knowledge of the environment.

USFWS

Students learn aquatic sampling at the "Envirothon" hosted by Upper Souris NWR.

Interpretation

Visitors have access to a wide array of interpretive media that describe refuge management, wildlife, wetlands, grasslands, Neotropical birds, history, fishing, and hunting.

Interpretive panels are found at two visitor kiosks, along an auto tour route and a walking trail, at road pull-offs, and at refuge headquarters. Interpretive exhibits at refuge headquarters focus on the CCC and historical trade routes. In 2006, two new kiosks with interpretive signs will be completed.

The Prairie–Marsh Scenic Drive will be improved by adding new interpretive stops, redesigning the trails brochure, and paving the road surface. This 12-stop interpreted drive will give visitors a first-class look at prairie habitats and marsh habitats that support a diversity of wildlife.

The Theodore Roosevelt Nature and History Association has generously cooperated with the refuge to provide visitors a chance to purchase wildlife and habitat books and games for all ages (sales area is open 8 a.m.–4:30 p.m. weekdays). Profit from the sale of items is returned to the refuge for biology and visitor service programs.

Socioeconomic Environment

The local and regional demographics—that is, statistical data about the population—are described below for the communities in the five-county study area pertaining to the Souris River basin refuges.

Population

Table 2 shows population estimates and trends for the regional area and communities near the refuges. In 2000, the five counties in the study area accounted for approximately 12% of North Dakota's total population (U.S. Census Bureau 2000). From 1990 to 2000, North Dakota's overall population increased by 0.5%. Ward County was the only county within the study area to increase its population (1.5 %), over the same period. The other four counties all had negative population growth rates—ranging from a decrease of 25.3% in Burke County to an 8.3% decrease in McHenry County, over the same period.

Bowbells in Burke County and Kenmare in Ward County are the centers of visitation activity associated with the Des Lacs NWR, as follows:

- Kenmare, a community of 1,081 residents, offers world-class upland hunting as well as abundant opportunities for hunters to bag white-tailed deer and pronghorn. Goose hunting is also a popular hunting activity in and around Kenmare as reflected in its

Table 2. Local and regional population estimates and characteristics for the five-county study area, North Dakota.

Area	*Population in 2000*		% Population Change 1990–2000
	Number of Residents	*Persons per Square Mile*	
Bottineau County	7,149	4.3	-10.8
Burke County	2,242	2.0	-25.3
McHenry County	5,987	3.2	-8.3
Renville County	2,610	3.0	-17.4
Ward County	58,795	29.2	1.5
Five-county Area Total	76,783	—	—
North Dakota Total	642,200	9.3	0.5

Source: U.S. Census Bureau (2000).

nickname, the "Goose Capital of North Dakota" (city of Kenmare). Kenmare residents are also proud of the birding and ecotourism opportunities provided by the refuge (city of Kenmare).

- Bowbells, a town of 406, is another popular destination for hunters. Its abundant wildlife provides thrills for hunters of a variety of game, from waterfowl to pheasant to big game. Fishing at the Northgate Dam recreation area gives anglers the opportunity to land trout, walleye, largemouth bass, and bluegill (city of Bowbells). Farmers in the area produce flax, canola, peas, barley, oats, sunflowers, durum, and hard red spring wheat (city of Bowbells).

The towns of Newburg, Bottineau, and Westhope in Bottineau County and the towns of Upham, Towner, and Granville in McHenry County are the principal communities near the J. Clark Salyer NWR. These six communities surrounding the refuge are relatively small, with populations ranging from 88 in Newburg to 2,336 in the county seat of Bottineau (U.S. Census Bureau 2000). Descriptions of four of these communities follow:

- The town of Upham is located on the western side of the refuge and hosts the refuge headquarters. In 2000, the population of Upham was 155 residents (U.S. Census Bureau 2000).
- The town of Westhope has 533 residents and is northwest of the refuge near the Canada border.
- Towner (McHenry County seat) is a small community on the southern end of the refuge with a population of 574 (U.S. Census Bureau 2000). The only tree nursery in the state is located in Towner.
- Granville has 286 residents and is also on the southern end of the refuge (U.S. Census Bureau 2000). Granville is home to Big Sky Buffalo Ranch, which houses "Mystical," an albino bison bull.

Carpio and Minot in Ward County and Tolley and Grano in Renville County are the primary local communities surrounding the Upper Souris NWR. Ward County is the fourth most-populated county in the state, with a population of 58,795 residents. The bulk of these residents are concentrated in the county seat of Minot, home to 36,567 people. Community descriptions follow:

- Minot was nicknamed the "Magic City" some 100 years ago because "when the railroad arrived, the city sprouted up like magic" (Minot 2005). Minot is home to the Minot Air Force Base, which houses the 5th Bomb Wing and the 91st Space Wing, as well as Minot State University.
- Carpio is a small town composed of 148 residents, located southwest of the refuge on the Des Lacs River.
- Tolley and Grano are small communities located along the north central portion of the refuge. In 2000, Tolley's population was 63 and Grano's was 9 (U.S. Census Bureau 2000).

In 2000, four out of five counties in the study area consisted of a higher percentage of white persons not of Hispanic or Latino origin than the North Dakota state average of 92.4%. Ward County exactly matched the state average and McHenry County had the greatest percentage, 98.7%. Ancestry patterns were similar across counties, with heavy German and Norwegian influences (U.S. Census Bureau 2000).

The state percentage of residents from Hispanic or Latino descent was 1.2%, and all five counties were similar to this estimate. Likewise, the Asian population of the five counties was similar to the state average of 0.6%. North Dakota's American Indian population compiled 4.9% of the state total.

All five counties were below this average, with Ward County having the highest American Indian or Alaska Native population, consisting of 2.1% of the county's residents. Ward County had a greater percentage of its population that comprises Black or African Americans, with 2.2%, compared to the state average of 0.6%. The four other counties closely resembled the state average (U.S. Census Bureau 2000).

Approximately 83.9% of North Dakota residents 25 years and older were high school graduates. The five counties were all similar to the state average in this category, ranging from 76.9% in McHenry County to 87.4% in Ward County. The percentage of residents 25 years and older who held a bachelor's or advanced degree ranged from 12% in Burke County to 22% in Ward County. The state average was 22% (U.S. Census Bureau 2000).

Employment and Income

Employment estimates for the five-county study area are shown in table 3. Agriculture composes a substantial percentage of employment in all counties. As a percent of a county's total jobs, farm employment ranges from 36.1% in McHenry County to 3.4% in Ward County (U.S. Department of Commerce 2002).

Ward County is the most populated in the study area, which explains its role as the economic hub for northern North Dakota, in addition to its relatively lower dependence on farm employment. The city of Minot, located in Ward County, hosts a diverse range of corporate offices for such companies as ING and Choice Hotels International, as well as Minot State University and Minot Air Force Base (Minot Chamber of Commerce 2005).

The services and government sectors are also key employers in the five-county region. As a percentage of total nonfarm employment, the service sector ranged from 22% in Renville County to more than 35% in McHenry County. Government employment composed nearly 20–25% of all nonfarm employment in all five counties, with Renville County having the greatest percentage, 28%.

U.S Census Bureau (2000) data for median household income, unemployment and percentage of persons below poverty in 1999 are shown in table 4 (U.S. Census Bureau 2000). The median household income for the five-county study area is below the state and national averages. Also, the percent of unemployed of all counties is below the state and national averages. The percent of population below the federal poverty line is an indicator of the economic distress within a community. Bottineau, Renville, and Ward counties are below the state average of 11.9% of persons living in poverty and the national average of 12.4%. Both Burke and McHenry counties are above both the state and national averages for this category.

Table 3. Employment for the five-county study area, North Dakota (2000).

	Percent of Total Employment				
	County				
Industry	*Bottineau*	*Burke*	*McHenry*	*Renville*	*Ward*
Farm Employment	22.5%	31.5%	27.9%	36.1%	3.4%
Nonfarm Employment	77.5%	68.5%	72.1%	63.9%	96.6%
Agricultural services, forestry, and fishing	D[1]	D	D	D	0.8%
Mining	3.8%	5.2%	6.0%	D	0.8%
Construction	D	D	3.2%	8.2%	5.0%
Manufacturing	2.5%	D	2.3%	D	2.2%
Transportation and public utilities	6.1%	10.2%	D	D	5.1%
Wholesale trade	4.1%	5.9%	6.6%	6.6%	4.5%
Retail trade	17.8%	16.1%	13.4%	11.2%	19.3%
Finance, insurance, and real estate	7.5%	6.4%	6.2%	5.8%	7.1%
Services	31.3%	25.8%	35.7%	21.9%	29.8%
Government (federal, state, and local)	18.5%	21.6%	20.2%	28.2%	25.5%
Total Full- and Part-time Employment	4,501	1,701	1,600	2,873	40,144

Source: U.S. Department of Commerce (2002).
[1]*D—not shown to avoid disclosure of confidential information, but the estimates for this item are included in the totals.*

Table 4. Income, unemployment, and poverty estimates for the five-county study area, North Dakota.

Area	*Median Household Income (1999)*	*Percent Unemployed (2000)*	*Percent of Persons Below Poverty (1999)*
United States	$41,994	4.1%	12.4%
North Dakota	$36,604	3.0%	11.9%
Bottineau County	$29,853	2.7%	10.7%
Burke County	$25,330	1.5%	15.4%
McHenry County	$27,274	2.9%	15.8%
Renville County	$30,746	1.1%	11.0%
Ward County	$33,670	2.7%	10.8%

Source: U.S Census Bureau (2000).

4 Alternatives and Environmental Consequences

This chapter describes the management alternatives and associated environmental consequences considered for the Souris River basin refuges. Alternatives are different approaches to planning unit management designed to achieve

the refuges' purposes, vision, and goals;

the mission of the Refuge System;

the mission of the Service.

Alternatives are formulated to address the significant issues, concerns, and problems identified by the Service, the public, and the governmental partners during public scoping and throughout the development of the draft plan.

This chapter contains the following sections:

- summary of alternatives
- summary of environmental consequences
- detailed description of alternatives and consequences (table 5)
- economic impacts of no-action and proposed action alternatives

SUMMARY OF ALTERNATIVES

Four alternatives, identified and evaluated, represent different approaches to enhance protection and restoration of fish, wildlife, plants, habitats, and other resources. Alternative A, the no-action alternative, describes ongoing refuge management. The no-action alternative is a basis for comparison of alternatives B–D. Alternative B is the Service's proposed action and basis for the draft CCP (chapter 5).

The planning team assessed biological conditions and external relationships affecting the refuges. This information contributed to the development of alternatives. As a result, each alternative presents a unique approach for addressing long-term goals. Each alternative was evaluated based on expected progress in meeting the vision and goals of the refuges and how it addresses core wildlife and habitat issues and threats. Where data are available, trends in habitat and wildlife are evaluated, and environmental consequences of each alternative are projected.


Gary Eslinger/USFWS

Black-eyed Susan

Elements Common to All Alternatives

Several elements of refuge management are common to all alternatives. Management activities that could affect natural, archaeological, and historical resources would be managed to comply with applicable laws, regulations, and policies.

All alternatives would provide equal protection and management of cultural resources. Individual projects may require additional consultation with North Dakota's State Historic Preservation Office. Additional consultation, surveys, and clearance may be required when activities potentially affect properties eligible for the National Historic Register.

Description of Alternatives

Management actions to advance the mission of the Refuge System and the purpose and vision of the Souris River basin refuges are summarized below. The alternatives reflect options to address significant threats, problems, and issues raised by public agencies, private citizens, and interested organizations.

Each alternative differs in its ability to achieve long-term wildlife and habitat goals. However, each is similar in its approach to managing the refuges.

Each alternative

would pursue the goals outlined in chapter 2;

would protect and enhance a diverse assemblage of habitats;

would promote wildlife-dependent recreational use;

would be consistent with the purpose of the refuges, and with the mission and goals of the Refuge System.

The focus and actions for each of alternatives A–D are summarized below.

Alternative A (Current Management, No Action)

Alternative A, the no-action alternative, reflects the current management of the Souris River basin refuges. It provides the baseline against which to compare other alternatives. It is also a requirement of the NEPA that a no-action alternative is addressed in the planning process.

Key elements of alternative A follow:

- Habitat and wildlife management practices to benefit migratory birds and other wildlife would continue at present levels unless staffing or funding were reduced. Refuge habitats would continue to be managed opportunistically and would continue to decline in terms of biological diversity, ecological integrity, and environmental health.
- The refuges would continue to perform only limited, issue-driven, scientific research and only monitor long-term changes in vegetation communities.
- Outreach, partnerships, and priority public uses that are compatible and wildlife-dependent (fishing, hunting, wildlife observation, wildlife photography, environmental education, and interpretation) would continue at present levels unless staffing or funding were reduced.

Alternative B (Proposed Action)

This alternative (the draft CCP) embodies the concept of "ecological triage." Triage is defined here as the assignment of priority order to habitats or habitat types on the basis of where funds and resources can be best used, are most needed, or are most likely to achieve success in meeting stated goals and objectives. Management under alternative B would acknowledge pre-existing declines in quantity and quality of native upland and wetland habitats as the result of human-induced modification of the local landscape. Because some of these changes are significant, many refuge habitats can no longer be fully restored to the condition existing prior to settlement of the region (1750–1850). In these cases, habitats or habitat units that are ranked as lower priority for restoration may be managed to meet other resource needs (for example, migratory bird production), or would be minimally managed until additional resources were available.

Key elements of alternative B follow:

- Significant gaps in current and projected funding and staffing would be assumed. These gaps would likely limit widespread, full-scale habitat restoration.
- Habitats and habitat units with the highest probability of restoration would be prioritized for management. Other habitats or habitat units may only be partially restored, and many habitats or habitat units would be minimally managed. As funding, staff, and knowledge change, restorations may be expanded to additional habitats or habitat units.
- Some visitor services would decrease as some staff and funding shifts to habitat restoration, while others remain at current levels.
- Environmental education, scientific research, and monitoring would improve.

Alternative C

Alternative C would emphasize enhancement of waterfowl habitat and production over other refuge activities, and acknowledges the significance of the Souris River basin refuges as important local and regional habitats for breeding and migrating waterfowl.

Key elements of alternative C follow:

- Waterfowl habitat management and waterfowl production would be emphasized over other refuge programs.
- Scientific research and monitoring would focus on actions that enhance waterfowl habitat, increase waterfowl nest densities, and increase nest and brood survival.
- Visitor service programs that use or enhance waterfowl-related activities such as hunting, environmental education, or wildlife viewing would be emphasized over other activities.

Alternative D

Alternative D would require restoration of all refuge habitats and habitat units to the fullest extent feasible. This alternative would assume significant increases in staffing, funding, and scientific knowledge relative to the other alternatives.

Key elements of alternative D follow:

- Full restoration of ecological processes, vegetation communities, and wildlife characteristics of the presettlement period (1750–1850) would be emphasized.

- Scientific research and monitoring would focus on strategies that enhance or restore native plant and animal communities.
- Public uses that are compatible or that support habitat restoration would be emphasized.
- Interpretation and environmental education would be expanded, with an emphasis on restoration of ecological processes (for example, fire and grazing) important for enhancing natural plant and animal communities.

Summary of Environmental Consequences

The planning team assessed the environmental consequences of implementing each alternative on the biological, physical, social, economical, cultural, and historical resources of the refuges.

Effects Common to All Alternatives

Some projected effects would be similar for all alternatives.

- The implementation of any alternative would follow the Service's best management practices.
- The alternatives would minimize impacts to federally threatened and endangered species, to the extent possible and practicable.
- The refuges, contractors, researchers, and other consultants would continue to acquire all applicable permits, for example, for future construction activities.

The sections below describe other projected effects common to all alternatives.

Cultural Resources

As a whole, cultural resources would be enhanced through protection of existing resources and by extending such protections to newly discovered cultural resources.

Cultural resource surveys at the refuges have been limited. Therefore, additional surveys would be required prior to any new construction or excavation to fully satisfy provisions of the NEPA and applicable acts and policies related to historical and archaeological resources.

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

Environmental Justice

None of the management alternatives described in this EA would disproportionately place any adverse environmental, economic, social, or health effects on minority or low-income populations.

Implementation of any action alternative that includes visitor services and environmental education is anticipated to benefit minority and low-income citizens living near the Souris River basin refuges.

Climate Change

All alternatives would prioritize preservation and restoration of natural resources to varying degrees, which would enhance carbon sequestration (explained further in this section). Carbon sequestration is one method to mitigate human effects related to human-induced global climate change.

The U.S. Department of the Interior requires consideration of potential climate change effects during long-range planning such as CCP development. The increases of carbon within the earth's atmosphere are linked to the gradual rise in surface temperature commonly referred to as global warming.

The U.S. Department of Energy defines carbon sequestration as the capture and secure storage of carbon that would otherwise be emitted to or remain in the atmosphere. Terrestrial biomes of all sorts (such as grassland, wetland, and forest) are effective in both preventing carbon emission and acting as a biological "scrubber" of atmospheric carbon. The U.S. Department of Energy report notes that ecosystem protection is an important element in efforts to sequester carbon that might otherwise be released into the atmosphere.

The National Climate Data Center has entered into a long-term agreement with the Service to install and operate one of the National Oceanic and Atmospheric Administration's U.S. Climate Reference Network meteorological stations at the Des Lacs NWR. The station will provide data on long-term climate change in the northern Great Plains as one of a series of meteorological stations. The station will be located at the northwest end of the refuge, 2.2 miles south of the Canada border, and should be operational by 2006.

Soils

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

Water Quality, Wetlands, and Floodplains

All alternatives would positively affect water quality. Positive effects are anticipated from protecting groundwater recharge, preventing runoff, retaining sediment, and minimizing nonpoint source pollution. The management alternatives are not anticipated to have any adverse effects on the areas' wetlands and floodplains, pursuant to EO 11990 and EO 11988.


USFWS

Unit 4 at Des Lacs NWR

Public Health and Safety

Based on the nature of each alternative, the location of the refuges, and current land use, all alternatives are anticipated to have no significant negative effects on the quality of the human environment, including public health and safety.

Detailed Description of Alternatives and Consequences

Management actions are prescribed for each alternative as the means for responding to problems and issues raised by Service managers, the public, and governmental partners. Because management would differ for each alternative, environmental and social effects resulting from implementation would likely differ as well.

Table 5 describes management direction of alternative A (current management) for comparison with action alternatives B–D. In most instances, proposed management (outlined in alternatives B–D) would differ significantly from current management (alternative A).

Table 5 is organized as follows:

- Columns in the table contain management actions for each alternative, organized in rows. For each alternative, these actions describe (1) a general management philosophy, (2) direction for managing ecological processes (such as soils, fire, and grazing), and (3) direction for managing plant communities.
- The predicted environmental consequences of carrying out the prescribed actions follow. The consequences are organized in rows by their projected effects following 15 years of CCP implementation. The planning team evaluated effects on (1) environmental processes, (2) plant community integrity and structure, and (3) trust wildlife species. The section "50 Years Hence" describes projected effects assuming 50 years of prescribed management.
- Management actions and their consequences are organized first by major habitats found on the refuges, followed by visitor services, research and science, and operations. Comparisons can be made across alternatives A–D for a given topic, for example, management actions for drift prairie or environmental effects of hunting.
- Unless otherwise noted, the actions and consequences apply to all three refuges.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B—(Proposed Action)*	*Alternative C*	*Alternative D*
DRIFT PRAIRIE—Management Actions			
Des Lacs NWR—5,393 acres; J. Clark Salyer NWR—4,420 acres; Upper Souris NWR—3,680 acres			
GENERAL APPROACH Manage extensively but imprecisely, using a coarse, generic approach with little regards for special restoration needs and limitations of individual management units.	GENERAL APPROACH Emphasize the fullest possible restoration of a diverse native flora only on units with the greatest potential for success (for example, the most floristically intact). On other (most) units, concede to invasion by cool-season introduced grasses.	GENERAL APPROACH Emphasize tall, robust, undisturbed vegetation composed of grasses, forbs, and low shrubs. Directly control mammals that are potential predators of waterfowl nests (versus no direct species-specific or population control in other alternatives).	GENERAL APPROACH Strive to fully restore native plant communities and the ecological processes that shaped them. Emphasize broad-scale management that affords significant competitive advantages to native herbaceous plants and that discourages woody plants and introduced plant species (such as smooth brome, Kentucky bluegrass, sweetclover, and state-listed noxious weeds).
ECOLOGICAL PROCESSES ***Refuge Qualifiers*** *Des Lacs NWR:* Use fire and grazing extensively and generally, within a broad range across refuge units with regard to type, timing, frequency, and intensity of disturbances. *J. Clark Salyer NWR:* Use fire and grazing in selected units—within a broad range with regard to type, timing, frequency, and intensity of the disturbances—mainly to reduce litter and periodically rejuvenate grassland vegetation. *Upper Souris NWR:* Use grazing extensively and generally, within a broad range across refuge units with regard to type, timing, frequency, and intensity of the disturbances. Use fire to reduce litter and woody vegetation on areas where most feasible.	ECOLOGICAL PROCESSES Incorporate frequent, carefully timed fire and grazing disturbances (for example, in 4 of every 5 years) on high-priority units. Use intensive, locally focused, or specialized restoration methods as needed to restore processes. Account for landscape composition, interconnectivity, and extent when planning management to provide large, contiguous tracts of treeless grassland (the largest grasslands may include adjacent old cropland, prairie slope, and private grassland tracts).	ECOLOGICAL PROCESSES Use fire infrequently (for example, every 5–10 years), only to reduce excess litter and periodically restore plant vigor.	ECOLOGICAL PROCESSES *Same as alternative B, except* extend intensive effort throughout each refuge's drift prairie.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B—(Proposed Action)*	*Alternative C*	*Alternative D*
DRIFT PRAIRIE—Management Actions			
PLANT COMMUNITY INTEGRITY AND STRUCTURE Maintain a broad range of vegetation structure across units. Periodically remove plant litter. Use an integrated approach to control noxious weeds, especially leafy spurge. ***Refuge Qualifier*** *Des Lacs NWR and J. Clark Salyer NWR:* Reduce woody vegetation, including tree shelterbelts around old farmsteads.	PLANT COMMUNITY INTEGRITY AND STRUCTURE On high-priority units, maintain relatively low levels of plant litter, mainly by frequent use of prescribed fire. On low-priority units, reduce plant litter as opportunities arise. Use an integrated approach to control noxious weeds, especially leafy spurge. Reseed native plants in the most degraded grassland dominated by smooth brome. Reduce woody vegetation, including tree shelterbelts around old farmsteads.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Provide late-successional grassland structure on most areas, with vegetation structure more important than composition. Periodically reduce excessive litter and restore plant vigor. Use an integrated approach to control noxious weeds, especially leafy spurge. Reduce trees and tall shrubs but enhance low shrubs such as western snowberry. Seed the most degraded areas of drift prairie to DNC.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Restore plant species diversity. Strive to attain plant communities dominated by native herbaceous species on all units. Allow vegetation structure to be a function of the dynamic, frequent disturbances that would be restored to units. Full restoration would require a much more intensive effort on the most degraded tracts. Use an integrated approach to control noxious weeds, especially leafy spurge.
DRIFT PRAIRIE—Environmental Consequences			
ECOLOGICAL PROCESSES ***Refuge Qualifiers*** *Des Lacs NWR and J. Clark Salyer NWR:* Grazing would be too infrequent to facilitate historical levels of nutrient cycling, hindering a diverse soil invertebrate fauna. Grazing also would be too infrequent to exert natural defoliation influences on plant competition via dynamic changes in physiology and morphology. *Upper Souris NWR:* Fire would be too infrequent for managing litter and woody vegetation.	ECOLOGICAL PROCESSES On tracts deemed most restorable (only the most floristically intact), fire and grazing disturbances would approximate historical frequency, timing, and intensity. Associated nutrient cycles would largely be restored. The relatively arid soil surface environment would be less hospitable to introduced plant species. Soil mycorrhizae and symbiotic relationships would be restored and maintained.	ECOLOGICAL PROCESSES Grazing rarely would be used as a plant defoliation method. Nutrient cycling would be restricted, limiting the diversity of soil invertebrate fauna. Grazing also would be too infrequent to exert natural defoliation influences on plant competition via dynamic changes in physiology and morphology. Fire would be infrequently applied to reduce tall woody vegetation and periodically control litter. *(continued)*	ECOLOGICAL PROCESSES *Same as alternative B, except* effects would be measurable and extend to most drift prairie units.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
DRIFT PRAIRIE—Environmental Consequences			
		ECOLOGICAL PROCESSES CONTINUED Slow and fast nutrient cycles would be significantly reduced (these are essential to plant competition and critical in the evolution and development of native plant communities).	
PLANT COMMUNITY INTEGRITY AND STRUCTURE The most-intact native prairie would not be restored and maintained due to the demands of an extensive management approach. Native plant abundance and diversity would continue to decline. Introduced cool-season grasses would continue to gradually increase, interspersed with sparse low shrub. The diversity of vegetation structure would continue to decline on multiple scales especially due to the prevalence of smooth brome, the abundance of which would be furthered by spring burning and infrequent grazing. A short–sparse structure would be underrepresented in the grassland landscape. ***Refuge Qualifiers*** *Des Lacs NWR:* Western snowberry communities would be degraded, while silverberry would regenerate more than *(continued)*	PLANT COMMUNITY INTEGRITY AND STRUCTURE The plant community on restorable, high-priority units would become increasingly dominated by native herbaceous species. Low shrub species would occur infrequently (5–10% occurrence) on high-priority units. Tall woody vegetation would become increasingly rare. Vegetation structure across units would be diverse, including much short–sparse cover (0–2 inches spring visual obstruction reading [VOR]; some moderate cover (2–5.9 inches); and relatively little tall, robust cover (>5.9 inches). Structure would vary temporally and spatially within and among high-priority units. On low-priority units, native plant species would become more rare and, except for a few species of forbs, gradually disappear from some units.		PLANT COMMUNITY INTEGRITY AND STRUCTURE *Same as restorable, high-priority tracts in alternative B, except* that effects would extend to most drift prairie units as a result of extensively applied management. Complete restoration to a presettlement condition probably would not be biologically feasible on many or most tracts because they are too badly degraded.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B—(Proposed Action)*	*Alternative C*	*Alternative D*
DRIFT PRAIRIE—Environmental Consequences			
PLANT COMMUNITY INTEGRITY AND STRUCTURE CONTINUED desired. Tall woody vegetation would become increasingly rare. *Upper Souris NWR:* The net (overall) invasion by tall woody vegetation would not be reversed because fire would be too infrequently applied on most refuge units where coulee woodland edge is a prominent landscape component.			
TRUST WILDLIFE SPECIES Endemic species of wildlife, plus many other species that historically were common, would be absent or rare (such as Richardson's ground squirrel, burrowing owl, chestnut-collared longspur, Baird's sparrow, northern pintail, and marbled godwit). ***Refuge Qualifiers*** *Des Lacs NWR:* The abundances of breeding bird species associated with woody cover would generally decline. Gradual reduction of scattered, isolated patches of tall shrub and green ash trees would result in decreased nest parasitism by brown-headed cowbirds and increased nest survival for songbirds because edge predators are reduced. *(continued)*	TRUST WILDLIFE SPECIES On restorable, high-priority units, the diversity of species that use grassland would increase, especially those that require early successional grassland and that avoid woody plants. The abundances of species that require tall woody plants would gradually decline.	TRUST WILDLIFE SPECIES *Many effects are the same as alternative A; additionally*, management to sustain plant structure ideal for nesting ducks would be successful in the short term (5–20 years), but not in the long-term due to significant changes in plant community composition, which ultimately affect plant structure. For example, management for nesting cover for mallards and gadwalls (average of about 5.9 inches spring VOR) would become less and less sustainable as smooth brome irreversibly replaced low shrub communities that would provide important nesting cover. As a result, duck nesting densities would decline and the makeup of nesting species would change. *(continued)*	TRUST WILDLIFE SPECIES *Same as restorable, high-priority tracts in alternative B, except* that wildlife species that require grassland with tall, robust structure (>5.9 inches spring VOR) would decline as such vegetation became less available.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B—(Proposed Action)*	*Alternative C*	*Alternative D*
DRIFT PRAIRIE—Environmental Consequences			
TRUST WILDLIFE SPECIES CONTINUED *Upper Souris NWR:* Abundances of breeding bird species associated with woody cover would increase. Grassland bird species that avoid woody vegetation (such as Baird's sparrow and grasshopper sparrow) would persist but would be sparsely distributed.		TRUST WILDLIFE SPECIES CONTINUED Nest survival of ducks and sharp-tailed grouse would be sustained at relatively high levels (versus other alternatives) via intensive, though expensive, annual predator control.	
	50 YEARS HENCE Prairies would be increasingly dominated by native herbaceous species. On high-priority units, the breeding and nesting bird community would become more diverse, characterized by at least 10 species including northern pintail, blue-winged teal, northern shoveler, burrowing owl, chestnut-collared longspur, Baird's sparrow, grasshopper sparrow, Savannah sparrow, Sprague's pipit, western meadowlark, marbled godwit, and upland sandpiper. Richardson's ground squirrels would occur, with colonies conspicuous on some restored tracts. On low-priority tracts (>75% of the drift prairie), plant community and trust species response would be similar to responses under alternative A, characterized by a continued, gradual decline in diversity of native flora and fauna.	50 YEARS HENCE *Same as alternative A, except* losses of native plant and animal species diversity would be accelerated.	50 YEARS HENCE *Same as restorable, high-priority tracts in alternative B, except* that effects would extend to most drift prairie units as a result of extensively applied management. Complete restoration to a presettlement condition probably would not be biologically feasible on many or most tracts because they are too badly degraded.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
PRAIRIE SLOPE—Management Actions			
Des Lacs NWR—4,231 acres; J. Clark Salyer NWR—almost none; Upper Souris NWR—11,225 acres			
GENERAL APPROACH Manage in concert with the adjacent drift prairie as contiguous units, using the same general approach for both.	GENERAL APPROACH Manage in concert with the adjacent drift prairie as contiguous units, using the same general approach for both. ***Refuge Qualifiers*** *Des Lacs NWR:* Regardless of priority rank of adjoining drift prairie, intensively manage several of the most extensive examples of south- to west-facing prairie slope, including an area readily visible to the public, to preserve near-pristine plant communities. *Upper Souris NWR (prairie slope is the most common upland habitat):* Carry out the fullest possible restoration of a diverse native flora on units with prairie slope that have the best potential for success (those most floristically intact).	GENERAL APPROACH *Same as alternative A.*	GENERAL APPROACH *Similar to drift prairie; plus* extend an intensive, comprehensive restoration effort throughout each refuge's prairie slope. Emphasize south- to west-facing prairie slope as a uniquely pristine native flora by including frequent monitoring and locally intensive restoration.
ECOLOGICAL PROCESSES *Similar to drift prairie;* use fire and grazing disturbances extensively, within a broad range of prescriptions as regards type, timing, frequency, and intensity.	ECOLOGICAL PROCESSES *Similar to drift prairie;* use intensive, locally focused, or specialized restoration methods as needed to restore processes on high-priority areas.	ECOLOGICAL PROCESSES *Similar to drift prairie;* use fire is infrequently. Use almost no grazing.	ECOLOGICAL PROCESSES *Similar to drift prairie;* use intensive, locally focused, or specialized restoration methods as needed to restore processes on all areas.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
PRAIRIE SLOPE—Management Actions			
PLANT COMMUNITY INTEGRITY AND STRUCTURE Periodically remove litter (although on mid- to upper-slopes, it accumulates at much slower rates than on drift prairie). Use an integrated approach to control noxious weeds, especially leafy spurge.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Use frequent prescribed fire to reduce litter in lower slopes of high-priority areas. Use an integrated approach to control noxious weeds, especially leafy spurge. Significantly reduce trees and tall shrubs on high-priority areas.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Maintain late successional vegetation structure on lower slope areas by restricting disturbance, especially prescribed fire. Use an integrated approach to control noxious weeds, especially leafy spurge.	PLANT COMMUNITY INTEGRITY AND STRUCTURE *Similar to drift prairie.*
PRAIRIE SLOPE Environmental Consequences			
ECOLOGICAL PROCESSES *Similar to drift prairie, except* the more arid microenvironment of south- to west-facing prairie slopes would have significant implications for invasion by woody and introduced plant species.	ECOLOGICAL PROCESSES On high-priority units, fire and grazing disturbances would approximate historical frequency, timing, and intensity. Associated nutrient cycles would be largely restored. The soil surface environment would remain arid and generally inhospitable to introduced plant species, especially on high-priority units. Soil mycorrhizae and symbiotic relationships would be restored and maintained on high-priority units.		ECOLOGICAL PROCESSES *Same as alternative B, except* that effects would extend to most prairie slope units as a result of extensively applied management. Restored prairie slope would more likely represent a presettlement condition in the Souris River basin than would other habitats on the refuges.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
PRAIRIE SLOPE—Environmental Consequences			
PLANT COMMUNITY INTEGRITY AND STRUCTURE The diversity of native, herbaceous plant species would respond more favorably and rapidly to burning or grazing of south- to west-facing prairie slope than would the drift prairie. Introduced, cool-season grasses would continue to gradually increase along the lower slopes. ***Refuge Qualifiers*** *Des Lacs NWR:* Tall woody vegetation would become increasingly rare. *Upper Souris NWR:* The net (overall) invasion by tall woody vegetation would not be reversed because prescribed fire would be too infrequently applied on most refuge units where coulee woodland edge is a prominent landscape component.	-	PLANT COMMUNITY INTEGRITY AND STRUCTURE South- to west-facing prairie slopes would be more floristically intact and would experience a slower rate of invasion by woody and introduced plant species than adjoining drift prairie. Woody and introduced plant species would continue to expand on north- to east-facing slopes. Slow and fast nutrient cycles would be significantly reduced. These are essential to plant competition and critical in the evolution and development of native plant communities.	PLANT COMMUNITY INTEGRITY AND STRUCTURE The already diverse native plant community of south- to west-facing prairie slope would respond favorably and rapidly to burning or grazing. Introduced plant species would become increasingly rare and woody plants would become inconspicuous, subdominant components of the plant community. Restoration of many north- to east-facing slopes to nearly a presettlement condition probably would not be biologically feasible because they are so badly degraded.
TRUST WILDLIFE SPECIES Habitat on southwest-facing slopes would remain suitable for vesper sparrow and grasshopper sparrow. The value of lower slopes would continue to gradually decline for nesting ducks, clay-colored sparrow, and Savannah sparrow as smooth brome would continue to replace snowberry. Limited habitat for Sprague's *(continued)*	TRUST WILDLIFE SPECIES On south- to west-facing slopes of high-priority units, occurrences of some grassland bird species such as Sprague's pipit would increase. Woodland-edge species such as song sparrow, yellow warbler, and gray catbird would decline on these areas. On most north- to east-facing slopes, woodland edge species and those tolerant of smooth brome would increase gradually.	TRUST WILDLIFE SPECIES With the emphasis of nondisturbance, there would be an overall decline in occurrences of grassland bird species, especially along lower slopes and near shallow drainages and coulees. Conversely, there would be a gradual increase in breeding species associated with woody cover or tolerant of smooth brome.	TRUST WILDLIFE SPECIES Occurrence and abundance of grassland bird species would increase, although clay-colored sparrow and vesper sparrow would decrease slightly. For prairie ducks, nest-site habitat on lower slopes would shift to favor species associated with relatively short, herbaceous cover (such as blue-winged teal). Species associated with woodland edge would decrease.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
PRAIRIE SLOPE—Environmental Consequences			
TRUST WILDLIFE SPECIES CONTINUED pipit would remain available along some upper slopes. ***Refuge Qualifiers*** *Des Lacs NWR:* Breeding bird species associated with woody cover would generally decline. *Upper Souris NWR:* Breeding bird species associated with woodland edge would increase. Grassland bird species that avoid woody vegetation would persist but would be sparsely distributed.			
50 YEARS HENCE Kentucky bluegrass, smooth brome, and woody vegetation would expand significantly on lower slopes and along drainages. Native herbaceous flora would remain relatively common on the middle and upper slopes. ***Refuge Qualifiers*** *Des Lacs NWR:* There would be little change in the breeding bird community on southwest-facing prairie slopes, but a marked reduction in woodland edge species on other slopes. Nesting success would improve measurably for some bird species as abundances of brown-headed cowbirds and nest predators associated with woodland edge *(continued)*	50 YEARS HENCE Tall woody vegetation would be increasingly rare. Kentucky bluegrass, smooth brome, and woody vegetation would expand significantly on lower slopes and along drainages. Native herbaceous flora would remain relatively common on the middle and upper slopes. There would be little change in the breeding bird community on southwest-facing prairie slopes, but a marked reduction in woodland edge species on other slopes. Nesting success would improve measurably for some bird species as abundances of brown-headed cowbirds and *(continued)*	50 YEARS HENCE Woody and introduced plant species would expand significantly. Diversity of breeding birds would be diminished, although some grassland bird species persist along south- to west-facing slopes. Despite desires to maintain western snowberry, smooth brome and tall shrubs would characterize most north- to east-facing slopes.	50 YEARS HENCE Tall woody vegetation would be increasingly rare. Prairie slopes would be dominated by native herbaceous species. Although the total number of birds would be unchanged, the number of common grassland bird species would increase measurably, as would their reproductive success. Once common, woodland-edge species such as brown-headed cowbird, yellow warbler, and spotted towhee would now be uncommon. Abundances of some woodland edge mammals such as white-tailed deer, deer mouse, and Franklin's ground squirrel would be diminished.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
PRAIRIE SLOPE—Environmental Consequences			
50 YEARS HENCE CONTINUED declined (for example, deer mouse). *Upper Souris NWR:* Species of wildlife associated with woodland edge would gradually displace species of grassland wildlife that are intolerant of woody vegetation.	50 YEARS HENCE CONTINUED nest predators associated with woodland edge declined (for example, deer mouse).		
PRAIRIE PARKLAND—Management Actions			
Des Lacs NWR—none; J. Clark Salyer NWR—9,580 acres; Upper Souris NWR—none			
GENERAL APPROACH Emphasize to the fullest extent possible, restoration of a diverse native flora on units with the greatest potential for success (for example, tree cover <30% and most floristically intact). Elsewhere, concede to invasion by aspen–oak woodland.	GENERAL APPROACH *Same as alternative A, except* extend management to smaller (40- to 100-acre) prairies mostly surrounded by aspen–oak woodland.	GENERAL APPROACH Minimally manage prairie parkland as resources are diverted to other habitats more suitable for waterfowl production. Passively manage, mainly using rest, to provide late-successional grassland structure that is tall and dense.	GENERAL APPROACH Strive to fully restore native plant communities and the ecological processes that shaped them. Emphasize broad-scale management that affords significant competitive advantages to native herbaceous plants and that discourages tall woody plants and introduced species of plants.
ECOLOGICAL PROCESSES Use prescribed fire intensively within high-priority units to reduce woody vegetation. Use grazing extensively within a broad range of prescriptions.	ECOLOGICAL PROCESSES *Same as alternative A, except* account for landscape composition, interconnectivity, and extent when planning management to provide large, contiguous tracts of open grassland; the largest grasslands may include adjacent old cropland, meadow, sandhill, and private grassland tracts.	ECOLOGICAL PROCESSES Use prescribed fire and grazing infrequently, mainly to reduce litter and periodically restore plant vigor.	ECOLOGICAL PROCESSES *Same as alternative B, except* extend intensive efforts to all prairie parkland units.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
PRAIRIE PARKLAND—Management Actions			
PLANT COMMUNITY INTEGRITY AND STRUCTURE Reverse woodland invasion and restore prairie in areas where cover of aspen–oak woodland is <30%. Elsewhere, concede to woodland invasion. On restoration units, control plant litter and reduce introduced species of plants—community composition (native herbaceous emphasized) is more important than vegetation structure. Use an integrated approach to control noxious weeds, especially leafy spurge.	PLANT COMMUNITY INTEGRITY AND STRUCTURE *Same as alternative A, except* also control woody vegetation within the interiors of small (40- to 100-acre), but floristically intact, prairie patches.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Use mainly rest to provide late-successional vegetation structure on most areas; vegetation structure is more important than composition. Minimally control woody plants. Use an integrated approach to control noxious weeds, especially leafy spurge.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Reverse woodland invasion in most prairies. Retain only the woodland patches >200 acres in size. Restore plant species diversity, to be characterized mostly by native herbaceous species. Allow vegetation structure to be a function of the dynamic, frequent disturbances restored to units; plant composition is more important than vegetation structure. Use an integrated approach to control noxious weeds, especially leafy spurge.
PRAIRIE PARKLAND—Environmental Consequences			
ECOLOGICAL PROCESSES The extent and frequency of grazing and fire would be adequate to facilitate historical levels of nutrient cycling only on areas where woodland extent were reduced. Soil mycorrhizae, invertebrate diversity, and symbiotic relationships would gradually recover. Elsewhere, extensive woodland would limit use of grazing and fire as defoliation tools. Soil functions and symbiotic relationships would shift to those characteristic of woodlands.	ECOLOGICAL PROCESSES *Same as alternative A, except* effects would be extended to smaller (40- to 100-acre) prairies mostly surrounded by aspen–oak woodland.		ECOLOGICAL PROCESSES Grazing and fire would approximate historical frequency, timing, and intensity. Historical levels of nutrient cycling would be gradually restored over most areas. The relatively arid soil surface environment would be less hospitable to introduced plant species. Soil mycorrhizae, invertebrate diversity, and symbiotic relationships would gradually recover. *(continued)*

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
PRAIRIE PARKLAND—Environmental Consequences			
			ECOLOGICAL PROCESSES CONTINUED Grazing and fire would be adequate to exert natural defoliation influences on plant competition.
PLANT COMMUNITY INTEGRITY AND STRUCTURE Aspen–oak woodland would be reduced or eliminated on tracts where it currently accounts for <30% cover, but would replace many small, isolated prairie tracts elsewhere. Native herbaceous plant species would increasingly dominate restoration tracts, but would decline elsewhere as woody and introduced plants increased. Vegetation structure would be variable and would be a function of dynamic, frequent disturbances, where they occurred.	PLANT COMMUNITY INTEGRITY AND STRUCTURE *Same as alternative A, except* effects would be extended to small (40- to 100-acre) prairies mostly surrounded by aspen–oak woodland.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Most remaining prairie would be gradually replaced by aspen–oak woodland. Declines in native plant abundance and species diversity would be accelerated. The last opportunities for restoring open grassland or parkland would be lost. Vegetation structure would be less variable, and would be typically tall and dense.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Aspen–oak woodland and tall shrubs would be gradually reduced and, in some areas, eliminated. Native grass–forb and low shrub communities would increase. Complete restoration to a presettlement condition would be unlikely on some units that have been dominated by aspen woodland for more than 60 years. Vegetation structure would be variable and would be a function of dynamic, frequent disturbances.
	TRUST WILDLIFE SPECIES *Similar to alternative A, except* smaller prairies would also provide habitat for Sprague's pipit, vesper sparrow, grasshopper sparrow, and clay-colored sparrow.		TRUST WILDLIFE SPECIES Abundance and diversity of grassland-dependent wildlife would gradually increase. Overall species diversity would decline, mainly because woodland and shrubland wildlife species would decline and, in some areas, would disappear.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
PRAIRIE PARKLAND—Environmental Consequences			
50 YEARS HENCE The landscape would be less heterogeneous because patchy and edge habitats would be increasingly replaced by either grassland (restoration areas) or woodland (unmanaged areas). Grassland-dependent wildlife would be common in large, treeless grasslands. Important species would be vesper sparrow, clay-colored sparrow, Sprague's pipit, grasshopper sparrow, and upland sandpiper. Elsewhere, large woodland patches would support forest-interior species such as hairy woodpecker, rose-breasted grosbeak, ovenbird, and veery. Many edge and habitat-generalist wildlife species would be less common, found only in areas where woodland and shrubland occurred.	50 YEARS HENCE *Same as alternative A, except* several small, isolated grasslands would be restored as representative examples of intact prairie plant communities.		50 YEARS HENCE The landscape would be less heterogeneous because woodland and shrub habitats would be increasingly replaced by grassland. Woodland cover would be widely and extensively reduced. Grassland-dependent wildlife would be common, increasingly dominated by species intolerant of woody vegetation (such as Sprague's pipit, grasshopper sparrow, Baird's sparrow, chestnut-collared longspur, and upland sandpiper). Woodland- and shrubland-associated wildlife species would persist, but would be sparsely distributed.
SANDHILLS—Management Actions			
Des Lacs NWR—none; J. Clark Salyer NWR—2,800 acres; Upper Souris NWR—none			
GENERAL APPROACH Manage in concert with prairie parkland. Restore a diverse native flora on the sandhills with the greatest potential for success (for example, aspen woodland cover <30% and more floristically intact).	GENERAL APPROACH *Same as alternative A.*	GENERAL APPROACH Minimally manage the sandhills as resources are diverted to other habitats (such as drift prairie, old cropland, meadow, and wetland) more suitable for waterfowl production.	GENERAL APPROACH Strive to fully restore native plant communities and the ecological processes that shaped them. Emphasize broad-scale management that affords significant competitive advantages to native herbaceous plants and discourages tall woody plants and introduced plant species.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
SANDHILLS—Management Actions			
ECOLOGICAL PROCESSES Use fire to reduce woody plant cover. Exclude cattle.	ECOLOGICAL PROCESSES *Same as alternative A, except* account for landscape composition, interconnectivity, and extent when planning management to provide large, contiguous tracts of open grassland; the largest grasslands may include prairie parkland, adjacent old cropland, meadow, and private grassland tracts.	ECOLOGICAL PROCESSES Use fire infrequently, mainly to reduce litter and periodically restore plant vigor. Exclude cattle.	ECOLOGICAL PROCESSES *Same as alternative A, except* extend intensive effort to all sandhill units. Exclude cattle until effective leafy spurge control is used. Restore sand blowouts.
PLANT COMMUNITY INTEGRITY AND STRUCTURE Reverse invasion by aspen woodland. Restore prairie and oak savanna in conjunction with priority, prairie parkland units. Plant composition is more important than vegetation structure. Use an integrated approach to control noxious weeds, especially leafy spurge.	PLANT COMMUNITY INTEGRITY AND STRUCTURE *Same as alternative A.*	PLANT COMMUNITY INTEGRITY AND STRUCTURE Use an integrated approach to control noxious weeds, especially leafy spurge.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Restore plant species diversity—ideal savanna contains widely scattered patches of bur oak within a matrix of native prairie. Allow vegetation structure to be a function of the dynamic, frequent disturbances restored to units; plant composition is more important than vegetation structure. Use an integrated approach to control noxious weeds, especially leafy spurge.
SANDHILLS—Environmental Consequences			
ECOLOGICAL PROCESSES On areas managed in concert with priority, prairie parkland units, fire disturbance would be adequate to exert natural defoliation influences on plant competition. Broadly, nutrient cycling and defoliation influences on grassland plant *(continued)*		ECOLOGICAL PROCESSES Grazing and fire disturbances would be too infrequent to facilitate historical levels of nutrient cycling across most areas. Slow and fast nutrient cycles would be reduced. The characteristically arid soils of sandhills *(continued)*	ECOLOGICAL PROCESSES Grazing and fire would approximate their historical frequency, timing, and intensity; and would be adequate to facilitate historical levels of nutrient cycling over most areas. The characteristically arid soils of sandhills *(continued)*

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
SANDHILLS—Environmental Consequences			
ECOLOGICAL PROCESSES CONTINUED physiology and competition would not be achieved because grazing disturbance would be too infrequent. Soil mycorrhizae, invertebrate diversity, and symbiotic relationships would gradually recover except in heavily wooded areas, where they would be characteristic of woodlands.			ECOLOGICAL PROCESSES CONTINUED would be inhospitable to introduced plant species, except leafy spurge. Soil mycorrhizae, invertebrate diversity, and symbiotic relationships would gradually recover.
PLANT COMMUNITY INTEGRITY AND STRUCTURE Aspen woodland would be reduced in sandhills that are managed in conjunction with restored prairie parkland units. Native herbaceous plants would gradually increase on restoration tracts, but would decline elsewhere as woody plants increase. Without an effective method of control, leafy spurge would invade native prairie. The characteristically arid soils of sandhills would be inhospitable to introduced plant species, except leafy spurge.		PLANT COMMUNITY INTEGRITY AND STRUCTURE Most remaining prairie and savanna would be gradually replaced by aspen–oak woodland. Leafy spurge would invade many remaining prairie tracts. Compared to other alternatives, declines in native plant abundance and species diversity would be accelerated. The last opportunities for restoring open prairie or savanna would be lost.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Aspen–oak woodland and tall shrubs would be gradually reduced, and would be eliminated in some areas. Native grass–forb and low shrub communities would increase. Complete restoration to a presettlement condition would be unlikely on some units that have been dominated by aspen woodland for more than 60 years. Vegetation structure would be variable and would be a function of dynamic, frequent disturbances. Without an effective method of control, leafy spurge would invade native prairie.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B—(Proposed Action)*	*Alternative C*	*Alternative D*
SANDHILLS—Environmental Consequences			
TRUST WILDLIFE SPECIES Grassland-dependent wildlife species would be common on areas devoid of tall woody plants. Elsewhere, woodland and shrubland species of wildlife would increase.	TRUST WILDLIFE SPECIES *Same as alternative A.*	TRUST WILDLIFE SPECIES Woodland and shrubland species of wildlife would gradually increase. Diversity and abundance of grassland-dependent species of wildlife would decrease.	TRUST WILDLIFE SPECIES Abundance and diversity of grassland-dependent wildlife would gradually increase. Woodland and shrubland species of wildlife would decline as woody plants were reduced.
-			50 YEARS HENCE The landscape would be predominantly grassland and savannah. Grassland-dependent wildlife would be common and widespread. Composition would be increasingly composed of species intolerant of woody vegetation (for example, Sprague's pipit and grasshopper sparrow). Woodland- and shrubland-associated wildlife species would persist, but would be sparsely distributed. Without an effective method of control, leafy spurge would become codominant with native herbaceous plants.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B—(Proposed Action)*	*Alternative C*	*Alternative D*
OLD CROPLAND—Management Actions			
Des Lacs NWR—1,816 acres; J. Clark Salyer NWR—7,675 acres; Upper Souris NWR—1,068 acres			
GENERAL APPROACH Continue to maintain herbaceous vegetation on old cropland areas by either using periodic farming and reseeding, or by maintaining current grass–forb stands, which typically are heavily invaded by introduced, cool-season species of grasses that are undesirable. If reseeding, treat only the most degraded stands, such as those dominated by smooth brome.	GENERAL APPROACH Establish native vegetation on most old cropland units that adjoin high-priority drift prairie tracts.	GENERAL APPROACH Seed and maintain DNC in all old cropland to provide attractive nesting cover for ducks. Reseed stands that become dominated by undesirable, cool-season grasses when tall, dense structure can no longer be restored and maintained. Reduce mammals that are potential nest predators in areas surrounding DNC stands that support high densities of nesting ducks.	GENERAL APPROACH Restore as closely as possible the floristic composition and structural characteristics of northern mixed-grass prairie.
ECOLOGICAL PROCESSES Occasionally use fire, haying, or grazing within a broad range of prescriptions. Continue to use a farming rotation as an option for periodically adding stands of robust vegetation.	ECOLOGICAL PROCESSES Use hay harvests to help establish native grass and forb species on old cropland areas of high priority (those adjacent to high-priority drift prairie and prairie slope). Then, apply mainly fire and grazing in concert with management of adjoining drift prairie and prairie slope to further competitiveness of native plant species. Account for landscape composition, interconnectivity, and extent when planning management to provide large, contiguous tracts of open grassland; the largest grasslands may include adjacent drift prairie, prairie slope, parkland, and private grassland tracts.	ECOLOGICAL PROCESSES Infrequently defoliate, emphasizing hay harvests and fire, only as necessary to reduce excess litter and restore plant vigor.	ECOLOGICAL PROCESSES Use hay harvests to help establish recently seeded native species, and then apply mainly fire and grazing treatments, managing old cropland in concert with management of adjoining drift prairie and prairie slope. Emphasize defoliation events to further competitiveness of native plants. Consider restoration of mycorrhizal fungi.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
OLD CROPLAND—Management Actions			
PLANT COMMUNITY INTEGRITY AND STRUCTURE Attempt to establish perennial herbaceous cover that is dense and dominated by tall species. Strive to maintain this robust structure on at least some old cropland areas. Disregard species composition unless structure can no longer be restored by routine management treatments. Control noxious weeds.	PLANT COMMUNITY INTEGRITY AND STRUCTURE On high-priority units, emphasize a composition that is dominated by warm-season grasses. Remove nearby tree shelterbelts. Manage low-priority units opportunistically, disregarding structure and composition. Control noxious weeds.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Maximize tall, dense, late-successional structure. Disregard native species as an important vegetation component on most or all old cropland units. Remove nearby tree shelterbelts. Control noxious weeds.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Restore as closely as possible the floristic composition and structural characteristics of northern mixed-grass prairie. Remove nearby tree shelterbelts. Emphasize biological approaches for controlling noxious weeds.
OLD CROPLAND—Environmental Consequences			
ECOLOGICAL PROCESSES Excessive plant litter would be controlled and plant vigor would be stimulated through fire, haying, and occasional grazing. The farming cycle would be a major source of soil erosion, which would degrade adjoining native prairie. Compared to pristine native grasslands, the diversity of soil invertebrate species and nutrient cycling processes would be vastly simplified. The seeded stand would be markedly less efficient in capturing and transferring solar energy, sequestering carbon, and resisting disturbances such as weed species invasions. Seeded legumes would facilitate fixation of soil nitrogen.			ECOLOGICAL PROCESSES Soil erosion potential would be negligible with permanent plant cover established and no cropping cycle. Fire and grazing disturbances would follow historical frequency, timing, and intensity. Associated nutrient cycles would be largely restored. Compared to denser, taller plant cover in other alternatives, the arid soil surface environment under this alternative would be less hospitable to introduced plant species. Soil mycorrhizae, invertebrate diversity, and symbiotic relationships would gradually recover. *(continued)*

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
OLD CROPLAND—Environmental Consequences			
			ECOLOGICAL PROCESSES CONTINUED Carbon sequestration would be enhanced in the more floristically diverse community.
	PLANT COMMUNITY INTEGRITY AND STRUCTURE On high-priority areas, the native warm-season component would be enhanced, while introduced cool-season plant species would be discouraged, by prescribed fire applied with proper frequency and timing. Source sites for smooth brome and yellow sweetclover would be reduced significantly around high-priority drift prairie and prairie slope, which would help restore and protect native plant species composition in these areas.	PLANT COMMUNITY INTEGRITY AND STRUCTURE *Same as alternative A, except* that the present DNC stands are, on average, of greater height and density. DNC stands would be homogenous, with almost no structural diversity.	PLANT COMMUNITY INTEGRITY AND STRUCTURE The plant community would be characterized by 6–10 native species, which would present a heterogeneous structure that varies spatially and temporally (a cool-season growth period would be followed by a warm-season growth period from spring to summer). Compared to DNC or old cropland invaded by undesirable, introduced plants, a varied structure would provide living space for a greater number of wildlife species.
TRUST WILDLIFE SPECIES Habitat for trust wildlife species associated with the tall-grass prairie component of northern mixed-grass prairie would be maintained or increased. ***Refuge Qualifier*** *Des Lacs NWR:* Nesting ducks would be attracted to some old cropland areas where they would experience mediocre nest survival (average annual nest survival in DNC at Des Lacs NWR is 15–20% [Mayfield *(continued)*	TRUST WILDLIFE SPECIES Vegetation structure generally would be less attractive to bird species that prefer the tallest, densest grass–forb cover possible. Mallard, gadwall, northern harrier, and sedge wren would be replaced by species attracted to mid-height density ranges such as blue-winged teal, short-eared owl, upland sandpiper, grasshopper sparrow, Savannah sparrow, and western meadowlark.	TRUST WILDLIFE SPECIES Structure of DNC in old cropland would be suited for bird species such as mallard, gadwall, and northern harrier, which prefer the tallest, densest, grass–forb cover possible for nest sites. Other grassland bird species would be uncommon or rare. Nest survival of ducks and sharp-tailed grouse would be sustained at relatively higher levels (versus other alternatives), because of annual predator control.	TRUST WILDLIFE SPECIES Numbers of bird species and of other vertebrates that rely on grasslands would increase, especially species that require early successional, short–sparse grassland and that avoid woody plants.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
OLD CROPLAND—Environmental Consequences			
TRUST WILDLIFE SPECIES CONTINUED Survival of ducklings probably would be limited in these areas, where open-water impoundments account for nearly all wetland habitat.			
	50 YEARS HENCE Native warm-season grasses would dominate high-priority sites. Undesirable, introduced grasses would dominate low-priority sites. Breeding bird densities would decline on high-priority old cropland, but makeup of the community would be more diverse. Densities of early nesting species such as mallard and northern pintail would possibly decline, as might densities of species that use newly growing vegetation for nesting (such as gadwall).		50 YEARS HENCE *Same as alternative B, except* native plants would dominate all old cropland areas. In some areas, warm-season grasses would begin to reinvade adjoining drift prairie and prairie slope. Volunteer native forbs would be evident in most areas.
COULEE WOODLAND—Management Actions			
Des Lacs NWR—1,255 acres; J. Clark Salyer NWR—none; Upper Souris NWR—1,604 acres			
GENERAL APPROACH ***Refuge Qualifiers*** *Des Lacs NWR:* Reduce tall woody vegetation in all but the most contiguous woodland patches. Reverse invasion by introduced woody plants. *Upper Souris NWR:* Continue modest effort to slow invasion by tall woody vegetation on a limited area of the refuge uplands.	GENERAL APPROACH Strive to eliminate woodland and edge, particularly near high-priority drift prairie, prairie slope, and the largest tracts of open grassland.	GENERAL APPROACH Generally slow the spread of woodland edge, while principally managing for late successional cover on grasslands. Do not attempt to manage the largest, most contiguous woodland patches.	GENERAL APPROACH Ultimately, eliminate nearly all but the most mature, contiguous woodland patches. Among the latter areas, stop further woody expansion and reverse the rapid spread of common buckthorn and other introduced woody plants in the understory.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B—(Proposed Action)*	*Alternative C*	*Alternative D*
COULEE WOODLAND—Management Actions			
ECOLOGICAL PROCESSES Apply recurrent fire. Use grazing animals to knock down dead woody fuels and create openings in the regenerating woody plant cover.	ECOLOGICAL PROCESSES *Same as alternative A.*	ECOLOGICAL PROCESSES Apply fire infrequently to woodland edge as a component of adjacent grassland-dominated units being treated by fire.	ECOLOGICAL PROCESSES *Same as alternative A;* apply recurrent fire widely and aggressively. Precisely time fire applied to woodland edge that borders drift prairie and prairie slope, as regards phenology and competitive abilities of native herbaceous plants.
PLANT COMMUNITY INTEGRITY AND STRUCTURE Gradually decrease trees and tall shrubs that extend from edges of coulee woodlands into adjacent grasslands. Disregard the extent, distribution, and structure of contiguous coulee woodlands. Control noxious weeds.	PLANT COMMUNITY INTEGRITY AND STRUCTURE *Same as alternative A, except* completely remove woodland edge from and adjacent to high-priority drift prairie and prairie slope units. Control noxious weeds.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Use fire infrequently, chiefly to maintain late successional grassland cover, but, in some areas, to achieve simultaneously modest reductions in coulee woodland edge that may harbor predators of duck nests. Ignore structure and composition of coulee woodland. Control noxious weeds.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Create an upland landscape nearly devoid of patches of trees and tall shrubs including those extending from contiguous woodlands. Restrict remaining tall woody to contiguous woodland in the deepest, broadest coulees into which fire can scarcely penetrate. Maintain this as mature woodland with a low edge-to-interior ratio, variably broken canopy, and variable densities of understory tall shrub and sapling trees. Use cutting and herbicides to eliminate introduced species of woody plants in interiors of coulee woodlands.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
COULEE WOODLAND—Environmental Consequences			
	ECOLOGICAL PROCESSES *Same as alternative A*; *however*, nutrient cycling, occurrence of mycorrhizal relationships, and overall competitiveness of native herbaceous plants would be more improved in high-priority areas where grass–forb vegetation mostly replaced tall woody vegetation.	ECOLOGICAL PROCESSES *Same as alternative A*, only the changes would be more severe. Major ecological processes important in the evolution of prairie plant communities would be disrupted including (1) patterns of nutrient cycling, (2) the diversity of soil invertebrates and their relationships with plants, (3) patterns of water uptake, and (4) site-related influences on plant morphology and physiology.	ECOLOGICAL PROCESSES Fire and grazing disturbances would approximate historical frequency, timing, and intensity. Associated nutrient cycles would be largely restored. The relatively arid soil surface environment would be less hospitable to introduced plant species. Soil mycorrhizae and symbiotic relationships would be largely restored and maintained. Restoration of some areas to a near-presettlement condition probably would not be biologically feasible because they already are so badly degraded.
PLANT COMMUNITY INTEGRITY AND STRUCTURE Coulee woodland edge would be steadily diminished on most of the refuge. Some areas would be mostly open grassland, sometimes with mature woodland. Drift prairie and prairie slope would increase in area. Weedy forbs including noxious species (such as Canada thistle) would invade woodland edge immediately after burning, but gradually would be replaced by grasses over following years. *(continued)*	PLANT COMMUNITY INTEGRITY AND STRUCTURE Coulee woodland edge would be steadily decreased by frequently applied fire, especially near high-priority drift prairie and prairie slope. Some areas would begin to be characterized as open grassland and distinct, mature woodland with an abrupt transition between the two. Common buckthorn and other introduced species of shrub would be inhibited by fire away from contiguous woodland. Replacement of woody cover by smooth brome- *(continued)*	PLANT COMMUNITY INTEGRITY AND STRUCTURE Fire would be too infrequently applied to control expansion of coulee woodland edge over most of the refuges. Woodland edge would continue to be a widespread, conspicuous part of the landscape. Introduced species of shrubs would continue to expand, mainly in contiguous woodlands, and would replace native shrubs and tree saplings in the understory. Smooth brome expansion would not be reduced with infrequent, imprecisely timed fires *(continued)*	PLANT COMMUNITY INTEGRITY AND STRUCTURE *Same as alternative B*, *only* the changes apply to coulee woodland and coulee woodland edge across each refuge.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
COULEE WOODLAND—Environmental Consequences			
PLANT COMMUNITY INTEGRITY AND STRUCTURE CONTINUED Invasion by smooth brome would be hastened at the expense of western snowberry communities. Common buckthorn and other introduced species of shrub would be inhibited by fire away from contiguous woodland. ***Refuge Qualifier*** *Upper Souris NWR:* The net (overall) invasion by tall woody vegetation would not be reversed because fire would be too infrequently applied on most refuge units where coulee woodland edge is a prominent landscape component.	PLANT COMMUNITY INTEGRITY AND STRUCTURE CONTINUED dominated types on high-priority areas would be markedly slowed by carefully timed, frequent grazing, and native herbaceous plants would more successfully reinvade.	PLANT COMMUNITY INTEGRITY AND STRUCTURE CONTINUED and little grazing. Loss of western snowberry as a nest site habitat would be rapid with infrequent disturbance. Heavy accumulations of plant litter in the grass understory would inhibit light penetration and decrease aridity at the soil interface, which would create inhospitable conditions for native herbaceous plant species.	
TRUST WILDLIFE SPECIES Habitat would increase for several common, grassland-dependent species, especially Savannah sparrow and bobolink. Habitat would decrease for edge-generalist bird species such yellow warbler. Occurrence of woodland species such as ovenbird and black-capped chickadee would be unaffected, although abundance would be reduced. Parasitism rates would decrease among nests of grassland birds in adjoining drift prairie and prairie slope, due to *(continued)*	TRUST WILDLIFE SPECIES *Same as alternative A; on high-priority areas, however*, the changes would be more rapid—reduction of habitat for woodland-edge birds would proceed quickly, while the increase in grassland bird habitat would be rapid. Conversely, the change would proceed slowly on low-priority areas. There would be parallel implications for nest parasites and nest predators.	-	TRUST WILDLIFE SPECIES *Same as alternative A, only* the changes would be more rapid, widespread, and complete. Refuge uplands would begin to be characterized by distinctly different grassland and woodland bird communities, with almost no overlap or transition.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B—(Proposed Action)*	*Alternative C*	*Alternative D*
COULEE WOODLAND—Environmental Consequences			
TRUST WILDLIFE SPECIES CONTINUED decreased occurrence of brown-headed cowbirds and perches. Predation rates would decrease among nests of grassland birds in adjoining drift prairie and prairie slope, due to decreased occurrence of raccoons, great horned owls, deer mice, and other predator species. ***Refuge Qualifier*** *Upper Souris NWR:* Because there would be little change in the overall extent of woodland edge, change in abundances of bird species tied mainly to this habitat would be small. Nest parasitism and predation influences indirectly associated with prevalence of woodland edge would also be unchanged.			
50 YEARS HENCE Herbaceous cover, especially smooth brome, would dominate most areas that extend from coulees and were once variably interspersed with patches of tall shrubs and trees. Most areas of refuge uplands would be characterized by open grassland and contiguous woodland, with an abrupt transition between the two. Other than a few species of forbs, native herbaceous plants would seldom be found in areas formerly occupied by woodland edge. *(continued)*		50 YEARS HENCE Woodland edge would be conspicuous across much of the upland landscape, merging with tall shrub and tree patches on north- to east-facing prairie slope. Almost no native herbaceous vegetation would remain as an understory component; the herbaceous vegetation would be irreversibly degraded, especially due to prevalence of smooth brome. Along with Savannah sparrows in open grassland, brown-headed cowbirds, yellow *(continued)*	50 YEARS HENCE Herbaceous cover, mainly a mix of native species and Kentucky bluegrass, would dominate areas that extend from coulees and were once variably interspersed with patches of tall shrubs and trees. Refuge uplands would be characterized by open grassland and contiguous woodland, with an abrupt transition between the two. Several bird species that rely on woodland edge and that were once abundant and widespread would be uncommon to *(continued)*

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B—(Proposed Action)*	*Alternative C*	*Alternative D*
COULEE WOODLAND—Environmental Consequences			
50 YEARS HENCE CONTINUED Several bird species that rely on woodland edge and that were once abundant and widespread would be far less common. Much more habitat would be available for grassland bird species, especially those sensitive to tall woody cover in the landscape. ***Refuge Qualifier*** *Upper Souris NWR:* Although variable across the refuge, habitat for shrub-associated and habitat-generalist bird species would increase and that for grassland-dependent species would decline. Kentucky bluegrass would be the dominant grass species in woodland edge habitat and almost no herbaceous native species would be found.		50 YEARS HENCE CONTINUED warblers, and clay-colored sparrow would be the most abundant songbirds. Despite goals for waterfowl production, nest survival of ducks and songbirds in adjacent grasslands would be compromised due to increased predation and parasitism rates.	50 YEARS HENCE CONTINUED rare. The area and security of habitat available for grassland bird species, especially those sensitive to tall woody cover in the landscape, would measurably support levels of reproductive success that contribute to population levels for the respective species.
RIPARIAN WOODLAND—Management Actions			
Des Lacs NWR—none; J. Clark Salyer NWR—2,470 acres; Upper Souris NWR—609 acres			
GENERAL APPROACH Manage in concert with adjacent meadow. Maintain current extent of riparian woodland.	GENERAL APPROACH Manage in concert with adjacent meadow. Maintain current extent of riparian woodland. Increase coordination among the refuges and other water users.	GENERAL APPROACH *Same as alternative B, except* install and maintain nesting structures to increase waterfowl recruitment.	GENERAL APPROACH Manage in concert with adjacent meadow. Where feasible, restore the presettlement extent and plant composition of riparian woodland.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
RIPARIAN WOODLAND—Management Actions			
ECOLOGICAL PROCESSES Make minor to modest efforts to reduce flooding that occurs outside the natural hydroperiod. Maintain Lake Darling at a maximum operational elevation of 1,597.0 feet above mean sea level. Suppress and exclude fire.	ECOLOGICAL PROCESSES Within existing physical and political constraints, restore natural frequency, timing, and duration of flooding. Reduce the occurrence and duration of summer flooding. Maintain Lake Darling at a maximum operational elevation of 1,596.0 feet above mean sea level. Suppress and exclude fire.	ECOLOGICAL PROCESSES *Same as alternative B.*	ECOLOGICAL PROCESSES In conjunction with management of riverine wetlands and meadows, strive to fully restore natural frequency, timing, and duration of flooding. Suppress and exclude fire.
PLANT COMMUNITY INTEGRITY AND STRUCTURE Maintain current extent of woodland cover.	PLANT COMMUNITY INTEGRITY AND STRUCTURE *Same as alternative A.*	PLANT COMMUNITY INTEGRITY AND STRUCTURE *Same as alternative A.*	PLANT COMMUNITY INTEGRITY AND STRUCTURE Maintain current extent woodland cover. Attempt to restore American elm as the codominant tree species in riparian woodland. ***Refuge Qualifier*** *Upper Souris NWR:* Restore some or all riparian woodland.
RIPARIAN WOODLAND—Environmental Consequences			
ECOLOGICAL PROCESSES Flooding would be periodic, occurring mainly in the spring but also occurring outside the historical natural hydroperiod. Summer flooding would occur more frequently than is desirable.			ECOLOGICAL PROCESSES Within ecological and political constraints, flooding would be mostly confined within the historical, natural hydroperiod.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
RIPARIAN WOODLAND—Environmental Consequences			
PLANT COMMUNITY INTEGRITY AND STRUCTURE The current extent of riparian woodland would be preserved, except frequent or prolonged summer flooding may slightly reduce woodland area. American elm would persist but be sparsely distributed. Summer flooding periodically increases tree mortality.	PLANT COMMUNITY INTEGRITY AND STRUCTURE The current extent of riparian woodland would be preserved. American elm would persist but be sparsely distributed. Tree mortality would be reduced as the frequency and duration of summer flooding were reduced.		PLANT COMMUNITY INTEGRITY AND STRUCTURE The current extent of riparian woodland would be unchanged. Restoration of American elm would be contingent on development of new cultivars (cultivated varieties of a plant) resistant to Dutch elm disease. ***Refuge Qualifier*** *Upper Souris NWR:* Some riparian woodland would be restored if the area of Lake Darling were reduced during wetland restoration.
TRUST WILDLIFE SPECIES The current extent of riparian woodland habitat for woodland-dependent species of wildlife would be preserved or slightly reduced. Riparian woodland would provide local habitat for area-sensitive, forest-interior and woodland edge bird species.	TRUST WILDLIFE SPECIES The current extent of riparian woodland habitat for woodland-depend species of wildlife would be preserved. Riparian woodland would provide local habitat for area-sensitive, forest-interior and woodland edge bird species.	TRUST WILDLIFE SPECIES *Same as alternative B.*	TRUST WILDLIFE SPECIES *Same as alternative B, except* some habitat for wetland-dependent wildlife species would be replaced by habitats for woodland-associated wildlife species.
50 YEARS HENCE The current extent of riparian woodland would be preserved or slightly reduced, especially at Upper Souris NWR. Riparian woodland would provide local habitat for area-sensitive, forest-interior and woodland edge bird species. Veery, ovenbird, American *(continued)*	50 YEARS HENCE The current extent of riparian woodland would be preserved. Riparian woodland would provide local habitat for area-sensitive, forest-interior and woodland edge bird species. Veery, ovenbird, American redstart, hairy woodpecker, and *(continued)*		50 YEARS HENCE *Same as alternative B;* composition of riparian woodland would be gradually restored with reintroduction of American elm. ***Refuge Qualifier*** *Upper Souris NWR:* The current extent of riparian woodland may increase.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B—(Proposed Action)*	*Alternative C*	*Alternative D*
RIPARIAN WOODLAND—Environmental Consequences			
50 YEARS HENCE CONTINUED redstart, hairy woodpecker, and Cooper's hawk would be common. Widely scattered nesting colonies, mainly of herons, would continue to persist.	50 YEARS HENCE CONTINUED Cooper's hawk would be common. Widely scattered nesting colonies, mainly of herons, would continue to persist.		
MEADOW—Management Actions			
Des Lacs NWR—360 acres; J. Clark Salyer NWR—5,570 acres; Upper Souris NWR—1,570 acres			
GENERAL APPROACH Reduce tall woody vegetation and noxious weeds.	GENERAL APPROACH To the extent possible, restore a diverse native flora only on units with the greatest potential for success (the most floristically intact). Increase coordination among the refuges and other water users.	GENERAL APPROACH Reduce tall woody vegetation and noxious weeds. Increase coordination among the refuges and other water users. Control mammalian predators and install nesting structures to increase waterfowl production.	GENERAL APPROACH Strive to fully restore native plant communities and the ecological processes that shaped them. Emphasize broad-scale management that affords significant competitive advantages to native herbaceous plants and that discourages tall woody plants and introduced plant species such as quackgrass, reed canarygrass, and state-listed noxious weeds.
ECOLOGICAL PROCESSES Make minor to modest efforts to reduce flooding that occurs outside the historical natural hydroperiod.	ECOLOGICAL PROCESSES Within existing physical and political constraints, restore natural frequency, timing, and duration of flooding; reduce the occurrence and duration of summer flooding. Incorporate frequent, extensively applied haying on high-priority units. Reintroduce fire as an important defoliation disturbance. *(continued)*	ECOLOGICAL PROCESSES *Same as alternative B.*	ECOLOGICAL PROCESSES Strive to fully restore the natural frequency, timing, and duration of flooding. Apply fire, grazing, and haying extensively to reduce woody vegetation.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
MEADOW—Management Actions			
	ECOLOGICAL PROCESSES CONTINUED Account for landscape composition, interconnectivity, and extent when planning management to provide large, contiguous tracts of open grassland; the largest grasslands may include adjacent drift prairie, prairie parkland, and private grassland tracts.		
PLANT COMMUNITY INTEGRITY AND STRUCTURE Use haying to reduce cover of tall woody vegetation and noxious weeds. Control of tall woody vegetation is more important than trying to manage vegetation composition. Vegetation structure is largely a function of biannual haying. Use an integrated approach to control noxious weeds, especially leafy spurge.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Use haying and fire on high-priority units to reduce the cover of tall woody plants and noxious weeds. Do not control woody vegetation in low-priority units. (Control of tall woody vegetation is more important than trying to manage composition of herbaceous vegetation.) Allow vegetation structure to be a function of biannual haying and periodic use of fire. Use an integrated approach to control noxious weeds, especially leafy spurge.	PLANT COMMUNITY INTEGRITY AND STRUCTURE *Same as alternative B, except* maximize tall and dense vegetation structure attractive to nesting waterfowl.	PLANT COMMUNITY INTEGRITY AND STRUCTURE Use haying, grazing, and fire extensively to reduce cover of tall woody vegetation and restore native plant communities. Emphasize restoration of native plant communities. Allow vegetation structure to be a function of dynamic, frequent disturbances restored to units. Use an integrated approach to control noxious weeds, especially leafy spurge.
MEADOW— Environmental Consequences			
ECOLOGICAL PROCESSES Flooding would be periodic, occurring mainly in the spring but also occurring outside the historical natural hydroperiod. Summer flooding would occur *(continued)*	ECOLOGICAL PROCESSES Flooding would be periodic, occurring mainly in the spring but also occurring outside the historical natural hydroperiod. The frequency and duration *(continued)*	ECOLOGICAL PROCESSES *Same as alternative B.*	ECOLOGICAL PROCESSES The timing, frequency, and extent of flooding would more closely approximate the natural condition. Complete restoration of the historical natural fluvial *(continued)*

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B—(Proposed Action)*	*Alternative C*	*Alternative D*
MEADOW— Environmental Consequences			
ECOLOGICAL PROCESSES CONTINUED more frequently than desirable. Haying would replace grazing as an important defoliation disturbance. Disturbance would be inadequate for facilitating historical nutrient cycling.	ECOLOGICAL PROCESSES CONTINUED of summer flooding would be somewhat reduced by better coordination among the refuges and other water users. Natural nutrient cycles would be partially restored. Haying would replace grazing as an important defoliation. Fire would be reintroduced as a defoliation disturbance on high-priority meadows. Soil mycorrhizae, invertebrate diversity, and symbiotic relationships would gradually recover, but only in high-priority meadows. Elsewhere, disturbance would be inadequate to restore these processes to historical levels.		ECOLOGICAL PROCESSES CONTINUED processes would be unlikely because of continued conflicts among water users and irreversible human-induced physical changes in river dynamics. Wet–dry cycles, fire, and grazing disturbances would approximate historical frequency, timing, and intensity. Haying would continue as an important method for controlling tall woody plants. Soil mycorrhizae, invertebrate diversity, and symbiotic relationships would gradually recover.
PLANT COMMUNITY INTEGRITY AND STRUCTURE Tall woody vegetation would be controlled in the largest and most intact meadows. Elsewhere, tall shrubs and trees would gradually replace herbaceous vegetation. Native herbaceous species would gradually decline and be replaced by introduced species such as quackgrass, reed canarygrass, Canada thistle, and leafy spurge. *(continued)*	PLANT COMMUNITY INTEGRITY AND STRUCTURE Tall woody vegetation would be controlled in high-priority meadows. In low-priority meadows, tall shrubs and trees would gradually replace herbaceous vegetation. In intensively managed meadows, cover of native herbaceous vegetation would increase and cover of tall woody plants would decrease. Elsewhere, native herbaceous species would *(continued)*		PLANT COMMUNITY INTEGRITY AND STRUCTURE Cover of tall woody plants would be widely reduced. The diversity of native herbaceous plant species would gradually increase. Complete restoration to a presettlement condition would be unlikely on some units that have been dominated by tall woody plants or introduced grasses for more than 60 years. *(continued)*

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
MEADOW— Environmental Consequences			
PLANT COMMUNITY INTEGRITY AND STRUCTURE CONTINUED With haying as the main defoliation disturbance, meadows would alternate between years of tall-dense cover and moderate-dense cover.	PLANT COMMUNITY INTEGRITY AND STRUCTURE CONTINUED gradually decline and be replaced by introduced species such as quackgrass, reed canarygrass, Canada thistle, and leafy spurge. With haying as the main defoliation disturbance, meadows would alternate between years of tall-dense cover and moderate-dense cover. However, use of fire would increase structural heterogeneity.		PLANT COMMUNITY INTEGRITY AND STRUCTURE CONTINUED Vegetation structure would be variable and would be a function of dynamic, frequent disturbance.
-	TRUST WILDLIFE SPECIES *Same as alternative A, except* the frequency of summer flooding would possibly decline, thereby increasing bird occurrence and nest survival.	TRUST WILDLIFE SPECIES *Same as alternative B, except* waterfowl nest survival would be enhanced via annual removal of mammalian nest predators.	TRUST WILDLIFE SPECIES The abundance and diversity of grassland- and wetland-dependent wildlife species would gradually increase as tall woody plants were reduced and native plant diversity increased. Wildlife species that are associated with woodland and shrubland would persist but would be sparsely distributed.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
MEADOW— Environmental Consequences			
50 YEARS HENCE The extent of open, treeless meadows would be relatively unchanged. Meadows would be less floristically diverse and increasingly dominated by introduced plant species. Meadow would provide important habitat for many species of grassland- and wetland-dependent wildlife.	50 YEARS HENCE The extent of open, treeless meadows would gradually increase. High-priority meadows would be more floristically diverse, dominated by native herbaceous species. Remaining meadows would be dominated by woody and introduced plant species. Meadow would provide important habitat for many species of grassland- and wetland-dependent wildlife. Some wetland-dependent species would increase, such as sandhill crane and yellow rail.	50 YEARS HENCE *Same as alternative B, except* waterfowl nest survival would be enhanced via annual removal of mammalian nest predators. Compared to alternative B, meadows would be less floristically diverse, because controlling woody vegetation and maximizing tall and dense structure would be more important than native plant composition.	50 YEARS HENCE Native herbaceous plants would dominate meadows. Grassland- and wetland-dependent wildlife diversity and abundance would increase. Wildlife species that are associated with woodland and shrubland would persist but would be sparsely distributed. Despite extensive restorations, potential effects associated with 70 years of altered river hydrology (especially hydroperiod) would remain poorly understood. Meadow would provide important habitat for grassland- and wetland-dependent wildlife species.
WETLAND Management Actions			
Des Lacs NWR—6,800 acres; J. Clark Salyer NWR—26,000 acres; Upper Souris NWR—12,175 acres			
GENERAL APPROACH Under existing constraints, enhance the long-term capacity of riverine wetlands to support diverse plant and wildlife communities. Manage nonriverine wetlands in concert with the surrounding habitats (such as drift prairie and prairie parkland). Exclude carp from riverine wetlands.	GENERAL APPROACH To the fullest extent possible, prolong the capacity of riverine wetlands to support diverse plant and wildlife communities, especially on units with the greatest potential for success. To this end, increase coordination among refuges and other water users. Manage nonriverine wetlands in concert with the surrounding habitats (such as drift prairie and prairie parkland). Exclude carp from riverine wetlands.	GENERAL APPROACH *Same as alternative B.*	GENERAL APPROACH Strive to fully restore native plant communities and ecological processes that shaped them. Manage nonriverine wetlands in concert with the surrounding habitats (such as drift prairie and prairie parkland). Exclude carp from riverine wetlands. Develop effective coordination among Souris River water users, especially among the three refuges. Amend or modify existing river management plans to support restoration of the system.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
WETLAND—Management Actions			
ECOLOGICAL PROCESSES To the extent possible, use water level management to coarsely mimic periodic wet and dry cycles. When applicable, manage impoundments according to the 1959 interim agreement (as modified) between Canada and the United States. Obtain remaining prescriptive water rights through North Dakota State Water Commission. Continue to monitor water quantity. ***Refuge Qualifiers*** *Des Lacs NWR:* Monitor water quality of releases from Kenmare sewage lagoon. *Upper Souris NWR:* Periodically supply water to marshes at J. Clark Salyer NWR and Upper Souris NWR.	ECOLOGICAL PROCESSES To the extent possible, use water level management to coarsely mimic periodic wet and dry cycles. Enhance coordination with all water users within the watershed to restore or mimic natural fluvial dynamics of riverine wetlands. Increase water quality monitoring and reduce nonpoint source pollution and sedimentation. Obtain remaining prescriptive water rights through North Dakota State Water Commission. Buy additional water rights. ***Refuge Qualifier*** *Des Lacs NWR:* Monitor water quality of releases from Kenmare sewage lagoon; enforce North Dakota standards.	ECOLOGICAL PROCESSES *Same as alternative B.*	ECOLOGICAL PROCESSES Strive to fully restore historical natural fluvial dynamics, including hydrology and hydroperiod. Where feasible, remove dikes, dams, channels, right-of-way berms, spoil piles, and islands to restore processes or physical habitat features locally to sustain long-term form and function to a riverine marsh system. Obtain remaining prescriptive water rights through North Dakota State Water Commission. Enhance water quality monitoring and work to reduce nonpoint source pollution and sedimentation. ***Refuge Qualifier*** *Des Lacs NWR:* Monitor water quality of releases from Kenmare sewage lagoon; enforce North Dakota standards.
PLANT COMMUNITY INTEGRITY AND STRUCTURE To the extent possible, maintain a broad array of vegetation composition and structure, including annual, emergent, and submergent wetland plant species. Maintain varied interspersion of vegetation and open water (hemi-marsh is 50% open water and 50% emergent vegetation). *(continued)*	PLANT COMMUNITY INTEGRITY AND STRUCTURE In high-priority units, emphasize long-term capacity of wetlands to support diverse wetland plant communities. In priority impoundments, use periodic disturbance to provide the full spectrum of wetland conditions, including dry marsh, densely vegetated marsh (regenerative phase), hemi-marsh, open *(continued)*	PLANT COMMUNITY INTEGRITY AND STRUCTURE *Same as alternative B.*	PLANT COMMUNITY INTEGRITY AND STRUCTURE Restore fluvial dynamics to improve vegetation composition, structure, and interspersion. Restore wetlands to improve structure and function of wetland plant communities. Expand detection and control of invasive species such as purple loosestrife and salt cedar. *(continued)*

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B—(Proposed Action)*	*Alternative C*	*Alternative D*
WETLAND—Management Actions			
PLANT COMMUNITY INTEGRITY AND STRUCTURE CONTINUED Use an integrated approach to detect and control noxious weeds, especially purple loosestrife and salt cedar.	PLANT COMMUNITY INTEGRITY AND STRUCTURE CONTINUED marsh (degenerative phase), and open water. Use an integrated approach to detect and control noxious weeds, especially purple loosestrife and salt cedar. ***Refuge Qualifiers*** *Des Lacs NWR and J. Clark NWR:* Evaluate construction of a bypass channel to improve wetland management.		PLANT COMMUNITY INTEGRITY AND STRUCTURE CONTINUED Remove created wetlands and restore upland prairie communities in these sites.
WETLAND Environmental Consequences			
ECOLOGICAL PROCESSES Disruption of natural fluvial dynamics and physical attributes of the Souris River would be extreme, because of low-head dams and other physical structures that have been constructed along the rivers. Wetlands would be semipermanent or lake-like compared to the natural, presettlement condition. Water-level fluctuations would be less dynamic that the historical condition, which would hinder soil and wetland functions. Wetland soils would remain perennially moist and be infrequently oxidized. The degree to which pollution and *(continued)*	ECOLOGICAL PROCESSES Although physically altering the Souris River system to a further extent (especially at Des Lacs NWR), attempts to restore significant ecological processes and wetland function would potentially prolong the functional lifespan of riverine wetlands in high-priority units. In high-priority wetland units, soils would periodically dry and oxidize during the dry-marsh phase. The degree to which pollution and sedimentation threats were addressed at the watershed level would determine their short- and long-term effects on riverine wetlands.		ECOLOGICAL PROCESSES Wetland processes would be widely restored. In other units, restorations would be biologically impossible, politically constrained, or cost prohibitive. The physical disruption of hydrologic function would gradually decline as dikes, dams, channels, right-of-way berms, spoil piles, and islands were removed. Wetland soils would dry and be frequently oxidized during the dry-marsh phase. The degree to which pollution and sedimentation threats were addressed at the watershed level would determine their short- and long-term effects on riverine wetlands.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
WETLAND—Environmental Consequences			
ECOLOGICAL PROCESSES CONTINUED sedimentation threats were addressed at the watershed level would determine their short- and long-term effects on riverine wetlands.			
PLANT COMMUNITY INTEGRITY AND STRUCTURE Many wetland units would lack capacity to provide the full spectrum of wetland conditions, including dry marsh, densely vegetated marsh (regenerative phase), hemi-marsh, open marsh (degenerative phase), and open water. Some units would remain static, almost perpetually in either a densely vegetated or an open-water phase. The critically important drawdown (dry marsh) phase would be the most unattainable stage of the wetland cycle. Soils would remain relatively moist during drawdown; germination of important annual plants would rarely occur. When wetland units were successfully dewatered, annual, emergent, and submergent plant species would be common. Remaining units would be perennially dominated by algae and submerged aquatic plants (open-water phase) or robust emergent plant species (densely vegetated phase).	PLANT COMMUNITY INTEGRITY AND STRUCTURE In high-priority units, the capacity to provide the full spectrum of wetland conditions would increase. All phases would be represented including dry marsh, densely vegetated marsh (regenerative phase), hemi-marsh, open marsh (degenerative phase), and open water. Elsewhere, units would remain static, almost perpetually in either a densely vegetated or an open-water phase. As high-priority wetlands were cycled through all marsh phases, wetland plant species and structural diversity would increase. Annual, emergent, and submergent plant species would be common. Remaining units would be perennially dominated by algae and submerged aquatic plants (open-water phase) or robust emergent plant species (densely vegetated phase). The frequency of germination of important annual wetland plants (such as smartweeds) and the control of robust emergent vegetation would increase in high-priority units.		PLANT COMMUNITY INTEGRITY AND STRUCTURE Collectively, riverine wetlands would gradually shift from a static lake-like system to a dynamic riverine system. Wetlands with seasonal and temporary water regimes would increase. The area of semipermanent wetlands would possibly decrease; the area of lakes would markedly decrease. Many wetlands would naturally cycle through the full spectrum of wetland conditions including dry marsh, densely vegetated marsh (regenerative phase), hemi-marsh, open marsh (degenerative phase), and open water. Wetland plant diversity would increase, especially annual wetland plants such as smartweeds. Complete restoration of wetland plant communities would be unlikely in units with significant sediment accretion or in units that have been dominated for more than 40 years by robust emergent vegetation, especially cattail and common reed.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B—(Proposed Action)*	*Alternative C*	*Alternative D*
WETLAND—Environmental Consequences			
	-		TRUST WILDLIFE SPECIES Wetlands would provide important habitat for grassland- and wetland-dependent wildlife species. Wildlife diversity would increase with more diverse wetland conditions. Dynamic wetland conditions would favor plant and invertebrate foods that attract breeding and migrating birds such as shorebirds. Species that use temporary, seasonal, and semipermanent wetlands would increase. Species that rely on large, stable wetlands (such as white pelican, double-crested cormorant, and western grebe) would occur, but would not be widespread. Game fish, especially walleye and perch, would be rare.
50 YEARS HENCE With their limited lifespans, riverine impoundments would continue to decline in quality. The capacity to manage water levels would decline significantly because of high sedimentation rates and accretion of organic materials. Robust emergent plants would increase and dominate many wetland units. Riverine wetlands would remain important nesting *(continued)*	50 YEARS HENCE *Same as alternative A; however*, the rate of decline in wetland functions would be moderately to significantly reduced dependent on the degree to which wetland processes were restored. Without significant reductions in soil erosion and wetland destruction within the watershed (outside the refuges), wetland quality would continue to decline due *(continued)*	50 YEARS HENCE *Same as alternative B.*	50 YEARS HENCE Processes that create and maintain wetlands would be measurably enhanced. However, successful restoration would depend on agreement among water users within the Souris River basin to enhance the long-term capacity of wetlands to remain productive (potentially in conflict with other objectives that govern use of the Souris and Des Lacs rivers). *(continued)*

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B—(Proposed Action)*	*Alternative C*	*Alternative D*
WETLAND—Environmental Consequences			
	50 YEARS HENCE CONTINUED to irreversible accretions of sediment, organic material, and pollution.		50 YEARS HENCE CONTINUED Despite extensive restorations, potential effects associated with 70 years of altered river hydrology (especially hydroperiod) would remain poorly understood. Without significant reductions in soil erosion and wetland destruction within the watershed (outside the refuges), wetland quality would continue to decline due to irreversible accretions of sediment, organic material, and pollution.
ISLANDS—Management Actions			
Des Lacs NWR—8 islands; J. Clark Salyer NWR—50 islands; Upper Souris NWR—28 islands			
GENERAL APPROACH Control predators during drought years to increase waterfowl recruitment. Give priority to islands that have historically attracted high densities of nesting waterfowl. ***Refuge Qualifier*** *Des Lacs NWR:* Annually control predators.	GENERAL APPROACH Control predators during drought years to increase waterfowl recruitment. Give priority to islands that have historically attracted high densities of nesting waterfowl. Remove islands that have perennially low waterfowl nest densities. ***Refuge Qualifier*** *Des Lacs NWR:* Annually control predators.	GENERAL APPROACH Annually control predators to maximize waterfowl production on all islands. Restore or reconstruct damaged and poorly constructed islands. Build more islands.	GENERAL APPROACH Remove all artificial islands.
ECOLOGICAL PROCESSES Use water-level management to attract waterfowl and increase nest survival. Increase open-water barriers surrounding islands. Periodically use fire to rejuvenate vegetation.	ECOLOGICAL PROCESSES *Same as alternative A.*	ECOLOGICAL PROCESSES *Same as alternative A, except* periodically reduce water levels in impoundments during winter to reduce mink survival.	ECOLOGICAL PROCESSES *No longer applies.*

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B—(Proposed Action)*	*Alternative C*	*Alternative D*
ISLANDS—Management Actions			
PLANT COMMUNITY INTEGRITY AND STRUCTURE	PLANT COMMUNITY INTEGRITY AND STRUCTURE	PLANT COMMUNITY INTEGRITY AND STRUCTURE	PLANT COMMUNITY INTEGRITY AND STRUCTURE
Use water-level management to reduce emergent plant cover surrounding islands. Enhance island cover to attract nesting ducks and discourage gull nesting.	*Same as alternative A*	*Same as alternative A, except* use Rodeo® herbicide to augment water-level management to reduce emergent plant cover surrounding islands.	*No longer applies.*
ISLANDS—Environmental Consequences			
			ECOLOGICAL PROCESSES With islands removed, there would no longer be potential conflicts between their management and wetland management. Soil erosion would be reduced.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
ISLANDS—Environmental Consequences			
PLANT COMMUNITY INTEGRITY AND STRUCTURE Cover of emergent vegetation (especially cattail and common reed) surrounding islands would be reduced, making islands more attractive to nesting waterfowl. Planted, dense patches of low shrub would increase duck nesting and reduce gull nesting. Leafy spurge, Canada thistle, and wormwood would be common on some islands and would be dispersion seed sources to mainland shorelines.	PLANT COMMUNITY INTEGRITY AND STRUCTURE On high-priority islands, cover of emergent vegetation (especially cattail and common reed) surrounding islands would be reduced, making islands more attractive to nesting waterfowl. On unproductive islands, cover would possibly be burned annually to reduce nesting. Some unproductive islands would be removed and would revert to wetland. Leafy spurge, Canada thistle, and wormwood would be common on some islands and would be dispersion seed sources to mainland shorelines.	PLANT COMMUNITY INTEGRITY AND STRUCTURE On all islands, surrounding and shoreline emergent cover (especially cattail and common reed) would be reduced to make nesting islands more attractive to waterfowl. Opportunities for using muskrats to manage wetland vegetation would be mostly lost because water levels would be kept intentionally low during winter to reduce occurrence of mink. Leafy spurge, Canada thistle, and wormwood would be common on some islands and would be dispersion seed sources to mainland shorelines.	PLANT COMMUNITY INTEGRITY AND STRUCTURE About 50–100 acres of upland island habitat would be converted to wetland habitat. Islands would no longer be seed sources for leafy spurge, Canada thistle, and wormwood.
	TRUST WILDLIFE SPECIES *Same as alternative A, except* perennially unproductive islands would be removed, reducing risk of some islands functioning as "population sinks."		TRUST WILDLIFE SPECIES Some ducks, geese, double-crested cormorants, American avocets, and other waterbirds that nest on islands would be displaced to upland or overwater nest sites. Local waterfowl production would decline.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B—(Proposed Action)*	*Alternative C*	*Alternative D*
ISLANDS—Environmental Consequences			
50 YEARS HENCE Objectives for wetland management and island management would periodically conflict. Island maintenance would be expensive. Islands would enhance local waterfowl production.	50 YEARS HENCE *Same as alternative A, except* resources expended on islands would dilute management of other habitats.	50 YEARS HENCE *Same as alternative A, except* waterfowl production would be greater than for other alternatives.	50 YEARS HENCE Local waterfowl production would decline.
CULTURAL RESOURCES—Management Actions			
Continue to protect cultural resources as they are found. Inventory resources only for construction projects.	*Same as alternative A, plus* promote interpretation of cultural resources.	*Same as alternative A, plus* promote interpretation of cultural resources.	Inventory and protect cultural resources. Enhance the understanding of cultural resources through research and interpretation.
CULTURAL RESOURCES—Environmental Consequences			
Existing and newly discovered cultural resources would be protected.	*Same as alternative A, plus* public and refuge staff awareness of the cultural history prior to and during refuge establishment would be enhanced.	*Same as alternative A, plus* public and refuge staff awareness of the cultural history prior to and during refuge establishment would be enhanced.	Existing and newly discovered cultural resources would be inventoried and protected. Public and refuge staff awareness of the cultural history prior to and during refuge establishment would be enhanced. Scientific knowledge about the role of human habitation in or near refuges would increase.
VISITOR SERVICES, *Hunting*—Management Actions			
Continue hunting programs to manage wildlife and provide recreational hunting opportunities.	Provide hunting opportunities only when resources needed to administer hunting do not negatively affect the ability to carry out habitat management.	Evaluate opportunities for waterfowl hunting (may require congressional approval). Review and evaluate the effects of other hunting programs on breeding and migrating waterfowl.	*Same as alternative A.*

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B—(Proposed Action)*	*Alternative C*	*Alternative D*
VISITOR SERVICES, *Hunting*—Environmental Consequences			
There would be no significant change to the hunting program.	There would be no significant change to hunting programs that do not adversely affect the ability to carry out habitat management.	Waterfowl hunting opportunities would possibly be added or expanded. There would be no significant change to the other hunting programs that do not adversely affect waterfowl management. Waterfowl hunting would possibly disturb or cause resting waterfowl to leave the refuge, thereby negatively affecting waterfowl hunting outside the refuge boundary. Hunting would possibly increase refuge visitation. Habitat changes would possibly shift hunting opportunities from one species group to another. For example, increases in tall shrubs and trees could affect the attractiveness of upland habitats to game birds (for example, sharp-tailed grouse hunting opportunities would decline and ruffed grouse hunting opportunities would increase). Effects on deer populations would be negligible.	*Similar to alternative A, except* habitat changes would possibly shift hunting opportunities from one species group to another. For example, decreases in tall shrubs and trees could affect the attractiveness of upland habitats to game birds (for example, sharp-tailed grouse hunting opportunities would increase and ruffed grouse hunting opportunities would decline).
VISITOR SERVICES, *Fishing*—Management Actions			
Continue recreational fishing. ***Refuge Qualifier*** *Des Lacs NWR:* Do not provide fishing.	Provide recreational fishing opportunities only when resources needed to administer fishing do not negatively affect the ability to carry out habitat management.	Review and evaluate the effects of fish population dynamics (for example, stocking and predators) and recreational fishing on breeding and migrating waterfowl.	Continue a recreational fishing program, but limit stocking to the reintroduction of locally native fish species. Investigate the effects of introduced biota not native to the Hudson Bay headwaters/mixed-grass prairie drainage.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B—(Proposed Action)*	*Alternative C*	*Alternative D*
VISITOR SERVICES, *Fishing*—**Environmental Consequences**			
There would be no significant change to the fishing program. ***Refuge Qualifier*** *Des Lacs NWR:* Fishing would not be provided.	Fishing opportunities would remain relatively unchanged. However, populations of yellow perch and walleye may periodically decline due to more frequent winterkill. Fish habitat would improve in conjunction with more dynamic water level fluctuations, thereby enhancing fish populations over the long term.		Fishing opportunities would be dramatically reduced. Fishing visits would possibly decrease drastically. Stocking would be limited to locally native species.
VISITOR SERVICES, *Wildlife Observation, Wildlife Photography, Interpretation, Environmental Education*—**Management Actions**			
Continue recreational wildlife observation and photography. Continue minimal interpretation and environmental education.	Maintain or increase development of wildlife observation and photography programs and facilities. Expand interpretation and environmental education with an emphasis on natural plant and animal communities and habitat restoration.	Maintain or increase development of wildlife observation and photography programs and facilities. Expand interpretation and environmental education with an emphasis on waterfowl.	*Same as alternative B.*
VISITOR SERVICES, *Wildlife Observation, Wildlife Photography, Interpretation, Environmental Education* **Environmental Consequences**			
There would be no significant change to these programs. Interpretive value would be diminished with the continued decline of native prairie flora.	*Similar to alternative A, except* improved habitat conditions in some areas would possibly result in more opportunities for observation and photography of a greater diversity of native wildlife and plants. Interpretive and education programs would enhance awareness of prairie and wetland ecology and management.		Improved habitat conditions would result in more opportunities for observation and photography of a greater diversity of prairie wildlife and plants. Interpretive and education programs would significantly enhance awareness of prairie and wetland ecology and management and engage the public in prairie restoration efforts.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
VISITOR SERVICES, *Non-wildlife Dependent Recreation*—Management Actions			
Permit non-wildlife-dependent recreational activities (such as canoeing and hiking), when compatible under compatibility guidelines.	*Same as alternative A.*	*Same as alternative A.*	*Same as alternative A.*
VISITOR SERVICES, *Non-wildlife Dependent Recreation* Environmental Consequences			
Based on compatibility guidelines, changes would possibly occur in some of the non-wildlife-dependent uses.	*Same as alternative A.*		*Same as alternative A.*
RESEARCH AND SCIENCE Management Actions			
Emphasize inventory and applied research over short- and long-term monitoring. Limit research to evaluations of strategies to enhance native plant communities and discouraging invasive plants. Track only broad, long-term vegetation succession. Focus efforts mainly on baseline inventories and basic assessments of trust wildlife species–habitat interactions. Collaborate on, cooperate with, or otherwise support relevant research by outside parties.	Emphasize inventory and applied research over short- and long-term monitoring. Limit research to evaluations of strategies to enhance native plant communities and discouraging invasive plants. Intensively assess changes in vegetation composition and structure on high-priority units; otherwise, monitor only long-term, general vegetation changes. Focus efforts mainly on baseline inventories and basic assessments of trust wildlife species–habitat interactions. Collaborate on, cooperate with, or otherwise support relevant research by outside parties.	Expand research to focus on methods that enhance waterfowl production, especially nest density, nest survival, hen survival, and brood survival. Track nest survival as an index to recruitment rate. Assess extent and effectiveness of predator control.	Expand research to focus on restoration of ecological processes (such as landscape factors, and fire– and grazing–plant interactions) important in maintaining northern prairie and wetland plant communities. Carry out rigorous, experimental approaches as well as case history studies. Expand research to predict trust wildlife species responses to habitat restoration. Expand baseline assessments to include invertebrate communities. Collaborate on, cooperate with, or otherwise support relevant research by outside parties.

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B— (Proposed Action)*	*Alternative C*	*Alternative D*
RESEARCH AND SCIENCE Environmental Consequences			
Many invasive plant issues would remain unresolved. Small, annual changes in vegetation composition on upland sites would continue unrecognized until plant communities became compromised, to the point that future restorations would be unlikely. Knowledge of some vegetation management strategies would be enhanced. Limited inventory, research, and monitoring would be conducted in wetland systems, resulting in a poor ability to defend management actions. Basic relationships of bird species to their habitats would be understood, but investigations would be limited to high-priority management issues.	Inventory and applied research would be emphasized over monitoring. Knowledge regarding effects of invasive plant species; prairie management methods; and prairie vegetation, community dynamics would increase. Most emphasis would be placed on monitoring and applied research of upland habitat restorations. Without additional staff, limited inventory, research, and monitoring would be conducted in wetland systems, resulting in a poor ability to defend management actions. Basic relationships of bird species to their habitats would be understood, but investigations would be limited to high-priority management issues.	Methods that attract waterfowl and increase recruitment would be investigated. Annual waterfowl production would be estimated. Significant knowledge gaps would remain regarding invasive plant species management; prairie management; and prairie vegetation, community dynamics. Important changes in vegetation composition on upland sites would be unrecognized. Effects of waterfowl habitat and population management (such as predator control) on nontarget wildlife species are unknown.	Extensive inventories, short- and long-term monitoring and applied research would vastly increase. The adaptive resource management process would be fully implemented. There would be a significant increase in biological staffing to support research, monitoring, and inventory. The Souris River basin refuges would serve as demonstration sites for habitat management and restoration.
OPERATIONS—Management Actions			
Continue the current level of operations and maintenance for natural resources, existing visitor service facilities, and administrative infrastructure. ***Refuge Qualifiers*** *Des Lacs NWR:* Retain current staffing of 13 full-time equivalent (FTE) employees (2 FTEs assigned to the refuge; 11 FTEs assigned to the Des Lacs NWR Complex). *(continued)*	Increase funding to support ecological restoration efforts. ***Refuge Qualifiers*** *Des Lacs NWR:* Attain target (minimum) staffing level to carry out this alternative—19 FTEs (assign 5 FTEs to the refuge; assign 14 FTEs to the Des Lacs NWR Complex). *(continued)*	Increase funding for waterfowl habitat and visitor service facilities. ***Refuge Qualifiers*** *Des Lacs NWR:* Attain target (minimum) staffing level to carry out this alternative—19 FTEs (assign 5 FTEs to refuge; assign 14 FTEs to Des Lacs NWR Complex). *(continued)*	Increase funding to support ecological restoration efforts and visitor service facilities. ***Refuge Qualifiers*** *Des Lacs NWR:* Attain target staffing level to carry out this alternative—29 FTEs (assign 8 FTEs to refuge; assign 21 FTEs to Des Lacs NWR Complex). *(continued)*

Table 5. Management alternatives and environmental consequences for the draft CCP and EA, Souris River basin refuges, North Dakota.

Alternative A (Current Management)	*Alternative B—(Proposed Action)*	*Alternative C*	*Alternative D*
OPERATIONS—Management Actions			
J. Clark Salyer NWR: Retain current staffing of 16 FTEs (12 FTEs assigned to the refuge; 4 FTEs assigned to the J. Clark Salyer NWR Complex). *Upper Souris NWR:* Retain current staffing of 7.0 FTEs.	*J. Clark Salyer NWR:* Attain target (minimum) staffing level to carry out this alternative—22 FTEs (assign 18 FTEs to the refuge; assign 4 FTEs to the J. Clark Salyer NWR Complex). *Upper Souris NWR:* Attain target (minimum) staffing level to carry out this alternative—9.5 FTEs.	*J. Clark Salyer NWR:* Attain target (minimum) staffing level to carry out this alternative—22 FTEs (assign 18 FTEs to refuge; assign 4 FTEs to J. Clark Salyer NWR Complex). *Upper Souris NWR:* Attain target (minimum) staffing level to carry out this alternative—9.5 FTEs.	*J. Clark Salyer NWR:* Attain target (minimum) staffing level to carry out this alternative—33.5 FTEs (assign 25 FTEs to refuge; assign 48.5 FTEs to J. Clark Salyer NWR Complex). *Upper Souris NWR:* Attain target (minimum) staffing level to carry out this alternative—18.0 FTEs.
OPERATIONS—Environmental Consequences			
There would be no significant change to staffing and funding levels. Target (minimum) staff and resources would carry out this alternative, which would be inadequate to conserve prairie and wetland resources.	Target (minimum) staffing levels, with adequate funding, would carry out this alternative—only priority areas would improve, others would continue to degrade. Under triage management, the amount of conservation and restoration work done would be commensurate with the amount of available staffing and funding. Additional staff and resources would ensure that a greater range of priority areas would receive attention.	Target (minimum) staffing levels, with adequate funding, would carry out this alternative—certain habitats would not receive needed restoration.	Target (minimum) staffing levels, with adequate funding, would carry out this alternative. If additional staffing and funding were provided, all habitat areas would improve.

Economic Impacts of the No-action and Proposed Action Alternatives

This section analyzes the local economic impacts associated with current management activities (alternative A) at each refuge and the change in management activities associated with the proposed action (alternative B).

Impacts from Refuge Administration

Each year, the refuges purchase a wide variety of supplies and services for operations and maintenance activities.

Refuge Spending

Purchases that are made locally contribute to the local economic impacts associated with the refuge. Major local expenditures for all refuges include: (1) auto repairs, parts, and fuel; (2) equipment; (3) supplies and services related to building maintenance; (4) miscellaneous supplies; and (5) utilities.

Another major annual local expenditure for J. Clark Salyer NWR is easement payments to landowners.

In 2005, the nonsalary budget was $264,594 for Des Lacs NWR, $303,727 for J. Clark Salyer NWR, and $372,900 for Upper Souris NWR. According to refuge personnel, Des Lacs NWR purchases approximately 21% of annual nonsalary budget expenditures locally in the towns of Kenmare and Bowbells, J. Clark Salyer NWR purchases approximately 70% within Bottineau and McHenry counties, and Upper Souris NWR purchases approximately 47% within Ward and Renville counties. Table 6 shows the current impacts (alternative A) associated with the nonsalary budget purchases made locally for each refuge.

The local work-related purchases by Des Lacs NWR account for $70,500 in local output annually (2005$). This generates a total impact of $20,600 in personal income and 0.8 of a job annually in the Kenmare and Bowbells area (table 6). The local work-related purchases by J. Clark Salyer NWR account for $243,800 in local output annually, which generates a total impact of $40,800 in personal income and 2.1 jobs annually in Bottineau and McHenry counties. The local work-related purchases by Upper Souris NWR account for $228,200 in local output annually, which generates a total impact of $80,200 in personal income and three jobs annually in Ward and Renville counties.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Prairie Rose

According to refuge personnel, under the proposed action (alternative B), annual nonsalary expenditures are anticipated to remain similar to alternative A for Des Lacs NWR, increase by $108,894 for J. Clark Salyer NWR, and increase by $149,100 for Upper Souris NWR. It was assumed the proportion spent locally would remain the same as for alternative A for each refuge. The resulting economic impacts associated with nonsalary budget purchases made locally for each refuge for alternative B in table 7.

The change in local nonsalary spending impacts between alternative A and alternative B are shown in table 8. The local work-related purchases by Des Lacs NWR under alternative B are expected to be the same as under alternative A. The local work-related purchases by J. Clark Salyer NWR under alternative B are expected to account for $331,100 in local output annually, which would generate a total impact of $55,400 in personal income and 2.8 jobs

Table 6. Economic impacts of local nonsalary budget purchases for alternative A for the Souris River basin refuges, North Dakota (2005$).

Local Economic Impact Area	*Des Lacs NWR (Kenmare and Bowbells Area)*	*J. Clark Salyer NWR (Bottineau and McHenry Counties)*	*Upper Souris NWR (Ward and Renville Counties)*
Local Output ($/year)	$70,500	$243,800	$228,200
Income ($/year)	$20,600	$40,800	$80,200
Jobs	0.8	2.1	3.0

annually in Bottineau and McHenry counties. This represents an increase of $87,300 in local output, $14,600 in personal income, and 0.7 of a job as compared to alternative A (table 8). The local work-related purchases by Upper Souris NWR under alternative B are expected to account for $319,300 in local output annually, which would generate a total impact of $112,200 in personal income and 4.2 jobs annually in Ward and Renville counties. This represents an increase of $91,000 in local output, $32,000 in personal income, and 1.2 jobs as compared to alternative A (table 8).

Refuge Employee Spending

Refuge employees reside and spend their salaries on daily living expenses in communities near their refuge, thereby generating impacts within the local economy. Household consumption expenditures consist of payments by individuals/households to industries for goods and services used for personal consumption. The IMPLAN modeling system contains household consumption spending profiles that account for average household spending patterns by income level. These profiles also capture average annual savings and allow for leakage of household spending to outside the region.

In 2005, the salary budget (including benefits) was $431,168 for Des Lacs NWR, $820,013 for J. Clark Salyer NWR, and $553,500 for Upper Souris NWR. Table 9 shows the current impacts (alternative A) associated with local staff salary spending for each refuge. Spending of salaries by Des Lacs NWR staff accounts for $328,200 in local output annually (2005$). This generates a total impact of $71,600 in personal income and three jobs annually in the Kenmare and Bowbells area. Spending of salaries by J. Clark Salyer NWR staff accounts for $705,100 in local output annually, which generates a total impact of $70,400 in personal income and 4.3 jobs annually in Bottineau and McHenry counties.

Table 7. Economic impacts of local nonsalary budget purchases for alternative B for the Souris River basin refuges, North Dakota (2005$).

Local Economic Impact Area	*Des Lacs NWR (Kenmare and Bowbells Area)*	*J. Clark Salyer NWR (Bottineau and McHenry Counties)*	*Upper Souris NWR (Ward and Renville Counties)*
Local Output ($/year)	$70,500	$331,100	$319,300
Income ($/year)	$20,600	$55,400	$112,200
Jobs	0.8	2.8	4.2

Table 8. Change in local nonsalary spending impacts between alternatives A and B for the Souris River basin refuges, North Dakota (2005$).

Local Economic Impact Area	*Des Lacs NWR (Kenmare and Bowbells Area)*	*J. Clark Salyer NWR (Bottineau and McHenry Counties)*	*Upper Souris NWR (Ward and Renville Counties)*
Local Output ($/year)	$0	+$87,300	+$91,000
Income ($/year)	$0	+$14,600	+$32,000
Jobs	0	+0.7	+1.2

Table 9. Local economic impacts of salary spending by refuge personnel for alternative A for the Souris River basin refuges, North Dakota (2005$).

Local Economic Impact Area	*Des Lacs NWR (Kenmare and Bowbells Area)*	*J. Clark Salyer NWR (Bottineau and McHenry Counties)*	*Upper Souris NWR (Ward and Renville Counties)*
Local Output ($/year)	$328,200	$705,100	$600,700
Income ($/year)	$71,600	$70,400	$125,100
Jobs	3.0	4.3	5.9

Table 10. Local economic impacts of salary spending by refuge personnel for alternative B for the Souris River basin refuges, North Dakota (2005$).

Local Economic Impact Area	*Des Lacs NWR (Kenmare and Bowbells Area)*	*J. Clark Salyer NWR (Bottineau and McHenry Counties)*	*Upper Souris NWR (Ward and Renville Counties)*
Local Output ($/year)	$328,200	$889,000	$917,600
Income ($/year)	$71,600	$89,800	$191,200
Jobs	3.0	5.5	9.1

Table 11. Change in salary spending impacts between alternatives A and B for the Souris River basin refuges, North Dakota (2005$).

Local Economic Impact Area	*Des Lacs NWR (Kenmare and Bowbells Area)*	*J. Clark Salyer NWR (Bottineau and McHenry Counties)*	*Upper Souris NWR (Ward and Renville Counties)*
Local Output ($/year)	$0	+$193,900	+$316,900
Income ($/year)	$0	+$19,400	+$66,100
Jobs	0	+1.2	+3.2

Spending of salaries by Upper Souris NWR staff account for $600,700 in local output annually, which generates a total impact of $125,100 in personal income and 5.9 jobs annually in Ward and Renville counties.

According to refuge personnel, under the proposed action (alternative B), the annual salary budget is anticipated to remain similar to alternative A for Des Lacs NWR, increase by $295,181 for J. Clark Salyer NWR, and increase by $292,000 for Upper Souris NWR. The resulting economic impacts associated with local staff salary spending for each refuge for alternative B are presented in table 10.

The changes in salary spending impacts between alternative A and alternative B are shown in table 11. Spending of salaries by Des Lacs NWR staff under alternative B are expected to be the same as alternative A. Spending of salaries by J. Clark Salyer NWR staff under alternative B are expected to account for $889,000 in total output annually, which would generate a total impact of $89,800 in personal income and 5.5 jobs annually in Bottineau and McHenry counties. This represents an increase of $193,900 in total output, $19,400 in personal income, and 1.2 jobs as compared to alternative A. Spending of salaries by Upper Souris NWR staff under alternative B are expected to account for $917,600 in total output annually, which would generate a total impact of $191,200 in personal income and 9.1 jobs annually in Ward and Renville counties. This represents an increase of $316,900 in local output, $66,100 in personal income, and 3.2 jobs as compared to alternative A.


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Visitors of all ages enjoy the refuges.

Visitor Spending

Spending associated with recreational visits to national wildlife refuges generates considerable economic activity. A visitor usually buys a wide range of goods and services while visiting an area. Major expenditure categories include lodging, restaurants, supplies, groceries, and recreational equipment rental. The recent Service report, "Banking on Nature: The Economic Benefits of National Wildlife Refuges Visitation to Local Communities," estimated the impact of national wildlife refuges on their local economies (Caudill and Henderson 2003). According to the report, more than 35.5 million visits were made to national wildlife refuges in fiscal year 2002, which generated $809 million of sales in regional economies. Spending by national wildlife visitors generated nearly 19,000 jobs and more than $315 million in employment income (Caudill and Henderson 2003).

In fiscal year 2002, hunting- and fishing-related visitors typically spent longer amounts of time at national wildlife refuges than nonconsumptive users, but nonconsumptive users generated approximately 30% more economic activity because the numbers of nonconsumptive use of wildlife at many refuges far exceeded the number of hunters and anglers (Caudill and Henderson 2003). Table 12 summarizes estimated current refuge visitation (alternative A) by type of visitor activity.

Table 12. Estimated annual refuge visitation for alternative A for the Souris River basin refuges, North Dakota.

Visitor Activity	*Number of Visits*	*Percentage (%) of Nonlocal Visits*[1]	*Number of Nonlocal Visits*	*Number of Hours Spent at the Refuge*[1]	*Number of Nonlocal Visitor Days*[2]
Des Lacs NWR					
Nonconsumptive use	9,400	75	7,050	2.7	2,379
Fishing	0	0	0	0	0
Big game hunting	800	25	200	8.0	200
Waterfowl and migratory bird hunting	300	80	240	8.0	240
Upland game hunting	175	25[2]	44	8.0	44
Total	10,675	—	7,534	—	2,863
J. Clark Salyer NWR					
Nonconsumptive use	10,030	75	7,523	4.8	4,514
Fishing	400	0	0	0	0
Big game hunting	2,000	65	1,300	8.0	1,300
Waterfowl and migratory bird hunting	1,800	97	1,746	8.0	1,746
Upland game hunting	600	50	300	8.0	300
Total	14,830	—	10,873	—	7,860
Upper Souris NWR					
Nonconsumptive use	12,462	16	1,994	3.3	822
Fishing	53,000	15	7,950	8.0	7,950
Big game hunting	2,200	21	462	8.0	462
Waterfowl and migratory bird hunting	0	0	0	0	0
Upland game hunting	50	34	17	8.0	17
Total	67,712	—	11,489	—	9,256

[1] *Estimates were based on visitor survey results conducted by Sexton et al. (2005).*
[2] *One visitor day = 8 hours.*

Results from USGS visitor surveys provided the average spending estimates for most visitor activities. The visitor survey asked respondents to report the amount spent in the categories of lodging, food and drink, transportation, and other expenses during their most recent visit to the refuge. Total nonlocal visitor spending per day by visitor activity for each refuge is reported in table 13. The average spending for upland game hunters was $129 per person per day, as reported in the "2001 National Survey of Fishing, Hunting, and Wildlife-associated Recreation" (U.S. Department of the Interior and U.S. Department of Commerce 2002).

Current Visitation Levels (Alternative A)

For each refuge, the resulting economic impacts associated with current visitation (alternative A) are shown in table 14. Nonlocal Des Lacs NWR visitor spending accounts for $156,000 in local output annually (2005$). This generates a total impact of $50,000 in personal income and 2.6 jobs annually in the Kenmare and Bowbells area (table 14). Nonlocal J. Clark Salyer NWR visitor spending accounts for $561,600 in local output annually, which generates a total impact of $144,900 in personal income and 9.9 jobs annually in Bottineau and McHenry counties. Nonlocal Upper Souris NWR visitor spending accounts for approximately $1.16 million in local output annually, which generates a total impact of more than $317,500 in personal income and 16.7 jobs annually in Ward and Renville counties.

Visitation Levels Associated with the Proposed Action (Alternative B)

According to refuge personnel, under the proposed action (alternative B), the total number of refuge visits is anticipated to decrease at Des Lacs NWR, and increase at J. Clark Salyer NWR and at Upper Souris NWR. Table 15 shows the estimated annual number of visits by activity for each refuge and the conversion of nonlocal visits to visitor days. At Des Lacs NWR, visits related to hunting activities are anticipated to remain similar to alternative A while nonconsumptive activities are expected to decline by 900 visits annually because of an increased focus on habitat rather than visitor services under alternative B. At J. Clark Salyer NWR, all visitor activities are anticipated to increase as compared to alternative A, from 14,830 to 22,930 total annual visits (tables 12 and 15). At Upper Souris NWR, visits related to big game hunting are anticipated to remain similar to alternative A while all other visitor activities are expected to increase, from 67,712 to 88,200 total annual visits (tables 12 and 15).

Table 13. Average nonlocal visitor spending per person per day for the Souris River basin refuges, North Dakota.

Visitor Activity	*Des Lacs NWR*	*J. Clark Salyer NWR*	*Upper Souris NWR*
Nonconsumptive use	$35.89	$31.23	$94.42
Fishing	*(not an activity)*	*(no nonlocal visitors)*	$81.00
Big game hunting	$24.15	$24.15	$88.95
Waterfowl and migratory bird hunting	$111.94	$111.94	*(not an activity)*
Upland game hunting	$129.00	$129.00	$129.00

Table 14. Annual local economic impacts of nonlocal visitor spending for alternative A for the Souris River basin refuges, North Dakota (2005$).

Local Economic Impact Area	*Des Lacs NWR (Kenmare and Bowbells Area)*	*J. Clark Salyer NWR (Bottineau and McHenry Counties)*	*Upper Souris NWR (Ward and Renville Counties)*
Local Output ($/year)	$156,000	$561,600	$1,160,000
Income ($/year)	$50,000	$144,900	$317,500
Jobs	2.6	9.9	16.7

Table 15. Estimated annual refuge visitation for alternative B for the Souris River basin refuges, North Dakota.

Visitor Activity	*Number of Visits*	*Percentage (%) of Nonlocal Visits*[1]	*Number of Nonlocal Visits*	*Number of Hours Spent at the Refuge*[1]	*Number of Nonlocal Visitor Days*[2]
Des Lacs NWR					
Nonconsumptive use	8,500	75	6,375	2.7	2,152
Fishing	0	0	0	0	0
Big game hunting	800	25	200	8.0	200
Waterfowl and migratory bird hunting	300	80	240	8.0	240
Upland game hunting	175	25	44	8.0	44
Total	9,775	—	6,859	—	2,635
J. Clark Salyer NWR					
Nonconsumptive use	16,130	75	12,098	4.8	7,259
Fishing	1,400	0	0	0	0
Big game hunting	2,500	65	1,625	8.0	1,625
Waterfowl and migratory bird hunting	2,050	97	1,989	8.0	1,989
Upland game hunting	850	50	425	8.0	425
Total	22,930	—	16,136	—	11,297
Upper Souris NWR					
Nonconsumptive use	21,850	16	3,496	3.3	1,442
Fishing	64,000	15	9,600	8.0	9,600
Big game hunting	2,200	21	462	8.0	462
Waterfowl and migratory bird hunting	0	0	0	0	0
Upland game hunting	150	34	51	8.0	51
Total	88,200	—	13,609	—	11,555

[1] *Estimates were provided by refuge personnel.*
[2] *Estimates were based on visitor survey results conducted by Sexton et al. (2005).*
[3] *One visitor day = 8 hours.*

The economic impacts associated with refuge visitation for alternative B are presented in table 16. The change in impacts between alternative A and alternative B are shown in table 17. Nonlocal Des Lacs NWR visitor spending under alternative B is anticipated to account for $145,700 in local output annually (2005$). This would generate a total impact of $46,600 in personal income and 2.4 jobs annually in the Kenmare and Bowbells area (table 16). This represents a decrease of $10,300 in local output, $3,400 in personal income, and less than half of a job as compared to alternative A (table 17).

Table 16. Annual local economic impacts of nonlocal visitor spending for alternative B for the Souris River basin refuges, North Dakota (2005$).

Local Economic Impact Area	*Des Lacs NWR (Kenmare and Bowbells Area)*	*J. Clark Salyer NWR (Bottineau and McHenry Counties)*	*Upper Souris NWR (Ward and Renville Counties)*
Local Output ($/year)	$145,700	$749,900	$1,458,100
Income ($/year)	$46,600	$197,200	$399,100
Jobs	2.4	13.2	21.0

Table 17. Change in visitor-spending impacts between alternatives A and B for the Souris River basin refuges, North Dakota (2005$).

Local Economic Impact Area	*Des Lacs NWR (Kenmare and Bowbells Area)*	*J. Clark Salyer NWR (Bottineau and McHenry Counties)*	*Upper Souris NWR (Ward and Renville Counties)*
Local Output ($/year)	-$10,300	+$188,300	+$298,100
Income ($/year)	-$3,400	+$52,300	+$81,600
Jobs	-0.2	+3.3	+4.3

Nonlocal J. Clark Salyer NWR visitor spending under alternative B is expected to account for $749,900 in local output annually, which would generate a total impact of $197,200 in personal income and 13.2 jobs annually in Bottineau and McHenry counties. This represents an increase of $188,300 in local output, $52,300 in personal income, and 3.3 jobs as compared to alternative A (table 17). Nonlocal Upper Souris NWR visitor spending under alternative B is expected to account for $1.46 million in local output annually, which would generate a total impact of $399,100 in personal income and 21 jobs annually in Ward and Renville counties. This represents an increase of more than $298,100 in local output, $81,600 in personal income, and 4.3 jobs as compared to alternative A (table 17).

Summary and Conclusions

Table 18 summarizes the total economic impacts for all refuge management activities at Des Lacs NWR for alternative A and for alternative B and the change in impacts between alternatives. All refuge activities would account for $607,700 in total output, $142,200 in personal income, and 6.4 jobs in the Kenmare and Bowbells area (table 18). Current refuge management activities account for 0.44% of local employment and 1.44% of local income. Alternative B would slightly decrease total employment by 0.2 of a job and total personal income by $3,400 because of anticipated decreases in refuge visitation.

Table 19 summarizes the total economic impacts for all refuge management activities at J. Clark Salyer NWR for alternative A and for alternative B and the change in impacts between alternatives. All refuge activities would account for $1.51 million in total output, $256,100 in personal income, and 16.3 jobs in Bottineau and McHenry counties (table 19). Current refuge management activities account for 0.29% of local employment and 0.08% of local income. Alternative B would increase total employment by 5.2 jobs and total personal income by $86,300 because of anticipated increases in refuge staffing, local nonsalary spending, and visitation.

Table 20 summarizes the total economic impacts for all refuge management activities at Upper Souris NWR for alternative A and for alternative B and the change in impacts between alternatives. All refuge activities would account for $1.99 million in total output, $522,800 in personal income, and 25.6 jobs in Ward and Renville counties (table 20). Current refuge management activities account for 0.03% of local employment and 0.07% of local income. Alternative B would increase total employment by 8.7 jobs and total personal income by $179,700 because of anticipated increases in refuge staffing, local nonsalary spending, and visitation.

Table 18. Summary of the economic impacts of all refuge management activities for alternatives A and B for Des Lacs NWR (Kenmare and Bowbells area), North Dakota.

	Alternative A	*Alternative B*	*Difference*
Local Output ($/year)	$607,700	$597,400	-$10,300
Income ($/year)	$142,200	$138,800	-$3,400
Jobs	6.4	6.2	-0.2
Percentage of total local income	1.14%	1.13%	-0.02%
Percentage of total local employment	0.44%	0.42%	-0.01%

Table 19. Summary of the economic impacts of all refuge management activities for alternatives A and B for J. Clark Salyer NWR (Bottineau and McHenry counties), North Dakota.

	Alternative A	*Alternative B*	*Difference*
Local Output ($/year)	$1,510,500	$1,980,000	+$469,500
Income ($/year)	$256,100	$342,400	+$86,300
Jobs	16.3	21.5	+5.2
Percentage of total local income	0.08%	0.10%	0.02%
Percentage of total local employment	0.29%	0.35%	0.07%

Table 20. Summary of the economic impacts of all refuge management activities for alternatives A and B for Upper Souris NWR (Ward and Renville counties), North Dakota.

	Alternative A	*Alternative B*	*Difference*
Local Output ($/year)	$1,988,900	$2,695,000	$706,000
Income ($/year)	$522,800	$702,500	$179,700
Jobs	25.6	34.3	8.7
Percentage of total local income	0.03%	0.04%	0.01%
Percentage of total local employment	0.07%	0.08%	0.01%

5 Implementation of the Proposed Action


Dave Menke/USFWS

Northern Pintail

Once a management alternative has been selected and finalized, the CCP has been approved, and the Service has notified the public of its decision, the implementation phase of the CCP process begins.

During the next 15 years, the objectives and strategies presented below would be realized. The final CCP will serve as the primary management document for the Souris River basin refuges until it is formally revised. The Service will carry out the final CCP with assistance from existing and new partner agencies and organizations, and the public.

Although a number of needs were identified during the planning process, there are no assurances that projects identified in this draft CCP will be fully or even partially funded. However, within every planning effort, there are opportunities to examine current funding and resources and to determine the best available uses based on a comprehensive evaluation of critical needs. If this were never completed, issues could go unresolved due to a lack of public and administrative understanding and support.

Determination of the Proposed Action (draft CCPs)

The planning team for the Souris River basin refuges developed four unique management alternatives based on the issues, concerns, and opportunities expressed during the scoping process (see chapter 1). The issues discussed throughout this EA and draft CCP were derived from the collective input of local citizens and communities, cooperating agencies, conservation organizations, and refuge staff.

In identifying the alternative for proposed action, the team determined probable effects of each alternative on five program areas: (1) habitats and wildlife populations; (2) cultural resources; (3) visitor services; (4) research and science; and (5) refuge operations. Effects on habitats and wildlife populations received stronger consideration than effects projected for other program areas. Below is a brief discussion of the determination of the proposed action alternative, as well as the other three alternatives, in ranked order of desirability.

1. Alternative B—Proposed Action, Draft CCP

Alternative B is ranked first of four alternatives as the proposed action (draft CCP) for best addressing the vision and goals for the Souris River basin refuges. The proposed action is fully developed under "Draft CCP" for each refuge, later in this chapter.

This alternative would emphasize restoration of ecological processes important in the evolution and maintenance of native plant communities and wildlife populations in the northern Great Plains. This ecological triage theme would require assessment of biological, economic, and political feasibilities associated with habitat restoration.

Specific criteria and objectives identify areas for restoration, with high-priority areas more likely restored than those more degraded. In recognition of inadequate resources to manage all wildlife habitats and populations occurring at the Souris River basin refuges, triage would require careful and deliberate consideration of management priorities (especially allocation of funding and staffing) relative to expected ecological resource benefits. The ecological triage theme would allow adjustments to management effort equal to changes in staff and funding.

Cultural resources would be protected when found. Some visitor services would likely decrease as some staff and funding shift to habitat restoration, while others would remain at current levels. Research and science would support habitat restoration.

2. Alternative D

Alternative D ranked second of four alternatives as the proposed action. This alternative ranked below the proposed action, alternative B, because (1) many habitats would likely decline; and (2) required funding would not likely be available.

This alternative would emphasize restoration of ecological processes important in the evolution and maintenance of native plant communities and wildlife populations in the northern Great Plains. Unlike alternative B, this alternative would require that all habitats be restored, regardless of biological, economic, or political feasibilities for restoration. Given current or modest increases in funding, many or all habitats would likely decline because limited resources would be too diluted to recover or restore any habitats.

Cultural resource, interpretation, environmental education, and research and science programs would be expanded in support of ecological restoration.

This alternative would require significant increases in staff and operational funding. Based on past and current budgets, such increases are unlikely.

3. Alternative C

Alternative C ranked third of four alternatives for desirability as the proposed action. This alternative ranked below the proposed action, alternative B, because (1) native plant communities and associated native wildlife other than waterfowl would be negatively affected; and (2) the variety of visitor services would be reduced.

From 1965 to 1995, management at the Souris River basin refuges emphasized waterfowl production over other programs, giving the team a good basis for evaluating potential effects associated with alternative B.

Past history suggests that management to maximize habitat use and nest survival for a narrow group of species, such as waterfowl, would have unforeseen negative consequences for plant and wildlife community ecology, health, and integrity.

Past waterfowl management emphasized tall and dense vegetation structure, with little regard to long-term changes in native plant communities. This resulted in unintended expansions of introduced cool-season grasses (for example, smooth brome, Kentucky bluegrass, and reed canarygrass) and tall woody plants (for example, aspen and willow). Ironically, despite short-term (20 years) increases in waterfowl production, long-term (50 years) waterfowl production would be expected to decline as biological integrity of native plant communities declined.

Cultural resources would be protected when found. Visitor services not oriented toward waterfowl-related activities would be reduced. Research and science would be specific to waterfowl population and habitat management.

4. Alternative A—Current Management

Alternative A ranked last of four alternatives because management issues would not be adequately addressed.

The CCP process offers an opportunity for the Souris River basin refuges to assess effects of past and current management. This timely and introspective analysis encouraged development, consideration, and selection of alternatives to current management that better address old and emerging management issues.

MANAGEMENT DIRECTION

The planning team developed objectives in support of goals identified in chapter 2 to carry out the proposed action (alternative B) for management of the Souris River basin refuges, North Dakota. Strategies to achieve objectives are suggested. Rationale is included that supports goals, objectives, and strategies. Assumptions are discussed.

Biological goals and objectives emphasize management of plant communities as habitat for wildlife, especially migratory birds, and are organized by major habitat types represented at the three refuges. Goals and objectives are habitat-based rather than wildlife-based, because wildlife often respond to factors beyond control of local refuge management (for example, disease outbreaks or habitat conditions on important staging or wintering sites can affect populations of migratory birds). Furthermore, management practices (for example, fire, grazing, haying, and water level manipulation) are usually to plant communities rather than to wildlife populations. Habitat-based objectives emphasize monitoring of important vegetation attributes such as community composition and vegetation structure over time. In most cases, wildlife population responses to habitat changes are not monitored. Rather, site-specific inventories, applied research, and literature reviews allow for reasonable predictions of wildlife response to habitat management.

Management practices such as grazing, haying, and farming are compatible with the mission of the Service as applied on the Souris River basin refuges (approved compatibility determinations are found in appendixes L–N). In addition, appendix O describes the fire management program for the refuges.

Additional goals, objectives, and strategies are developed for visitor services, cultural resources, research and science, and refuge operations.

Management direction to achieve the vision for the Souris River basin refuges is presented separately for each refuge:

- Des Lacs NWR (pages 129–146)
- J. Clark Salyer NWR (pages 146–168)
- Upper Souris NWR (pages 168–189)

Tim Bowman/USFWS

Horned Lark

DRAFT CCP—*DES LACS NWR*

The following goals, objectives, and strategies for Des Lacs NWR outline the actions needed to achieve the vision of the Souris River basin refuges.

Drift Prairie Goal

Restore and maintain extensive examples of plant communities dominated by native flora characteristic of the mid-1800s drift prairie. Create the temporally and spatially dynamic habitat conditions that will attract most breeding bird species and other vertebrate fauna characteristic of that era.

Objective 1

By 1 year after CCP approval, use current vegetation inventory data and landscape considerations to characterize each habitat management unit with ≥40 acres of drift prairie as either high or low management priority. Reevaluate prioritization 15 years after CCP approval.

Strategy

— Apply multiple selection criteria.

CRITERIA FOR HIGH-PRIORITY UNITS

Floristic Composition. Vegetation is characterized by ≥20% mean frequency (percentage occurrence) of pristine, native herbaceous types (plant groups 41–43 and 46–48 [Grant et al. 2004b]; see appendix E) plus native herbaceous-dominated vegetation with Kentucky bluegrass as the main subdominant (plant group 53).

Floristic Potential. Vegetation is characterized by <20% mean frequency of smooth brome-dominated types (plant groups 61 and 62).

Landscape Context. The unit is contiguous with the best examples of prairie slope habitat (largest slopes with the most intact native plant composition or greatest availability to the public, or both)

or

is adjacent to other high-priority, drift prairie units and/or tracts of native prairie adjacent to the refuge under non-Service ownership (especially important if the unit has relatively little drift prairie area, that is, <40 acres).

CRITERIA FOR LOW-PRIORITY UNITS

Floristic Composition. Vegetation is characterized by <20% mean frequency of pristine, native herbaceous types (plant groups 41–43 and 46–48 [Grant et al. 2004b]) plus native herbaceous-dominated vegetation with Kentucky bluegrass as the main subdominant (plant group 53).

Floristic Potential. Vegetation is characterized by ≥20% mean frequency of smooth brome-dominated types (plant groups 61 and 62).

Landscape Context. The unit is neither contiguous with significant prairie slope habitat, nor adjacent to high-priority drift prairie units and/or tracts of native prairie adjacent to the refuge.

Rationale and Assumptions

Most northern mixed-grass prairie has been destroyed. Losses have been particularly severe in the Drift Plain physiographic region, such that drift prairie could be considered an endangered resource. Key roles of the Refuge System include contribution to ecosystem integrity and conservation of biological diversity. The Souris River basin refuges should contribute to the conservation of native prairie communities unique to the Drift Plain region. However, the native mixed-grass drift prairie at the refuges is badly deteriorated, mainly through extensive invasion by introduced cool-season grasses.

Recent inventory data indicate that occurrences of relatively intact, native herbaceous flora are rare (<5% frequency) on most drift prairie management units of Des Lacs NWR. Native warm-season grasses are nearly absent. Under appropriate management, warm-season grasses can outcompete introduced cool-season grasses if the former are sufficiently abundant (>20% frequency).

Most drift prairie at Des Lacs NWR likely has already passed a threshold, such that restoration of a modestly diverse, native herbaceous flora is an unrealistic and impractical goal. However, restoration may be possible on some tracts where native grasses, sedges, and forbs are more common and widespread. Such tracts need to be identified by objective criteria that focus on (1) diversity and prevalence of existing native plants, and (2) landscape area and connectivity, which underlie the quality of nesting habitat for grassland birds, a species group of significant conservation concern (see appendix G) in North America.

This approach would shift investment to manage more intensively (than under current management) select units. This would improve the chances of restoring at least some drift prairie.

Objective 2

On high-priority drift prairie units, use frequent and precisely timed disturbances (principally fire and grazing) to restore vegetation to the following standards within 15 years of CCP approval. This would provide habitat for most wildlife species that were characteristic of North Dakota's eastern mixed-grass prairie but that currently are rare or absent at the refuge (burrowing owl, horned lark, Baird's sparrow, Sprague's pipit, chestnut-collared longspur, northern pintail, and Richardson's ground squirrel).

- Composition on each unit includes (1) >40% pristine native and native-dominated/bluegrass-subdominant vegetation (plant groups 41–43, 46–48, and 53); (2) <20% smooth brome-dominated vegetation (plant groups 61 and 62); and (3) <20% low shrub-dominated vegetation (plant groups 11–17) (based on percentage frequency of occurrence on belt transects, per Grant et al. 2004b).
- Native trees and tall shrubs are absent or nearly so, comprising <0.1% land cover on each unit, and no nonnative or planted native woody vegetation exists.
- Leafy spurge frequency is decreased by >50% on each unit, to <1% frequency (frequencies per belt transects; most high-priority units currently have little to no spurge); absinth wormwood is actively controlled; and yellow toadflax and other newly appearing species of noxious weed that pose a threat to the drift prairie are eliminated within 5 years of initial detection.

Strategies

— Disturb the vegetation, typically by livestock grazing or fire, at least 2 of every 3 years. An ideal management sequence over 5 years might be BGGGR (B=prescribe burn the first year; G=graze in each of years 2, 3, and 4; then R=rest), then reinitiate the sequence. The area covered by trees, tall shrubs, and low shrubs would be incrementally reduced with this burning frequency.

— Primarily use prescribed fire when smooth brome plants are at least in the 4- to 5-leaf stage, but not yet showing an inflorescence; this generally occurs during a narrow mid-May through early June window. A less preferred option is to burn in fall in anticipation of a negative, winter drought effect on smooth brome and Kentucky bluegrass.

— Graze mainly during late May through August or September, via a rotation approach with many (7–10) relatively small grazing cells (for example, 40–60 acres) per unit and short grazing periods (4–7 days) per cell. Adjust stocking rates to facilitate regrazing of individual smooth brome plants at least once within a grazing period, but move livestock to the next cell before native plants are regrazed (be sure to note grazing of native upland sedges, an important forage base in some management units).

— Annually survey for noxious weeds. Continue widespread use of biological control by monitoring local areas for *Apthona* spp. beetles and by redistributing beetles among leafy spurge patches as needed. Use herbicides as needed along boundaries with private lands.

— Reseed adjoining old cropland units into native vegetation dominated by warm-season grasses (see objectives for old cropland). Manage these intensively, in concert with the high-priority drift prairie units they adjoin, to sustain a native-dominated flora and to reduce sources of invasion by introduced cool-season grasses and noxious weeds (see objectives and strategies for old cropland).

— Experiment on low-priority tracts with new or high-risk restoration methods for use on high-priority tracts.

— Experiment with specialized control of dense silverberry patches. Cutting tends to stimulate resprouting in silverberry, as does burning. Therefore, foliar applications of glyphosate, which have been used to control other species of the genus *Elaeagnus*, may achieve the best possible control. Application must be done in ways that does not harm understory native herbaceous vegetation (for example, use a wick applicator). One approach may be to chemically treat silverberry and achieve a kill, and then apply prescribed fire.

— Experiment with horses as alternative grazing tools; horses may have greater impact than cattle on woody vegetation, especially silverberry. Since horses may founder (succumb to hoof inflammation) on rich, green vegetation, an appropriate approach in a 3-year grazing cycle may be to use cattle during the first 2 years, then horses the third year.

— Experiment with control of introduced cool-season grasses and release of native plants on a small, localized scale with selective herbicide treatment.

— Experiment with seeding of native warm-season grass mixes in brome monotypes on unit edges. Apply prescribed fire followed by multiple herbicide treatments over 2 years for site preparation. Use similar approaches on brome-dominated edges of adjoining, low-priority units.

NOTE: Service policy regarding refuge management implicitly promotes seeding to reestablish native plants in native sod where such plants have become rare or absent (National Wildlife Refuge System Biological Integrity, Diversity, and Environmental Health, 601 FW 3, 2001).

— Experiment with "interseeding" of native plants, principally warm-season species, into brome monotypes within units. Apply prescribed fire or repeated intensive grazing, and then use a wick applicator to apply herbicide to emerging smooth brome and Kentucky bluegrass. Follow by seeding via drill.

— Experiment with localized hand plantings and husbandry (such as weed control and herbivore exclusion) of select native forbs such as milkvetches (*Astragalus* spp.) to increase plant species diversity and structural diversity.

— Transplant and release Richardson's ground squirrels on areas of low-stature vegetation within high-priority units, wherever an adjacent source for colonization appears unavailable.

— Remove local, human disturbances and artifacts of twentieth-century origin (including the refuge era). This includes prominent plow furrows, old road grades, rock piles, and impoundment dams on intermittent drainages (except on those essential as livestock water sources). Restore such sites as close as possible to their original condition.

Rationale and Assumptions

This objective focuses on restoration of floristic composition. Smooth brome and Kentucky bluegrass are widespread and common on the Drift Plain at Des Lacs NWR. Kentucky bluegrass tends to increase under prolonged rest or with grazing, but decreases with fire especially when burning occurs during stem elongation or in dry years. Smooth brome also increases under rest but, in contrast to Kentucky bluegrass, appears sensitive to repeated grazing but unaffected or variably affected by prescribed fire. A strategy to improve competitive abilities of native herbaceous plants should match the types, timing, and frequencies of disturbances under which these plants evolved. Meanwhile, a strategy to decrease competitive abilities of bluegrass and brome on the relatively rich loam soils of the Drift Plain should focus on combined use of fire and grazing.

Smooth brome-dominated types are twice as prevalent as Kentucky bluegrass-dominated types on the drift prairie of Des Lacs NWR, indicating that smooth brome may be more competitive than Kentucky bluegrass in the relatively rich loam soils. Of the two introduced species, smooth brome generally seems more difficult to control and more significantly alters the quality and structure of northern prairie habitats. Therefore, restoration management should focus more on strategies to reduce brome.

The contemporary breeding bird community on the drift prairie of Des Lacs NWR is characterized by three to four species that tolerate introduced cool-season grasses and relatively dense, rank, oftentimes brushy cover. Grassland bird species that are uncommon to absent generally require shorter, sparser, more herbaceous prairie vegetation than that available on the refuge's drift prairie. These species also are of much greater conservation concern due mainly to declining population trends (for example, Sprague's pipit and chestnut-collared longspur). Thus, habitat for a broader array of northern prairie birds—including several endemic species and other species characteristic of the historical mixed-grass prairie community—can be significantly increased by providing frequent disturbance and the resulting increases in early successional stages.

In the historical setting, Richardson's ground squirrels were characteristically widespread and contributed to the maintenance of early seral stages, and their burrows provided unique microhabitats. The ground squirrel should be a component of the restored prairie community.

Historically, the drift prairie was treeless. Trees and tall shrubs can diminish the survival of nests of grassland birds by harboring potential nest predators. They also provide perches from which brown-headed cowbirds can find other species' nests in which to lay eggs. Furthermore, recent data from the Souris River basin refuges indicate that relatively small areas of tall woody vegetation can effectively fragment grassland habitats and cause many grassland bird species to avoid entire landscapes. Elimination of tall woody cover is a logical strategy for restoration of landscape structure and plant community makeup, and to improve the attractiveness and security of the habitat for a variety of grassland breeding bird species.

Objective 3

On low-priority drift prairie units, apply disturbance (principally fire) every 5–8 years to remove plant litter, restore plant vigor, reverse woody plant expansion, and provide a mix of structural types that include (1) relatively short/sparse vegetation for species such as killdeer, horned lark, and Brewer's blackbird; (2) moderately short vegetation for species such as blue-winged teal and upland sandpiper; and (3) tall/dense vegetation for species such as mallard, short-eared owl, Le Conte's sparrow, and bobolink. Vegetation should present the below characteristics within 15 years of CCP approval.

There is almost no monitoring of vegetation on these units except for routine, cursory surveillance for noxious weeds. Knowledge of relationships between fire frequency and resulting, postfire vegetation structure is adequate to predict habitat conditions described below.

- One-fourth of the area in 0- to 1-year postdisturbance, one-fourth in 2–3 years postdisturbance, and one-half in 4–6+ years postdisturbance—corresponding roughly to a structure of <2 inches VOR, 2–3.9 inches VOR, and >3.9 inches VOR (mean VORs in early spring, per Robel et al. 1970).
- Native trees and tall shrubs compose <0.2% land cover on each unit above the prairie slope, and all nonnative woody vegetation and planted, native woody vegetation is eliminated from at least half of the units.
- Leafy spurge is maintained at <2% frequency, absinth wormwood is actively controlled, and yellow toadflax and other newly appearing species of noxious weed that pose a threat to the drift prairie are eliminated within 5 years of initial detection.

Killdeer

Strategies

- — Apply prescribed fire on each unit at least every 5–8 years, increasing burn frequency during dry years when possible to more effectively reduce tall shrubs and trees. Rotate burns among units. Burn opportunistically, at any time, mainly to remove litter and control tall shrubs and trees.
- — To increase structural diversity, occasionally introduce livestock grazing—with wide latitude on timing, intensity, and duration—if and when doing so will not detract from management of high-priority units. Experiment with seeding and "interseeding" of native warm-season grass mixes in smooth brome monotypes, mainly to help develop effective restoration approaches for high-priority units.
- — Periodically survey for noxious weeds. Continue widespread use of biological control by monitoring local areas for *Apthona* spp. beetles and redistributing beetles among leafy spurge patches as needed. Use herbicides as needed along boundaries with private lands.

Rationale and Assumptions

This objective focuses on providing vegetation structural diversity. Most drift prairie at Des Lacs NWR has almost no intact native herbaceous vegetation. From a practical standpoint, most of the drift prairie probably cannot be restored to a state where native herbaceous vegetation is a widely noticeable or otherwise common vegetation component. However, with modest effort, the prevalent, introduced cool-season grasses and scattered low shrub can be managed to provide a mix of postdisturbance structural types attractive to a broad array of native grassland bird species.

The most appropriate management of these units is to provide structural variety, and use the units as a basis for creating extensive areas of grassland (including off-refuge lands) to satisfy needs of several area-sensitive, native grassland bird species. This would also reduce predation and nest (brood) parasitism incidence associated with edge-dominated, highly fragmented grassland. The rationale for reducing tall shrubs and trees is similar to that for high-priority drift prairie (objective 2 above).

Objective 4

Improve or help maintain the habitat quality and the economic sustainability of nonfederally owned, native prairie remnants adjacent to drift prairie units within 15 years of CCP approval. Extend protection and stewardship to most other grassland that adjoins drift prairie units. Seek opportunities to expand the total grassland area and create broad, contiguous blocks of open grassland, principally as habitat for breeding grassland birds.

Strategy

— Use grassland easements and extension agreements, for example, for specialized livestock grazing systems on native prairie, or native grass establishment and management, or to remove "hostile" cover such as trees and tall shrubs that could harbor nest (brood) parasites and nest predators. Certain grazing systems can improve livestock carrying capacity and the condition of annually grazed prairie, to enhance the economic viability of native prairie and reduce chances of conversion to other land uses, especially cultivation.

Rationale and Assumptions

The quality of prairie as breeding habitat for grassland birds (in terms of average annual nest success and relative contribution to population recruitment) is directly related to its extent or, conversely, indirectly related to the degree of its fragmentation.

Native prairie on the Drift Plain could be considered an endangered resource and little of it remains in the Des Lacs River valley. Conserving remnant tracts adjacent to the refuge, by whatever means possible, should be among the highest priorities for landscape conservation.

Prairie Slope Goal

Restore representative examples of prairie slopes to preserve some of the most pristine plant communities that remain in the Souris River basin and promote appreciation and stewardship of prairie resources.

Objective 1

By 1 year after CCP approval, use vegetation inventory data and topographic considerations to characterize management units with significant prairie slope resources as high-priority units. Reevaluate prioritization 15 years after CCP approval.

Strategy

— Apply multiple selection criteria.

CRITERIA FOR HIGH-PRIORITY UNITS

Floristic Composition. Vegetation is characterized by >60% mean frequency of pristine, native herbaceous types (plant groups 41–43 and 46–48 [Grant et al. 2004b]) plus native low shrub with a native plant understory (plant groups 11, 12, and 15)

Physical Characteristics. Unit aspect is principally south- to west-facing; slope is 25–60%; and elevation gain is >100 feet from slope bottom to top.

Rationale and Assumptions

Native flora is relatively intact along much of the east side of the Des Lacs River valley, in particular, areas with the longest southwest-facing slopes on Des Lacs NWR. Conservation and appreciation of native plant communities needs special consideration.

Some of these high-priority prairie slopes may adjoin high-priority drift prairie units and can be managed in conjunction with the drift prairie. However, some of the best-quality slopes may adjoin low-priority drift prairie. These latter slopes need to be identified and managed more intensively than the drift prairie they adjoin, to retain or improve their native plant diversity. Much of this high-quality prairie occurs along a major roadway (Old Lake Road, recently designated as a scenic byway), and has much exposure to the public along with access.

Objective 2

On high-priority prairie slope units, apply disturbance (principally fire and grazing) every 5–6 years to restore vegetation to the following standards within 15 years after CCP approval.

- Composition on the slope in each unit includes (1) >65% pristine, native herbaceous types (plant groups 41–43 and 46–48); (2) <10% smooth brome-dominated types (plant groups 61 and 62); and (3) <20% low shrub-dominated types (plant groups 11–17) (based on percentage frequency of occurrence on belt transects located from top to bottom of slope).
- Native trees and tall shrubs are few, comprising <1% of all cover on the prairie slope of each unit, and no nonnative or planted native woody vegetation exists.
- Leafy spurge frequency is decreased by >50% on slope of each unit, to <1% frequency; absinth wormwood is actively controlled; and yellow toadflax and other newly appearing species of noxious weeds that pose a threat to the prairie slope are eliminated within 5 years of initial detection.

Strategies

— Use fire and generally follow historical fire patterns with which native plants evolved. Burn about every 5–6 years, alternating the timing of burning among late spring (mid-May through early June), summer (mid-July through early September), and fall (late September through late October) seasons. Late May and early June burns should be particularly effective restoration strategies on slopes, allowing the unusually prevalent warm-season grasses to outcompete smooth brome and Kentucky bluegrass. Avoid early spring burning, which generally would promote introduced cool-season grasses and woody species that resprout vigorously.

— Use livestock grazing, generally following grazing strategies for high-priority drift prairie units, but with lighter (for example, 50–75% lower) initial stocking rates. Use grazing mainly for smooth brome control. Have livestock regraze individual brome plants at least once within a grazing period, but move cattle to the next cell just before native plants are regrazed. Avoid early spring grazing, which may reduce the competitiveness of native cool-season grasses.

Rationale and Assumptions

The contemporary prairie slope plant community is dominated by a balance of native warm- and cool-season grasses and forbs, especially on mid- and upper slopes (for example, sideoats grama and porcupine grass are unusually prevalent). Native plants are highly competitive on the relatively arid, thin soils of these sites and, compared to their counterparts on drift prairie, need less frequent and less intensive management for restoration. However, on drainages and subirrigated sites scattered along the slopes and on the more mesic lower slopes, smooth brome, Kentucky bluegrass, and western snowberry generally are codominant, along with big bluestem. Scattered tall shrubs and trees also are often conspicuous in these sites, and leafy spurge infestations on slopes are primarily distributed here. Thus, restoration management should primarily target these mesic areas of slopes. The management approach is somewhat similar to that on high-priority drift prairie units, but is more flexible and less frequent and intensive—disturb the vegetation, typically by livestock grazing or fire, about every other year, on average. A management sequence over 5 years might be BRGGR or BRGRR.

Prairie slope is not extensive but supports some of the most pristine native flora in the Souris River basin, making this a highly valued resource worthy of careful stewardship. Prairie slopes probably offer the most accessible, best examples of native prairie heritage to the public.

Old Cropland Goal

On high-priority old cropland areas, establish native-dominated, perennial herbaceous cover that, with modest management, resists invasion by introduced cool-season grasses and noxious weeds. This seeded cover will help form extensive, contiguous blocks of structurally diverse, open grassland for grassland-dependent, breeding bird species.

Objective 1

By 10 years after CCP approval, locate and determine boundaries of old cropland areas and record these in the refuge's geographic information system (GIS) database.

Strategies

— Identify old cropland areas, including those considered DNC, that were seeded to introduced grasses and forbs and/or native grasses since the mid-1970s.

— Identify other old cropland areas, as evidenced by

❐ distinct field edges, especially deep furrows and linear piles of wind-borne topsoil that had been deposited along preexisting fence lines and subsequently vegetated;

❐ rock piles or rocks strewn linearly along what appears to be a field edge (although rock sometimes was cleared for native hay harvests);

❐ nearly monotypic stands of smooth brome, typically with some Kentucky bluegrass but with little native sedge in the understory (several native plant species often reinvade these stands, such as western snowberry, Wood's rose, white sage, western yarrow, several goldenrod species, and silver scurfpea);

❐ no partly buried rocks with profuse lichens;

❐ no clubmoss or cryptogamic crust.

— Use acquisition records, old refuge narratives, 1938–1939 aerial photographs, and U.S. Soil Conservation Service records for ancillary support.

— Flag the probable boundaries of areas verified as old cropland, record via GPS, and upload into the refuge's GIS database.

Rationale and Assumptions

Furrows and other linear disturbances caused by implements (for example, plows, disks, and seed drills) are much more evident after an area is treated with prescribed fire or heavily grazed. They are also more readily detected from horseback. Evidence of soil A-horizon disturbance due to cultivation may be determined by NRCS staff. Some areas with signs of farming disturbance (for example, furrows) may have been cropped only for a few years circa 1900–1930 or may have been broken during this period yet never cropped. Such areas often are successfully reinvaded by native plants, and may currently support native vegetation at levels approaching the most pristine areas on similar site types on the refuge that are considered native sod.

Objective 2

Within 15 years after CCP approval, convert DNC on at least eight old cropland units to vegetation dominated by several species of native warm-season grasses that vary in stature and growth form, and that include several species of native forbs wherever possible. Give priority to units with stands of vegetation that have become decadent and overrun by undesirable, introduced cool-season grasses, especially where such units are adjacent to or within high-priority drift prairie units or high-priority prairie slope units.

Strategies

— Following multiple applications of a broad-spectrum herbicide, seed a native plant mixture that mainly consists of 80–90% warm-season grass species especially big bluestem, little bluestem, switchgrass, and sideoats grama.

— During the first 3–4 years after seeding, annually mow the stand with a hay conditioner and harvest the hay. Substitute grazing or prescribed fire treatments in the subsequent 3–4 years. Use herbicide spot spraying or "interseeding" where necessary.

Rationale and Assumptions

Although initially expensive, native warm-season grasses are economically and ecologically superior to seeded stands of introduced plants in old croplands because

— permanent, perennial cover eliminates regular (every 12–14 years) replacement of seeded, introduced species cover via a farming cycle and thus nearly eliminates potential for soil erosion;

— native grasses reduce local habitat fragmentation and eliminate "edge" associated with the farming cycle;

— a warm-season growth strategy for plants vastly improves the capacity for an assemblage of plants to outcompete smooth brome—by which seeded stands of introduced grasses and forbs are most typically degraded—mainly by affording broader and more effectively timed management opportunities;

— there is improved opportunity for prescribed burning in late spring compared to high-priority drift prairie units because the warm-season-dominated cover has relatively high fuel value through early June (versus mostly green vegetation on cool-season-dominated cover on the drift prairie by late May);

— there is a broader window (later in summer) for harvest of hay that still has forage value;

— native grasses are in compliance with policy that discourages planting of introduced species on Service lands and encourages planting of native species (National Wildlife Refuge System Biological Integrity, Diversity, and Environmental Health, 601 FW 3, 2001);

— native grasses reduce "source sites" from which introduced and weedy plants invade adjoining native prairie; native grasses have improved and longer-lasting structural diversity within stands.

Objective 3

By 10 years after CCP approval, identify other old cropland areas (those not known to have been seeded since the mid-1970s) that are high management priority (areas most important to convert to native warm-season grasses). Develop a detailed plan to convert these during the subsequent 10–15 years to vegetation dominated by several species of native warm-season grasses that vary in stature and growth form, and that include several species of native forbs wherever possible.

NOTE: There are no goals and objectives for remaining old cropland areas in uplands. They are low priority and would be managed with adjoining habitats.

Strategy

— Apply multiple selection criteria.

CRITERIA FOR HIGH MANAGEMENT PRIORITY OLD CROPLAND IN UPLANDS (excluding DNC and other old cropland known to have been seeded since the mid-1970s)

Floristic Composition. Vegetation is characterized by <20% mean frequency of pristine, native herbaceous types (plant groups 41–43 and 46–48 [Grant et al. 2004b]) plus native herbaceous-dominated vegetation with Kentucky bluegrass as the main subdominant (plant group 53).

Floristic Potential. Vegetation is characterized by >20% mean frequency of smooth brome-dominated types (plant groups 54, 61, and 62).

Landscape Context. The unit has no size criterion

and

bears clear evidence of a farming history

and

is contiguous with high-priority drift prairie, prairie slope units, or tracts of native prairie adjacent to the refuge under non-Service ownership.

Rationale and Assumptions

Native grass and forb seed is very costly, as is the time and expense of materials needed to prepare seedbeds, plant seed, and annually manage newly seeded areas, per strategies and rationale listed under objective 2.

Old cropland that adjoins high-priority drift prairie or prairie slope and supports little, native, herbaceous vegetation likely is a source of invasion by undesirable, introduced grasses and weedy forbs. Without attempts to establish native vegetation through seeding, such areas are unpromising candidates for restoration to grassland in which native herbaceous plants are evident, much less an important codominant component of the plant community.

Old cropland areas with a more prominent native plant component, such as areas farmed for 5–10 years before refuge establishment—presumably, before smooth brome and Kentucky bluegrass were widely distributed—that may have been reinvaded by native herbaceous plants. These areas may have restoration potential that at least equals that of adjoining, high-quality drift prairie or prairie slope.

Objective 4

After seeding and establishing native warm-season plants in an old cropland unit, maintain native plants as the most dominant vegetation cover, per qualitative estimation.

NOTE: There are no goals and objectives for other old cropland units (those not yet converted to warm-season-dominated communities); they are low priority.

Strategies

— Seeded warm-season stands of herbaceous plants should be well established 5–8 years after seeding; manage these by a disturbance treatment about every 2–3 years. They probably can be disturbed more flexibly with regard to phenology, mainly to discourage smooth brome invasion.

— Use grazing as an alternate management treatment and take advantage of the wide, spring-grazing window afforded by the warm-season-dominated community.

— Integrate management with that of surrounding drift prairie while focusing on treatment approaches that promote native warm-season plant species.

— In the interim between prescribed burns, possibly harvest hay every 2–3 years from old cropland units, alternating among July, August, and September to favor warm-season grasses.

— If and where occasionally needed along unit boundaries, use herbicides to reduce encroaching, introduced cool-season grasses and release native warm-season plants. Use integrated pest management to treat local infestations of noxious weeds as needed.

Rationale and Assumptions

The warm-season growth strategy for plants vastly improves the capacity for an assemblage of grassland plants to outcompete smooth brome—by which seeded stands of introduced grasses and forbs are most typically degraded—mainly by affording broader and more effectively timed management opportunities.

Objective 5

Within 15 years of CCP approval, eliminate planted tall shrubs and trees and any naturalized, nonnative woody vegetation that occurs within or adjacent to high-priority old cropland areas as they are being restored to native-dominated vegetation.

Strategy

— Remove tree–shrub plantings by mechanical means (for example, cutting ash trees by hand; shearing caragana shrubs with a tractor blade or bucket during winter); follow by herbicide treatment of stumps; or follow by broadly applied herbicide, rotary mowing, and/or prescribed burning of resprouting vegetation wherever necessary.

Rationale and Assumptions

Trees and tall shrubs can diminish the survival of nests of grassland birds by harboring potential nest predators. They also provide perches from which brown-headed cowbirds can find other species' nests in which to lay eggs. Furthermore, recent data from the Souris River basin refuges indicate that relatively small areas of tall woody vegetation can effectively fragment grassland habitats and cause many grassland bird species to avoid entire landscapes. Elimination of tall woody cover is a logical strategy for restoration of landscape structure and plant community makeup, and to improve the attractiveness and security of the habitat for a variety of grassland breeding bird species.

Coulee Woodland and Coulee Woodland Edge Goal

Acknowledge a nearly irreversible, localized establishment of mature, contiguous woodland and minimally manage these areas as breeding and migration habitat principally for forest-interior, migratory bird species such as veery and ovenbird. Strive to eliminate remaining, noncontiguous, edge-dominated tree and tall shrub cover, particularly near high-priority drift prairie and the largest, most contiguous grassland tracts.

Objective 1

By 1 year after CCP approval, use GIS vegetation data and topographic considerations to classify management units with significant (>20% cover) tree and tall shrub cover as either "coulee woodland units" or "coulee woodland edge units."

Strategies

— Use this criteria for identifying units with significant tree and tall shrub cover as coulee woodland units: The uppermost vegetation strata of a unit comprises >50% tree cover with some tall shrub, forming woodland patches that generally are contiguous (minimum woodland width × length = 330 × 660 feet; about 5 acres).

— Use this criteria for identifying units with significant tree and tall shrub cover as coulee woodland edge units: The uppermost vegetation strata of a unit comprises 5–50% tree and tall shrub cover, generally occurring in narrow bands and is not contiguous.

Rationale and Assumptions

Distinguishing between management units with considerable woodland cover versus those with much woodland edge is critical to the refuge's vision and to a triage management approach. Coulee woodland at Des Lacs NWR is difficult to restore back to prairie, mainly because understory and ground fuels are too few to carry fires of sufficient extent and intensity to kill overstory trees. Such areas probably do not have native prairie, grass–forb seed banks. However, coulee woodland could continue to provide modest habitat for forest-interior bird species, such as veery and ovenbird, without slowing widespread improvement in grassland bird habitat elsewhere at the refuge.

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Ovenbird

In contrast, coulee woodland edge is a widespread habitat type that, in the absence of fire, would continue to fragment drift prairie and some prairie slope. None of the breeding bird species that are common in this edge habitat is of management concern. However, 11 grassland bird species that occur or used to occur at Des Lacs NWR are species of concern.

Conversion of woodland edge habitat to open prairie at the refuge could be achieved through repeated use of prescribed fire. This conversion would insignificantly influence continental population trends of woodland bird species, while helping reverse population declines of grassland bird species. Reduction of woodland edge may also reduce cowbird parasitism rates among grassland bird nests.

Objective 2

Minimally manage several green ash-dominated, contiguous coulee woodland that covers a total of about 800 acres and that presents the following characteristics within 15 years:

- There are 260–350 trees per acre and 55–60% canopy cover (roughly same as current condition, based on 1995 random plot data in Nenneman et al. 2003).
- Chokecherry, serviceberry, and green ash saplings are principle understory shrubs with ≥75% frequency each (current condition, based on 1995 data from random plots [Nenneman and Murphy, unpublished data]).
- Noxious weeds are controlled within woodland (common buckthorn, leafy spurge, common burdock, and other noxious weed species are each reduced to <3% frequency and newly discovered species of noxious weeds eliminated); and elsewhere on each woodland unit (buckthorn and other introduced species of tall shrubs or trees are eliminated and leafy spurge is reduced by >50%, to <5% frequency). Infestations of any other, newly appearing species of noxious weed are detected and eliminated.

Strategies

— Except for active control of noxious weeds, rely mainly on passive management, that is, do almost nothing. Contiguous woodland cover at Des Lacs NWR probably is nearing its maximum extent, apparently limited by local site potential (Grant and Murphy 2005). American elm formerly was codominant with green ash, but by the late 1990s was widely decimated at the refuge by Dutch elm disease, with little recent evidence of recruitment (3% shrub frequency).

— In open areas around woodland, continue to reduce leafy spurge by occasional redistribution of *Apthona* spp. beetles, plus limited use of herbicides at refuge boundaries if necessary.

Leafy spurge occurs uncommonly in woodland (<3% frequency, 1996 data).

— Within woodland, control common buckthorn by combinations of mechanical (hand-cutting) and chemical means (via herbicides applied on stumps freshly exposed by cutting). Common buckthorn was fairly common (25% frequency) on random woodland plots in 1996. The shrub appears to be steadily increasing, especially in HB14 (south half) and HB18. Without prompt, concerted control efforts, buckthorn likely will dominate forest understories at Des Lacs NWR within 15 years and significantly diminish habitat values for forest-interior bird species such as veery and ovenbird, in addition to other undesirable impacts. Buckthorn is readily identified in late fall, because it retains green leaves long after leaf-fall of other deciduous trees and tall shrubs. Seeds of the shrub are readily disseminated by many bird species, and extended control must also include regular vigilance.

— Remove or aggressively destroy, wherever opportunity allows, other introduced woody plants (Russian olive, honeysuckle, and Siberian pea). These plants seldom occur in woodland (<3% frequency; 1996 data), but occur outside woodland in the same and other units (for example, Russian olive is particularly widespread near refuge headquarters).

Rationale and Assumptions

The area covered by coulee woodland increased significantly through the late 1960s but appears to have reached its potential extent. Most areas covered by coulee woodland at Des Lacs NWR may be difficult to restore back to prairie, but probably could continue to provide modest habitat for forest-interior bird species without hindering widespread improvement in grassland bird habitat elsewhere at the refuge.

Objective 3

On each coulee woodland edge unit, apply disturbance (principally fire) every 5–6 years to restore the vegetation to the following standards within 15 years:

- Tree and tall shrub cover are reduced by >50% (measured via remote imagery).
- Plant litter is removed and herbaceous plant vigor and structural diversity are restored by management treatment applied every 5–6 years (these responses would be unmeasured and instead would be assumed to coincide with disturbance events).
- At any given time, about one-fourth of the area of all woodland edge units is in 0–1 year postdisturbance; one-fourth is in 2–3 years postdisturbance; and one-half is in 4–6+ years postdisturbance. This corresponds roughly to VOR height–density classes of 0–2.0 inches, 2.0–3.9 inches, and 3.9–5.9 inches, respectively, to contribute to the variety of grassland structural types across the landscape.
- Noxious weeds are controlled: (1) buckthorn, caragana, and other introduced species of tall shrubs or trees are nearly eliminated; (2) leafy spurge is reduced by >50%, to <5% frequency; (3) absinth wormwood and Canada thistle are actively controlled at the refuge boundary; and (4) infestations of yellow toadflax and any other, newly appearing species of noxious weed are detected and eliminated.

Strategies

— Apply prescribed fire every 5–6 years, varying the timing of burns within a given unit. Concede to continued invasion by introduced cool-season grasses, especially smooth brome, over much of these units, although upper slope areas may continue to support small (0.1–2.0 acre) patches of relatively diverse, native plant communities with a prominent warm-season grass component (somewhat similar to southwest-facing prairie slopes).

— So long as critical needs of priority management units (especially high-priority drift prairie) are not compromised, seek opportunities for occasional grazing by livestock during years between prescribed burns, to improve structural heterogeneity and slow litter accumulation. Grazing prescriptions can be very flexible, even allowing occasional, relatively severe defoliations, although such events may result in local increases in weeds such as Canada thistle and yellow sweetclover.

Rationale and Assumptions

Coulee woodland edge is a widespread habitat type at Des Lacs NWR that, in the absence of fire, would continue to fragment drift prairie and some prairie slope. None of the breeding bird species that are common in this edge habitat are of management concern, whereas 11 grassland bird species that occur or used to occur at the refuge are considered species of concern. Conversion of woodland edge habitat to open prairie, through repeated prescribed fire, would negligibly influence continental population trends of woodland bird species while helping reverse population declines of grassland bird species. Reduction of woodland edge may also help reduce cowbird parasitism rates among grassland bird nests.

Meadow Goal

Restore and maintain extensive examples of plant communities dominated by native flora characteristic of seasonally flooded meadows within the Souris River floodplain to attract grassland- and wetland-dependent bird species and other wildlife.

Objective 1

Manage meadows to present a mosaic of short–sparse herbaceous cover to tall–dense herbaceous cover and limit tall woody vegetation to <1% of the overall plant cover.

Strategy

- Manage meadows with the broader habitats that they adjoin or in which they are imbedded (marsh units, prairie slope), using periodic prescribed fire and grazing where possible.

Rationale and Assumptions

Meadow is limited in area at Des Lacs NWR, occurring in small (<40-acre), isolated, often long, narrow patches. Meadows occur at the mouths of major coulees or on the periphery of marsh units along the southern one-third of the refuge. Although these areas contribute to plant and wildlife diversity (for example, Baltic rush/saltgrass/sedge community, including several unique species of sedge; sedge wren and Nelson's sharp-tailed sparrow), it generally is impractical to exclusively target these areas in management planning.

Combinations of prescribed burning and grazing are appropriate management. However, grazing without recurrent fire treatments could increase occurrences of grazing-tolerant species such as foxtail barley and curly-cup gumweed. Local invasion by two introduced, rhizomatous grasses, reed canarygrass and quackgrass, might be exacerbated by grazing without recurrent fire. Fire also would maintain the current low occurrence of willow and meadowsweet, plus that of western snowberry in the relatively high, less moist sites within meadows.

Wetland Goal

Manage riverine wetlands, including marshes and lakes, to sustain the long-term capacity of riverine wetlands to support diverse plant and wildlife communities. Restore ecological processes that sustain long-term productivity of wetlands.

Objective 1

Within 5 years of CCP approval, synthesize available information on the effects of physical alterations, altered hydrology and hydroperiod, increased sedimentation, and changes in water quality of the riverine system, past and present: (1) develop a report to describe consequences of these alterations on long-term viability of riverine marshes, (2) determine biological potentials and constraints for each wetland impoundment, and (3) develop criteria to prioritize refuge impoundments with the greatest potential for sustained productivity.

Strategies

- Use past narratives, aerial photographs, unpublished refuge files, and scientific literature to evaluate the biological potential of wetland impoundments and prioritize units for management.
- Map physical areas within each impoundment that are expected to respond to management.
- Develop and prioritize a list of knowledge gaps and research needs.
- In cooperation with USGS's Northern Prairie Wildlife Research Center, complete sediment accretion study and contaminants studies.
- Monitor groundwater and soil moisture levels in impoundments and within the adjacent meadow zone.

Rationale and Assumptions

This objective focuses on compiling past and current data regarding development and management of the Des Lacs River wetlands. Although riverine wetlands form one of the most extensive and important habitats at the refuge, site-specific information is limited regarding effects of habitat management (especially water level management) on vegetation structure and composition, species diversity and density of aquatic invertebrates, and wetland-dependent bird species. Models for managing northern prairie wetlands exist, but their utility is limited for managing riverine marshes at the Souris River basin refuges, primarily because impoundments include flow-through of the rivers, which limits wetland management capabilities.

This objective requires compilation of existing wetland management records along with a clear, succinct treatment of threats and management opportunities and limitations for riverine wetlands. A biological assessment of wetland conditions for the Souris River basin refuges was completed recently by Laubhan and others (2003); this report provides a start in meeting this objective and those that follow.

USFWS

Unit 2 at Des Lacs NWR

Objective 2

Within 15 years of CCP approval, evaluate and comprehend crucial ecological processes that maintain long-term wetland productivity. Develop a range of biological indicators (for example, sago pondweed biomass, decline of important invertebrate species, shifts in extent and juxtaposition of aquatic emergent vegetation) useful as references or benchmarks for implementing management strategies such as water level management and prescribed fire to maintain wetland productivity over the long term.

Strategies

— Complete development of a USGS computer application that uses long-term flow data from gauging stations to assess effects associated with long-term alterations in river hydrology and hydroperiod on wetland plants, wildlife, and (ultimately) the potential to sustain long-term wetland productivity.

— In cooperation with USGS's Northern Prairie Wildlife Research Center, complete a sediment accretion study and determine impacts of sedimentation for long-term management of riverine marshes.

— In cooperation with USGS and others, assess available contour maps for wetlands; where inadequate, develop detailed contour maps of marsh bottoms for all impoundments to help construct models that predict vegetation response to water level management.

— In the absence of full restoration of the natural hydrograph and hydroperiod of the Des Lacs River, continue to study the economic, physical, and biological feasibility of constructing a major bypass channel to expand management opportunities at all impoundments.

— Develop a method to inventory contemporary vegetation communities in managed wetlands. Expand use of remote imagery (1) to monitor sago pondweed biomass, which is positively correlated with invertebrate diversity and density at the refuge (Euliss et al. 2003), and (2) to develop methods for long-term monitoring of other wetland vegetation.

— In cooperation with USGS and others, use information derived above to develop models that predict effects of water management (especially hydroperiod) on wetland plants, invertebrates, and migratory birds; revise objective 1 accordingly.

Rationale and Assumptions

This objective focuses on synthesizing existing scientific research on wetland function and cycles in northern prairie wetlands and impounded riverine wetlands. It also prompts site-specific inventory, monitoring, and research to support management of riverine marshes.

A biological assessment of wetland conditions for the Souris River basin refuges was completed recently (Laubhan et al. 2003). This report provides context for the original construction and subsequent physical and operational modifications to the managed wetland system at the Souris River basin refuges. Additionally, long-term threats to the system are discussed. However, past management of riverine wetlands has been based more on "gut feeling," an irregular local climate, and politics, than on sound science. Site-specific data are lacking regarding effects of wetland management on vegetation structure and composition, aquatic invertebrate densities, and wetland-dependent wildlife species.

Relative to upland habitats, managers have less effective control over wetland systems, due in part to the following:

— misunderstandings about the biological significance of drought and of complete drawdown, dating back to the original construction of wetland impoundments;

— limited knowledge of long-term impacts of low-head dams on rivers in the northern Great Plains;

— significant physical limitations of constructed impoundments, especially inability to manipulate water levels of adjacent impoundments independently;

— inherent difficulties in conducting basic inventory, long-term monitoring, or applied research in wetlands relative to upland sites.

Objective 3

During the 15 years after CCP approval, develop and implement a new management philosophy that emphasizes long-term wetland productivity over older models based on "oasis" management, where wet acres are maximized (especially during extreme drought) or years of "hemi-marsh" conditions are maximized. In high-priority impoundments, use periodic disturbance to provide the full spectrum of wetland conditions—for example, (1) dry marsh, (2) densely vegetated marsh (regenerative phase), (3) hemi-marsh, (4) open marsh (degenerative phase), and (5) open water—to benefit wetland-dependent migratory birds.

Strategies

— Re-create, where possible, the natural hydrology and hydroperiod of the Des Lacs River. In most areas, physical disruptions such as rights-of-way, dikes, and control structures compromise the degree to which this strategy could be carried out. Focus management on the lower refuge impoundments (units 4–7), which probably have the greatest potential for sustained productivity (from objective 1).

— Use natural climatic fluctuations to increase wetland management opportunities. Periodic drought may hasten full or partial drawdowns in some units. Although such drawdowns maximize the long-term viability of wetlands, the availability of wetlands with water is reduced during drought. In contrast, previous management emphasized retaining as much water as possible to offset landscape-level drought effects on migratory birds at the expense of long-term capacity to sustain wetland productivity in refuge impoundments.

— Use periodic, growing-season drawdown over multiple seasons if required to (1) stimulate production of seed-bearing annual plants, (2) increase invertebrate biomass, and (3) stimulate establishment and expansion of emergent and submergent plant species.

— During the drawdown phase, use additional disturbances, especially prescribed fire, mechanical soil treatment (for example, disking and farming), and defoliation (haying or grazing) to (1) boost vegetation and invertebrate response during the regenerative phase and (2) to control robust emergent vegetation. Refer to appendices K, L, and M for compatibility determinations for grazing, haying, and farming, respectively.

— Use periodic inundation to reduce robust emergent vegetation, especially cattail and common reed.

— Use aerially applied herbicides when needed to reduce the extent of monotypic, robust stands of emergent vegetation in portions of impoundments that, historically, do not respond to water level management (cannot hold >3 feet of water during the growing season).

— Obtain remaining water rights through North Dakota State Water Commission. Buy additional water rights.

— Detect and eliminate purple loosestrife and salt cedar.

— Maintain carp-free status.

Rationale and Assumptions

This objective focuses on implementation and management, using the best available science. Past management goals and objectives rarely addressed or incorporated unforeseen impacts related to the physical disruptions of the river (for example, original construction of dikes and dams), or changes in habitat (biotic and abiotic) resulting from these events. Inevitable decreases in water quality and in marsh management capabilities—especially because of accretion of sediments—are assumed, based on current knowledge of such trends on this and similar impounded riverine marshes in the northern Great Plains.

Productivity of northern prairie wetlands was historically maintained by periodic wet and dry cycles. Productivity is particularly enhanced during reflooding following natural drought or drawdown (in managed wetlands). Riverine marshes have an inherent reduced capacity to be dewatered during the growing season because the river flows through each impoundment. Departures from a natural hydroperiod can render prescriptive drawdowns ineffective because marsh sediments never dry sufficiently to (1) oxidize soils, (2) establish annual wetland plants (important waterfowl foods and a substrate for invertebrate production), or (3) establish perennial emergent and submergent vegetation (food cover and invertebrate substrate). Furthermore, control of robust emergent plants (cattail, reed, and bulrush) becomes difficult because of continued anoxic (absence of oxygen) conditions, with little reduction in organic material in marsh soils. Consequently, wetlands often cycle rapidly between open water and a dense-vegetated marsh phase, both of which are less productive than intervening stages. A periodic dry marsh phase is rarely achieved. Instead, under this objective, wetland management would become more opportunistic. Periodic drawdowns would be emphasized, typically working in conjunction with wet-to-dry cycles to achieve management objectives.

Objective 4

Over the course of the CCP, introduce efforts on a watershed level that reduce sedimentation and nonpoint source pollution and/or their effects on riverine marshes.

Strategies

— Develop models—similar to the “mallard model” developed by the HAPET—that target areas within the watershed (for example, adjacent to major tributaries or drainage systems) that have the highest potential for sediment transport, especially during extreme rainfall or snowmelt events.

— Use models to target areas for conversion from cropland to grassland via USDA’s CRP, Wetland Reserve Program, or other USDA conservation initiatives. Identify drained wetlands within targeted areas for restoration. Initiate and develop additional conservation measures that reduce or mitigate impacts from sedimentation and pollution.

— Work with the NRCS to ensure compliance with “Sodbuster,” “Swampbuster,” and other provisions in the Farm Bill (current and future) that reduce soil erosion.

— Explore construction of sediment traps at the refuge to reduce sediment inputs. Where management capability has already been reduced, explore the feasibility of dredging to reduce accumulated sediment in certain impoundments.

— Protect native prairie and prairie wetlands within target areas or adjacent to the refuge, using perpetual easements.

— In cooperation with the USGS and the state of North Dakota, monitor and document sediment loads and water quality associated with various flows. Consider trying to pass flows with high sediment loads or that significantly reduce water quality.

Rationale and Assumptions

Initial samples collected at the Souris River basin refuges document only slightly elevated levels of sediment accretion for most impoundments. However, over many decades, sedimentation is expected to continue to the point where storage capacity (water depth) of pools would decline. This would result in reduced capability to manage wetland vegetation, especially robust emergent plants, using water level manipulations. Results from an ongoing sedimentation study at the Souris River refuges are expected to confirm this assumption.

Sedimentation and pollution mainly originate within the watershed, but outside refuge boundaries. Sediment is transported mainly via agricultural runoff carried in major tributaries and wetland drainage projects. Flows that contain high sediment loads or that significantly reduce water quality appear associated with floods originating from heavy winter snowmelt or significant rainfall events.

Island Goal

Manage islands to attract waterfowl and increase nest survival, especially during drought years when wetland habitat outside of the Souris River basin refuges is limited.

Objective 1

By 1 year after CCP approval, prioritize nesting islands based on past waterfowl use, nest survival, and maintenance feasibility.

Strategies

— Use data from nest studies (1990s) to evaluate each nesting island for waterfowl production. Emphasize islands far from shore with a large, surrounding, open-water barrier and islands with extensive, relatively dense, tall nesting cover (for example, VOR >5.9 inches).

— Identify and maintain islands that (1) have value for migratory bird species of management concern as secure nesting habitat, and (2) require almost no maintenance (for example, erosion control and occasional predator removal; less than $250 average annual expenditures per island).

— Allow islands that are poorly designed and unproductive for nesting waterfowl to deteriorate.

Rationale and Assumptions

Island management would be lower priority than restoration of other, more extensive, habitat types. Therefore, limited resources expended on island management should target islands with the greatest potential to produce waterfowl. Data on waterbird nesting and nest success were collected during the 1990s on islands available for nesting by waterfowl and other migratory birds. Data on presence of mammalian predators also were collected, based on annual trapping records. Anecdotal, incidental notes have been gathered on use of islands for nesting and roosting by a variety of migratory bird species.

Objective 2

Remove nesting islands with a history of low waterfowl nest densities and/or low nest survival. Burn some islands with low nest survival in late-April or May to discourage waterfowl nesting.

Strategies

— Allow islands to slowly deteriorate through erosion.

— Level islands by bulldozing during drought or drawdown periods.

Rationale and Assumptions

Islands that consistently support low levels of waterfowl nest success detract from species population goals.

Objective 3

During drought conditions, remove mammalian predators from islands selected as high priority for management and discourage nesting by gulls.

Strategies

— Trap predators such as skunk, raccoon, and mink soon after ice-out in the spring, during drought years or when resources allow. The spring window for effectively capturing mink is narrow; capture is unlikely once nesting has begun.


Dave Menke/USFWS

Raccoon

— Except for poisoning (currently not an approved strategy), the best mink control is attained by limiting winter muskrat populations that maintain survival of mink during winter months.

— Partial winter drawdowns can be used to control muskrat populations.
— Discourage gull nesting by maintaining tall, dense vegetation.

Rationale and Assumptions

Islands can potentially support high levels of waterfowl nest density and nest success, but only if free from predators. Island objectives remain secondary to marsh management objectives that maintain long-term wetland productivity.

Cultural Resource Goal

Discover and protect cultural resources and interpret sites when the interpretation does not adversely affect habitat management.

Objective 1

Within 15 years of CCP approval, identify and protect cultural resources present at the refuge.

Strategies

— Complete cultural resource surveys as needed for management purposes.
— Identify and store known cultural resource sites on a secure GIS database layer that can be used during management planning.
— Secure funding to survey the entire refuge for cultural resource sites.
— Protect known sites with refuge law enforcement, barriers, signing, and special use permits.

Rationale and Assumptions

There are limited resources (funding and staff) that would be allocated yearly to the refuge. The priority for these funding and staffing resources is to protect and manage upland and wetland habitats for wildlife. Protection of cultural resources is an integral part of the purpose. All cultural resource laws and policies would be complied with to prevent the destruction of known and unknown sites.

Objective 2

Within 10 years of CCP approval, develop a cultural resource interpretive program that will convey the cultural history of the Des Lacs River valley to refuge visitors.

Strategy

— Develop a self-guided interpretive route at the Munch's Coulee National Recreation Trail that details life on the prairie in the 18^{th} century, using replicated cultural resource sites.

Rationale and Assumptions

The interpretation of cultural resources is encouraged if sufficient funding and staff are available (so that habitat management will not be negatively affected). Interpretation of the Souris River basin culture would enhance visitors' appreciation and knowledge of the role of refuges to protect native habitats and wildlife. In addition, visitors would be taught to respect, value, and protect cultural resources.

Creating replicas of cultural resource sites would convey the message that is learned from cultural resource sites without risking damage to actual sites. Replicas would allow many types of sites to be viewed in a limited area, reducing impacts to important habitats.

Visitor Service Goal

Provide wildlife-dependent recreational opportunities to a diverse audience when the administration of these programs does not adversely affect wildlife and habitat management.

Hunting Objective

Within 5 years of CCP approval, provide hunting opportunities for 500 visitors when resources needed to administer these programs do not adversely affect the refuge's ability to implement habitat management. Continue to provide hunters with safe, reasonable harvest opportunities; uncrowded conditions; minimal conflicts with other users; and satisfaction with their overall experiences.

Strategies

— Annually determine whether resources (funding and staff) would be available to provide hunting opportunities at the current level.
— When compatible, add other designated game animals to the list of species open for hunting.
— Provide hunting opportunities and access for hunters with disabilities, on request, when determined to be compatible.
— Continue to work with the NDGF to provide quality hunting opportunities where possible.
— Continue providing the public with information on refuge hunting opportunities by news releases, updated hunting brochures, signs, and the refuge website, as needed.
— Continue to regulate hunting with refuge law enforcement.

Rationale and Assumptions

"Hunting is clearly an important activity with visitors making multiple trips to the refuge to do so. These visitors feel that hunting at the refuge provides a unique experience they cannot find elsewhere," (Sexton et al. 2005). However, there are limited resources (funding and staff) that would be allocated yearly to the refuge. The priority for these resources is to protect and manage upland and wetland habitats. Hunting programs would be allowed if resources needed to administer hunting would not materially detract from habitat management. The Service intends to keep the present level of programs, unless funding or staffing shortfalls increase. The greatest expenses for the hunting program are for law enforcement, sign development and maintenance, development and printing of hunting brochures, answering questions, and updating the refuge website.

The draft compatibility determination for recreational hunting is in appendix P.

Wildlife Observation and Photography Objective

Within 5 years of CCP approval, provide wildlife observation and photography opportunities for no less than 8,000 visitors annually as a result of improved tour routes and habitat and wildlife diversity.

Strategies

- Continue efforts to improve the Scenic Backway auto tour route (asphalt surfacing on the south section and improved gravel surfacing on the north section).
- Develop partnerships with wildlife groups and organizations to market available birding and wildlife opportunities at the refuge.


USFWS

Scenic Byway at Des Lacs NWR

Rationale and Assumptions

Visitors drawn to the refuge for nonconsumptive activities found birding, wildlife observation, the auto tour route, and walking interpretive trails to be the most important activities. Visitors tend to observe and photograph wildlife collaterally at the same time they participate in other wildlife-dependent activities. The auto tour route gives visitors excellent opportunities to view birds and other wildlife. Although there are no plans to expand these existing facilities, they can be enhanced. Habitat management improvements would provide a greater diversity of wildlife available for observing and photographing.

The draft compatibility determination for wildlife observation and wildlife photography is in appendix Q.

Environmental Education and Interpretation Objective

Within 5 years of CCP approval, provide environmental education programming to no less than 100 students per year. Provide interpretive exhibits that will be viewed by 15 percent of visitors per year. Emphasize learning about natural plant and animal communities, ecological processes, refuge management, and restoration of upland and wetland.

Strategies

- Develop educational partnerships with schools and other government entities to efficiently tell the refuge story.
- Complete the redesign of visitor center exhibits to tell the story of the refuge and the Refuge System, and to emphasize the importance of the prairie grassland ecosystem.
- Maintain existing interpretation panels at the Scenic Backway and overlooks.
- Complete interpretation of Munch's Coulee National Recreation Trail.
- In cooperation with partners, participate in at least one special event annually to increase visitors' knowledge and understanding of wildlife conservation and related issues.

Rationale and Assumptions

There are limited opportunities to educate a large number of people about the refuge and the Refuge System in the rural communities surrounding the refuge. Most visitors and users of the refuge are local. There are opportunities to educate local youth about wildlife and habitat; most of these youth will leave the state when they graduate and take the message elsewhere.

Unfortunately, the Des Lacs NWR does not have educational facilities or staff to provide this valuable service. The refuge's priority is to protect and manage upland and wetland habitats to prevent degradation. Existing educational programs would be continued, but less frequently, and would rely on volunteers and other groups to contribute more time.

The draft compatibility determination for environmental education and interpretation is in appendix Q.

Non-wildlife-dependent Public Use Objective

Objectives and strategies would not be developed for non-wildlife-dependent public use activities. Examples of these activities are canoeing, boating, berry picking, horseback riding, walking, hiking, bicycling, cross-country skiing, snowshoeing, four-wheeling, swimming, water skiing, sailing, and snowmobiling.

These types of activities may be compatible when associated with wildlife-dependent public use. For example, berry picking along a trail might be allowed as a compatible activity incidental to the wildlife-dependent public use of wildlife observation. Compatibility of activities would be determined on an individual basis by the refuge manager as needed in the future.

USFWS

Refuge staff measure vegetation.

Research and Science Goal

Conduct innovative natural resource management using sound science and applied research to advance the understanding of natural resource function and management within the northern Great Plains.

Objective 1

During the 15 years following CCP approval, identify and prioritize research needs required to meet the refuge's goals and objectives; promote investigations that reliably address these needs.

Strategies

— Conduct vegetation and wildlife inventories of all plant communities within major habitats identified in chapter 3. Use initial inventories as baseline data to assess past and future changes in plant and animal community composition.

— Use periodic surveys (for example, every 5 years) to assess vegetation composition and structure of high-priority refuge habitats.

— Focus wildlife population research on assessments of species–habitat relationships. Develop models that predict wildlife response to habitat management or restoration.

— Design and conduct issue-driven research unlikely to be reliably addressed using long-term monitoring. Develop predictive models of habitat management and restoration.

— Promote refuge research and science priorities within the broader scientific community. Ensure that cooperative research focuses on meeting information needs identified in habitat management goals and objectives.

Rationale and Assumptions

Habitat-based goals and objectives form the basis for setting research and monitoring priorities for Des Lacs NWR. Investigations must be sufficiently designed, funded, and carried out to reliably address proposed hypotheses or questions.

Partnerships are integral to meeting the research and science goal and objectives. Cooperative efforts are supported with shared funding, lodging, vehicles, equipment, knowledge, and expertise.

Operations Goal

Efficiently use funding and staffing for the benefit of all natural and cultural resources, the National Wildlife Refuge System, and present and future generations. Effectively manage visitor service programs that complement habitat management.

Objective 1

Within 15 years of CCP approval, hire three additional personnel to restore native prairie habitat and manage wetland resources on 100% of high-priority habitat units and 50% of moderate-priority habitat units.

Strategies

— Hire a full-time refuge manager with duties to plan and carry out intensive habitat restoration efforts on the highest priority habitats and units.

— Hire a full-time wildlife biologist to monitor wildlife and habitat responses to habitat protection, management, and restoration efforts.

— Hire a full-time tractor operator to carry out the habitat restoration work.

Rationale and Assumptions

There are limited resources (funds and staff) allocated yearly to the refuge. The priority for these resources is to manage upland and wetland habitats. If the target (minimum) staffing level and funding are not reached or only partially reached, fewer accomplishments would be achieved.

Objective 2

Within 15 years of CCP approval, secure additional funding necessary to complete habitat restoration on 100% of high-priority habitat units and 50% of moderate-priority habitat units. Include restoration with (1) native prairie reseeding; and (2) intensive management of existing native prairie including woody plant reduction, invasive species control, and increased prescribed fire and grazing activities.

Strategies

— Use additional funding to purchase native grass and forb seeds for reseeding former cropland and planted cover.

- Use additional funding to purchase herbicides to control invasive species and remove/control woody plant expansion.
- Continue to use maintenance management funding to maintain or replace equipment and facilities, as needed, to Service standards.
- Secure additional funding to construct an equipment storage building to protect existing equipment and implements to extend their useful life. Equipment is necessary for habitat protection and restoration and maintenance of existing facilities.
- Maintain existing facilities and equipment to Service standards, including necessary roads, dikes, water control structures, buildings, and fences (all of which are critical in habitat management and protection).

Rationale and Assumptions

There are limited resources (funds and staff) allocated yearly to the refuge. The priority for these resources is to protect and manage upland and wetland habitats for wildlife. Operational funding would be targeted to work on the highest priority habitats and habitat units at the refuge. Management intensity would be increased on those habitats and units and would require additional personnel and funding to restore native prairie.

Blue-eyed Grass
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DRAFT CCP—*J. CLARK SALYER NWR*

The following goals, objectives, and strategies for J. Clark Salyer NWR outline the actions needed to achieve the vision of the Souris River basin refuges.

Drift Prairie Goal

Restore and maintain extensive examples of plant communities dominated by native flora characteristic of the mid-1800s drift prairie. Create the temporally and spatially dynamic habitat conditions that will attract most breeding bird species and other vertebrate fauna characteristic of that era.

Prairie Slope Goal

Restore representative examples of prairie slopes to preserve some of the most pristine plant communities that remain in the Souris River basin and promote appreciation and stewardship of prairie resources.

NOTE: The limited prairie slope habitat at J. Clark Salyer NWR would be managed in conjunction with the refuge's drift prairie, through application of the below drift prairie objectives.

Objective 1

By 1 year after CCP approval, use current vegetation inventory data and landscape considerations to characterize each habitat management unit with ≥40 acres of drift prairie as either high or low management priority. Reevaluate prioritization 15 years after CCP approval.

Strategy

- Apply multiple selection criteria.

  CRITERIA FOR HIGH-PRIORITY UNITS

  Floristic Composition. Vegetation is characterized by >10% mean frequency of pristine, native herbaceous types (plant groups 41–43 and 46–48 [Grant et al. 2004b]; see appendix E), plus native herbaceous-dominated vegetation with Kentucky bluegrass as the main subdominant (plant group 53).

  Floristic Potential. Vegetation is characterized by <30% mean frequency of smooth brome-dominated vegetation (plant groups 61 and 62).

  Landscape Context. The unit is contiguous with the best examples of prairie slope habitat (largest prairie slopes with the most intact native plant composition).

  or

  is adjacent to other high-priority, drift prairie units and/or tracts of native prairie adjacent to the refuge under non-Service ownership (especially important if the unit has relatively little drift prairie area, that is, <40 acres).

CRITERIA FOR LOW-PRIORITY UNITS

Floristic Composition. Vegetation is characterized by <10% mean frequency of pristine, native herbaceous types (plant groups 41–43 and 46–48 [Grant et al. 2004b]) plus native herbaceous-dominated vegetation with Kentucky bluegrass as the main subdominant (plant group 53).

Floristic Potential. Vegetation is characterized by >30% mean frequency of smooth brome-dominated vegetation (plant groups 61 and 62).

Landscape context. The unit is small (<100 acres) and not contiguous with significant prairie slope habitat, nor adjacent to high-priority drift prairie units and/or tracts of native prairie adjacent to the refuge.

Rationale and Assumptions

Most northern mixed-grass prairie has been destroyed. Losses have been particularly severe in the Drift Plain physiographic region, such that drift prairie could be considered an endangered resource. Key roles of the Refuge System include contribution to ecosystem integrity and the conservation of biological diversity. The Souris River basin refuges should contribute to the conservation of native prairie communities unique to the Drift Plain region. However, the native mixed-grass drift prairie at the refuges is badly deteriorated, mainly through extensive invasion by introduced cool-season grasses.

Recent inventory data indicate that occurrences of relatively intact, native herbaceous flora are rare (<5% frequency) on most drift prairie management units of J. Clark Salyer NWR. Native warm-season grasses are nearly absent. Under appropriate management, warm-season grasses can outcompete introduced cool-season grasses if the former are sufficiently abundant (>20% frequency).

Most drift prairie at J. Clark Salyer NWR likely has already passed a threshold, such that restoration of a modestly diverse, native herbaceous flora is an unrealistic and impractical goal. However, restoration may be possible on some tracts where native grasses, sedges, and forbs are more common and widespread. Such tracts need to be identified by objective criteria that focus on (1) diversity and prevalence of existing native plants, and (2) landscape area and connectivity, which underlie the quality of nesting habitat for grassland birds, a species group of significant conservation concern (see appendix G) in North America.

A major assumption is that, under current management, native herbaceous flora would continue to decline and disappear on drift prairie units. This approach would improve the chances that some drift prairie would be restored.

Gary Eslinger/USFWS

Highbush Cranberry

Objective 2

On high-priority drift prairie units, apply frequent and precisely timed disturbance (principally fire and grazing) to restore vegetation to the following standards within 15 years of CCP approval. This would provide habitat for most wildlife species that were characteristic of North Dakota's eastern mixed-grass prairie but that currently are rare or absent at the refuge (burrowing owl, horned lark, Baird's sparrow, Sprague's pipit, chestnut-collared longspur, northern pintail, and Richardson's ground squirrel).

- Composition on each unit includes (1) >40% pristine native and native-dominated/bluegrass-subdominant vegetation (plant groups 41–43, 46–48, and 53); (2) <20% smooth brome-dominated vegetation (plant groups 61 and 62); and (3) <20% low shrub-dominated vegetation (plant groups 11–17) (based on percentage frequency of occurrence on belt transects, per Grant et al. 2004b).
- Native trees and tall shrubs are absent or nearly so, comprising <0.1% land cover on each unit, and no nonnative or planted native woody vegetation exists.
- Leafy spurge is decreased by >50% on each unit, to <1% frequency (frequencies per belt transects; most high-priority units currently have little to no spurge); absinth wormwood is actively controlled; and yellow toadflax and other newly appearing species of noxious weed that pose a threat to the drift prairie are eliminated within 5 years of initial detection.

Strategies

— Disturb the vegetation, typically by livestock grazing or fire, at least 2 of every 3 years. An ideal management sequence over 5 years might be BGGGR (B=prescribe burn the first year; G=graze in each of years 2, 3, and 4; then R=rest), then reinitiate the sequence. The area covered by trees, tall shrubs, and low shrubs would be incrementally reduced with this burning frequency.

— Primarily use prescribed fire when smooth brome plants are at least in the 4- to 5-leaf stage, but not yet showing an inflorescence; this generally occurs during a narrow mid-May through early June window. A less preferred option is to burn in fall in anticipation of a negative, winter drought effect on smooth brome and Kentucky bluegrass.

— Graze mainly during May through August or September, via a rotation approach with many (7–10) relatively small grazing cells (for example, 40–60 acres) per unit and short grazing periods (4–7 days) per cell. Adjust stocking rates to facilitate regrazing of individual smooth brome plants at least once within a grazing period, but move livestock to the next cell before native plants are regrazed (be sure to note grazing of native upland sedges, an important forage base in some management units).

— Annually survey for noxious weeds. Continue widespread use of biological control by monitoring local areas for *Apthona* spp. beetles and by redistributing beetles among leafy spurge patches as needed. Use herbicides as needed along boundaries with private lands.

— Reseed adjoining old cropland units into native vegetation dominated by warm-season grasses (see objectives for old cropland). Manage these intensively, in concert with the high-priority drift prairie units they adjoin, to sustain a native-dominated flora and to reduce sources of invasion by introduced cool-season grasses and noxious weeds (see objectives and strategies for old cropland).

— Experiment on low-priority tracts with new or high-risk restoration methods for use on high-priority tracts.

— Experiment with horses as alternative grazing tools; horses may have greater impact than cattle on woody vegetation, especially silverberry. Since horses may founder (succumb to hoof inflammation) on rich, green vegetation, an appropriate approach in a 3-year grazing cycle may be to use cattle during the first 2 years, then horses the third year.

— Experiment with control of introduced cool-season grasses and release of native plants on a small, localized scale with selective herbicide treatment.

— Experiment with seeding of native warm-season grass mixes in brome monotypes on unit edges. Apply prescribed fire followed by multiple herbicide treatments over 2 years for site preparation. Use similar approaches on brome-dominated edges of adjoining, low-priority units.

NOTE: Service policy regarding refuge management implicitly promotes seeding to reestablish native plants in native sod where such plants have become rare or absent (National Wildlife Refuge System Biological Integrity, Diversity, and Environmental Health, 601 FW 3, 2001).

— Experiment with "interseeding" of native plants, principally warm-season species, into brome monotypes within units. Apply prescribed fire or repeated intensive grazing, and then use a wick applicator to apply herbicide to emerging smooth brome and Kentucky bluegrass. Follow by seeding via drill.

— Experiment with localized hand plantings and husbandry (such as weed control and herbivore exclusion) of select native forbs such as milkvetches (*Astragalus* spp.) to increase plant species diversity and structural diversity.

— Transplant and release Richardson's ground squirrels on areas of low-stature vegetation within high-priority units, wherever an adjacent source for colonization appears unavailable.

— Remove local, human disturbances and artifacts of twentieth-century origin (including the refuge era). This includes prominent plow furrows, old road grades, rock piles, and impoundment dams on intermittent drainages (except on those essential as livestock water sources). Restore such sites as close as possible to their original condition.

Rationale and Assumptions

This objective focuses on restoration of floristic composition. Smooth brome and Kentucky bluegrass are widespread and common on the Drift Plain at J. Clark Salyer NWR. Kentucky bluegrass tends to increase under prolonged rest or with grazing, but decreases with fire especially when burning occurs during stem elongation or in dry years. Smooth brome also increases under rest but, in contrast to Kentucky bluegrass, appears sensitive to repeated grazing but unaffected or variably affected by prescribed fire. A strategy to improve competitive abilities of native herbaceous plants should match the types, timing, and frequencies of disturbances under which these plants evolved. Meanwhile, a strategy to decrease competitive abilities of bluegrass and brome on the relatively rich loam soils of the Drift Plain should focus on combined use of fire and grazing.

Smooth brome-dominated types are twice as prevalent as Kentucky bluegrass-dominated types on the drift prairie of J. Clark Salyer NWR, indicating that smooth brome may be more competitive than Kentucky bluegrass in the relatively rich loam soils. Of the two introduced species, smooth brome generally seems more difficult to control and more significantly alters the quality and structure of northern prairie habitats.

Therefore, restoration management should focus more on strategies to reduce brome.

The contemporary breeding bird community on the drift prairie at J. Clark Salyer NWR is characterized by three to four species that tolerate introduced cool-season grasses and relatively dense, rank, oftentimes brushy cover. Grassland bird species that are uncommon to absent generally require shorter, sparser, more herbaceous prairie vegetation than that available on the refuge's drift prairie. These species also are of much greater conservation concern due mainly to declining population trends (for example, Sprague's pipit and chestnut-collared longspur). Thus, habitat for a broader array of northern prairie birds (including several endemic species and other species characteristic of the historical mixed-grass prairie community) can be significantly increased by providing frequent disturbance and the resulting increases in early successional stages.

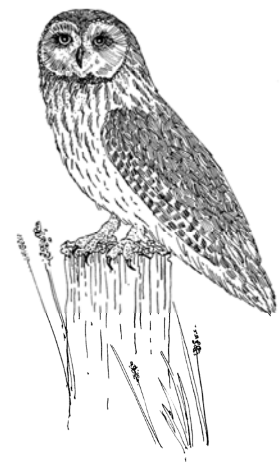
In the historical setting, Richardson's ground squirrels were characteristically widespread and contributed to the maintenance of early seral stages, and their burrows provided unique microhabitats. The ground squirrel should be a component of the restored prairie community.

Historically, the drift prairie was a treeless landscape. Trees and tall shrubs can diminish the survival of nests of grassland birds by harboring potential nest predators. They also provide perches from which brown-headed cowbirds can find other species' nests in which to lay eggs. Furthermore, recent data from the Souris River basin refuges indicate that relatively small areas of tall woody vegetation can effectively fragment grassland habitats and cause many grassland bird species to avoid entire landscapes. Elimination of tall woody cover is a logical strategy for restoration of landscape structure and plant community makeup, and to improve the attractiveness and security of the habitat for a variety of grassland breeding bird species.

In restorations, vegetation composition is considered along a habitat continuum, where plant communities can be separated by degree of invasion by undesirable plants. A continuum for drift prairie (least desirable vegetation to the left) follows: woodland ← tall shrubland ← leafy spurge ← smooth brome ← low shrub ← Kentucky bluegrass ← native herbaceous vegetation. With management, less desirable plant species are replaced by more desirable plant groups. For example, it is acceptable in the short term to increase Kentucky bluegrass in areas where leafy spurge is reduced. Conversely, replacement of Kentucky bluegrass by smooth brome is undesirable.

Objective 3

On low-priority drift prairie units, apply disturbance (principally fire) every 5–8 years to remove plant litter, restore plant vigor, reverse woody plant expansion, and provide a mix of structural types that include (1) relatively short/sparse vegetation for species such as killdeer, horned lark, and Brewer's blackbird; (2) moderately short vegetation for species such as blue-winged teal and upland sandpiper; and (3) tall/dense vegetation for species such as mallard, short-eared owl, Le Conte's sparrow, and bobolink. Vegetation should present the below characteristics within 15 years of CCP approval.



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There is almost no monitoring of vegetation on these units except for routine, cursory surveillance for noxious weeds. Knowledge of relationships between fire frequency and resulting, postfire vegetation structure is adequate to predict habitat conditions described below.

- One-fourth of the area in 0- to 1-year postdisturbance, one-fourth in 2–3 years postdisturbance, and one-half in 4–6+ years postdisturbance—corresponding roughly to a structure of <2 inches VOR, 2–3.9 inches VOR, and >3.9 inches VOR (mean VORs in early spring, per Robel et al. 1970).
- Native trees and tall shrubs compose <0.2% land cover on each unit above the prairie slope, and all nonnative woody vegetation and planted, native woody vegetation is eliminated from at least half of the units.
- Leafy spurge frequency is maintained at <2% frequency, absinth wormwood is actively controlled, and yellow toadflax and other newly appearing species of noxious weed that pose a threat to the drift prairie are eliminated within 5 years of initial detection.

Strategies

— Apply prescribed fire on each unit at least every 5–8 years, increasing burn frequency during dry years when possible to more effectively reduce tall shrubs and trees. Rotate burns among units. Burn opportunistically, at any time, mainly to remove litter and control tall shrubs and trees.

— To increase structural diversity, occasionally introduce livestock grazing—with wide latitude on timing, intensity, and duration, if and when doing so will not detract from management of high-priority units. Experiment with seeding and "interseeding" of native warm-season grass mixes in smooth brome monotypes, mainly to help develop effective restoration approaches for high-priority units.

— Periodically survey for noxious weeds. Continue widespread use of biological control by monitoring local areas for *Apthona* spp. beetles and redistributing beetles among leafy spurge patches as needed. Use herbicides as needed along boundaries with private lands.

Rationale and Assumptions

This objective focuses on providing vegetation structural diversity. Most drift prairie at J. Clark Salyer NWR has almost no intact native herbaceous vegetation. From a practical standpoint, low-priority drift prairie probably cannot be restored to a state where native herbaceous vegetation is a widely noticeable or otherwise common vegetation component. However, with modest effort, the prevalent, introduced cool-season grasses and scattered low shrub can be managed to provide a mix of postdisturbance structural types attractive to a broad array of grassland bird species.

The most appropriate management of these units is to provide structural variety, and use the units as a basis for creating extensive areas of grassland (including off-refuge lands) to satisfy needs of several area-sensitive, native grassland bird species. This would also reduce predation and nest (brood) parasitism incidence associated with edge-dominated, highly fragmented grassland. The rationale for reducing tall shrubs and trees is similar to that for high-priority drift prairie (objective 2).

Objective 4

Improve or help maintain the habitat quality and the economic sustainability of nonfederally owned, native prairie remnants adjacent to drift prairie units within 15 years of CCP approval. Extend protection and stewardship to most other grassland that adjoins drift prairie units. Seek opportunities to expand the total grassland area and create broad, contiguous blocks of open grassland, principally as habitat for breeding grassland birds.

Strategy

— Use grassland easements and extension agreements, for example, for specialized livestock grazing systems on native prairie, or native grass establishment and management, or to remove "hostile" cover such as trees and tall shrubs that could harbor nest predators and parasitic brown-headed cowbirds. Certain grazing systems can improve livestock carrying capacity and the condition of annually grazed prairie, to enhance the economic viability of native prairie and reduce chances of conversion to other land uses, especially cultivation.

Rationale and Assumptions

The quality of prairie as breeding habitat for grassland birds (in terms of average annual nest success and relative contribution to population recruitment) is directly related to its extent or, conversely, indirectly related to the degree of its fragmentation.

Native prairie on the Drift Plain could be considered an endangered resource and little of it remains in the Souris River valley. Conserving remnant tracts adjacent to the refuge, by whatever means possible, should be among the highest priorities for landscape conservation.

Prairie Parkland Goal

Restore and maintain extensive examples of plant communities characteristic of the mid-1800s prairie parkland. Create the temporally and spatially dynamic habitat conditions that will attract most breeding bird species and other vertebrate fauna characteristic of that era.

Objective 1

By 1 year after CCP approval, use the on-site vegetation inventory data, recent satellite imagery, and landscape considerations to characterize each management unit within the prairie parkland as high, moderate, or low management priority. Reevaluate prioritization 15 years after CCP approval.

Strategy

— Apply multiple selection criteria.

CRITERIA FOR HIGH-PRIORITY UNITS

Contemporary woodland coverage. A unit is characterized by <30% total cover of trees and tall shrubs (mainly aspen–oak woodland and chokecherry shrubland).

Floristic potential. Vegetation (excluding woodland) is characterized by >30% mean frequency of pristine, native herbaceous types (plant groups 41–43 and 46–48 [Grant et al. 2004b]) plus native herbaceous-dominated vegetation with Kentucky bluegrass as the main subdominant (plant group 53).

Degree of connectivity to treeless grassland. The unit is adjacent to treeless refuge grassland or private grassland, especially native prairie.

CRITERIA FOR MODERATE-PRIORITY UNITS

Contemporary woodland coverage. A unit is characterized by 30–70% total cover of trees and tall shrubs (mainly aspen–oak woodland and chokecherry shrubland); many tracts may be medium to large (40–600 acres) grasslands that are mostly surrounded by aspen–oak woodland.

Floristic potential. Vegetation (excluding woodland) is characterized by > 40% mean frequency of pristine, native herbaceous types (plant groups 41–43 and 46–48 [Grant et al. 2004b]) plus native herbaceous-dominated vegetation with Kentucky bluegrass as main subdominant (plant group 53).

Degree of connectivity to treeless grassland. By default, moderate-priority units are isolated from other treeless grasslands.

Criteria for Low-priority Units

Contemporary woodland coverage. A unit is characterized by > 70% total cover of trees and tall shrubs (mainly aspen–oak woodland and chokecherry shrubland).

Floristic potential. Extensive woodland cover makes restoration of grassland patches unlikely, regardless of floristic composition.

Size and degree of connectivity to treeless grassland. Remaining grassland patches (<30% cover) are isolated by surrounding woodland from other higher priority grasslands, making restoration impractical.

Rationale and Assumptions

Criteria used to prioritize management units reflect three important issues affecting ecological integrity of the prairie parkland: (1) trees and tall shrubs compromise the integrity of native prairie, and (2) woody plants are detrimental to grassland birds as an ecological group, and (3) intact native-dominated plant communities are more likely to be restored than units invaded by woody and introduced plants.

Objective 2

On high-priority prairie parkland units, apply periodic disturbance (principally fire and grazing) to restore vegetation to the following standards within 15 years of CCP approval, to provide habitat for most indigenous bird species, especially Baird's sparrow, Sprague's pipit, vesper sparrow, chestnut-collared longspur, western meadowlark, and upland sandpiper.

- Aspen woodland on a unit has <10% coverage by 15 years after CCP approval.
- Vegetation composition is >40% pristine native and native-dominated/bluegrass subdominant (plant groups 41–43, 46–48, and 53 [Grant et al. 2004b]).


John and Karen Hollingsworth/USFWS

Western Meadowlark

Strategies

— Use high-intensity spring fires (late-March to April, prior to leaf-out) to initially kill mature aspen trees; within 4 years, again use fire during the dormant season (spring or fall) to reduce viability of aspen clones, especially dense aspen suckers. Continue control of trees and tall shrubs with periodic fire (every 3–6 years) applied from March to November. As woodland cover is reduced, frequency and timing of fire can change to facilitate control of other invasive species, especially Kentucky bluegrass.

— Between prescribed fire intervals, use grazing to periodically reduce shading and seed production of yellow sweetclover. Where smooth brome occurs, use season-long (light to moderate stocking rates) or rotation grazing (begin mid- to late April) to reduce cover of smooth brome. Tracts with brome may be grazed in consecutive years, allowing 1 year of rest to accumulate sufficient fuels for burning.

— Experiment with "interseeding" of native warm-season grasses into brome monotypes or on unit edges, using fire followed by multiple herbicide treatments over 2 years for site preparation.

— In winter (over frozen ground), use mechanical treatment (bulldozer) to create islands of dead fuel within large or fire-resistant aspen woodland. Use drum chopper or hydro ax to reduce dead standing timber and willows near hazards such as prescribed fire unit boundaries, and reduce aspen and willow sprouting in patches resistant to fire.

— Experiment with control of leafy spurge using Plateau® herbicide. Release flea beetles (*Apthona* spp.) in patches of leafy spurge growing on various microsites. If flea beetles become locally adapted to survive on sandy sites, then begin wide-scale releases to control leafy spurge.

Rationale and Assumptions

This objective focuses on restoration of open, treeless grasslands. Trees, tall shrubs, and introduced cool-season plants, especially Kentucky bluegrass and leafy spurge, compromise integrity of native prairie.

Since 1850, the extent of aspen woodland has more than doubled in prairie parkland units, due primarily to fire suppression and elimination of large herds of bison and elk. Reducing trees and tall shrubs will benefit 10–15 grassland-dependent bird species including three species endemic to the northern Great Plains (Baird's sparrow, chestnut-collared longspur, and Sprague's pipit). Prairie parkland becomes largely unsuitable for these species when woodland cover (within a quarter-section) exceeds 25–30%. Trees and tall shrubs can diminish the survival of nests of grassland birds by harboring potential nest predators. Trees and shrubs provide perches from which brown-headed cowbirds can find other species' nests in which to lay eggs.

The quality of prairie parkland units is further diminished by introduced plants and by loss of important ecological processes such as fire and grazing that historically maintained these areas as predominantly grassland. Introduced grasses decrease the suitability of prairies for some bird species such as Sprague's pipit, chestnut-collared longspur, and horned lark.

Based on recent inventory data, parkland prairies are degraded mainly by Kentucky bluegrass and, to a lesser extent, by leafy spurge and smooth brome. Kentucky bluegrass increases under prolonged rest or with grazing, but decreases with fire. Smooth brome also increases under rest, but, in contrast to Kentucky bluegrass, appears sensitive to repeated grazing and may be unaffected by fire (see "Drift Prairie" for more detail on controlling Kentucky bluegrass and smooth brome).

Leafy spurge remains a serious long-term threat to the integrity of prairie parkland. Use of flea beetles has been ineffective for spurge growing on sandy soils. Chemical control also is limited—many sites are inaccessible and use of certain chemicals (such as Tordon®) is prohibited because of concerns about groundwater contamination.

In restorations, vegetation composition is considered along a habitat continuum, where plant communities are separated by degree of invasion by undesirable plants. A continuum for prairie parkland (least desirable vegetation to the left) follows: mature woodland ← early successional woodland/tall shrubland ← leafy spurge ← smooth brome ← low shrub ← Kentucky bluegrass ← native herbaceous vegetation. With management, less desirable plant species are replaced by more desirable plants. For example, it is acceptable in the short term to increase Kentucky bluegrass cover in areas where aspen woodland has been reduced. Conversely, replacement of Kentucky bluegrass due to expansion of leafy spurge is undesirable.

Objective 3

On moderate-priority units, within 15 years after CCP approval, eliminate aspen groves on prairie interiors and maintain current patch size by minimizing woodland encroachment along grassland–woodland edges. These grasslands attract Sprague's pipit, vesper sparrow, horned lark, and clay-colored sparrow. Additionally, restore prairies to the following standards.

- Plant composition includes >50% pristine native and native dominant/bluegrass subdominant groups (plant groups 41–43, 46–48, and 53 [Grant et al. 2004a]).
- Leafy spurge is reduced to <2% composition and smooth brome (plant groups 61 and 62) compose <4% cover.

Strategies

- Use fire every 5–10 years to (1) eliminate aspen groves within the interior of moderate-priority units, (2) control invasion of woodland edge into the prairie patches, and (3) reduce cover of Kentucky bluegrass.
- Use mechanical treatments (drum chopper) in cases where fire is impractical for removing trees and tall shrubs.
- Use herbicides for spot control of minor invasions of leafy spurge and smooth brome.
- Experiment with control of leafy spurge using Plateau® herbicide. Release flea beetles (*Apthona* spp.) in patches of leafy spurge growing on various microsites. If flea beetles become locally adapted to survive on sandy sites, then begin wide-scale releases to control leafy spurge.

Rationale and Assumptions

This objective focuses on restoration of high-quality prairie plant communities. Most moderate-priority units are prairie patches that are mostly surrounded by aspen woodland (the extent of open, treeless grasslands is less than that on high-priority units).

Many of the most floristically intact prairie communities occur in moderate-priority units where woodland cover currently exceeds 30%. Moderate-priority units are attractive to several grassland bird species of regional or national management concern, such as vesper sparrow, Sprague's pipit, clay-colored sparrow, and grasshopper sparrow.

Rationale for controlling introduced cool-season plants is the same as objective 2.

Objective 4

In low-priority units, opportunistically rejuvenate 100–200 acres of mature (>60 years old) aspen woodland to provide structural diversity (various age classes) important for woodland birds.

Strategies

- Under certain circumstances (once every 15–25 years), expand prescribed fire in moderate- or high-priority prairie parkland units to include adjacent low-priority units that are extensively wooded; some mature (>60 years old) aspen–oak woodland can be periodically regenerated using prescribed fire.
- Use mechanical treatment (winter shearing with a bulldozer) or commercial timber removal to periodically rejuvenate small patches (<10 acres)

within large aspen–oak woodlands. Retain mature bur oak and shade-tolerant tree species such as green ash.

Rationale and Assumptions

This objective recognizes that most low-priority units are former grasslands that have been mostly replaced by aspen-oak woodland. Large contiguous patches of woodland are a significant component of contemporary prairie parkland. However, restoration of these (former) grasslands is unlikely. Within low-priority units, woodland patches will continue to expand, further displacing small, scattered prairies.

Aspen woodland is an early successional forest type maintained by periodic disturbance, usually fire. Large woodlands provide important habitat for area-sensitive, forest-interior bird species (such as veery, ovenbird, hairy woodpecker, rose-breasted grosbeak, and ruffed grouse), many of which have shown steep regional or continental population declines. Ideally, large woodlands include several age classes of aspen and oak. Some bird species (for example, ruffed grouse) rely on many age classes during their lifecycle. Other species such as yellow warbler and willow flycatcher breed mainly in young (<20 years) aspen woodland. Many species (for example, ovenbird, veery, and hairy woodpecker) nest only in mature aspen–oak woodland.

Objective 5

Opportunistically protect extensive native prairie remnants adjacent to high- and moderate-priority prairie parkland units.

Strategy

— Use grassland easements and extension agreements, for example, for specialized livestock grazing systems on native prairie, or native grass establishment and management, or to remove “hostile” cover such as trees and tall shrubs that could harbor nest (brood) parasites and nest predators. Certain grazing systems can improve livestock carrying capacity and the condition of annually grazed prairie, to enhance the economic viability of native prairie and reduce chances of conversion to other land uses, especially cultivation.

Rationale and Assumptions

Northern mixed-grass prairie has declined by >70% from its historical extent. More than 1,560 square miles of native rangeland have been converted for agricultural production in North Dakota, South Dakota, and Montana since 1985.

Grassland in McHenry County, including J. Clark Salyer NWR, comprises one of the largest, most contiguous patches of northern mixed-grass prairie remaining in North America. Large prairie patches are more valuable than smaller prairie patches to grassland-dependent wildlife, especially grassland birds (for example, sharp-tailed grouse, upland sandpiper, marbled godwit, and Baird’s sparrow). In addition, large prairie patches have less edge and, therefore, less potential for invasion by introduced cool-season plants (for example, smooth brome). Protecting adjacent prairie from conversion to agricultural production is critical to preserving the integrity of refuge tracts and meeting the goal and objectives for prairie parkland habitat.

Sandhills Goal

Restore and maintain plant communities characteristic of the mid-1800s sandhills within the prairie parkland landscape.

Objective 1

By 1 year after CCP approval, use on-site vegetation inventory data, data from satellite imagery, and landscape considerations to characterize the sandhills, which are embedded within more extensive prairie parkland, as either high or low management priority. Reevaluate prioritization 15 years after CCP approval.

Strategy

— Apply multiple selection criteria.

CRITERIA FOR HIGH-PRIORITY UNITS

Contemporary woodland coverage. A unit is characterized by <30% total cover by trees and tall shrubs (mainly aspen–oak woodland and chokecherry shrubland).

Floristic potential. Vegetation (excluding woodland area) is characterized by >35% mean frequency of pristine, native herbaceous types (plant groups 41–43 and 46–48 [Grant et al. 2004b]) and <10% leafy spurge.

Degree of connectivity to treeless grasslands. The unit is embedded within high-priority prairie parkland units.

NOTE: The remaining sandhills are low priority for management, mainly dominated by woody plants or leafy spurge or both.

Rationale and Assumptions

Criteria used to prioritize management units reflect three important issues affecting ecological integrity of sandhills: (1) trees and tall shrubs compromise integrity of native prairie; (2) woody plants are detrimental to grassland birds as an ecological group; and (3) more intact native-dominated plant communities are more likely to be restored than sandhills invaded by woody and introduced plants.

Objective 2

On high-priority units, by 15 years after CCP approval, restore two representative examples of sandhills to the following standard: (1) reduce aspen woodland to <10% coverage while retaining all oak savanna; (2) reduce leafy spurge to <5% composition, contingent on finding an effective, widely applicable method to control leafy spurge; and (3) contingent on *(2)*, apply leafy spurge control to low-priority sandhills.


Gary Eslinger/USFWS

Aspen in the Sandhills

Strategies

- Use high-intensity spring fires (late-March to April, prior to leaf-out) to initially kill mature aspen trees. Within 4 years, again use fire during the dormant season (spring or fall) to reduce viability of aspen clones, especially dense aspen suckers. Continue control of trees and tall shrubs with periodic fire (every 6–10 years) applied from March to November.
- Where access allows, experiment with control of leafy spurge using Plateau® herbicide. Release flea beetles (*Apthona* spp.) in patches of leafy spurge growing on various microsites. If flea beetles become locally adapted to survive on sandy sites, begin wide-scale releases to control leafy spurge.
- Until leafy spurge can be controlled, exclude livestock grazing from the sandhills. Soil disturbance associated with grazing hastens the spread of leafy spurge.

Rationale and Assumptions

This objective extends restoration objectives for the prairie parkland to the high-priority sandhills.

The sandhills are imbedded within the more extensive prairie parkland and, like prairie parkland, the sandhills prairie has been degraded by trees and tall shrubs. Most oak–savanna characteristic of the 1850s has been converted to closed canopy aspen–oak woodland. Oak savanna is maintained by periodic ~~fires~~ that reduces the cover of aspen, chokecherry, and other woody plants. Oak savanna is important habitat for lark sparrow, black-and-white warbler, orange-crowned warbler, pocket gopher, and American badger.

The most pristine native plant assemblages at J. Clark Salyer NWR occur within the sandhills where soils and topography limit invasion by introduced cool-season plants. Leafy spurge and, to a lesser extent, Kentucky bluegrass threaten the sandhills prairie. Periodic fire reduces Kentucky bluegrass on harsh sites in the sandhills. In contrast, leafy spurge is adapted to sandy soils and thrives within the varied slope and aspects characteristic of the sandhills. Based on recent inventories, leafy spurge composes 17% of contemporary cover in the sandhills. Biological control efforts have been ineffective on similar sandy sites throughout North Dakota. Furthermore, the sandhills are mostly inaccessible, limiting chemical control options. It may take a decade or more to find an effective biological control for leafy spurge growing in the sandhills.

Old Cropland Goal

On high-priority old cropland areas, establish native-dominated, perennial herbaceous cover that, with modest management, resists invasion by introduced cool-season grasses and noxious weeds. This seeded cover will help form extensive, contiguous blocks of structurally diverse, open grassland for grassland-dependent, breeding bird species.

Objective 1

By 10 years after CCP approval, locate and determine boundaries of old cropland areas and record these in the refuge's GIS database.

Strategies

- Identify old cropland areas, including those considered DNC, that were seeded to introduced grasses and forbs and/or native grasses since the mid-1970s.
- Identify other old cropland areas, as evidenced by
  - ❒ distinct field edges, especially deep furrows and linear piles of wind-borne topsoil that had been deposited along preexisting fence lines and subsequently vegetated;
  - ❒ rock piles or rocks strewn linearly along what appears to be a field edge (although rock sometimes was cleared for native hay harvests);
  - ❒ nearly monotypic stands of smooth brome, typically with some Kentucky bluegrass but with little native sedge in the understory (several native plant species often reinvade these stands, such as western snowberry, Wood's rose, white sage, western yarrow, several goldenrod species, and silver scurfpea);
  - ❒ no partly buried rocks with profuse lichens;
  - ❒ no clubmoss or cryptogamic crust.

— Use acquisition records, old refuge narratives, 1938–1939 aerial photographs, and U.S. Soil Conservation Service records for ancillary support.

— Flag the probable boundaries of areas verified as old cropland, record via GPS, and upload into the refuge's GIS database.

Rationale and Assumptions

Furrows and other linear disturbances caused by implements (for example, plows, disks, and seed drills) are much more evident after an area is treated with prescribed fire or heavily grazed. They are also more readily detected from horseback. Evidence of soil A-horizon disturbance due to cultivation may be determined by NRCS staff. Some areas with signs of farming disturbance (for example, furrows) may have been cropped only for a few years circa 1900–1930 or may have been broken during this period yet never cropped. Such areas often are successfully reinvaded by native plants, and may currently support native vegetation at levels approaching the most pristine areas on similar site types on the refuge that are considered native sod.

Objective 2

Within 15 years after CCP approval, convert at least 10 old cropland units to vegetation dominated by several species of native warm-season grasses that vary in stature and growth form, and that include several species of native forbs wherever possible. Give priority to units with stands of vegetation that have become decadent and overrun by undesirable, introduced cool-season grasses, especially where such units are adjacent to or within high-priority drift prairie units or high-priority prairie slope units.

Strategies

— Following multiple applications of a broad-spectrum herbicide, seed a native plant mixture that mainly consists of 80–90% warm-season grass species especially big bluestem, little bluestem, switchgrass, and sideoats grama.

— During the first 3–4 years after seeding, annually mow the stand with a hay conditioner and harvest the hay. Substitute grazing or prescribed fire treatments in the subsequent 3–4 years. Use herbicide spot spraying or "interseeding" where necessary.

Rationale and Assumptions

Although initially expensive, native warm-season grasses are economically and ecologically superior to seeded stands of introduced plants in old croplands because

— permanent, perennial cover eliminates regular (every 12–14 years) replacement of seeded, introduced species cover via a farming cycle and thus nearly eliminates potential for soil erosion;

— native grasses reduce local habitat fragmentation and eliminate "edge" associated with the farming cycle;

— a warm-season growth strategy for plants vastly improves the capacity for an assemblage of plants to outcompete smooth brome, mainly by affording broader and more effectively timed management opportunities;

— there is improved opportunity for prescribed burning in late spring compared to high-priority drift prairie units because the warm-season-dominated cover has relatively high fuel value through early June (versus mostly green vegetation on cool-season-dominated cover on the drift prairie by late May);

— there is a broader window (later in summer) for harvest of hay that still has forage value;

— native grasses are in compliance with policy that discourages planting of introduced species on Service lands and encourages planting of native species (National Wildlife Refuge System Biological Integrity, Diversity, and Environmental Health, 601 FW 3, 2001);

— native grasses reduce "source sites" from which introduced and weedy plants invade adjoining native prairie;

— native grasses have improved and longer-lasting structural diversity within stands.

Objective 3

By 10 years after CCP approval, identify other old cropland areas (those not known to have been seeded since the mid-1970s) that are high management priority (areas most important to convert to native warm-season grasses). Develop a detailed plan to convert these during the subsequent 10–15 years to vegetation dominated by several species of native warm-season grasses that vary in stature and growth form, and that include several species of native forbs wherever possible.

NOTE: There are no goals and objectives for remaining old cropland areas in uplands. They are low priority and would be managed with adjoining habitats.

Gary Eslinger/USFWS

Spiderwort in a Hay Meadow

Strategy

— Apply multiple selection criteria.

Criteria for High Management Priority Old Cropland in Uplands (excluding DNC and other old cropland known to have been seeded since the mid-1970s)

Floristic Composition. Vegetation is characterized by <20% mean frequency of pristine, native herbaceous types (plant groups 41–43 and 46–48 [Grant et al. 2004b]) plus native herbaceous-dominated vegetation with Kentucky bluegrass as the main subdominant (plant group 53).

Floristic Potential. Vegetation is characterized by >20% mean frequency of smooth brome-dominated types (plant groups 54, 61, and 62).

Landscape Context. The unit has no size criterion

and

bears clear evidence of a farming history

and

is contiguous with high-priority drift prairie, prairie slope units, or tracts of native prairie adjacent to the refuge under non-Service ownership.

Rationale and Assumptions

Native grass and forb seed is very costly, as is the time and expense of materials needed to prepare seedbeds, plant seed, and annually manage newly seeded areas, per strategies and rationale listed under objective 2.

Old cropland that adjoins high-priority drift prairie or prairie parkland and supports little native herbaceous vegetation likely is a source of invasion by undesirable, introduced grasses and weedy forbs. Without attempts to establish native vegetation through seeding, such areas are unpromising candidates for restoration to grassland in which native herbaceous plants are evident, much less an important codominant component. This includes areas that were farmed for 5–10 years before refuge establishment—presumably, before smooth brome and Kentucky bluegrass were widely distributed—that may have been reinvaded by native plants. These areas may have restoration potential that at least equals that of adjoining, high-quality drift prairie or prairie parkland.

Objective 4

After seeding and establishing native warm-season plants in an old cropland unit, maintain native plants as the most dominant vegetation cover, per qualitative estimation.

NOTE: There are no goals and objectives for other old cropland units (those not yet converted to warm-season-dominated communities); they are low priority.

Strategies

— Seeded warm-season stands of herbaceous plants should be well established 5–8 years after seeding; manage these by a disturbance treatment about every 2–3 years. They probably can be disturbed more flexibly with regard to phenology, mainly to discourage smooth brome invasion.

— Use grazing as an alternate management treatment and take advantage of the wide, spring-grazing window afforded by the warm-season-dominated community.

— Integrate management with that of surrounding drift prairie while focusing on treatment approaches that promote native warm-season plant species.

— In the interim between prescribed burns, possibly harvest hay every 2–3 years from old cropland units, alternating among July, August, and September to favor warm-season grasses.

— If and where occasionally needed along unit boundaries, use herbicides to reduce encroaching, introduced cool-season grasses and release native warm-season plants. Use integrated pest management to treat local infestations of noxious weeds as needed.

Rationale and Assumptions

The warm-season growth strategy for plants vastly improves the capacity for an assemblage of grassland plants to outcompete smooth brome—by which seeded islands of introduced grasses and forbs are most typically degraded—mainly by affording broader and more effectively timed management opportunities.

Objective 5

Within 15 years of CCP approval, eliminate planted tall shrubs and trees and any naturalized, nonnative woody vegetation that occurs within or adjacent to high-priority old cropland areas as they are being restored to native-dominated vegetation.

Strategy

— Remove tree–shrub plantings by mechanical means (for example, cutting ash trees by hand; shearing caragana shrubs with a tractor blade or bucket during winter); follow by herbicide treatment of stumps; or follow by broadly applied herbicide, rotary mowing, and/or prescribed burning of resprouting vegetation wherever necessary.

Rationale and Assumptions

Trees and tall shrubs can diminish the survival of nests of grassland birds by harboring potential nest predators. They also provide perches from which brown-headed cowbirds can find other species' nests in which to lay eggs. Furthermore, recent data from the Souris River basin refuges indicate that relatively small areas of tall woody vegetation can effectively fragment grassland habitats and cause many grassland bird species to avoid entire landscapes. Elimination of tall woody cover is a logical strategy for restoration of landscape structure and plant community makeup, and to improve the attractiveness and security of the habitat for a variety of grassland breeding bird species.

Objective 6

By 2 years after CCP approval, develop and implement an effective, practical comprehensive plan for integrated control of noxious weeds in DNC and other old cropland areas in the riparian zone. In these areas, continue to maintain perennial herbaceous cover comprised of introduced species and native plant species, or both, and the vegetation should present the following characteristics:

- About one-half of the area in 0- to 1-year postdisturbance and one-half in 2–3 years postdisturbance; corresponds roughly to a structure of 0–3.9 inches VOR and >3.9 inches VOR, respectively (mean VORs in early spring, per Robel et al. 1970).
- Native trees and tall shrubs compose <0.2% land cover on each old cropland area.
- Leafy spurge frequency is maintained at <2% frequency, absinth wormwood is actively controlled, and yellow toadflax and other newly appearing species of noxious weed that pose a threat to the drift prairie are eliminated within 5 years of initial detection. Canada thistle control is a low-priority weed control issue (mean frequency <25%).

Strategies

— Use hay harvest or fire at least every third year to maintain plant species vigor and vegetation structure and to control plant litter accumulation.

— Annually survey for noxious weeds. Continue widespread use of biological control by monitoring local areas for *Apthona* spp. beetles and redistributing beetles among leafy spurge patches as needed. Use herbicides as needed, especially along boundaries with private lands.

— Review and update the weed management plan, detailing specific methods and timetables for managing noxious weeds in old cropland areas of the riparian zone.

Rationale and Assumptions

Smooth brome, quackgrass, and Kentucky bluegrass dominate old cropland in riparian areas. These areas have relatively moist, deep silty loams that are particularly suitable for these introduced grass species and allow them to outcompete nearly all native herbaceous species. There currently are no practical avenues for sustainably converting these areas to more desirable stands of native herbaceous vegetation. There are, however, practical methods for simultaneously controlling most species of noxious weeds and providing vegetation structure that is attractive to grassland bird species native to the region. These birds prefer relatively dense, tall grassland vegetation and include mallard, northern harrier, Le Conte's sparrow, and bobolink.

In addition to removing litter, periodic prescribed fire would slow or reverse invasion by woody vegetation such as western snowberry and willow.

Canada thistle is a noxious weed that tends to pervade and persist in disturbed soils of the riparian zone at J. Clark Salyer NWR. This thistle is variably common across the region's cultivated lands, mainly due to its prolific production of highly mobile, wind-borne seed. This weed species cannot be controlled consistently by available means within most of the refuge's riparian zone. This is mainly because the soils typically are too damp in late spring and early summer to support wheeled vehicles that would apply herbicides at an appropriate time for effective control. Aerial application is possible in some areas, but tends to be more costly and controversial. Aerial application is more difficult to administer than ground-spraying, and adjacent areas of habitat or privately owned land may be subjected to overspray.

Regular monitoring and control of other noxious weed species such as leafy spurge and wormwood are more crucial than control of Canada thistle, and are far more gratifying (in terms of available methods of biological and other nonchemical controls, and overall costs versus benefits).

Riparian Woodland Goal

Maintain the approximate presettlement extent of green ash–American elm riparian woodland within the floodplain of the Souris River to benefit a broad suite of woodland-associated, breeding bird species.

Objective 1

By 10 years after CCP approval, complete a baseline floristic inventory of riparian woodland.

Strategy

— Use a modified James and Shugart (1970) method to inventory floristic composition and stand structure of all riparian woodland.

Rationale and Assumptions

Vegetation composition and structure of riparian woodland has not been inventoried, nor have breeding bird communities. Qualitative observations suggest that most American elm has been lost to Dutch elm disease.

Objective 2

Maintain, in perpetuity, the presettlement extent of riparian woodland. Explore methods that restore American elm as a codominant tree species of riparian woodland communities.

Strategies

— Use aerial photos and satellite imagery to periodically assess changes in the extent of riparian woodland.

— Assess methods to control Dutch elm disease including (1) biological control of the fungus or of native and introduced elm-bark beetles that spread the disease, and (2) development of disease-resistant cultivars of American elm adapted to survive severe North Dakota winters.

— Because ash–elm riparian woodland is fire intolerant, suppress and control fires. Since the potential long-term effects of alterations in the hydrology (especially hydroperiod) of the Souris River are unknown; carefully investigate even minor changes in woodland extent or composition.

Rationale and Assumptions

The extent of riparian woodland has changed little since the presettlement period. However, some meadow has been invaded by aspen–balsam poplar woodland and willow shrubland, which may succeed to ash–elm woodland, thereby expanding riparian woodland cover.

Contemporary riparian woodland forms large, extensive patches of mature, closed-canopy woodland. These woodlands are important habitat for forest-interior migratory birds such as northern waterthrush, red-eyed vireo, and American redstart. Great blue heron and black-crowned night-heron colonies also are found in riparian woodland.

Lee Karney/USFWS

Black-crowned Night-heron

Meadow Goal

Restore and maintain extensive examples of plant communities dominated by native flora characteristic of seasonally flooded meadows within the Souris River floodplain to attract grassland- and wetland-dependent bird species and other wildlife.

Objective 1

By 1 year after CCP approval, use on-site vegetation inventory data, data from satellite imagery, and landscape considerations to characterize meadows as high, moderate, or low management priority. Reevaluate prioritization in 15 years after CCP approval.

Strategy

— Apply multiple selection criteria.

CRITERIA FOR HIGH-PRIORITY UNITS

Contemporary tree and tall shrub coverage. A unit is characterized by <15% total cover by trees and tall shrubs (mainly aspen–balsam poplar woodland and willow shrubland). Some meadows may have significant continuous woody cover around unit perimeters, but little willow or aspen in unit interiors.

Floristic potential. Vegetation (excluding woodland area) is characterized by >15% mean frequency of pristine, native herbaceous pristine types (low prairie and meadow types [plant groups 43 and 46, modified from Grant et al. 2004b] and less than 10% reed canarygrass [plant group 78]).

Degree of connectivity to treeless grasslands. A unit is adjacent to a large meadow, a high-priority prairie parkland unit, or native grassland.

CRITERIA FOR MODERATE-PRIORITY UNITS

Contemporary tree and tall shrub coverage. A unit is characterized by ≤30% total cover by trees and tall shrubs (mainly aspen–balsam poplar woodland and willow shrubland). Some meadows may have significant continuous woody cover around unit perimeters, but little willow or aspen in unit interiors.

Floristic potential. Meadow may be degraded by introduced grasses, especially quackgrass, smooth brome, and reed canarygrass.

Degree of connectivity to treeless grasslands. The unit is either adjacent to a large meadow, a high-priority prairie parkland unit, or native prairie grassland.

NOTE: The remainder low-priority meadows occur when willow and aspen have mostly replaced herbaceous plants; these units have little restoration potential.

Rationale and Assumptions

Criteria used to prioritize units recognize two issues that compromise grassland, including meadow: (1) tall woodland plants are detrimental to grassland birds as an ecological group and to the ecological integrity of meadow, and (2) more intact native-dominated plant communities are more likely to be restored than meadows invaded by woody and introduced plant species.

Objective 2

Within 15 years of CCP approval, restore vegetation to the following standards on high-priority meadows, mainly as habitat for grassland- and wetland-dependent bird species. Meadow units include

- <10% cover of woody vegetation taller than 3 feet;
- >40% cover of low prairie and meadow types (plant groups 43 and 46).

Strategies

— Use cooperators to biannually clip (hay) meadow vegetation to control willows <3 feet tall. Use a drum chopper or hydro ax to remove taller woody vegetation. Meadows may be clipped every year (for several years) following extensive flooding.

— Reintroduce fire to control woody vegetation and litter.

— Locate and control leafy spurge. Experiment with control of leafy spurge using Plateau® herbicide. Release flea beetles (*Apthona* spp.) in patches of leafy spurge growing on various microsites, including meadow–woodland edges. Use fire or a combination of haying and raking to reduce litter on sites for flea beetle releases. Once flea beetles become locally adapted to meadow sites, begin wide-scale releases to control leafy spurge.

— Experiment with the timing of fire to reduce cool-season quackgrass and increase warm-season prairie cordgrass.

— Experiment with methods to control isolated patches of Canada thistle and reed canarygrass. (such as chemical, biological, and "interseeding" methods).

Rationale and Assumptions

This objective—which focuses on restoration of open, treeless meadows and on increasing native plant diversity—addresses the two imminent threats to meadow habitat: (1) expansion of tall shrubs and trees; and (2) invasion of introduced plants, especially quackgrass, reed canarygrass, Canada thistle, and leafy spurge.

Since 1938, tall shrub and tree cover in meadow increased from 3% to 26%. Clipping at a frequency ≤2 years appears effective in controlling trees and shrubs. When the interval between clippings increases, willows cannot be controlled by haying. In these cases, mechanical treatment using a hydro ax or drum chopper is effective. Meadows with >10–20% shrub and tree cover are avoided by several grassland bird species such as bobolink, sedge wren, and Le Conte's sparrow.

Meadow is a transitional habitat on the Souris River basin refuges, supporting both wetland and upland prairie plants, depending on moisture cycles. Quackgrass, reed canarygrass, Canada thistle, and leafy spurge degrade native grass–sedge–rush communities. Meadow vegetation evolved with periodic disturbances including flooding, grazing by elk and bison, and fire. Proposed strategies should favor native species (adapted to these disturbances) over introduced species.

In restorations, vegetation composition is considered along a habitat continuum, where plant communities are separated by degree of invasion by undesirable plants. A continuum for meadow (least desirable vegetation to the left) is: mature woodland ← willow shrubland ← leafy spurge or Canada thistle ← reed canarygrass ← smooth brome or quackgrass ← low shrubs ← native herbaceous vegetation. With management, less desirable plant species are replaced by more desirable plants. For example, it is acceptable in the short term to increase quackgrass cover in areas where willow shrubland has been reduced. Conversely, it is undesirable to replace quackgrass with leafy spurge.

Objective 3

Manage large meadows composed variously of nonnative and native plants to provide a mosaic of relatively short–sparse and tall–dense herbaceous-dominated cover. By 15 years after CCP approval, reduce tall shrub and tree cover to <10% on moderate-priority units.

Strategies

— Use cooperators to biannually clip (hay) meadow vegetation to control willows <3 feet tall. Use a drum chopper or hydro ax to remove taller woody vegetation. Meadows may be clipped every year (for several years) following extensive flooding.

— Experiment with control of leafy spurge using Plateau® herbicide. Release flea beetles (*Apthona* spp.) in patches of leafy spurge growing on various microsites, including woodland edges. Once flea beetles become locally adapted to meadow sites, begin wide-scale releases to control leafy spurge.

Rationale and Assumptions

Moderate-priority meadows are extensively invaded by introduced herbaceous plants (especially quackgrass and reed canarygrass), such that full restoration of native plant assemblages is unlikely. This objective focuses on restoring open, treeless meadows. Reduction in tall woody plants should benefit grassland and wetland birds intolerant of woody plants (see objective 2). Meadows invaded by introduced grasses will benefit these species despite being floristically simple in composition. Such benefits have been noted for sites seeded to introduced grasses, most notably in the CRP (Johnson and Igl 1995).

Leafy spurge is actively controlled because infestations function as "source sites" for spurge invasion into adjacent meadow, prairie parkland, and sandhills habitats. Biological control of leafy spurge using flea beetles has not been tested in meadows, but holds promise as an effective control measure.

Objective 4

Minimally manage low-priority meadows that have mostly shifted from grassland to woodland–tall shrub communities. During the life of the plan, opportunistically rejuvenate 100 acres of willow shrubland to provide structural diversity in willow shrubland.

Strategies

- Under certain circumstances, fire or mechanical treatments may be used to rejuvenate willows in low-priority meadows adjacent to moderate- or high-priority meadows.
- Experiment with control of leafy spurge using Plateau® herbicide. Release flea beetles (*Apthona* spp.) in patches of leafy spurge growing on various microsites. Once flea beetles become locally adapted to meadow sites, begin wide-scale releases to control leafy spurge.

Rationale and Assumptions

Large patches of shrubland–woodland have irreparably replaced grass–sedge–rush communities such that restoration of these meadows is unlikely. Willow shrubland provides unique habitat for some species, especially willow flycatcher, yellow warbler, black-billed cuckoo, common yellowthroat, moose, and white-tailed deer.

Leafy spurge is commonly associated with aspen and willow patches that have invaded meadow sites. Many areas are inaccessible to vehicles and thus difficult to treat using herbicides. These infestations function as source sites for spurge invasion into adjacent meadow, prairie parkland, and sandhill habitats. Biological control of leafy spurge using flea beetles has not been tested in meadows, but holds promise as an effective control measure.

Cornell Lab of Ornithology/USFWS

Yellow Warbler

Wetland Goal

Manage riverine wetlands, including marshes and lakes, to sustain the long-term capacity of riverine wetlands to support diverse plant and wildlife communities. Restore ecological processes that sustain long-term productivity of wetlands.

Objective 1

Within 5 years of CCP approval, synthesize available information on the effects of physical alterations, altered hydrology and hydroperiod, increased sedimentation, and changes in water quality of the riverine system, past and present: (1) develop a report to describe consequences of these alterations on long-term viability of riverine marshes, (2) determine biological potentials and constraints for each wetland impoundment, and (3) develop criteria to prioritize impoundments with the greatest potential for sustained productivity.

Strategies

- Use past narratives, aerial photographs, unpublished refuge files, and scientific literature to evaluate the biological potential of wetland impoundments and prioritize units for management.
- Map physical areas within each impoundment that are expected to respond to management.
- Develop and prioritize a list of knowledge gaps and research needs.
- In cooperation with USGS's Northern Prairie Wildlife Research Center, complete sediment accretion study and contaminants studies.
- Monitor groundwater and soil moisture levels in impoundments and within the adjacent meadow zone.

Rationale and Assumptions

This objective focuses on compiling past and current data regarding development and management of the Souris River wetlands. Although riverine wetlands form one of the most extensive and important habitats at J. Clark Salyer NWR, site-specific information is limited regarding effects of habitat management (especially water level management) on vegetation structure and composition, species diversity and density of aquatic invertebrates, and wetland-dependent bird species. Models for managing northern prairie wetlands exist, but their utility is limited for managing riverine marshes at the Souris River basin refuges, primarily because impoundments include flow-through of the Souris River (which limits wetland management capabilities).

This objective requires compilation of existing wetland management records along with a clear, succinct treatment of threats and management opportunities and limitations for riverine wetlands. A biological assessment of wetland conditions for the Souris River basin refuges was completed recently by Laubhan and others (2003); this report provides a basic start in meeting this objective and those that follow.

Objective 2

Within 15 years of CCP approval, evaluate and comprehend crucial ecological processes that maintain long-term wetland productivity. Develop a range of biological indicators (for example, decline of important wetland plant or invertebrate species, shifts in extent and juxtaposition of emergent or submerged aquatic emergent vegetation) useful in the implementation of management strategies (for example, water level management, prescribed fire) intended to maintain long-term wetland productivity.

Strategies

— Complete development of a USGS computer application that uses long-term flow data from gauging stations to assess effects associated with long-term alterations in river hydrology and hydroperiod on wetland plants, wildlife, and (ultimately) the potential to sustain long-term wetland productivity. Particularly important is monitoring flows that cross international boundaries. Additionally, monitor inflows at major tributaries as necessary.

— In cooperation with USGS's Northern Prairie Wildlife Research Center, complete a sediment accretion study and determine impacts of sedimentation for long-term management of riverine marshes.

— In cooperation with the USGS and others, develop detailed contour maps of marsh bottoms for all impoundments to help construct models that predict vegetation response to water level management.

— In the absence of full restoration of the natural hydrograph and hydroperiod of the Souris River, study the economic, physical, and biological feasibility of constructing a major bypass channel to improve management of (1) pools 320, 326, and 332; (2) the Benson subimpoundment; and (3) the Redhead Unit.

— Develop a method to inventory contemporary vegetation communities in managed wetlands. Develop methods for long-term monitoring of wetland vegetation.

— In cooperation with the USGS and others, use information derived above to develop predictive models that determine effects of water management (especially hydroperiod) on wetland plants, invertebrates, and migratory birds; redefine objective 1.


USFWS

Pool 320 at J. Clark Salyer NWR

Rationale and Assumptions

This objective focuses on synthesizing existing scientific research on wetland function and cycles in northern prairie wetlands and impounded riverine wetlands. It also prompts site-specific inventory, monitoring, and research to support management of riverine marshes.

A biological assessment of wetland conditions for the Souris River basin refuges was completed recently (Laubhan et al. 2003). This report provides context for the original construction and subsequent physical and operational modifications to the managed wetland system at the Souris River basin refuges. Additionally, long-term threats to the system are discussed. However, past management of riverine wetlands has been based more on "gut feeling" and politics than on sound science. Site-specific data are lacking regarding effects of wetland management on vegetation structure and composition, aquatic invertebrate densities, and species of wetland-dependent wildlife.

Relative to upland habitats, managers have less effective control over wetland systems, due in part to the following:

— misunderstandings about the biological significance of drought and complete drawdown, dating back to the original construction of wetland impoundments;

— significant physical limitations of constructed impoundments, especially the lack of independence among adjacent wetland units when manipulating water levels;

— inherent difficulties in conducting basic inventory, long-term monitoring, or applied research in wetlands relative to upland sites.

Objective 3

During the 15 years after CCP approval, develop and implement a new management philosophy that emphasizes long-term wetland productivity over older models based on (1) political management based on 5-year cycles, (2) "oasis" management, where wet acres are maximized especially during extreme drought, or (3) maximizing years of "hemi-marsh" conditions.

In high-priority impoundments, use periodic disturbance to provide the full spectrum of wetland conditions—for example, (1) dry marsh, (2) densely vegetated marsh (regenerative phase), (3) hemi-marsh, (4) open marsh (degenerative phase), and (5) open water—to benefit wetland-dependent species of wildlife.

Strategies

— Re-create, where possible, the natural hydrology and hydroperiod of the Souris River. In most areas, physical disruptions and conflicts among water users compromise the degree to which this strategy can be carried out. Focus management on units that have the greatest potential for sustained productivity (from objective 1).

— Use natural climatic fluctuations to increase wetland management opportunities. Periodic drought may hasten full or partial drawdowns in some units. Although such drawdowns maximize the long-term viability of wetlands, the availability of wetlands with water is reduced during drought. In contrast, previous management emphasized retaining as much water as possible to offset landscape-level drought effects on migratory birds at the expense of long-term capacity to sustain wetland productivity in refuge impoundments.

— Confine major releases from upstream reservoirs to the period from September to May, reducing extended inundation during the growing season when most wetland birds are nesting. Ideally, releases from Canada to the United States should occur according to the natural hydroperiod as identified in the international agreement for the Souris River basin (United States and Canadian Negotiating Delegation 1989).

— Use water stored in Lake Darling to supplement spring and summer flows at J. Clark Salyer NWR (1) during extended or extreme drought, or (2) during the regenerative marsh phase following drawdown of priority impoundments.

— Use periodic, growing-season drawdown over multiple seasons if required to (1) stimulate production of seed-bearing annual plants, (2) increase invertebrate biomass, and (3) stimulate establishment and expansion of emergent and submergent plant species.

— During the drawdown phase, use additional disturbance, especially prescribed fire, mechanical soil treatment (for example, disking and sheep-foot packer), and defoliation (haying or grazing) to (1) increase vegetation and invertebrate response during the regenerative phase, and (2) to control robust emergent vegetation.

— Use periodic water level management and muskrat herbivory to reduce robust emergent vegetation, especially cattail and common reed.

— Periodically use aerially applied herbicides to reduce the extent of monotypic emergent vegetation in portions of impoundments that, historically, do not respond (water levels >3 feet cannot be attained during the growing season).

— Obtain remaining prescriptive water rights through North Dakota State Water Commission. Buy additional water rights.

— Detect and eliminate purple loosestrife and salt cedar.

— Maintain the carp-free status.

— As the final water user in the United States portion of the Souris River, supply the North Dakota obligation of 20 cfs to Manitoba, Canada from June 1 through October 31, unless certain drought conditions exist.

Rationale and Assumptions

This objective focuses on implementation and management, using the best available science. Historically, conflicts in direction for wetland management have occurred among various water users of the Souris River. Past management goals and objectives rarely addressed or incorporated unforeseen impacts related to the physical disruptions of the river (original construction of dikes and dams), or changes in habitat (biotic and abiotic) resulting from these events. Inevitable decreases in water quality and in marsh management capabilities—especially because of accretion of sediments—are assumed, based on current knowledge of this and similar impounded riverine marshes in the northern Great Plains.

Productivity of northern prairie wetlands historically was maintained by periodic wet and dry cycles. Productivity is particularly enhanced during reflooding following natural drought or drawdown (in managed wetlands). Riverine marshes have an inherent reduced capacity to be dewatered during the growing season because the river flows through each impoundment. Departures from the normal hydroperiod, ill-timed upstream water releases, or significant summer rains can render prescriptive drawdowns ineffective because marsh sediments never dry sufficiently to (1) oxidize soils, (2) establish wetland plants (important waterfowl foods and a substrate for invertebrate production), or (3) establish perennial emergent and submergent vegetation (food cover and invertebrate substrate). Furthermore, control of robust emergent plants (cattail, common reed, and bulrush) becomes difficult because of continued anoxic (absence of oxygen) conditions resulting in little reduction in organic material in marsh soils. Consequently, wetlands often cycle rapidly between open water and a dense-vegetated marsh phase, both of which are less productive than intervening stages. Because attainment of the periodic dry marsh phase is a significant factor limiting long-term wetland function, periodic drawdowns are emphasized under this objective. By necessity, wetland management would become more opportunistic, often working in conjunction with wet and dry cycles to achieve management objectives.

Objective 4

Over the course of the CCP, introduce efforts on a watershed level that reduce sedimentation and nonpoint source pollution and/or their effects on riverine marshes.

Strategies

- Develop models—similar to the "mallard model" developed by the HAPET—that target areas within the watershed (for example, adjacent to major tributaries or drainage systems) that have the highest potential for sediment transport, especially during extreme rainfall or snowmelt events.
- Use models to target areas for conversion from cropland to grassland via USDA's CRP, Wetland Reserve Program, or other USDA conservation initiatives. Identify drained wetlands within targeted areas for restoration. Initiate and develop additional conservation measures that reduce or mitigate impacts from sedimentation and pollution.
- Work with the NRCS to ensure compliance with "Sodbuster," "Swampbuster," and other provisions in the Farm Bill (current and future) that reduce soil erosion.
- Explore construction of sediment traps to reduce the extent of sediment accumulations. Where management capability has already been reduced, explore the feasibility of dredging to reduce accumulated sediment in certain impoundments.
- Protect native prairie and prairie wetlands within target areas or adjacent to the refuge, using perpetual easements.
- In cooperation with the USGS, the state of North Dakota, and the USACE, monitor and document sediment loads and water quality associated with various flows. Consider passing flows that contain high sediment loads or that significantly reduce water quality.

Rationale and Assumptions

Initial samples collected at the Souris River basin refuges document only slightly elevated levels of sediment accretion for most impoundments. However, over many decades, sedimentation is expected to continue to the point where storage capacity (water depth) of pools would decline. This would result in reduced capability to manage wetland vegetation, especially robust emergent plants, using water level manipulations. Results from an ongoing sedimentation study at the Souris River refuges are expected to confirm this assumption.

Sedimentation and pollution mainly originate within the watershed, but outside refuge boundaries. Sediment is transported via agricultural runoff carried in major tributaries and wetland drainage projects. Flows that contain high sediment loads or that significantly reduce water quality appear associated with runoff originating from heavy winter snowmelt or significant rainfall events.

Island Goal

Manage islands to attract waterfowl and increase nest survival, especially during drought years when wetland habitat outside of the Souris River basin refuges is limited.

Objective 1

By 1 year after CCP approval, prioritize nesting islands based on waterfowl nest densities, nest survival, and maintenance costs.

Strategies

- Use data from nest studies (1992–1994) to evaluate nesting islands for waterfowl production. Prioritize management of islands far from shore—with a large open-water barrier surrounding the island—and islands with extensive cover of low shrubs.
- Identify islands that are high maintenance, especially those that are prone to extensive erosion.

Rationale and Assumptions

Island management would be lower priority for restoration than other, more extensive, habitat types. Therefore, limited resources expended on island management should target islands with the greatest potential to produce waterfowl. Use of nesting islands by waterfowl has been intensively studied at J. Clark Salyer NWR since 1950, and criteria useful in prioritizing islands are readily available.

Objective 2

During drought conditions, maintain 70% apparent nest survival on 20 islands most attractive to waterfowl. Within pools 320, 326, and 332, island objectives remain secondary to marsh management objectives that enhance long-term wetland productivity.

Strategies

- Manage islands for the following characteristics: (1) large open-water barrier surrounding an island, (2) open shoreline without tall emergent vegetation, (3) far from the mainland, and (4) cover dominated by shrubs, grasses, or tall forbs. Achieve this with the following strategies: (1) water level management, (2) herbicide application to reduce emergent cover surrounding an island, and (3) cover manipulation using plantings and prescribed fire.
- Trap predators such as skunk, raccoon, and mink soon after ice-out in the spring, during drought years or when staff and funding are available. The spring window for effectively capturing mink is narrow; capture is unlikely once nesting has begun.
- Additionally, control mink populations by reducing muskrat populations (the major winter food source of mink). Use partial winter drawdowns to control muskrat populations.
- Remove nesting islands with a history of low nest densities and/or low nest survival. Some islands with low nest survival can be burned in late-April or May to discourage waterfowl nesting.

Mink
© Cindie Brunner

Rationale and Assumptions

The J. Clark Salyer NWR has more than 50 nesting islands that vary in attractiveness to nesting waterfowl. Some islands can support densities of more than 400 nests per acre during drought years. Other islands are rarely used or have perpetually low nest survival; these islands should be removed when funding and winter access allows.

Island objectives remain secondary to marsh management objectives that maintain long-term wetland productivity. Periodic water management, for example, holding water level high to facilitate muskrat herbivory, may conflict with maintenance of predator-free nesting islands (mink numbers are mainly influenced by winter muskrat populations). Summer drawdowns limit the utility of nesting, especially during drought years.

Cultural Resource Goal

Discover and protect cultural resources and interpret sites when the interpretation does not adversely affect habitat management.

Objective 1

Within 15 years of CCP approval, identify refuge cultural resources and protect them from degradation.

Strategies

- Complete a cultural resources survey as needed when new projects may disturb refuge lands.
- Protect known cultural resources by minimizing disturbances in sensitive areas.
- Compile historical records pertaining to cultural resources mainly by consolidating available files and photographs and by interviewing area residents.
- In support of the Archaeological Resources Protection Act, develop a plan for managing refuge archaeological resources.

Rationale and Assumptions

There are limited resources (funding and staff) that would be allocated yearly to the refuge. The priority for these funding and staffing resources is to protect and manage upland and wetland habitats for wildlife. Protection of cultural resources is an integral part of the purpose. All cultural resource laws and policies would be complied with to prevent the destruction of known and unknown sites.

Objective 2

Within 10 years of CCP approval, promote interpretation and protection of cultural resources and their importance to refuge wildlife and habitat resources.

Strategies

- Enhance the understanding of the CCC Camp BF-4, Company 766 site by establishing an interpretive area that describes the work of the CCC in early development of refuge infrastructures.
- Add an on-site kiosk and headquarters' brochures to identify the Woods End and the Steven's Ranch sites.

Rationale and Assumptions

Protection and interpretation of cultural resources at the refuge, especially those that relate to the wildlife and habitat found there, would help visitors understand some of the environmental changes that have taken place. Interpreting the work of the CCC in developing much of the early refuge infrastructure would allow visitors to understand the importance of habitat management and restoration. The Steven's Ranch would serve as an example of the role grazing—first by wildlife, then by livestock—had in maintaining and changing native prairie grasslands.

Visitor Service Goal

Provide wildlife-dependent recreational opportunities to a diverse audience when the administration of these programs does not adversely affect wildlife and habitat management.

USFWS

Hunting White-tailed Deer at J. Clark Salyer NWR

Hunting Objective

Within 5 years of CCP approval, provide hunting opportunities for 1,000 visitors when resources needed to administer these programs do not adversely affect the refuge's ability to implement habitat management. Provide hunters with safe, reasonable harvest opportunities; uncrowded conditions; minimal conflicts with other users; and satisfaction with their overall experiences.

Strategies

- Annually determine whether resources (funding and staff) would be available to provide hunting opportunities at the current level.
- When compatible, add other designated game animals to the list of species open for hunting.
- Continue to work with the NDGF to provide quality hunting opportunities.
- When compatible, on request, provide special use permits for hunters with disabilities.
- Enhance public understanding of refuge hunting opportunities by regularly updating hunting brochures, signs, and the refuge website.
- Increase the visibility of refuge law enforcement to seek compliance with regulations to ensure ethical hunting.

Rationale and Assumptions

There are limited resources (funding and staff) allocated yearly to the refuge. The priority for these resources is to manage upland and wetland habitat. Hunting programs would be allowed if resources needed to administer hunting would not materially detract from habitat management. The Service intends to keep the present level of programs, unless funding or staffing shortfalls increase. The greatest expenses for the hunting program are for law enforcement and printing of hunting brochures.

The draft compatibility determination for recreational hunting is in appendix P.

Fishing Objective

Within 5 years of CCP approval, provide fishing opportunities for 1,000 anglers when resources needed to administer the program do not adversely affect the refuge's ability to implement habitat management. Provide anglers with safe, reasonable harvest opportunities; minimal conflicts with others; and satisfaction with their overall experiences.

Strategies

- Annually determine whether resources (funding and staffing) would be available to provide fishing opportunities at the current level.
- Provide anglers with disabilities with the current level of fishing opportunities and explore ways to expand access.
- Continue to work with the NDGF to provide quality fishing opportunities.
- Enhance public understanding of refuge fishing opportunities by regularly updating fishing brochures, signs, and the refuge website.
- Increase the visibility of refuge law enforcement to seek compliance with regulations to ensure ethical fishing.

— Develop cost-effective partnerships to increase and improve shore-angler access to the water.

Rationale and Assumptions

There are limited resources (funding and staff) allocated yearly to the refuge. The priority for these resources is to manage upland and wetland habitat. Fishing programs would be allowed if resources needed to administer fishing do not materially detract from habitat management. Most fishing opportunities are at bank locations along public roads and along water control structures. Costs to administer this program are limited to law enforcement and brochure printing; no additional expenses are anticipated to occur.

The Service intends to keep the present level of fishing access, unless funding and staffing shortfalls require fishing access to be closed. Fishing opportunities likely would not be expanded. However, partnerships with local sporting groups and outdoor clubs could be used to enhance access for shore anglers.

The draft compatibility determination for recreational fishing is in appendix R.

Wildlife Observation and Photography Objective

Within 5 years of CCP approval, provide wildlife observation and photography opportunities for no less than 6,000 visitors as a result of improved habitat and wildlife diversity.

Strategies

— Develop a short brochure describing opportunities.

— Develop partnerships with local groups to provide birding and other wildlife tours.

— Modify the refuge website to include a current list of wildlife sightings.

Rationale and Assumptions

In a 2003–2004 refuge visitor survey, wildlife observation was ranked the third-largest use by visitors, behind fishing and hunting. Visitors tend to observe and photograph wildlife collaterally at the same time they participate in other wildlife-dependent activities. For example, while fishing, anglers have ample opportunities to see a wide diversity of waterbirds swimming or flying overhead.

The Scenic and Grassland trails, grouse-dancing photo blinds, and viewing platforms near refuge headquarters are the only facilities developed for wildlife observation and photography. Wildlife observation and photography goes hand-in-hand with interpretation and environmental education programs. Although the Service does not plan to expand these facilities, a greater diversity of wildlife would be available for watching and photographing as the habitat improves.

The draft compatibility determination for wildlife observation and wildlife photography is in appendix Q.


Gary Eslinger/USFWS

Sunset at the Redhead Unit

Environmental Education and Interpretation Objective

Within 5 years of CCP approval, provide environmental education programming to no less than 100 students per year. Provide interpretive exhibits that will be viewed by 15 percent of visitors per year. Emphasize learning about natural plant and animal communities, ecological processes, refuge management practices, and restoration of upland and wetland habitat.

Strategies

— Build an interactive website for education and interpretation.

— Write an education and interpretive plan that focuses on enhancing awareness of prairie and wetland ecology and management. Ensure the curriculum is fresh and dynamic and meets the needs of all students and adults.

— Develop strong educational partnerships with schools and other government entities to efficiently tell the refuge story.

— Complete two new kiosks with interpretive panels.

— Complete reconstruction of the Scenic and Grassland trails and development of interpretive panels by the Federal Highway Administration.

— Upgrade and replace interpretive and informational panels throughout the refuge and along the Canoe Trail, so they are consistent with the refuge theme.

— Upgrade the audiovisual equipment and the refuge orientation slide show.

— In cooperation with partners, participate in at least two special events annually to increase visitors' knowledge and understanding of wildlife conservation and related issues.

Rationale and Assumptions

Within commuting distance of J. Clark Salyer NWR is a population exceeding 60,000. There are unlimited opportunities to educate youth about wildlife and habitat of the northern Great Plains and to carry that knowledge into adulthood. The results of a 2003–2004 visitor survey indicated satisfaction with the management of the refuge, and a desire to learn more about the natural resources present and the methods used to manage it.

Unfortunately, the refuge does not have educational facilities or staff to provide this valuable service. The refuge's priority is to manage habitats to prevent degradation. Improving the habitat while keeping visitors informed of activities would create more environmental education opportunities for visitors to learn, appreciate, and support management efforts.

The draft compatibility determination for environmental education and interpretation is in appendix Q.

Non-wildlife-dependent Public Use

Objectives and strategies would not be developed for non-wildlife-dependent public use activities. Examples of these activities are canoeing, boating, berry picking, horseback riding, walking, hiking, bicycling, cross-country skiing, snowshoeing, four-wheeling, swimming, water skiing, sailing, and snowmobiling.

These types of activities may be compatible when associated with wildlife-dependent public use. For example, berry picking along a trail might be allowed as a compatible activity incidental to the wildlife-dependent public use of wildlife observation. Compatibility of activities would be determined on an individual basis by the refuge manager as needed in the future.

Research and Science Goal

Conduct innovative natural resource management using sound science and applied research to advance the understanding of natural resource function and management within the northern Great Plains.

Objective 1

During the 15 years following CCP approval, identify and prioritize research needs required to meet the refuge's goals and objectives; promote investigations that reliably address these needs.

Strategies

— Conduct vegetation and wildlife inventories of all plant communities within major habitats identified in chapter 3. Use initial inventories as baseline data to assess past and future changes in plant and animal community composition.

— Use periodic surveys (for example, every 5 years) to assess vegetation composition and structure of high-priority refuge habitats.

— Focus wildlife population research on assessments of species–habitat relationships. Develop models that predict wildlife response to habitat management or restoration.

— Design and conduct issue-driven research unlikely to be reliably addressed using long-term monitoring. Develop predictive models of habitat management and restoration.

— Promote refuge research and science priorities within the broader scientific community. Ensure that cooperative research focuses on meeting information needs identified in habitat management goals and objectives.

Rationale and Assumptions

Habitat-based goals and objectives form the basis for setting research and monitoring priorities for J. Clark Salyer NWR. Investigations must be sufficiently designed, funded, and carried out to reliably address proposed hypotheses or questions.

Partnerships are integral to meeting the research and science goal and objectives. Cooperative efforts are supported with shared funding, lodging, vehicles, equipment, knowledge, and expertise.

Operations Goal

Efficiently use funding and staffing for the benefit of all natural and cultural resources, the National Wildlife Refuge System, and present and future generations. Effectively manage visitor service programs that complement habitat management.

Objective 1

Within 15 years of CCP approval, hire six additional personnel to protect current resources; assist with administrative duties; and assist the rest of the staff to restore native prairie habitat and manage wetland resources on 100% of high-priority habitat units and 50% of moderate-priority habitat units.

Strategies

— Hire two full-time refuge managers with duties to plan and carry out intensive habitat restoration efforts on the highest priority habitats and units.

— Hire a full-time wildlife biologist and resource specialist to monitor wildlife and habitat responses to habitat protection, management, and restoration efforts.

- Hire a full-time law enforcement officer to protect resources and manage the visiting public.
- Hire an administrative clerk to assist with additional administrative duties.
- Maintain 40% of equipment and facilities to Service standards within 5 years of CCP approval.
- Replace 25% of worn-out equipment within 5 years of CCP approval, as needed.

Rationale and Assumptions

There are limited resources (funds and staff) allocated yearly to the refuge. The priority for these resources is to manage upland and wetland habitats. If the target (minimum) staffing level and funding are not reached or only partially reached, fewer accomplishments would be achieved.

Objective 2

Within 15 years of CCP approval, secure additional funding necessary to complete habitat restoration on 100% of high-priority habitat units and 50% of moderate-priority habitat units. Include restoration with (1) native prairie reseeding; and (2) intensive management of existing native prairie including woody plant reduction, invasive species control, and increased prescribed fire and grazing activities.

Strategies

- Use additional funding to purchase native grass and forb seeds for reseeding former cropland and planted cover.
- Use additional funding to purchase herbicides to control invasive species and remove/control woody plant expansion.
- Continue to use maintenance management funding to maintain or replace equipment and facilities, as needed, to Service standards.
- Secure additional funding to enhance streamflow monitoring and water management and develop new area-capacity data for refuge marshes.
- Maintain existing facilities and equipment to Service standards, including necessary roads, dikes, water control structures, buildings, and fences (all of which are critical in habitat management and protection).

Rationale and Assumptions

There are limited resources (funds and staff) allocated yearly to the refuge. The priority for these resources is to protect and manage upland and wetland habitats for wildlife. Operational funding would be targeted to work on the highest priority habitats and habitat units at the refuge. Management intensity would be increased on those habitats and units and would require additional personnel and funding to restore native prairie.

DRAFT CCP—*UPPER SOURIS NWR*

The following goals, objectives, and strategies for Upper Souris NWR outline the actions needed to achieve the vision of the Souris River basin refuges.

USFWS

Upper Souris NWR

Drift Prairie Goal

Restore and maintain extensive examples of plant communities dominated by native flora characteristic of the mid-1800s drift prairie. Create the temporally and spatially dynamic habitat conditions that will attract most breeding bird species and other vertebrate fauna characteristic of that era.

Prairie Slope Goal

Restore representative examples of prairie slopes to preserve some of the most pristine plant communities that remain in the Souris River basin and promote appreciation and stewardship of prairie resources.

NOTE: For Upper Souris NWR, drift prairie and prairie slope habitats would be managed concurrently, with similar vegetation objectives in units that include both habitats. This is mainly because the contemporary vegetation composition is fairly similar between the two habitats, except that drift prairie has less pristine, native herbaceous plant life (mean frequency 4% versus 15% and 13% for southwest-facing and northwest- to southeast-facing slopes). In addition, most management units to be delineated that include drift prairie would also include adjoining prairie slope habitat.

Objective 1

By 1 year after CCP approval, delineate management units on uplands.

Strategies

- Divide refuge uplands into landscape units based on
  - ❐ borders of native-sod prairie wherever clearly evident;

- ❐ management history (for example, the area that consistently encompasses a general grazing rotation or a prescribed burn);
- ❐ obvious boundaries such as permanent fence lines;anticipated future management actions.

— Assign a logical sequence of identifiers for units (for example, sequential numbering, north to south).

Rationale and Assumptions

Designation of individual management units is essential for establishing management objectives and priorities, for planning habitat treatments, and for basic communication including that of management history on a detailed, local level. Designation of management units needs to be done by Service management staff who have several years of on-the-ground experience on the refuge and who are familiar with its management history.

Objective 2

Use current vegetation inventory data and area and landscape considerations to characterize each habitat management unit with native sod prairie as either high or low management priority upland prairie units. Reevaluate prioritization of 15 years after CCP approval.

Strategy

— Apply multiple selection criteria.

CRITERIA FOR HIGH-PRIORITY UNITS

Floristic composition. Vegetation is characterized by ≥20% mean frequency of pristine, native herbaceous types (plant groups 41–43 and 46–48 [Grant et al. 2004b]; see appendix E), plus native herbaceous-dominated vegetation with Kentucky bluegrass as the main subdominant (plant group 53).

Floristic potential. Vegetation is characterized by <20% mean frequency of smooth brome-dominated vegetation (plant groups 54, 61, and 62).

Size and landscape context. The unit has ≥40 acres of prairie that is clearly native sod

and

is contiguous with other high-priority, native prairie units or with tracts of native prairie adjacent to the refuge under non-Service ownership.

CRITERIA FOR LOW-PRIORITY UNITS

Floristic composition. Vegetation is characterized by <20% mean frequency of pristine, native herbaceous types (plant groups 41–43 and 46–48 [Grant et al. 2004b]), plus native herbaceous-dominated vegetation with Kentucky bluegrass as the main subdominant (plant group 53).

Floristic potential. Vegetation is characterized by >20% mean frequency of smooth brome-dominated vegetation (plant groups 54, 61, and 62).

Size and landscape context. The unit has <40 acres of native sod prairie

and

is neither contiguous with high-priority, native prairie units nor adjacent to tracts of native prairie under non-Service ownership.

Rationale and Assumptions

Drift prairie occurs as small, gently sloping, isolated patches at Upper Souris NWR. Vegetation dominated by Kentucky bluegrass occurs frequently (42%), but smooth brome-dominated vegetation occurs infrequently (13%). Of the two introduced grass species, smooth brome is considered a greater hindrance to restoration of both vegetation composition and vegetation structure in northern mixed-grass prairie. Brome generally seems more difficult to control and more significantly alters the quality and structure of northern prairie habitats.

Drift prairie at Upper Souris NWR probably has the greatest restoration potential of any such prairie on publicly-owned lands in the Drift Plain physiographic region in North Dakota. Restoration management should focus on strategies to increase the competitive ability of native herbaceous plants, especially warm-season grasses, while reducing the vigor Kentucky bluegrass and keeping smooth brome in check. When managed by strategies that incorporate carefully timed fire and grazing disturbances, Kentucky bluegrass can occur as a codominant or subdominant species and emulate native grasses in structure.

Prairie slope is three times more prevalent than drift prairie at the refuge (figure 9). Vegetation on the more potentially pristine, southwest-facing slopes is relatively degraded, however (mean frequency of vegetation dominated by Kentucky bluegrass and by smooth brome is 33% and 14%, respectively).

Management of upland native prairie should simultaneously and equally target drift prairie and prairie slope because

— drift prairie is relatively limited in area yet not significantly invaded by smooth brome;

— Kentucky bluegrass is prevalent on both drift prairie and prairie slope; management to reduce this introduced grass and increase native herbaceous vegetation would logically target both site types simultaneously where both occur within a management unit.

Objective 3

On high-priority units of prairie slope or high-priority units of prairie slope and drift prairie, apply frequent and precisely timed disturbance (principally fire and grazing) to restore vegetation and provide habitat for most wildlife species, especially burrowing owl, horned lark, Baird's sparrow, Sprague's pipit, chestnut-collared longspur, northern pintail, and Richardson's ground squirrel. Vegetation should present the below characteristics within 15 years of CCP approval.

- Mean frequency composition on each unit includes (1) >40% pristine-native and native-dominated/bluegrass subdominant vegetation (plant groups 41–43, 46–48, and 53); (2) <10% smooth brome-dominated vegetation (plant groups 54, 61, and 62); and (3) <15% low shrub-dominated vegetation (plant groups 11–17) (based on percentage frequency of occurrence on belt transects, per Grant et al. 2004b).
- Native trees and tall shrubs are absent or nearly so, comprising ≤1% land cover on each unit, and no nonnative or planted native woody vegetation exists.
- Leafy spurge frequency is decreased by at least 50% and is maintained at 1% frequency on each unit (frequencies per belt transects); absinth wormwood is actively controlled; and yellow toadflax and other newly appearing species of noxious weeds that pose a threat to the drift prairie are eliminated within 5 years of initial detection.

Strategies

— Disturb the vegetation, typically by livestock grazing or fire, at least 2 of every 3 years. An ideal management sequence over 5 years might be BGGGR (B=prescribe burn the first year; G=graze in each of years 2, 3, and 4; then R=rest), then reinitiate the sequence. The area covered by trees, tall shrubs, and low shrubs would be incrementally reduced with this burning frequency.

— Primarily use prescribed fire when smooth brome plants are at least in the 4- to 5-leaf stage, but not yet showing an inflorescence; this generally occurs during a narrow mid-May through early June window. A less preferred option is to burn in fall in anticipation of a negative, winter drought impact on smooth brome and Kentucky bluegrass.

— Graze mainly during late May through August or September, via a rotation approach with many (7–10) relatively small grazing cells (for example, 40–60 acres) per unit and short grazing periods (4–7 days) per cell. Adjust stocking rates to facilitate regrazing of individual smooth brome plants at least once within a grazing period, but move livestock to the next cell before native plants are regrazed (be sure to note grazing of native upland sedges, an important forage base in some management units).

— Annually survey for noxious weeds. Continue widespread use of biological control by monitoring local areas for *Apthona* spp. beetles and redistributing beetles among leafy spurge patches as needed. Use herbicides as needed along boundaries with private lands.

Deb Parker/USFWS

— Establish native vegetation dominated by warm-season grasses on adjoining, high-priority old cropland (see objectives for old cropland). Manage these intensively, in concert with the high-priority prairie units they adjoin, to sustain a native-dominated flora and to reduce sources of introduced cool-season grasses and noxious weeds.

— Experiment on old cropland areas within low-priority prairie units, with new or high-risk restoration methods that may have application for restoration of old cropland within high-priority prairie units. For example, attempt control of introduced cool-season grasses and release of native plants on a small, localized scale with selective herbicide treatment.

— Remove local, human disturbances and artifacts of twentieth-century origin (including the refuge era). This includes prominent plow furrows, old road grades, rock piles, and impoundment dams on intermittent drainages (except on those essential as livestock water sources). Restore such sites as close as possible to their original condition.

Rationale and Assumptions

Kentucky bluegrass is common among all topographic site types of upland native prairie at Upper Souris NWR. This grass tends to increase under prolonged rest or grazing, but decreases with fire especially when burning occurs during stem elongation or in dry years. Smooth brome, a less common introduced grass in drift prairie and prairie slope, also increases under rest. In contrast to Kentucky bluegrass, however, smooth brome appears sensitive to repeated grazing.

The upland native prairie has been treated regularly and extensively by livestock grazing, mostly via various rotation strategies. Conversely, little or no prescribed fire has been used to manage areas of upland native prairie, and most fire was applied only recently (2000–2005). Restoration management needs to focus on reduction of Kentucky bluegrass while keeping smooth brome in check. This is a challenging task, however, as a reduction of one of these grass species often is accompanied by an increase in the other. Increased use of fire to better match the types, timing, and frequencies of disturbances under which native herbaceous plants evolved would improve the competitive abilities of native herbaceous plants in high-priority, upland prairie units. Use of fire needs to be carefully executed to simultaneously decrease competitive abilities of both bluegrass and brome.

Makeup of the contemporary breeding bird community on drift prairie and prairie slope at Upper Souris NWR is incompletely documented. However, bird species diversity may be greater than that on the drift prairie at Des Lacs NWR or at J. Clark Salyer NWR mainly because there is much less smooth brome and more topographic variation at Upper Souris NWR. The refuge's high-priority upland prairie probably can be improved for birds and other wildlife species that historically were characteristic of northern mixed-grass prairie by incorporating more prescribed fire disturbance. Thus, there would be increased area in early successional stages.

Trees and tall shrubs increased significantly in area at the refuge during the past century (chapter 3). This tall woody cover can diminish the survival of nests of grassland birds by harboring nest predators. This cover also provides perches from which brown-headed cowbirds can find other species' nests in which to lay eggs.

Furthermore, recent data from the Souris River basin refuges indicate that relatively small areas of tall woody vegetation can effectively fragment grassland habitats and cause many grassland bird species to avoid entire landscapes. Elimination of tall woody cover is a logical strategy for restoration of landscape structure and plant community makeup, and to improve the attractiveness and security of the habitat for a variety of grassland breeding bird species.

Objective 4

On low-priority units of prairie slope or prairie slope plus drift prairie, apply disturbance (principally fire) every 5–8 years to remove plant litter, restore plant vigor, reverse or stall woody plant expansion. Provide a mix of structural types that include (1) relatively short/sparse vegetation for species such as killdeer, horned lark, and Brewer's blackbird; (2) moderately short vegetation for species such as blue-winged teal and upland sandpiper; and (3) tall/dense vegetation for species such as mallard, short-eared owl, Le Conte's sparrow, and bobolink. Vegetation should present the below characteristics within 15 years of CCP approval.

NOTE: There likely would be no monitoring of vegetation on these units except for routine, cursory surveillance for noxious weeds. Tree and tall shrub cover can be coarsely monitored over decades via remote imagery. Knowledge of relationships between fire frequency and resulting, postfire vegetation structure is adequate to predict habitat conditions described below.

- One-fourth of the area is 0–1 year postdisturbance, one-fourth is 2–3 years postdisturbance, and one-half is 4–6+ years postdisturbance (corresponding roughly to a structure of <2 inches VOR, 2–4 inches VOR, and >4 inches VOR, respectively [mean VORs in early spring, per Robel et al. 1970]).
- Native trees and tall shrubs comprise <4% land cover on each unit, and all nonnative woody vegetation and planted native woody vegetation is eliminated from at least one-half of the units.
- Leafy spurge is maintained at <2% frequency; absinth wormwood is actively controlled; and yellow toadflax and other newly appearing species of noxious weeds that pose a threat to the drift prairie are eliminated within 5 years of initial detection.


Donna Dewhurst/USFWS

Mallard Hen

Strategies

— Apply prescribed fire on each unit at least every 5–8 years, increasing burn frequency during dry years when possible to more effectively reduce tall shrubs and trees. Rotate burns among units. Burn opportunistically, at any time, mainly to remove litter and control tall shrubs and trees.

— To increase structural diversity, occasionally introduce livestock grazing with wide latitude on timing, intensity, and duration, when doing so will not detract from management of high-priority units.

— Periodically survey for noxious weeds. Continue widespread use of biological control by monitoring local areas for *Apthona* spp. beetles and redistributing beetles among leafy spurge patches as needed. Use herbicides as needed along boundaries with private lands.

Rationale and Assumptions

Some upland prairie units at Upper Souris NWR have little intact, native herbaceous vegetation. From a practical standpoint, these areas probably cannot be restored to a state where such plants are a widely noticeable or an otherwise common vegetation component. However, with modest effort, the prevalent introduced cool-season grasses and scattered low shrubs can be managed to provide a mix of post-disturbance structural types attractive to a broad array of native grassland bird species.

The most appropriate management of these units is to provide structural variety and to use the units as a basis to create extensive areas of grassland that include off-refuge lands, to satisfy needs of several area-sensitive, native grassland bird species. This could reduce predation and nest (brood) parasitism incidence associated with edge-dominated, highly fragmented grassland.

The rationale for reducing tall shrubs and trees is the same as that for high-priority prairie slope or prairie slope plus drift prairie (see objective 3).

Objective 5

Help improve or maintain the habitat quality and economic sustainability of nonfederally owned, native prairie remnants adjacent to the refuge's drift prairie and slope prairie units within 15 years after CCP approval. Extend protection and stewardship to most other grasslands that adjoin these units. Seek opportunities to expand the total grassland area and create broad, contiguous blocks of open grassland, principally as habitat for breeding grassland birds.

Strategy

— Use grassland easements and extension agreements (for example, specialized livestock grazing systems on native prairie) for native grass establishment and management, or to remove "hostile" cover such as trees and tall shrubs that could harbor nest (brood) parasites and nest predators. Certain grazing systems can improve livestock carrying capacity and the condition of annually grazed prairie, to enhance the economic viability of native prairie and reduce chances of conversion to other land uses, especially cultivation.

Rationale and Assumptions

The quality of prairie as breeding habitat for grassland birds (in terms of average annual nest success and relative contribution to population recruitment) is directly related to its extent or, conversely, indirectly to the degree of its fragmentation.

Native prairie on the Drift Plain could be considered an endangered resource and much of what remains of North Dakota's Drift Plain prairie occurs in the Souris River valley. Conserving remnant tracts adjacent to the refuge, by whatever means possible, should be among the highest priorities for landscape conservation.

Old Cropland Goal

On high-priority old cropland areas, establish native-dominated, perennial herbaceous cover that, with modest management, resists invasion by introduced cool-season grasses and noxious weeds. This seeded cover will help form extensive, contiguous blocks of structurally diverse, open grassland for grassland-dependent, breeding bird species.

Objective 1

By 10 years after CCP approval, locate and determine boundaries of old cropland areas and record these in the refuge's GIS database.

Strategies

— Identify old cropland (considered DNC) areas that were seeded to introduced grasses and forbs and/or native grasses since the mid-1970s.

— Identify other old cropland areas, as evidenced by

- ❐ distinct field edges, especially deep furrows and linear piles of windborne topsoil that had been deposited along preexisting fence lines and subsequently vegetated;
- ❐ rock piles or rocks strewn linearly along what appears to be a field edge (although rock sometimes was cleared for native hay harvests);
- ❐ nearly monotypic stands of smooth brome, typically with some Kentucky bluegrass but with little native sedge in the understory (several native plant species often reinvade these stands, such as western snowberry, Wood's rose, white sage, western yarrow, several goldenrod species, and silver scurfpea);
- ❐ no partly buried rocks with profuse lichens;
- ❐ no clubmoss or cryptogamic crust.

- Use acquisition records, old refuge narratives, 1938–1939 aerial photographs, and U.S. Soil Conservation Service records for ancillary support.
- Flag the probable boundaries of areas verified as old cropland, record via GPS and attribute, and upload into the refuge's GIS database.

Rationale and Assumptions

Furrows and other linear disturbances caused by implements (for example, plows, disks, and seed drills) are much more evident after an area is treated with prescribed fire or heavily grazed. They are also more readily detected from horseback. Evidence of soil A-horizon disturbance due to cultivation may be determined by NRCS staff. Some areas with signs of farming disturbance (for example, furrows) may have been cropped only for a few years circa 1900–1930 or may have been broken during this period yet never cropped. Such areas often are successfully reinvaded by native plants, and may currently support native vegetation at levels approaching the most pristine areas on similar site types on the refuge that are considered native sod.

Objective 2

Within 15 years after CCP approval, convert DNC on at least 10 old cropland units to vegetation dominated by several species of native warm-season grasses that vary in stature and growth form, and that include several species of native forbs wherever possible. Give priority to units with stands of vegetation that have become decadent and overrun by undesirable, introduced cool-season grasses, especially where such units are adjacent to or within high-priority drift prairie units or high-priority prairie slope units.

Strategies

- Following multiple applications of a broad-spectrum herbicide, seed a native plant mixture that mainly consists of 80–90% warm-season grass species especially big bluestem, little bluestem, switchgrass, and sideoats grama.
- During the first 3–4 years after seeding, annually mow the stand with a hay conditioner and harvest the hay. Substitute grazing or prescribed fire treatments in the subsequent 3–4 years. Use herbicide spot spraying or "interseeding" where necessary.

Rationale and Assumptions

Although initially expensive, native warm-season grasses are economically and ecologically superior to seeded stands of introduced plants in old croplands because

- permanent, perennial cover eliminates regular (every 12–14 years) replacement of seeded, introduced species cover via a farming cycle and thus nearly eliminates potential for soil erosion;
- native grasses reduce local habitat fragmentation and eliminate "edge" associated with the farming cycle;
- a warm-season growth strategy for plants vastly improves the capacity for an assemblage of plants to outcompete smooth brome, mainly by affording broader and more effectively timed management opportunities;
- there is improved opportunity for prescribed burning in late spring compared to high-priority drift prairie units because the warm-season-dominated cover has relatively high fuel value through early June (versus mostly green vegetation on cool-season-dominated cover on the drift prairie by late May);
- there is a broader window (later in summer) for harvest of hay that still has forage value;
- native grasses are in compliance with policy that discourages planting of introduced species on Service lands and encourages planting of native species (National Wildlife Refuge System Biological Integrity, Diversity, and Environmental Health, 601 FW 3, 2001);
- native grasses reduce "source sites" from which introduced and weedy plants invade adjoining native prairie;
- native grasses have improved and longer-lasting structural diversity within stands.

Objective 3

By 10 years after CCP approval, identify other old cropland areas (those not known to have been seeded since the mid-1970s) that are high management priority (areas most important to convert to native warm-season grasses). Develop a detailed plan to convert these during the subsequent 10–15 years to vegetation dominated by several species of native warm-season grasses that vary in stature and growth form, and that include several species of native forbs wherever possible.

Darla Leslie/USFWS

Rainbow over Upper Souris NWR

NOTE: There are no goals and objectives for remaining old cropland areas in uplands. They are low priority and would be managed with adjoining habitats.

Strategy

— Apply multiple selection criteria.

CRITERIA FOR HIGH MANAGEMENT PRIORITY OLD CROPLAND IN UPLANDS (excluding DNC and other old cropland known to have been seeded since the mid-1970s)

Floristic Composition. Vegetation is characterized by <20% mean frequency of pristine, native herbaceous types (plant groups 41–43 and 46–48 [Grant et al. 2004b]) plus native herbaceous-dominated vegetation with Kentucky bluegrass as the main subdominant (plant group 53).

Floristic Potential. Vegetation is characterized by >20% mean frequency of smooth brome-dominated types (plant groups 54, 61, and 62).

Landscape Context. The unit has no size criterion

and

bears clear evidence of a farming history

and

is contiguous with high-priority prairie units or tracts of native prairie adjacent to the refuge under non-Service ownership.

Rationale and Assumptions

Native grass and forb seed is very costly, as is the time and expense of materials needed to prepare seedbeds, plant seed, and annually manage newly seeded areas, per strategies and rationale listed under objective 2.

Old cropland that adjoins high-priority drift prairie or prairie slope and supports little native herbaceous vegetation likely is a source of invasion by undesirable, introduced grasses and weedy forbs. Without attempts to establish native vegetation through seeding, such areas are unpromising candidates for restoration to grassland in which native herbaceous plants are evident, much less an important codominant component. This includes areas that were farmed for 5–10 years before refuge establishment—presumably, before smooth brome and Kentucky bluegrass were widely distributed—that may have been reinvaded by native plants. These areas may have restoration potential that at least equals that of adjoining, high-quality drift prairie or prairie slope.

Objective 4

After seeding and establishing native warm-season plants in an old cropland unit, maintain dominance by native plants as the most dominant vegetation cover per qualitative estimation.

NOTE: There are no goals and objectives for other old cropland units (those not yet converted to warm-season-dominated communities); they are low priority.

Strategies

— Disturb less frequently (every 2–3 years) the seeded warm-season stands, which should be well established 5–8 years after seeding. They probably can be disturbed more flexibly with regard to phenology, mainly to discourage smooth brome invasion.

— Use grazing as an alternate management treatment and take advantage of the wide, spring-grazing window afforded by the warm-season-dominated community.

— Integrate management with that of surrounding prairie slope and drift prairie while focusing on treatment approaches that promote native warm-season plant species.

— In the interim between prescribed burns, possibly harvest hay every 2–3 years from old cropland units, alternating among July, August, and September to favor warm-season grasses.

— If and where occasionally needed along unit boundaries, use herbicides to reduce encroaching, introduced cool-season grasses and release native warm-season plants. Use integrated pest management to treat local infestations of noxious weeds as needed.

Rationale and Assumptions

The warm-season growth strategy for plants vastly improves the capacity for an assemblage of grassland plants to outcompete smooth brome (which typically degrades seeded introduced stands), mainly by affording broader and more effectively timed management opportunities.

Objective 5

Within 25 years of CCP approval, eliminate planted tall shrubs and trees and any naturalized, nonnative woody vegetation that occurs within or adjacent to high-priority old cropland areas as they are being restored to native-dominated vegetation.

Strategy

— Remove tree–shrub plantings by mechanical means (for example, cutting ash trees by hand; shearing caragana shrubs with a tractor blade or bucket during winter); follow by herbicide treatment of stumps; or follow by herbicide treatment, rotary mowing, and/or prescribed burning of resprouting vegetation wherever necessary.

Rationale and Assumptions

Trees and tall shrubs can diminish the survival of nests of grassland birds by harboring potential nest predators. They also provide perches from which brown-headed cowbirds can find other species' nests in which to lay eggs. Furthermore, recent data from the Souris River basin refuges indicate that relatively small areas of tall woody vegetation can effectively fragment grassland habitats and cause many grassland bird species to avoid entire landscapes. Elimination of tall woody cover is a logical strategy for restoration of landscape structure and plant community makeup, and to improve the attractiveness and security of the habitat for a variety of grassland breeding bird species.

Objective 6

By 2 years after CCP approval, develop and implement an effective, practical comprehensive plan for integrated control of noxious weeds in DNC and other old cropland areas in the riparian zone. In these areas, continue to maintain perennial herbaceous cover comprised of introduced species and native plant species or both, and the vegetation should present the following characteristics.

- About one-half of the area in 0- to 1-year postdisturbance and one-half in 2–3 years postdisturbance; corresponds roughly to a structure of 0–3.9 inches VOR and >3.9 inches VOR, respectively (mean VORs in early spring, per Robel et al. 1970).
- Native trees and tall shrubs compose <0.2% land cover on each old cropland area.
- Leafy spurge frequency is maintained at <2% frequency, absinth wormwood is actively controlled, and yellow toadflax and other newly appearing species of noxious weed that pose a threat to the drift prairie are eliminated within 5 years of initial detection. Canada thistle control is a low-priority weed control issue (mean frequency <25%).

Strategies

— Use hay harvest or fire at least every third year to maintain plant species vigor and vegetation structure and to control plant litter accumulation.

— Annually survey for noxious weeds. Continue widespread use of biological control by monitoring local areas for *Apthona* spp. beetles and redistributing beetles among leafy spurge patches as needed. Use herbicides as needed, especially along boundaries with private lands.

— Review and update the weed management plan, detailing specific methods and timetables for managing noxious weeds in old cropland areas of the riparian zone.

Rationale and Assumptions

Smooth brome, quackgrass, and Kentucky bluegrass dominate old cropland in riparian areas. These areas have relatively moist, deep silty loams that are particularly suitable for these introduced grass species and allow them to outcompete nearly all native herbaceous species. There currently are no practical avenues for sustainably converting these areas to more desirable stands of native herbaceous vegetation. There are, however, practical methods for simultaneously controlling most species of noxious weeds and providing vegetation structure that is attractive to grassland bird species native to the region. These birds prefer relatively dense, tall grassland vegetation and include mallard, northern harrier, Le Conte's sparrow, and bobolink.


S. Maslowski/USFWS

Bobolink

In addition to removing litter, periodic prescribed fire would slow or reverse invasion by woody vegetation such as western snowberry and willow.

Canada thistle is a noxious weed that tends to pervade and persist in disturbed soils of the riparian zone at Upper Souris NWR. This thistle is variably common across the region's cultivated lands, mainly due to its prolific production of highly mobile, wind-borne seed. This weed species cannot be controlled consistently by available means within most of the refuge's riparian zone. This is mainly because the soils typically are too damp in late spring and early summer to support wheeled vehicles that would apply herbicides at an appropriate time for effective control. Aerial application is possible in some areas, but tends to be more costly and controversial. Aerial application is more difficult to administer than ground-spraying and adjacent areas of habitat or privately owned land may be subjected to overspray.

Regular monitoring and control of other noxious weed species such as leafy spurge and wormwood are more crucial than control of Canada thistle, and are far more gratifying (in terms of available methods of biological and other nonchemical controls, and overall costs versus benefits).

Coulee Woodland and Coulee Woodland Edge Goal

Acknowledge a nearly irreversible, localized establishment of mature, contiguous woodland and minimally manage these areas as breeding and migration habitat principally for forest-interior, migratory bird species such as veery and ovenbird. Strive to eliminate remaining, noncontiguous, edge-dominated tree and tall shrub cover, particularly near high-priority drift prairie and the largest, most contiguous grassland tracts.

Objective 1

By 2 years after CCP approval, use GIS vegetation data and topographic considerations to classify management units with significant (>20% cover) tree and tall shrub cover as either "coulee woodland units" or "coulee woodland edge units."

Strategies

- *Use this criteria for identifying units with significant tree and tall shrub cover as coulee woodland units:* The uppermost vegetation strata of a unit comprises >50% tree cover with some tall shrub, forming woodland patches that generally are contiguous (minimum woodland width × length = 330 × 660 feet, about 5 acres).
- *Use this criteria for identifying units with significant tree and tall shrub cover as coulee woodland edge units:* The uppermost vegetation strata of a unit comprises 5–50% tree and tall shrub cover, generally occurring in narrow bands and is not contiguous.

Rationale and Assumptions

Distinguishing between management units with considerable woodland cover versus those with much woodland edge is critical to the refuge's vision and to a triage management approach. Coulee woodland at Upper Souris NWR is difficult to restore back to prairie, mainly because understory and ground fuels are too few to carry fires of sufficient extent and intensity to kill overstory trees.

Such areas probably do not have native prairie, grass–forb seed banks. However, coulee woodland could continue to provide modest habitat for forest-interior bird species, such as veery and ovenbird, without slowing widespread improvement in grassland bird habitat elsewhere at the refuge.

In contrast, coulee woodland edge is a widespread habitat type that, in the absence of fire, would continue to fragment drift prairie and prairie slope. None of the breeding bird species that are common in this edge habitat is of management concern. However, 11 grassland bird species that occur or used to occur at Upper Souris NWR are species of concern.

Conversion of woodland edge habitat to open prairie at the refuge could be achieved through repeated use of prescribed fire. This conversion would insignificantly influence continental population trends of woodland bird species, while helping reverse population declines of grassland bird species. Reduction of woodland edge may also reduce cowbird parasitism rates among grassland bird nests.

Objective 2

Within 5 years after CCP approval, analyze and summarize data that were collected during 2001–2003 on the composition and structure of a sample of coulee woodland at Upper Souris NWR.

Strategy

- Rank the summary and reporting of coulee woodland vegetation attributes among the highest priorities for a biologist who oversees the refuge's biological program.

Rationale and Assumptions

Available inventory data would provide critical insight on the status of American elm recruitment and the occurrence of noxious weed species. These data would provide a base for quantifying habitat relationships of bird species that breed in the refuge's woodland.

Objective 3

Minimally manage green ash-dominated, contiguous coulee woodland that, within 15 years of CCP approval, covers a total of about 1,500 acres (slightly less than the current level of 1,600 acres); and in which noxious weeds are controlled as follows: (1) common buckthorn, leafy spurge, common burdock, and other noxious weed species are each reduced and maintained at <3% frequency; and (2) newly discovered species of noxious weeds are eliminated.

Strategies

- Apply prescribed fire to halt further expansion of coulee woodland within and adjacent to high-priority upland prairie areas. Use frequent (for example, every 5 years) prescribed fire to reduce the area occupied by the smallest coulee woodlands that are adjacent to high-priority prairie areas.
- In open areas around woodland, continue to reduce leafy spurge by occasional redistribution of *Apthona* spp. beetles, plus limited use of herbicides at refuge boundaries if necessary.
- To assess the status of buckthorn and other noxious weeds in coulee woodland, complete the data summary and reporting in previous objective 2 and, if necessary, seek ways to extend the sampling and help direct control efforts. Common buckthorn may be invading coulee woodland at Upper Souris NWR and, if so, would threaten habitat values for forest-

interior bird species such as veery and ovenbird, in addition to other undesirable impacts.

Rationale and Assumptions

The area covered by coulee woodland at Upper Souris NWR has been increasing steadily during the past century (Grant and Murphy 2005). Coulee woodland continues to replace or indirectly diminish habitat values of the refuge's native upland prairie. Most areas covered by coulee woodland on the refuge may be difficult to restore back to prairie, but probably could continue to provide modest habitat for forest-interior bird species without hindering widespread improvement in grassland bird habitat elsewhere on the refuge.

Objective 4

On each coulee woodland edge unit, apply disturbance (principally fire) every 5–6 years to restore the vegetation to the following standards within 15 years:

- Tree and tall shrub cover are reduced by >50% (measured via remote imagery).
- Plant litter is removed and herbaceous plant vigor and structural diversity are restored by management treatment applied every 5–6 years (these responses would be unmeasured and instead would be assumed to coincide with disturbance events).
- At any given time, about one-fourth of the area of all woodland edge units is in 0–1 year postdisturbance; one-fourth is in 2–3 years postdisturbance; and one-half is in 4–6+ years postdisturbance. This corresponds roughly to VOR height–density classes of 0–2.0 inches, 2.0–3.9 inches, and 3.9–5.9 inches, respectively, to contribute to the variety of grassland structural types across the landscape.

  NOTE: There likely would be no monitoring of vegetation on nearly all of these units except for routine, cursory surveillance for noxious weeds. Tree and tall shrub cover could be coarsely monitored over decades via remote imagery. Knowledge of relationships between fire frequency and resulting, postfire vegetation structure is adequate to predict habitat conditions under this objective.
- Noxious weeds are controlled: (1) buckthorn, caragana, and other introduced species of tall shrubs or trees are nearly eliminated; (2) leafy spurge is reduced by >50%, to <5% frequency; (3) absinth wormwood and Canada thistle are actively controlled at the refuge boundary; and (4) infestations of yellow toadflax and any other, newly appearing species of noxious weed are detected and eliminated.

Strategies

— Apply prescribed fire every 5–6 years, varying the timing of burns within a given unit, to halt or reduce invasion by introduced cool-season grasses.

— So long as critical needs of priority management units (especially high-priority upland prairie) are not compromised, seek opportunities for occasional grazing by livestock during years between prescribed burns, to improve structural heterogeneity and slow litter accumulation. Grazing prescriptions can be very flexible, even allowing occasional, relatively severe defoliations, although such events may result in local increases in weeds such as Canada thistle and yellow sweetclover.

Rationale and Assumptions

Coulee woodland edge appears to be a widespread habitat type at Upper Souris NWR that, in the absence of fire, probably fragments significant areas of drift and prairie slope. None of the breeding bird species that are common in this edge habitat are of management concern, whereas 11 grassland bird species that occur or used to occur at the refuge are considered species of concern. Conversion of woodland edge habitat to open prairie, through repeated prescribed fire, probably would negligibly influence continental population trends of woodland bird species while helping reverse population declines of grassland bird species.

Riparian Woodland Goal

Maintain the approximate presettlement extent of green ash–American elm riparian woodland within the floodplain of the Souris River to benefit a broad suite of woodland-associated, breeding bird species.

Objective 1

By 10 years after CCP approval, complete a baseline floristic inventory of riparian woodland.

Strategy

— Use a modified James and Shugart (1970) method to inventory floristic composition and stand structure of all riparian woodland.

Rationale and Assumptions

Vegetation composition and structure of some riparian woodland has been inventoried, and breeding bird communities have also been inventoried. However, the data has not been analyzed and summarized. Qualitative observations suggest that most American elm has been lost to Dutch elm disease.

Objective 2

Maintain, in perpetuity, the riparian woodland present today. Explore methods that restore American elm as a codominant tree species of riparian woodland communities.

Strategies

- Use aerial photos and satellite imagery to periodically assess changes in the extent of riparian woodland.
- Assess methods to control Dutch elm disease including (1) biological control of the fungus or of native and introduced elm-bark beetles that spread the disease, and (2) development of disease-resistant cultivars (cultivated varieties of a plant) of American elm adapted to survive severe North Dakota winters.
- Because ash–elm riparian woodland is fire intolerant, suppress and control fires. Since the potential long-term effects of alterations in the hydrology (especially hydroperiod) of the Souris River are unknown; carefully investigate even minor changes in woodland.

Lee Karney/USFWS

Great Blue Heron

Rationale and Assumptions

The extent of riparian woodland has changed little since the presettlement period. However, some meadows have been invaded by aspen woodland and willow woodland, which may succeed to ash–elm woodland.

Contemporary riparian woodland forms large, extensive patches of mature, closed-canopy woodland. These woodlands are important habitat for forest-interior migratory birds such as northern waterthrush, red-eyed vireo, and American redstart. Great blue heron and black-crowned night-heron colonies also are found in riparian woodland.

Meadow Goal

Restore and maintain extensive examples of plant communities dominated by native flora characteristic of seasonally flooded meadows within the Souris River floodplain to attract grassland- and wetland-dependent bird species and other wildlife.

Objective 1

Manage meadows composed variously of nonnative and native plants to provide a mosaic of relatively short–sparse and tall–dense herbaceous-dominated cover. By 15 years after CCP approval, reduce tall shrub and tree cover to <10%.

Strategies

- Use cooperators to periodically clip (hay) meadow vegetation to control trees, shrubs, and noxious weeds, especially Canada thistle. Meadows may be clipped every year (for several years) following extensive flooding.
- Experiment with control of leafy spurge using Plateau® herbicide. Release flea beetles (*Apthona* spp.) in patches of leafy spurge growing on various microsites. Once flea beetles become locally adapted to meadow sites, begin wide-scale releases to control leafy spurge.

Rationale and Assumptions

Meadow is a transitional habitat on the Souris River basin refuges, where it supports some hydrophilic (water-loving) plants and is sometimes temporarily flooded. Meadow also supports vegetation characteristic of mesic (relatively moist) uplands. Quackgrass, reed canarygrass, Canada thistle, and leafy spurge degrade native grass–sedgerush communities. Meadow vegetation evolved with periodic disturbances including flooding, grazing by elk and bison, and fire.

Meadows at Upper Souris NWR are mostly invaded by cool-season introduced plants (especially quackgrass and reed canarygrass), such that full restoration of native plant assemblages is unlikely. This objective focuses on maintenance of open, treeless meadows. Reduction in tall woody plants should benefit grassland and wetland birds intolerant of woody plants. Meadows invaded by introduced grasses will benefit these species despite being floristically simple in composition. Such benefits have been noted for sites seeded to introduced grasses, most notably in the CRP (Johnson and Igl 1995).

Wetland Goal

Manage riverine wetlands, including marshes and lakes, to sustain the long-term capacity of riverine wetlands to support diverse plant and wildlife communities. Restore ecological processes that sustain long-term productivity of wetlands.


USFWS

Waterfowl congregate at an Upper Souris NWR wetland.

Objective 1

Within 5 years of CCP approval, synthesize available information on the effects of physical alterations, altered hydrology and hydroperiod, increased sedimentation, and changes in water quality of the riverine system, past and present: (1) develop a report to describe consequences of these alterations on long-term viability of riverine marshes, (2) determine biological potentials and constraints for each wetland impoundment, and (3) develop criteria to prioritize impoundments with the greatest potential for sustained productivity.

Strategies

— Use past narratives, aerial photographs, unpublished refuge files, and scientific literature to evaluate the biological potential of wetland impoundments and prioritize units for management.

— Map physical areas within each impoundment that are expected to respond to management.

— Develop and prioritize a list of knowledge gaps and research needs.

— In cooperation with USGS's Northern Prairie Wildlife Research Center, complete sediment accretion study and contaminants studies.

— Monitor groundwater and soil moisture levels in impoundments and within the adjacent meadow zone.

Rationale and Assumptions

This objective focuses on compiling past and current data regarding development and management of the Souris River wetlands. Although riverine wetlands form one of the most extensive and important habitats at Upper Souris NWR, site-specific information is limited regarding effects of habitat management (especially water level management) on vegetation structure and composition, density of aquatic invertebrates, and wetland-dependent bird species. Models for managing northern prairie wetlands exist, but their utility is limited for managing riverine marshes at the Souris River basin refuges, primarily because three impoundments include flow-through of the Souris River (which limits wetland management capabilities).

This objective requires compilation of existing wetland management records along with a clear, succinct treatment of threats, management limitations, and management potentials for riverine wetlands. A biological assessment of wetland conditions for the Souris River basin refuges was completed recently by Laubhan and others (2003); this report provides a basic start in meeting this objective and those that follow.

Existing models may be applicable to seven smaller impoundments that are physically located next to the Souris River, but are not totally affected by fluctuations in river flows. These impoundments all have water supplies taken from the Souris River that are independent of the fluctuations in river flows. However, most of the impoundments can only be drained when the in-stream riverine marshes are drawn down, which is readily accomplished most years.

Objective 2

Within 15 years of CCP approval, evaluate and comprehend crucial ecological processes that maintain long-term wetland productivity. Develop a range of biological indicators (for example, decline of important wetland plant or invertebrate species, shifts in extent and juxtaposition of emergent or submerged aquatic emergent vegetation) useful in the implementation of management strategies (for example, water level management, prescribed fire) intended to maintain long-term wetland productivity.

Strategies

— Complete development of a USGS computer application that uses long-term flow data from gauging stations to assess effects associated with long-term alterations in river hydrology and hydroperiod on wetland plants, wildlife, and (ultimately) the potential to sustain long-term wetland productivity. Particularly important is monitoring flows that cross international boundaries. Additionally, monitor inflows at major tributaries as necessary.

— Through USGS's Northern Prairie Wildlife Research Center, complete a study of sediment accretion and its implications for long-term management of riverine marshes.

— In cooperation with USGS and others, assess available contour maps for wetlands; where inadequate, develop detailed contour maps of marsh bottoms for all impoundments to help construct models that predict vegetation response to water level management.

— Develop a method to inventory contemporary vegetation communities in managed wetlands. Develop methods for long-term monitoring of wetland vegetation.

— In cooperation with the USGS and others, use information derived above to develop predictive models that determine effects of water management (especially hydroperiod) on wetland plants, invertebrates, and migratory birds.

— Since few on-site data are available, use relevant information from a broad spectrum of scientific publications and literature syntheses to address effects of Lake Darling water quality and water management. Reference documents may include, for example, a sediment accretion study completed through USGS's Northern Prairie Wildlife Research Center and an assessment of wetland conditions for the Souris River system by Laubhan et al. (2003).

Rationale and Assumptions

This objective focuses on synthesizing existing scientific research on wetland function and cycles in northern prairie wetlands and impounded riverine wetlands. It also prompts site-specific inventory, monitoring, and research to support management of riverine marshes.

A biological assessment of wetland conditions for the Souris River basin refuges was completed recently (Laubhan et al. 2003). This report provides context for the original construction and subsequent physical and operational modifications to the managed wetland system at the Souris River basin refuges. Additionally, long-term threats to the system are discussed. However, riverine wetlands have been managed mainly through opportunity, flood control objectives, and politics rather than sound science. Site-specific data are lacking regarding effects of wetland management on vegetation structure and composition, aquatic invertebrate densities, and wetland-dependent wildlife species.

Relative to upland habitats, managers have less effective control over wetland systems, due in part to the following:

— misunderstandings about the biological significance of drought and of complete drawdown, dating back to the original construction of wetland impoundments;

— limited understanding of long-term impacts of low-head dams constructed in rivers in the northern Great Plains;

— significant physical limitations of constructed impoundments, especially the lack of independence among adjacent wetland units when manipulating water levels;

— inherent difficulties in conducting basic inventory, long-term monitoring, or applied research in wetlands relative to upland sites.

Objective 3

During the 15 years after CCP approval, develop and implement a new management philosophy that emphasizes long-term wetland productivity over older models based on (1) political management based on 5-year cycles, (2) "oasis" management, where wet acres are maximized especially during extreme drought, or (3) maximizing years of "hemi-marsh" conditions.

In high-priority impoundments, use periodic disturbance to provide the full spectrum of wetland conditions—for example, (1) dry marsh, (2) densely vegetated marsh (regenerative phase), (3) hemi-marsh, (4) open marsh (degenerative phase), and (5) open water—to benefit wetland-dependent species of wildlife.

Strategies

— Re-create, where possible, the natural hydrology and hydroperiod of the Souris River. In most areas, physical disruptions and conflicts among water users compromise the degree to which this strategy can be carried out. Focus management on units that have the greatest potential for sustained productivity (from objective 1).

— Use natural climatic fluctuations to increase wetland management opportunities. Periodic drought may hasten full or partial drawdowns in some units. Although such drawdowns maximize the long-term viability of wetlands, the availability of wetlands with water is reduced during drought. In contrast, previous management emphasized retaining as much water as possible to offset landscape-level drought effects on migratory birds at the expense of long-term capacity to sustain wetland productivity in refuge impoundments.

— Use periodic, growing-season drawdown over multiple seasons if required to (1) stimulate production of seed-bearing annual plants,

(2) increase invertebrate biomass, and
(3) stimulate establishment and expansion of emergent and submergent plant species.

— During the drawdown phase, use additional disturbance, especially prescribed fire, mechanical soil treatment (for example, disking and sheep-foot packer), and defoliation (haying or grazing) to (1) increase vegetation and invertebrate response during the regenerative phase, and (2) to control robust emergent vegetation.

— Use water level management and muskrat herbivory to reduce robust emergent vegetation, especially cattail and common reed.

— Periodically use aerially applied herbicides to reduce the extent of monotypic emergent vegetation in portions of impoundments that, historically, do not respond to water level management (cannot hold >3 feet of water during the growing season).

— Confine major releases from upstream reservoirs to September through May, reducing extended inundation during the growing season when most wetland birds are nesting. Ideally, spring releases from Canada to the United States would occur according to the natural hydroperiod as identified in the international agreement for the Souris River basin (United States and Canadian Negotiating Delegation 1989).

— Use water stored in Lake Darling to supplement spring and summer flows at J. Clark Salyer NWR: (1) during extended or extreme drought, or (2) during the regenerative marsh phase following drawdown of priority impoundments.

Rationale and Assumptions

This objective focuses on implementation and management, using the best available science. Since establishment of the refuge, conflicts in uses of Souris River water, and in objectives for wetland management, have occurred among various water users. Past management goals and objectives rarely addressed or incorporated unforeseen impacts related to the physical disruptions of the Souris River (original construction of dikes and dams), or changes in habitat (biotic and abiotic) resulting from these events. Inevitable decreases in water quality and in marsh management capabilities—especially because of accretion of sediments—are assumed, based on current knowledge of this and similar impounded riverine marshes in the northern Great Plains.

Productivity of northern prairie wetlands historically was maintained by periodic wet and dry cycles. Productivity is particularly enhanced during reflooding following natural drought or drawdown (in managed wetlands). Riverine marshes have an inherent reduced capacity to be dewatered during the growing season because the river flows through each impoundment. Departures from the normal hydroperiod, ill-timed upstream water releases, or significant summer rains can render prescriptive drawdowns ineffective because marsh sediments never dry sufficiently to (1) oxidize soils, (2) establish annual wetland plants (important waterfowl foods and a substrate for invertebrate production), or (3) establish perennial emergent and submergent vegetation (food cover and invertebrate substrate). Furthermore, control of robust emergent plants (cattail, common reed, and bulrush) becomes difficult because of continued anoxic (absence of oxygen) conditions, resulting in little reduction in organic material in marsh soils. Consequently, wetlands often cycle rapidly between open water and a dense-vegetated marsh phase, both of which are less productive than intervening stages. Because attainment of the periodic dry marsh phase is a significant factor limiting long-term wetland function, periodic drawdowns are emphasized under this objective. By necessity, wetland management would become more opportunistic, often working in conjunction with periodic wet-to-dry cycles to achieve management objectives.

Objective 4

Over the course of the CCP, introduce efforts on a watershed level that reduce sedimentation and nonpoint source pollution and/or their effects on riverine marshes.

Strategies

— Develop models similar to the “mallard model” developed by the HAPET that target areas within the watershed (for example, adjacent to major tributaries or drainage systems) that have the highest potential for sediment transport, especially during extreme rainfall or snowmelt events.

— Use models to target areas for conversion from cropland to grassland via USDA’s Conservation Reserve Program, Wetland Reserve Program, or other USDA conservation initiatives. Identify drained wetlands within targeted areas for restoration. Initiate and develop additional conservation or legal measures, or both, that reduce or mitigate impacts from sedimentation and pollution.

— Work with the NRCS to ensure compliance with “Sodbuster,” “Swampbuster,” and other provisions in the Farm Bill (current and future) that reduce soil erosion.

— Explore construction of sediment traps to reduce the extent of sediment accumulations. Where management capability has already been reduced, explore the feasibility of dredging to reduce accumulated sediment in certain impoundments.

— Protect native prairie and prairie wetlands within target areas or adjacent to the refuge, using perpetual easements.

— In cooperation with the USGS, the state of North Dakota, and the USACE, monitor and document sediment loads and water quality associated with various flows. Consider passing flows that contain high sediment loads or that significantly reduce water quality.

Rationale and Assumptions

Initial samples collected at the Souris River basin refuges document only slightly elevated levels of sediment accretion for most impoundments. However, over many decades, sedimentation is expected to continue to the point where storage capacity (water depth) of pools would decline. This would result in reduced capability to manage wetland vegetation, especially robust emergent plants, using water level manipulations. Results from an ongoing sedimentation study at the Souris River refuges are expected to confirm this assumption.

Sedimentation and pollution mainly originate within the watershed, but outside refuge boundaries. Sediment is transported via agricultural runoff carried in the Souris River and its tributaries. Flows that contain high sediment loads or that significantly reduce water quality above Lake Darling are associated with runoff originating from rapidly melting snow or significant rainfall events.

Objective 5

Annually review and adhere to refuge mandates and laws plus pertinent federal, state, and international legal obligations, agreements, and policies when managing or planning to manage water levels of the Lake Darling impoundment, or when attempting to prevent or reduce threats to the impoundment presented by water management practices elsewhere in the Souris River system.

Darla Leslie/USFWS

Lake Darling from the Fire Lookout Tower

Strategies

— By late summer each year, coordinate with the North Dakota State Water Commission, J. Clark Salyer NWR, and Saskatchewan Watershed Authority to determine a fall water release schedule for impoundments on the Souris River in Saskatchewan and Lake Darling.

— Annually reduce the water level in Lake Darling to 1,595.85 feet by October 15 and release no water thereafter.

— Annually reduce the water level in Lake Darling to 1,596.0 feet by February 1 for spring flood control purposes.

— By June 1 each year, store water in Lake Darling up to the interim summer level of 1,596.0 feet for refuge management purposes. This strategy is a proposal to alter the summer storage elevation from 1,597.0 to 1,596.0 feet; implementation would require modification of the International Agreement.

— During spring runoff or after unusually heavy summer rains, release water as needed to avoid exceeding an elevation of 1596.5 feet and to permit storage of an additional 5,000 acre-feet of water beyond that provided by the interim summer level.

— Release no more than 500 cfs, measured at Minot, after June 1.

— Communicate with the North Dakota State Water Commission when planning to release water from Lake Darling to benefit wildlife resources downstream at J. Clark Salyer NWR.

— Pass water from Saskatchewan through Lake Darling to senior water right holders whenever possible. Coordinate with the North Dakota State Water Commission and J. Clark Salyer NWR when releasing such water. Reserve no water stored in Lake Darling for later use by senior or junior water permit holders.

— Routinely scrutinize the USACE operation and maintenance of the Souris River Flood Control Project to verify that it is “operated and maintained in a manner compatible with the migratory waterfowl refuge purpose of the project,” per section 21 of the Flood Control Act of 1965.

— Regularly communicate with the USACE, North Dakota State Water Commission, Saskatchewan Watershed Authority, and other agencies and downstream water users that have an interest in runoff releases. Coordination with the North Dakota State Water Commission and J. Clark Salyer NWR is prudent when discussing water management issues with the Saskatchewan Watershed Authority.

— Work with the USACE and North Dakota State Water Commission to protect Minot from 10-year flood events, per the operating plan of the international agreement for the Souris River basin (United States and Canadian Negotiating Delegation 1989). Alert the North Dakota State Water Commission and other members of the U.S. International Souris River Board when 10-year flood conditions do not occur: when runoff is less than a 10% (1 in 10 years) event and water allocated to the United States does not reach North Dakota to facilitate a natural hydrograph, as required in the international agreement. During such years, pass and/or store runoff water in Lake Darling according to the original intent of Upper Souris NWR as a refuge for migratory waterfowl.

— Publicize releases to describe their purpose and to stop users from removing water not allocated to them.

Rationale and Assumptions

This objectives focuses on legal and policy mandates for management of Lake Darling. Lake Darling contributes to the long-term capacity of riverine wetlands to support diverse plant and wildlife communities, within constraints of legal obligations. The main purpose of Lake Darling is to store a 2-year supply of water for managing downstream marshes at J. Clark Salyer NWR. This often has been incorrectly interpreted that Lake Darling should be kept as full as possible to maintain a lake-like character, except during extreme drought periods. This interpretation drove a decision to raise the summer operating level from 1,596.0 feet to 1,597.0 feet after the Souris River Flood Control Project was completed. This increased elevation and newly constructed dams in Saskatchewan have reduced the ability to appropriately manage wetland habitats at Upper Souris NWR and J. Clark Salyer NWR.

There are two reasons to keep the water elevation below 1,596.0 feet: (1) shoreline erosion, the incidence of botulism, and upstream flooding of riparian woodland are reduced, and (2) water clarity, availability of shoreline for shorebirds and other wildlife, and the extent of wetland vegetation for waterfowl food and cover are improved. Additionally, this elevation limit provides better water level management capability for pool 41.

Relatively low water levels can occur on the Lake Darling impoundment in late summer due to evaporation, low precipitation levels, or water releases to J. Clark Salyer NWR. Low water levels can be ecologically beneficial and, on Lake Darling, can provide storage for unusually heavy summer rains, reducing the untimely flooding of downstream marshes. At times, water that enters Lake Darling may contribute downstream flows that are greater than the legally permitted levels. The impoundment's elevation during such periods may exceed 1,596.5 feet. Such runoff could be stored temporarily in the impoundment as long as the elevation does not exceed 1,598.0 feet. Beyond this level, water could be released at the rate of its flow into the reservoir. Water stored below 1,596.5 feet can either be released slowly over time or allowed to evaporate to an elevation of 1,596.0 feet by February 1. Releases are coordinated with the North Dakota State Water Commission to avoid negative downstream effects.

The 1965 legislative act that authorizes the Souris River Flood Control Project states that flood control is to be "operated and maintained in a manner compatible with the migratory waterfowl refuge purpose of the project."

The act requires the government of Saskatchewan, the U.S. Army, and the Service to appoint a contact person with whom states, provinces, and agencies may consult about project operations. Representatives of the U.S. Army, the Saskatchewan Water Corporation (now the Saskatchewan Watershed Authority), the Service, and the North Dakota State Engineer's office must regularly monitor the project plan.

For flood control purposes, each impoundment designated under the Souris River Flood Control Project must not exceed a stipulated water elevation by February 1. During some years, however, water still flows in the Souris River from Saskatchewan into North Dakota after October 15; water may still need to be released from Lake Darling to reach the impoundment's elevation goal for that date. When this occurs, much of the water may not reach Manitoba before freeze-up, making it difficult to manage downstream water at J. Clark Salyer NWR and in Manitoba. However, water releases up to 500 cfs at Minot during September 1–October 15 should allow the extra water to enter Manitoba by November.

Operating Lake Darling at a summer elevation of 1,596.0 feet would, under normal evaporation rates, allow some water released from Saskatchewan to be stored in Lake Darling (up to 1,595.85 feet). This may result in less water being passed through Lake Darling—water that otherwise might negatively affect the management of downstream resources. Saskatchewan must end releases by October to allow the Souris River to regain flows. For about 15 days after the flows end, excess water drains from river pools and bank storage until most water has passed into Lake Darling. This additional water must be passed through Lake Darling if the impoundment is to be staged at 1,595.85 feet for winter.

Water stored in Lake Darling can be released to supplement spring and summer flows at J. Clark Salyer NWR during extended or extreme drought, or during a regenerative marsh phase that follows drawdown of high-priority wetland impoundments. Water released from Lake Darling is legally owned by the Service and cannot be withdrawn without the agency's written permission. If unauthorized withdrawals are not prevented by the North Dakota State Water Commission, less water arrives at J. Clark Salyer NWR. According to past experience, only 50% of the water that is released into a nearly dry riverbed eventually is delivered to J. Clark Salyer NWR; the remainder replenishes bank storage and fills deep river holes.

The following excerpt from the international agreement describes when water should be released to North Dakota from reservoirs in Saskatchewan.

> "Flow releases to the United States should occur (except in flood years) in the pattern which would have occurred in a state of nature. To the extent possible and in consideration of potential channel losses and operating efficiencies, releases from the Canadian dams will be scheduled to coincide with periods of beneficial use in North Dakota. Normally, the period of beneficial use in North Dakota coincides with the timing of the natural hydrograph, and that timing should be a guide to releases of the United States portion of the natural flows.
>
> Water must be delivered in the spring according to the historical hydrograph to be beneficially used by water permit holders on the Souris River. Delaying the water release from Saskatchewan means that senior water right holders may not be able to benefit from the later release. Late releases can have detrimental effects on fish spawning, waterfowl marsh filling, fishing, and reproduction of over-water-nesting migratory birds."

Island Goal

Manage islands to attract waterfowl and increase nest survival, especially during drought years when wetland habitat outside of the Souris River basin refuges is limited.

Objective 1

By 10 years after CCP approval, prioritize nesting islands based on waterfowl nest densities, nest survival, and maintenance costs.

Strategies

— Use data from nest studies conducted at other sites in North Dakota to evaluate nesting islands for waterfowl production.

— Identify islands that are high maintenance, especially those that are prone to extensive erosion.

— Map island locations and evaluate vegetation cover.

Rationale and Assumptions

Island management would be lower priority than restoration of other, more extensive, habitat types. Therefore, limited resources expended on island management should target islands with the greatest potential to produce waterfowl. Use of nesting islands by waterfowl has not been studied at Upper Souris NWR. Nesting islands have been sufficiently studied at other sites in North Dakota, particularly J. Clark Salyer NWR to provide a basis for evaluations.

Objective 2

During drought conditions, maintain 70% apparent nest survival on priority islands. Within all pools below Lake Darling, island objectives remain secondary to marsh management objectives that enhance long-term wetland productivity.

Strategies

— Manage islands for the following characteristics: (1) large open-water barrier surrounding an island; (2) open shoreline without tall emergent vegetation; (3) far from the mainland; and (4) cover dominated by shrubs, grasses, or tall forbs. Achieve this with the following strategies: water level management, herbicide application to reduce emergent cover surrounding an island, and cover manipulation using plantings and prescribed fire.

— Trap predators such as skunk, raccoon, and mink soon after ice-out in the spring, during drought years or when funding and staff are available. The spring window for effectively capturing mink is narrow; capture is unlikely once nesting has begun.

— Additionally, control mink populations by reducing muskrat populations (the major winter food source of mink). Use partial winter drawdowns to control muskrat populations.

— Remove nesting islands with a history of low nest densities and/or low nest survival. Some islands with low nest survival can be burned in late-April or May to discourage waterfowl nesting.


Dave Menke/USFWS

Muskrat

Rationale and Assumptions

The Upper Souris NWR has approximately 28 nesting islands that probably vary in attractiveness to nesting waterfowl. The two largest islands are only 2 acres apiece; most of the islands are no more than 0.1 acre in size. These islands may be marginally attractive to nesting waterfowl. Many islands are located in shallowly flooded pools, are spaced close together, are located close to shore, or are surrounded by emergent vegetation.

Island objectives remain secondary to marsh management objectives that maintain long-term wetland productivity. Periodic water management, for example, holding water level high to facilitate muskrat herbivory, may conflict with maintenance of predator-free nesting islands (mink numbers are mainly influenced by winter muskrat populations). Summer drawdowns limit the utility of nesting, especially during drought years.

Cultural Resource Goal

Discover and protect cultural resources and interpret sites when the interpretation does not adversely affect habitat management.

Objective 1

Within 15 years of CCP approval, identify refuge cultural resources and protect them from degradation.

Strategies

— Conduct government-to-government consultation with Native American nations—who lived, hunted, or used other resources in the Souris River basin—to identify which cultural or spiritually significant archaeological sites and traditional cultural properties are associated with them.

— Complete cultural resource surveys as needed for management purposes.

— Identify known cultural resource sites on a secure GIS database layer that can be used during management planning.

— Secure funding to survey the remainder of the refuge for cultural resource sites.

— Protect sites by using law enforcement patrol, special use permits, signing, and placement of physical barriers.

Rationale and Assumptions

There are limited resources (funding and staff) that would be allocated yearly to the refuge. The priority for these funding and staffing resources is to protect and manage upland and wetland habitats for wildlife. Protection of cultural resources is an integral part of the purpose. All cultural resource laws and policies would be complied with to prevent the destruction of known and unknown sites.

Objective 2

Within 7 years of CCP approval, develop an interpretive program that will convey the cultural history of the Souris River valley to refuge visitors.

Strategies

— Develop an interpretive area within the headquarters building that gives a visitor an appreciation of the development of the Souris River valley and how it contributes to the visitor's quality of life.

— Develop an interpretive brochure depicting the cultural history of the Souris River valley.

— Develop an interpretive program that can be geared to several ages of visitors.

Rationale and Assumptions

The interpretation of cultural resources is encouraged if sufficient funding and staff are available (so that habitat management will not be negatively affected). Interpretation of the Souris River basin culture would enhance visitors' appreciation and knowledge of the role of refuges to protect native habitats and wildlife. In addition, visitors would be taught to respect, value, and protect cultural resources.

Visitor Service Goal

Provide wildlife-dependent recreational opportunities to a diverse audience when the administration of these programs does not adversely affect wildlife and habitat management.

Hunting Objective

Within 5 years of CCP approval, provide hunting opportunities for 2,500 visitors when resources needed to administer these programs do not adversely affect the refuge's ability to implement habitat management. Continue to provide hunters with safe, reasonable harvest opportunities; uncrowded conditions; minimal conflicts with other users; and satisfaction with their overall experiences.

Strategies

— Annually determine whether resources (funding and staff) would be available to provide hunting opportunities at the current level.

— Add turkey, moose, or other species to the hunted list if compatible.

— Provide hunting opportunities and access for hunters with disabilities, on request, when determined to be compatible.

— Continue to work with the NDGF to provide quality hunting opportunities where possible.

— Continue providing the public with information on refuge hunting opportunities by regularly updating hunting brochures, signs, and the refuge website, on an as-needed basis.

— Continue to provide visibility of refuge law enforcement officers to seek adherence to regulations.

Rationale and Assumptions

"Hunting is clearly an important activity with visitors making multiple trips to the refuge to do so. These visitors feel that hunting at the refuge provides a unique experience they cannot find elsewhere," (Sexton et al. 2005). However, there are limited resources (funding and staff) that would be allocated yearly to the refuge. The priority for these resources is to manage upland and wetland habitat. Hunting programs would be allowed if resources needed to administer hunting would not materially detract from habitat management. The Service intends to keep the present level of programs, unless funding or staffing shortfalls increase. The greatest expenses for the hunting program are for law enforcement, sign development and maintenance, development and printing of hunting brochures, answering questions, and updating the refuge website.

The draft compatibility determination for recreational hunting is in appendix P.

Fishing Objective

Within 5 years of CCP approval, provide fishing opportunities for 50,000 to 75,000 anglers when resources needed to administer these programs do not adversely affect the refuge's ability to implement habitat management. Continue to provide anglers with safe, reasonable harvest opportunities; minimal conflicts with others; and satisfaction with their overall experiences.

Strategies

- Annually determine whether resources (funding and staffing) would be available and make adjustments as needed.
- Provide anglers with disabilities and elderly anglers with at least the current level of fishing opportunities and explore ways to expand access.
- Discuss enhancement of fishing opportunities with the NDGF.
- Continue providing the public with information on refuge fishing opportunities by regularly updating fishing brochures, signs, and the refuge website, on an as-needed basis.
- Continue to provide visibility of refuge law enforcement to seek adherence to regulations.
- Develop cost-effective partnerships to increase and improve shore-angler access to the water.

Rationale and Assumptions

The majority of visitors to the refuge are anglers. "Almost unanimously, fishing was identified as the most cited experience that would bring respondents back to the refuge. Angler visitors appear to be motivated to fish there simply for the enjoyment of the activity, being less concerned about catching large trophy fish. The majority of respondents who fish at the refuge would continue to do so even if they thought they would not catch any fish. This says much about the experience that the refuge provides for this activity, indicating they are likely gaining more from the experience than simple catching fish," (Sexton et al. 2005).


USFWS
Fishing is popular on the refuge.

All boat ramps and fishing access piers were replaced with quality facilities in 2005 and should need only minimal maintenance during the next 15 years. A request for "additional fishing access" areas such as piers and docks was the most frequent comment when asked, "What would enhance your experience at Upper Souris National Wildlife Refuge?" Included in this request was access that accommodated handicapped or elderly anglers (Sexton et al. 2005). Partnerships with local sporting groups could be explored to expand access for shore anglers.

There are limited resources (funding and staff) allocated yearly to the refuge. The priority for these resources is to manage upland and wetland habitat. Fishing programs would be allowed if resources needed to administer them do not materially detract from habitat management. Program expenses include (1) law enforcement, (2) brochure development and printing, (3) annual access and facility maintenance, (4) sign development and maintenance, (5) answering questions, and (6) website development and updating. The Service does not intend (1) to add additional areas for boat or shore fishing, or (2) to increase the hours in a day that anglers can fish at the refuge. The Service intends to keep the present level of fishing access, unless funding and staffing shortfalls require fishing access to be reduced.

The draft compatibility determination for recreational fishing is in appendix R.

Wildlife Observation and Photography Objective

Within 5 years of CCP approval, provide wildlife observation and photography opportunities for no less than 6,000 visitors as a result of improved habitat and wildlife diversity.

Strategies

- Develop a short brochure describing opportunities.
- Develop partnerships with wildlife groups and organizations to market available birding and wildlife opportunities at the refuge.

— Update the refuge website on a regular basis to provide details of current wildlife sightings.

Rationale and Assumptions

Nonconsumptive users most found wildlife observation, driving the Prairie–Marsh Scenic Drive, walking the interpretive trails, and wildlife photography to be important activities. Wildlife observation was ranked the third-largest use by visitors, behind fishing and hunting (Sexton et al. 2005). Visitors tend to observe and photograph wildlife collaterally at the same time they participate in other wildlife-dependent activities. Forty-nine to sixty percent of consumptive users rated viewing waterbirds and other wildlife as important. Sixty-eight percent of nonconsumptive users rated wildlife photography important and approximately 76–93% of nonconsumptive users rated wildlife observation as important (viewing songbirds, waterbirds, and other wildlife) (Sexton et al. 2005).

The Prairie–Marsh Scenic Drive, nature trails, and grouse-dancing photo blinds are the only facilities developed for wildlife observation and photography. However, every place that visitors walk or drive there is wildlife to be seen. Wildlife observation and photography go hand-in-hand with interpretation and environmental education programs. Although the Service does not plan to expand these facilities, a greater diversity of wildlife would be available for watching and photographing as the habitat improves.

Deb Parker/USFWS

Entry Point to the Prairie–Marsh Scenic Drive

The draft compatibility determination for wildlife observation and wildlife photography is in appendix Q.

Environmental Education and Interpretation Objective

Within 5 years of CCP approval, provide environmental education programming to no less than 100 students per year. Provide interpretive exhibits that will be viewed by 15 percent of visitors per year. Emphasize learning about natural plant and animal communities, ecological processes, refuge management, and restoration of upland and wetlands.

Strategies

— Build a learning center and hire an environmental education coordinator that would provide programs on and off the refuge to diverse citizens of all ages.

— Build an interactive education and interpretive website.

— Write an education and interpretive plan that focuses on enhancing awareness of prairie and wetland ecology and management. Ensure the curriculum is fresh and dynamic and meets the needs of all students and adults.

— Develop strong educational partnerships with schools and other government entities to efficiently tell the refuge story.

— Educate students and families of a transient Air Force workforce so they can advocate protecting fish and wildlife habitat and support refuges after they move.

— Complete two new kiosks and interpretive panels.

— Complete reconstruction of the Prairie–Marsh Scenic Drive and development of interpretive panels in conjunction with the Federal Highway Administration.

— Apply for Scenic Byway designation to attract visitors.

— Upgrade and replace interpretive and information panels that are consistent with the refuge theme.

— Build an elevated platform overlooking pools B and C to enhance the visitor's experience of marsh wildlife by interpreting the marsh ecosystem.

— Upgrade the audiovisual equipment and the refuge orientation slide show.

— In cooperation with partners, participate in at least two special events annually to increase visitors' knowledge and understanding of wildlife conservation and related issues.

— Construct additional interpreted hiking/walking trails or improve existing trails.

Rationale and Assumptions

Within commuting distance of Upper Souris NWR there is a population of at least 60,000 people, including Minot Air Force Base located 14 miles east. Survey results show that 93% of visitors reside within the state (Sexton et al. 2005). There are unlimited opportunities to educate youth about wildlife and habitat; most of these youth will leave the state when they graduate and take the message elsewhere.

During the public scoping meeting process, most participants asked for more environmental education opportunities at the refuge.

Refuge visitor survey results (Sexton et al. 2005) indicate the following:

— kiosks or signs with information about the refuge and its wildlife and self-guided interpretive trails and auto tours are important or very important to approximately 64% of visitors;

— environmental education programs, interpretive exhibits, and interpretive trails are important to 46–75% of visitors drawn to the refuge for nonconsumptive activities;

— 56% of visitors surveyed stated that special events (environmental education, open houses, Migratory Bird Day) at the refuge are important to their decision to visit the refuge;

— 33% of respondents indicated that having more education and interpretive programs would maximize their experience while visiting the refuge;

— 76% of nonconsumptive users stated they would like to see more hiking/walking trails.

Unfortunately, the Upper Souris NWR does not have educational facilities or staff to provide this valuable service. The refuge's priority is to manage upland and wetland habitats to prevent degradation. As the habitat improves and more is learned about refuge biology, there would likely be more ability to create increased environmental education opportunities for visitors to learn about, appreciate, and become supporters of refuge management efforts.

The draft compatibility determination for environmental education and interpretation is in appendix Q.

Non-wildlife-dependent Public Use

Objectives and strategies would not be developed for non-wildlife-dependent public use activities. Examples of these activities are canoeing, boating, berry picking, horseback riding, walking, hiking, bicycling, cross-country skiing, snowshoeing, four-wheeling, swimming, water skiing, sailing, and snowmobiling.

These types of activities may be compatible when associated with wildlife-dependent public use. For example, berry picking along a trail might be allowed as a compatible activity incidental to the wildlife-dependent public use of wildlife observation. Compatibility of activities would be determined on an individual basis by the refuge manager as needed in the future.

Research and Science Goal

Conduct innovative natural resource management using sound science and applied research to advance the understanding of natural resource function and management within the northern Great Plains.

Objective 1

During the 15 years following CCP approval, identify and prioritize research needs required to meet the refuge's goals and objectives; promote investigations that reliably address these needs.

Strategies

— Conduct vegetation and wildlife inventories of all plant communities within major habitats identified in chapter 3. Use initial inventories as baseline data to assess past and future changes in plant and animal community composition.

— Use periodic surveys (for example, every 5 years) to assess vegetation composition and structure of high-priority refuge habitats.

— Focus wildlife population research on assessments of species–habitat relationships. Develop models that predict wildlife response to habitat management or restoration.

— Design and conduct issue-driven research unlikely to be reliably addressed using long-term monitoring. Develop predictive models of habitat management and restoration.

— Promote refuge research and science priorities within the broader scientific community. Ensure that cooperative research focuses on meeting information needs identified in habitat management goals and objectives.

Rationale and Assumptions

Habitat-based goals and objectives form the basis for setting research and monitoring priorities for Upper Souris NWR. Investigations must be sufficiently designed, funded, and carried out to reliably address proposed hypotheses or questions.

Partnerships are integral to meeting the research and science goal and objectives. Cooperative efforts are supported with shared funding, lodging, vehicles, equipment, knowledge, and expertise.

Operations Goal

Efficiently use funding and staffing for the benefit of all natural and cultural resources, the National Wildlife Refuge System, and present and future generations. Effectively manage visitor service programs that complement habitat management.

Objective 1

Within 15 years of CCP approval, hire five additional personnel to protect current resources; assist with administrative duties; and assist the rest of the staff to properly handle public use and restore native prairie habitat and manage wetland resources on 100% of high-priority habitat units and 50% of moderate-priority habitat units.

Strategies

- Hire a public use specialist with to plan and carry out an intensive public awareness program to educate the public about habitat restoration efforts.
- Hire one full-time wildlife biologist and two permanent seasonal technicians to monitor wildlife and habitat responses to habitat protection, management, and restoration efforts.
- Hire a full-time fire management specialist to manage the fire program necessary for habitat restoration.
- Hire an administrative clerk to assist with additional administrative duties.
- Maintain 40% of equipment and facilities to Service standards within 5 years of CCP approval.
- Replace 25% of worn-out equipment within 5 years of CCP approval, as needed.

Rationale and Assumptions

There are limited resources (funds and staff) allocated yearly to the refuge. The priority for these resources is to manage upland and wetland habitats. If the target (minimum) staffing level and funding are not reached or only partially reached, fewer accomplishments would be achieved.

Objective 2

Within 15 years of CCP approval, secure additional funding necessary to complete habitat restoration on 100% of high-priority habitat units and 50% of moderate-priority habitat units. Include restoration with (1) native prairie reseeding; and (2) intensive management of existing native prairie including woody plant reduction, invasive species control, and increased prescribed fire and grazing activities.

Strategies

- Use additional funding to purchase native grass and forb seeds for reseeding former cropland and planted cover.
- Use additional funding to purchase herbicides to control invasive species and remove/control woody plant expansion.
- Continue to use maintenance management funding to maintain or replace equipment and facilities, as needed, to Service standards.
- Secure additional funding to enhance streamflow monitoring and water management and develop new area-capacity data for refuge marshes.
- Use additional funding to purchase facilities to increase the environmental education program and expand outreach activities.
- Maintain existing facilities and equipment to Service standards, including necessary roads, dikes, water control structures, buildings, and fences (all of which are critical in habitat management and protection).

Rationale and Assumptions

There are limited resources (funds and staff) allocated yearly to the refuge. The priority for these resources is to protect and manage upland and wetland habitats for wildlife. Operational funding would be targeted to work on the highest priority habitats and habitat units at the refuge. Management intensity would be increased on those habitats and units and would require additional personnel and funding to restore native prairie.

STEP-DOWN MANAGEMENT PLANS

The CCP for the Souris River basin refuges is intended to be a broad umbrella plan (1) that outlines general concepts and objectives for habitat, wildlife, visitor services, cultural resources, and partnerships; and (2) that guides refuge management for the next 15 years. Step-down management plans provide greater detail for carrying out specific actions authorized by the CCP. Tables 21–23 present step-down management plans for each refuge that are anticipated to be needed, along with their current status and next revision date.

PERSONNEL

Currently, the Des Lacs NWR has a staff of 13 full-time employees. Two employees are directly assigned to Des Lacs NWR, and the remaining 11 employees work in the Des Lacs NWR Complex with duties at Des Lacs NWR in addition to duties at three other stations in the refuge complex. Table 24 lists these positions along with six new positions (three specifically assigned to Des Lacs NWR) that are needed for full implementation of the CCP.

Currently, the J. Clark Salyer NWR Complex has a staff of 16 full-time employees to manage the refuge, seven easement refuges, and the J. Clark Salyer WMD. Table 25 lists these positions along with six new positions that are needed for full implementation of the CCP (those positions needed only for the refuge).

Currently, the Upper Souris NWR has a staff of seven full-time employees. Table 26 lists these positions along with four new positions that are needed for full implementation of the CCP.

Table 21. Step-down management plans for Des Lacs NWR, North Dakota.

Step-down Management Plan	*Completed Plan, Year Approved*	*New or Revised Plan, Completion Year*
Fire management plan	2003	2007
Habitat management plan	—	2010
Habitat management plan (annual)	2006	2007
Hunting plan	1993	2010
Integrated pest management plan	2005	2010
Law enforcement plan	—	2010
Predator management plan	1985	2010
Safety plan	1995	2007
Visitor service plan	1990	2010
Water management plan	2006	2007

Table 22. Step-down management plans for J. Clark Salyer NWR, North Dakota.

Step-down Management Plan	*Completed Plan, Year Approved*	*New or Revised Plan, Completion Year*
Cropland management plan	1997	2008
Development plan	1985 (obsolete)	2009
Duck viral enteritis contingency plan	1973 (obsolete)	2012
Fire management plan	2001	2006
Habitat management plan (annual)	2006	2006
Hunting and fishing plan	1986	1993
Integrated pest management plan	2005	2010
Law enforcement plan	—	2011
Predator management plan	1985	2012
Safety plan	1998	2008
Trapping plan	1968	2010
Visitor service plan	—	2014
Water management plan (annual)	2006	2006

Table 23. Step-down management plans for Upper Souris NWR, North Dakota.

Step-down Management Plan	*Completed Plan, Year Approved*	*New or Revised Plan, Completion Year*
Fire management plan	1999	2007
Grassland management plan	1995	2008*
Habitat work plan (annual)	2006	2007
Hunting plan	1993	2009
Integrated pest management plan	2000	2006
Law enforcement plan	—	2006
Predator management plan	1985	2006
Safety plan	2005	2006
Sign plan	1986	2012**
Visitor service plan	—	2006
Water management plan (annual)	2006	2007
Water management plan (long-range)	1968	2010*

* *Year dependent on hiring a biologist.*
** *Year dependent on hiring a public use specialist.*

Table 24. Current and proposed staff for Des Lacs NWR, North Dakota.

	Current Positions *GS=General Schedule Position* *WG=Wage Grade Position*	*Additional Proposed Positions* *(Unfunded Staffing)*
Management Staff	Refuge project leader, GS-14* Deputy project leader, GS-13*	Refuge operations specialist, GS-11 Resource specialist, GS-11*
Biological Staff	Wildlife biologist, GS-12*	Wildlife biologist, GS-11 Biological science technician, GS-7*
Visitor Service Staff	*None*	*None*
Administrative Staff	Administrative officer, GS-9* Administrative support assistant, GS-5*	*No additional positions*
Maintenance Staff	Engineering equipment operator, WG-10 Maintenance worker, WG-8	Tractor operator, WG-7
Fire Management Staff	Fire management officer, GS-11* Supervisory range technician, GS-7* Prescribed fire specialist, GS-7* Range technician, GS-6* Range technician, GS-5* Dispatcher, GS-6*	*No additional positions*
Law Enforcement Staff	*None*	Park ranger, GS-9*

** This position supports the refuge but is assigned to the Des Lacs NWR Complex, working at all four stations.*

Table 25. Current and proposed staff for J. Clark Salyer NWR, North Dakota.

	Current Positions *GS=General Schedule Position* *WG=Wage Grade Position*	*Additional Proposed Positions* *(Unfunded Staffing)*
Management Staff	Refuge complex project leader, GS-14 Deputy project leader, GS-13 Supervisory refuge operations specialist, GS-12* Refuge operations specialist, GS-5/7/9	Refuge operations specialist, GS-9/11 Refuge operations specialist, GS-9/11
Biological Staff	Refuge complex biologist, GS-12 Private lands biologist, GS-11*	Wildlife biologist, GS-11 Resource specialist, GS-11
Visitor Service Staff	*None*	Law enforcement officer, GS-9
Administrative Staff	Administrative officer, GS-9 Administrative support assistant, GS-6	Clerk, GS-5
Maintenance Staff	Auto mechanic, WG-10 Engineering equipment operator, WG-8 Engineering equipment operator, WG-8* Biological science technician, GS-8*	*No additional positions*
Fire Management Staff	Fire management officer, GS-11 Prescribed fire specialist, GS-9 Fire program technician, GS-7 Range technician, GS-5	*No additional positions*
Law Enforcement Staff	*None*	*None*

** This position supports the refuge, but primary duties are within the wetland management district.*

Table 26. Current and proposed staff for Upper Souris NWR, North Dakota.

	Current Positions *GS=General Schedule Position* *WG=Wage Grade Position*	*Additional Proposed Positions (Unfunded Staffing)*
Management Staff	Refuge project leader, GS-13 Deputy project leader, GS-12	*No additional positions*
Biological Staff	Wildlife biologist, GS-11*	Biological science technician, GS-9 (permanent career-seasonal, 0.5 FTE)
Visitor Service Staff	*None*	Outdoor recreation planner, GS-11
Administrative Staff	Administrative support assistant, GS-7	Clerk, GS-5 (permanent career-seasonal, 0.5 FTE)
Maintenance Staff	Maintenance worker, WG-8 Biological technician (wildlife), GS-9	*No additional positions*
Fire Management Staff	Fire program technician, GS-7	*No additional positions*
Law Enforcement Staff	Park ranger, GS-9	Park ranger, GS-9 (permanent career-seasonal, 0.5 FTE)

**Refuge operations needs system (RONS) position: currently unfunded (transferred to Lost Trail NWR in 2004).*

Funding

Projects required to carry out the CCP are funded through two separate systems, as follows:

- The refuge operations needs system (RONS) is used to document requests to Congress for funding and staffing needed to carry out projects above the existing base budget.
- The Service asset maintenance management system (SAMMS) is used to document the equipment, buildings, and other existing properties that require repair or replacement.

Lists of the RONS and SAMMS projects required to carry out this draft CCP (including maintenance of structures and equipment to a safe and productive standard for the 15 years of the CCP) are in the following appendices: Des Lacs NWR (appendix S), J. Clark Salyer NWR (appendix T), and Upper Souris NWR (appendix U).

Partnership Opportunities

Opportunities exist near the Souris River basin refuges to establish partnerships with sporting clubs, elementary and secondary schools, and community organizations. A strong partnership already exists between the Service and the NDGF.

At regional and state levels, partnerships might be established with organizations such as Ducks Unlimited, The Nature Conservancy, National Audubon Society, National Wild Turkey Federation, North Dakota Wildlife Federation, wildlife societies, Delta Waterfowl, and many others.

Monitoring and Evaluation

Adaptive management is a flexible approach to long-term management of biotic resources. Adaptive management is directed, over time, by the results of ongoing monitoring activities and other information. More specifically, adaptive management is a process by which projects are carried out within a framework of scientifically driven experiments to test the predictions and assumptions outlined within a CCP (figure 16).

To apply adaptive management, specific survey, inventory, and monitoring protocols would be adopted for the Souris River basin refuges. The habitat management strategies would be systematically evaluated to determine management effects on wildlife populations. This information would be used to refine approaches and determine how effectively the objectives are being accomplished. Evaluations would include participation by the HAPET, the ecosystem team, and other appropriate partners. If monitoring and evaluation indicate undesirable effects for target and nontarget species or communities, alterations to the management projects would be made. Subsequently, the CCP would be revised.

Specific monitoring and evaluation activities will be described in the step-down management plans (tables 21–23).

Plan Amendment and Revision

The final CCP will be reviewed annually to determine the need for revision. A revision would occur if and when significant information becomes available. The final CCP will be supported by detailed step-down management plans to address the completion of specific strategies in support of the Souris River basin refuges' goals and objectives. Revisions to the CCP and the step-down management plans will be subject to public review and NEPA compliance.

At a minimum, the final CCP will be evaluated every 5 years and revised after 15 years.

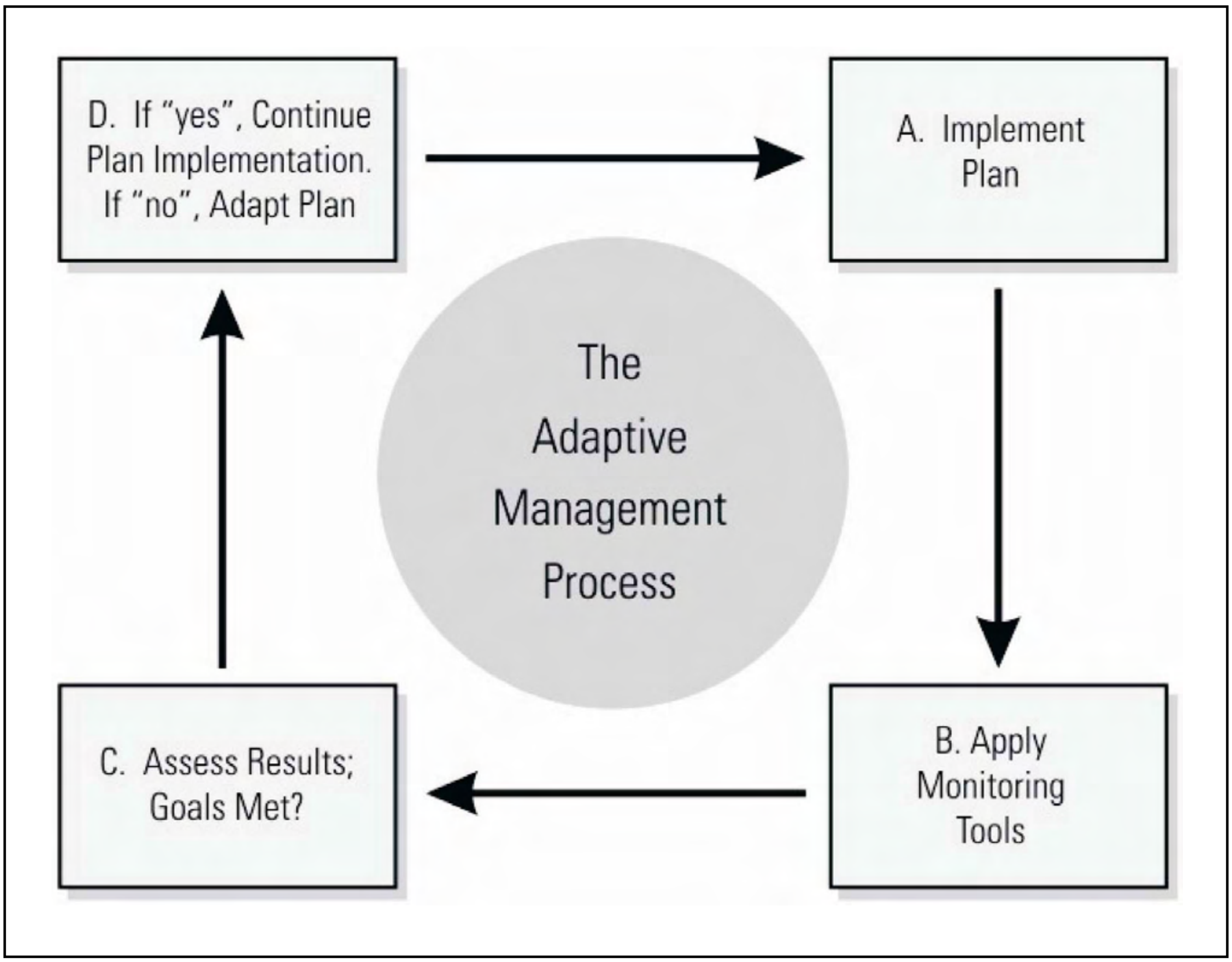

Figure 16. The adaptive management process.

Glossary

abiotic—Pertaining to nonliving things.

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

adaptive management—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 a 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.

Administration Act—National Wildlife Refuge System Administration Act of 1966.

alternatives—Different sets of objectives and strategies or means of achieving refuge purposes and goals, helping fulfill the Refuge System mission and resolving issues.

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

animal unit month (AUM)—Measure of the quantity of livestock forage. Equivalent to the amount of forage needed to support a 1,000-pound animal (or one cow/calf pair) for one month.

annual—A plant that flowers and dies within 1 year of germination.

approved acquisition boundary—Project boundary that the director of the U.S. Fish and Wildlife Service approves on completion of the detailed planning and environmental compliance process.

ATV—All-terrain vehicle.

AUM—See *animal unit month.*

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

biological control, *also* **biocontrol**—Reduction in numbers or elimination of unwanted species by the introduction of natural predators, parasites, or diseases.

biological diversity, *also* **biodiversity**—Variety of life and its processes, including the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur ("U.S. Fish and Wildlife Service Manual" 052 FW 1.12B). The National Wildlife Refuge System's focus is on endemic species, biotic communities, and ecological processes.

biological integrity—Composition, structure, and function at the genetic, organism, and community levels consistent with natural conditions and the biological processes that shape genomes, organisms, and communities.

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

biota—Animals and plants of a given region.

biotic—Pertaining to life or living organisms.

breeding habitat—Habitat used by migratory birds or other animals during the breeding season.

buffer zone or buffer strip—Protective land borders around critical habitats or water bodies that reduce runoff and nonpoint source pollution loading; areas created or sustained to lessen the negative effects of land development on animals and plants and their habitats.

canopy—Layer of foliage, generally the uppermost layer, in a vegetative stand; midlevel or understory vegetation in multilayered stands. Canopy closure *(also* canopy cover*)* is an estimate of the amount of overhead vegetative cover.

CCC—See *Civilian Conservation Corps.*

CCP—See *comprehensive conservation plan.*

CFR—See *Code of Federal Regulations.*

cfs—Cubic feet per second.

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.

climax—Community that has reached a steady state under a particular set of environmental conditions; a relatively stable plant community; the final stage in ecological succession.

Code of Federal Regulations (CFR)—Codification of the general and permanent rules published in the "Federal Register" by the executive departments and agencies of the federal government. Each volume of the CFR is updated once each calendar year.

community—Area or locality in which a group of people resides and shares the same government.

compatible use—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 U.S. Fish and Wildlife Service Manual" 603 FW 3.6). A compatibility determination supports the selection of compatible uses and identified stipulations or limits necessary to ensure compatibility.

complex—See *refuge complex.*

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 U.S. Fish and Wildlife Service Manual" 602 FW 1.5).

concern—See *issue.*

conservation—Management of natural resources to prevent loss or waste. Management actions may include preservation, restoration, and enhancement.

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

cool-season grass—Grass that begins growth earlier in the season and often become dormant in the summer; will germinate at lower temperatures (65–85°F). Examples are western wheatgrass, needle and thread, and green needlegrass.

cooperative agreement—Legal instrument used when the principal purpose of the transaction is the transfer of money, property, services or anything of value to a recipient in order to accomplish a public purpose authorized by federal statute and substantial involvement between the Service and the recipient is anticipated.

coordination area—Wildlife management area made available to a state, by "(A) cooperative agreement between the United States Fish and Wildlife Service and the state fish and game agency pursuant to Section 4 of the Fish and Wildlife Coordination Act (16 U.S.C. 664); of (B) by long-term leases or agreements pursuant to the Bankhead–Jones Farm Tenant Act (50 Stat. 525; 7 U.S.C. 1010 et seq.)." States manage coordination areas, but they are part of the Refuge System. CCPs are not required for coordination areas.

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

coulee—A deep ravine or gulch with sloping sides, often dry, that has been formed by running water.

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

CRP—Conservation Reserve Program.

cryptogamic crust—A thin, dry, somewhat flaky assemblage of algae, lichens, mosses, and fungi, plus byproducts of these organisms mixed with soil particles. Crusts influence processes at the soil–air interface. For example, they can prevent soil erosion, help facilitate nitrogen fixation, slow evaporation, and provide a hospitable environment for germinating plants. Although a somewhat inconspicuous component of the semi-arid northern prairie, these crusts are absent in areas disturbed by cultivation in the region.

cultivar—A plant variety that has been produced in cultivation by selective breeding.

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

cultural resource inventory—Professionally conducted study designed to locate and evaluate evidence of cultural resources present within a defined area. Inventories may involve various levels including background literature search (class I), sample inventory of project site distribution and density over a larger area (class II), or comprehensive field examination to identify all exposed physical manifestation of cultural resources (class III).

database—Collection of data arranged for ease and speed of analysis and retrieval, usually computerized.

deciduous—Pertaining to any plant organ or group of organs that is shed annually; perennial plants that are leafless for sometime during the year.

defoliation—Removing of vegetative parts; to strip vegetation of leaves; removal can be caused by weather, mechanical, animals, and fire.

demography—Quantitative analysis of population structure and trend.

dense nesting cover (DNC)—Composition of grasses and forbs that allows for a dense stand of vegetation that protects nesting birds from the view of predators, usually consisting of one to two species of wheatgrass, alfalfa, and sweetclover.

disturbance—Significant alteration of habitat structure or composition. May be natural (for example, fire) or human-caused events (for example, timber harvest).

DNC—See *dense nesting cover.*

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

EA—See *environmental assessment.*

early seral stage—Area that is in the primary stages of ecological succession.

easement—Agreement by which a landowner gives up or sells one of the rights on his/her property.

ecological succession—Orderly progression of an area through time from one vegetative community to another in the absence of disturbance. For example, an area may proceed from grass–forb through aspen forest to mixed-conifer forest.

ecological triage— Ecological triage is the assignment of priority order to habitats or habitat types on the basis of where funds and resources can be best used, are most needed, or are most likely to achieve success in meeting stated goals and objectives.

ecosystem—Dynamic and interrelating complex of plant and animal communities and their associated nonliving environment; a biological community, together with its environment, functioning as a unit. For administrative purposes, the 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.

ecotourism—Tourism that maintains and preserves natural resources as a basis for promoting economic growth and development resulting from visitation to an area.

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

endangered species, federal—Plant or animal species listed under the Endangered Species Act of 1973, as amended, that is in danger of extinction throughout all or a significant portion of its range.

endangered species, state—Plant or animal species in danger of becoming extinct or extirpated in a particular state within the near future if factors contributing to its decline continue. Populations of these species are at critically low levels or their habitats have been degraded or depleted to a significant degree.

endemic species—Plants or animals that occur naturally in a certain region and whose distribution is relatively limited to a particular locality.

environmental assessment (EA)—Concise public document, prepared in compliance with the National Environmental Policy Act, that briefly discusses the purpose and need for an action and alternatives to such action, and 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).

environmental education—Education aimed at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve these problems, and motivated to work toward their solution.

environmental health—Natural composition, structure, and functioning of the physical, chemical, and other abiotic elements, and the abiotic processes that shape the physical environment.

EO—Executive order.

EPA—Environmental Protection Agency.

extinction—Complete disappearance of a species from the earth; no longer existing.

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

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

federal land—Public land owned by the federal government, including lands such as national forests, national parks, and national wildlife refuges.

federally listed species—Species listed under the federal Endangered Species Act of 1973, as amended, either as endangered, threatened, or species at risk (formerly candidate species).

fee title—Acquisition of most or all of the rights to a tract of land.

fen, *also* **alkaline bog**—Wetland that is primarily organic soil material (peat or muck) that took thousands of years to develop.

FERC—Federal Energy Regulatory Commission.

finding of no significant impact (FONSI)—Document prepared in compliance with the National Environmental Policy Act, supported by an environmental assessment, that briefly presents why a federal action will have no significant effects on the human environment and for which an environmental impact statement will not be prepared (40 CFR 1508.13).

fire regime—Description of the frequency, severity, and extent of fire that typically occurs in an area or vegetative type.

flora—All the plant species of an area.

fluvial—Regarding flowing water, usually rivers and streams. Important fluvial processes include erosion, downcutting of channels, and suspension and transport of sediments.

FMP—Fire management plan.

FONSI—See *finding of no significant impact.*

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.

forest—Group of trees with their crown overlapping (generally forming 60–100% cover).

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; the process of reducing the size and connectivity of habitat patches, making movement of individuals or genetic information between parcels difficult or impossible.

FTE—Full-time equivalent employee.

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

geomorphology—The study of the physical features of the surface of the earth and their underlying geological structure.

GIS—See *geographic information system.*

global positioning system (GPS)—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 U.S. Fish and Wildlife Service Manual" 620 FW 1.5).

"go-back" prairie—Previously cultivated cropland that has been allowed to revert to herbaceous cover.

GPS—See *global positioning system.*

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

guild—A group of species that use a common resource base in a similar fasion within an ecological community. A guild can be generally defined (for example, grassland birds) or specifically defined (for example, seed-eating small mammals).

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

habitat conservation—Protection of animal or plant habitat to ensure that the use of that habitat by the animal or plant is not altered or reduced.

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

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

hemi-marsh—The emergent phase of a seasonal or semipermanent wetland where the ratio of open water area to emergent vegetation cover is about 50:50, and vegetation and open water areas are highly interspersed.

herbivore—Animal feeding on plants.

herbivory—The eating of plants, especially ones that are still living.

herptile—A reptile or amphibian.

hydrography—Graph of the water level or rate of flow of a body of water as a function of time, showing seasonal change.

hydroperiod—The seasonal and cyclical pattern of water in a wetland or river.

IBA—"Important Bird Area," as designated by the American Bird Conservancy.

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.

Improvement Act—National Wildlife Refuge System Improvement Act of 1997.

integrated pest management—Methods of managing undesirable species such as invasive plants; education, prevention, physical or mechanical methods of control, biological control, responsible chemical use, and cultural methods.

"interseed"—Mechanical seeding of one or several plant species into existing stands of established vegetation.

introduced species—A nonnative plant or animal species that is intentionally or accidentally released into an ecosystem where it was not previously adapted.

introduction—Intentional or unintentional escape, release, dissemination, or placement of a species into an ecosystem as a result of human activity.

invasive plant, *also* **noxious weed**—Species that is nonnative to the ecosystem under consideration and whose introduction causes, or is likely to cause, economic or environmental harm or harm to human health.

inviolate sanctuary—Place of refuge or protection where animals and birds may not be hunted.

issue—Any unsettled matter that requires a management decision; for example, a Service initiative, opportunity, resource management problem, a threat to the resources of the unit, conflict in uses, public concern, or the presence of an undesirable resource condition ("Draft U.S. Fish and Wildlife Service Manual" 602 FW 1.5).

lentic—Associated with standing fresh water.

lacustrine—Relating to, formed in, living in, or growing in lakes.

lek—A physical area where males of a certain animal species gather to demonstrate their prowess and compete for females before or during the mating season.

local agencies—Municipal governments, regional planning commissions, or conservation groups.

lotic—Relating to, or living in, flowing fresh water.

low-head dam—A human-constructed, wall-like structure that is typically built to back up water in a reservoir. The dam pools water as it flows over the crest or through control structures and drops to the lower water level downstream of the dam.

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

management alternatives—See *alternatives.*

management plan—Plan that guides future land management practices on a tract of land. See *cooperative agreement.*

mean sea level—The sea level halfway between average levels of high and low water.

mechanical control—Reduction in numbers or elimination of unwanted species through the use of mechanical equipment such as mowers and clippers.

mesic—Characterized by, relating to, or requiring a moderate amount of moisture; having a moderate rainfall.

microhabitat—Habitat features at a fine scale; often identifies a unique set of local habitat features.

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

migratory bird—Bird species that follow a seasonal movement from their breeding grounds to their wintering grounds. Waterfowl, shorebirds, raptors, and songbirds are all migratory birds.

migratory game bird—Bird species, regulated under the Migratory Bird Treaty Act and state laws (legally hunted, including ducks, geese, woodcock, and rails).

mission—Succinct statement of purpose or reason for being.

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

mixed-grass prairie—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.

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

monotypic—Having only one type or representative.

moraine—Mass of earth and rock debris carried by an advancing glacier and left at its front and side edges as it retreats.

national wildlife refuge (NWR)—Designated area of land, water, or an interest in land or water within the 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 (Improvement Act)—Sets the mission and the administrative policy for all refuges in the 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—Species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem.

NAWMP—See *North American Waterfowl Management Plan.*

Neotropical migrant, *also* **Neotropical migratory bird**—Bird species that breeds north of the United States–Mexico border and winters primarily south of this border.

NEPA—National Environmental Policy Act.

nest success—Percentage of nests that successfully hatch one or more eggs of the total number of nests initiated in an area.

NOI—See *notice of intent.*

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

North American Waterfowl Management Plan (NAWMP)—North American Waterfowl Management Plan, signed in 1986, recognizes that the recovery and perpetuation of waterfowl populations depends on restoring wetlands and associated ecosystems throughout the United States and Canada. It established cooperative international efforts and joint ventures composed of individuals; corporations; conservation organizations; and local, state, provincial, and federal agencies drawn together by common conservation objectives. The Souris River basin refuges are included in the "Prairie Pothole Joint Venture."

notice of intent (NOI)—Notice that an environmental impact statement will be prepared and considered (40 CFR 1508.22); published in the "Federal Register."

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 (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 United States and to public health.

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

NWI—National wetland inventory.

NWR—See *national wildlife refuge.*

NWRS—See *National Wildlife Refuge System.*

objective—Concise statement of what is to be achieved, when and where it is to be achieved, and who is responsible for the work. Objectives are derived from goals and provide the basis for determining management strategies. Objectives should be attainable, time-specific, and measurable.

palustrine—Refers to a nontidal wetland dominated by trees, shrubs, persistent emergents, and emergent mosses or lichens; or a wetland in tidal areas where salinity due to ocean-derived salts is below 0.5 parts per thousand.

paradigm—An example, view, or philosophy serving as a pattern or model.

Partners in Flight—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.

partnership—Contract or agreement entered into by two or more individuals, groups of individuals, organizations or agencies in which each agrees to furnish a part of the capital or some in–kind service, such as labor, for a mutually beneficial enterprise.

patch—Area distinct from that around it; 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.

phenology—The relationship between plant or animal development and climatic conditions.

PL—Public law.

planning team—Team that prepares the comprehensive conservation plan. Planning teams are interdisciplinary in membership and function. A team generally consists of a planning team leader; refuge manager and staff biologist; staff specialists or other representatives of Service programs, ecosystems or regional offices; and state partnering wildlife agencies as appropriate.

planning team leader—Typically a professional planner or natural resource specialist knowledgeable of the requirements of National Environmental Policy Act and who has planning experience. The planning team leader manages the refuge planning process and ensures compliance with applicable regulatory and policy requirements.

planning unit—Single refuge, an ecologically or administratively related refuge complex, or distinct unit of a refuge. The planning unit also may include lands currently outside refuge boundaries.

plant association—Classification of plant communities based on the similarity in dominants of all layers of vascular species in a climax community.

plant community—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 (ponderosa pine or bunchgrass).

population sink—A demographic deficit (deaths + immigration > births + emigration) that leads to local species extinction, without immigration from sources.

PPJV—"Prairie Pothole Joint Venture."

predation—Mode of life in which food is primarily obtained by the killing or consuming of animals.

prescribed fire—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—See *wildlife-dependent recreational use*.

pristine—Typical of original conditions.

private land—Land that is owned by a private individual, a group of individuals, or a nongovernmental organization.

private landowner—Any individual, group of individuals, or nongovernmental organization that owns land.

private organization—Any nongovernmental organization.

propagule—Any part of a plant (such as a bud, sucker, spore, or other offshoot) that aids in dispersal of the species and from which a new individual may develop.

proposed action—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). The draft comprehensive conservation plan.

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—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.

public involvement plan—Broad long-term guidance for involving the public in the comprehensive planning process.

public land—Land that is owned by the local, state, or federal government.

purpose of the refuge—Purpose 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 U.S. Fish and Wildlife Service Manual" 602 FW 1.5).

refuge complex—A grouping of two or more Service units (for example, national wildlife refuge, wetland management district) that is administered by staff at one of the units.

refuge lands—Lands in which the Service holds full interest in fee title, or partial interest such as limited-interest refuges.

"Refuge Operations Needs System" (RONS)—National database that contains the unfunded operational needs of each refuge. Projects included are those required to carry out approved plans and meet goals, objectives, and legal mandates.

refuge purpose—See *purpose of the refuge.*

Refuge System—See *National Wildlife Refuge System.*

region 6—"Mountain–Prairie Region" of the U.S. Fish and Wildlife Service, which administers Service programs in Colorado, Kansas, Montana, Nebraska, North Dakota, South Dakota, Wyoming, and Utah.

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

restoration—Artificial manipulation of a habitat to restore it to something close to its natural state. Involves taking a degraded grassland and reestablishing habitat for native plants and animals. Restoration usually involves the planting of native grasses and forbs, and may include shrub removal and prescribed burning.

rhizomatous—A plant having rhizomes.

rhizome—A continuously growing, horizontal, underground stem that produces roots and sends shoots upward at intervals (for example, many iris species).

riparian area *or* **riparian zone**—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.

riprap—Loose rock used in water or on soft ground to form an embankment or foundation for a structure.

RONS—See *Refuge Operations Needs System.*

rootstock—A root or part of a root used as a stock for reproduction.

runoff —Water from rain, melted snow, or agricultural or landscape irrigation that flows over the land surface into a water body.

SAMMS—See *Service Asset Maintenance Management System.*

sandhills—Sand dunes created by wind and wave action following the melting of large glaciers about 8,000–10,000 years ago. Soils are sand and silt. Local relief exceeds 80 feet in some places.

scarp—A line of low, steep-sloped cliffs or beaches caused by wind or wave erosion.

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

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

seral stage—Any plant community whose plant composition is changing in a predictable way; characterized by a group of species or plant community that will eventually be replaced by a different group of species or plant community, for example, an aspen community changing to a coniferous forest community.

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

"Service Asset Maintenance Management System" (SAMMS) —National database that 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.

shelterbelt—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.

snag—Standing dead tree from which the leaves or needles and most of the branches have fallen. Many species of wildlife and some plants rely on snags for food and cover.

sound professional judgment—Finding, determination, or decision that is consistent with principles of sound fish and wildlife management and administration, available science and resources, and adherence to the requirements of the National Wildlife Refuge System Administration Act and other applicable laws.

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; the Service's species of management concern; and species identified by the Partners in Flight program as being of extreme or moderately high conservation concern.

special use permit—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 ("National Wildlife Refuge System 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 that: (1) are documented or have apparent population declines; (2) are small or restricted populations; or (3) depend on restricted or vulnerable habitats.

stand—Any homogenous area of vegetation with more or less uniform soils, landform, and vegetation. Typically used to refer to forested areas.

step-down management plan—Plan that provides the details necessary to carry out management strategies identified in the comprehensive conservation plan ("Draft U.S. Fish and Wildlife Service Manual" 602 FW 1.5).

strategy—Specific action, tool, or technique or combination of actions, tools, and techniques used to meet unit objectives ("Draft U.S. Fish and Wildlife Service Manual" 602 FW 1.5).

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

SUP—Special use permit.

surficial—Relating to or occurring on the surface.

tansy ragwort—*Senecio jacobaea* is an Eurasian invasive plant in the sunflower family (Asteraceae). It spreads primarily by seed—a single tansy ragwort plant may produce up to 150,000 seeds, which may remain viable for up to 15 years. All parts of this plant are poisonous. It causes liver damage to cattle and horses, while sheep are affected to a lesser extent. (http://www.oneplan.org/index.htm)

temporarily flooded—Surface water is present for brief periods during the growing season.

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—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.

triage—See *ecological triage.*

trust resource—Resource that, through law or administrative act, is held in trust for the people by the government. A federal trust resource is one for which trust responsibility is given in part to the federal government through federal legislation or administrative act. Generally, federal trust resources are those considered to be of national or international importance no matter where they occur, such as endangered species and species such as migratory birds and fish that regularly move across state lines. In addition to species, trust resources include cultural resources protected through federal historic preservation laws, nationally important and threatened habitats, notably wetlands, navigable waters, and public lands such as state parks and national wildlife refuges.

trust species—See *trust resource.*

understory—Any vegetation whose canopy (foliage) is below, or closer to the ground than canopies of other plants.

upland—Dry ground; other than wetlands.

USACE—U.S. Army Corps of Engineers.

USDA—U.S. Department of Agriculture.

U.S. Fish and Wildlife Service (Service, USFWS)—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 composed 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.

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

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

U.S. Geological Survey (USGS)—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—Concise statement of what the planning unit should be, or what the Service hopes to do, based primarily on the Refuge System mission, specific refuge purposes, and other mandates. In addition, the vision statement is tied to the maintenance and restoration of biological integrity, diversity, and environmental health of each refuge and the Refuge System.

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)—Measurement of the density of a plant community; the height of vegetation that blocks the view of predators to a nest.

VOR—See *visual obstruction reading.*

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

warm-season grass—Grass that begins growth later in the season (early June); require warmer soil temperatures to germinate and actively grow when temperatures are warmer (85–95°F). Examples are Indiangrass, switchgrass, and big bluestem.

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

watershed—Geographic area within which water drains into a particular river, stream or body of water. A watershed includes both the land and the body of water into which the land drains.

wetland—Land transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water.

wetland easement—Perpetual agreement entered into by a landowner and the Service. The easement covers only the wetlands specified in the agreement. In return for a single lump-sum payment, the landowner agrees not to drain, burn, level, or fill wetlands covered by the easement.

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.

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

wilderness—"A wilderness, in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain" (Wilderness Act of 1964 Section 2c [PL 88-577)]). This legal definition places wilderness in the "untrammeled" or "primeval" end of the environmental modification spectrum. Wilderness is roadless lands, legally classified as component areas of the National Wilderness Preservation System, and managed to protect its qualities of naturalness, solitude, and opportunity for primitive types of recreation.

wilderness, recommended—Area studied and found suitable for wilderness designation by both the Director and Secretary, and recommended for designation by the President to Congress. These areas await only legislative action by Congress in order to become part of the Wilderness System. Such areas are also referred to as "pending in Congress" ("Draft U.S. Fish and Wildlife Service Manual" 610 FW 1.5).

wilderness, study area—Lands and waters identified through inventory as meeting the definition of wilderness and undergoing evaluation for recommendation for inclusion in the Wilderness System. A study area must meet the following criteria: (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least 5,000 contiguous roadless acres or is sufficient in size as to make practicable its preservation and use in an unimpaired condition ("Draft U.S. Fish and Wildlife Service Manual" 610 FW 1.5).

wildfire—Free-burning fire requiring a suppression response; all fire other than prescribed fire that occurs in wildlands ("U.S. Fish and Wildlife Service Manual" 621 FW 1.7).

wildland fire—Every wildland fire is either a wildfire or a prescribed fire ("U.S. Fish and Wildlife Service Manual" 621 FW 1.3).

wildlife-dependent recreational use—Use of a refuge involving hunting, fishing, wildlife observation and photography, or environmental education and interpretation. These are the six priority public uses of the Refuge System as established in the National Wildlife Refuge System Administration Act, as amended. Wildlife-dependent recreational uses, other than the six priority public uses, are those that depend on the presence of wildlife.

wildlife management—Practice of manipulating wildlife populations either directly through regulating the numbers, ages, and sex ratios harvested, or indirectly by providing favorable habitat conditions and alleviating limiting factors.

WMD—See *wetland management district.*

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

WUI—Wildland–urban interface.

xerophytic—Pertaining to a plant that needs very little water (adapted to growing in dry habitat).

Appendix A
Key Legislation and Policies

In alphabetical order of the name of the act, order, or regulation.

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 (16 U.S.C. 431–433): The act of June 8, 1906 (34 Stat. 225) authorizes the president to designate as national monuments objects or areas of historic or scientific interest on lands owned or controlled by the United States. The act required that a permit be obtained for examination of ruins, excavation of archaeological sites, and the gathering of objects of antiquity on lands under the jurisdiction of the Secretaries of Interior, Agriculture, and Army, and provided penalties for violations.

Archaeological Resources Protection Act (16 U.S.C. 470aa–470ll): Public Law (PL) 96-95, approved October 31, 1979 (93 Stat. 721): Largely supplants the resource protection provisions of the Antiquities Act for archaeological items. This act establishes detailed requirements for issuance of permits for any excavation for or removal of archaeological resources from federal or Indian lands. It also establishes civil and criminal penalties for the unauthorized excavation, removal, or damage of any such resources; for any trafficking in such resources removed from federal or Indian land in violation of any provision of federal law; and for interstate and foreign commerce in such resources acquired, transported, or received in violation of any state or local law.

> *PL 100-588, approved November 3, 1988 (102 Stat. 2983):* Lowers the threshold value of artifacts triggering the felony provisions of the act from $5,000 to $500; makes attempting to commit an action prohibited by the act a violation; and requires the land managing agencies to establish public awareness programs regarding the value of archaeological resources to the nation.

Architectural Barriers Act (1968): Requires federally owned, leased, or funded buildings and facilities to be accessible to persons with disabilities.

Archeological and Historic Preservation Act (16 U.S.C. 469–469c): PL 86-523, approved June 27, 1960 (74 Stat. 220) as amended by PL 93291, approved May 24, 1974 (88 Stat. 174) to carry out the policy established by the "Historic Sites Act" (see below), directed federal agencies to notify the Secretary of the Interior whenever they find a federal or federally assisted, licensed, or permitted project may cause loss or destruction of significant scientific, prehistoric, or archaeological data. The act authorizes use of appropriated, donated, and transferred funds for the recovery, protection, and preservation of such data.

Clean Water Act (1977): Requires consultation with the USACE for major wetland modifications.

Criminal Code of Provisions of 1940, as amended, (18 U.S.C. 41): States the intent of Congress to protect all wildlife within federal sanctuaries, refuges, fish hatcheries, and breeding grounds. Provides that anyone (except in compliance with rules and regulations promulgated by authority of law) who hunts, traps, or willfully disturbs any such wildlife, or willfully injures, molests, or destroys any property of the United States on such land or water, shall be fined up to $500 or imprisoned for not more than 6 months or both.

Emergency Wetland Resources Act of 1986: Authorizes the purchase of wetlands from Land and Water Conservation Fund monies, removing a prior prohibition on such acquisitions. The act also requires the Secretary to establish a national wetlands priority conservation plan, requires the states to include wetlands in their comprehensive outdoor recreation plans, and transfers to the Migratory Bird Conservation Fund amount equal to import duties on arms and ammunition.

Endangered Species Act of 1973 and recent amendments (16 U.S.C. 1531–1543; 87 Stat. 884), as amended: This establishing legislation provides for conservation of threatened and endangered species of fish, wildlife, and plants by federal action and by encouraging state programs. Specific provisions include

> the listing and determination of critical habitat for endangered and threatened species and consultation with the Service on any federally funded or licensed project that could affect any of these agencies;
>
> prohibition of unauthorized taking, possession, sale, transport, etc., of endangered species;
>
> an expanded program of habitat acquisition;
>
> establishment of cooperative agreements and grants-in-aid to states that establish and

maintain an active, adequate program for endangered and threatened species;

assessment of civil and criminal penalties for violating the act or regulations.

Environmental Education Act of 1990 (20 U.S.C. 5501–5510; 104 Stat. 3325): PL 101-619, signed November 16, 1990, established the Office of Environmental Education within the U.S. Environmental Protection Agency (EPA) to develop and administer a federal environmental education program. Responsibilities of the office include developing and supporting programs to improve understanding of the natural and developed environment, and the relationships between humans and their environment; supporting the dissemination of educational materials; developing and supporting training programs and environmental education seminars; managing a federal grant program; and administering an environmental internship and fellowship program. The office is required to develop and support environmental programs in consultation with other federal natural resource management agencies, including the Service.

EO 11644—Use of Off-road Vehicles on Public Lands (1972): Provides policy and procedures for regulating off-road vehicles.

EO 11988—Floodplain Management: This executive order, signed May 24, 1977, prevents federal agencies from contributing to the "adverse impacts associated with occupancy and modification of floodplains" and the "direct or indirect support of floodplain development." In the course of fulfilling their respective authorities, federal agencies "shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by floodplains."

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

EO 13007—Indian Sacred Sites (1996): Directs federal land management agencies to accommodate access to and ceremonial use 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.

Federal Water Pollution Control Act of 1972, Section 401 (PL 92-500; 86 Stat. 816, 33 U.S.C. 1411): Requires any applicant for a federal license or permit to conduct any activity that may result in a discharge into navigable waters to obtain a certification from the state in which the discharge originates or will originate, or, if appropriate, from the interstate water pollution control agency having jurisdiction over navigable waters at the point where the discharge originates or will originate, that the discharge will comply with applicable effluent limitations and water quality standards. A certification obtained for construction of any facility must also pertain to subsequent operation of the facility.

Federal Water Pollution Control Act of 1972, Section 404 (PL 92-500, 86 Stat. 816): Authorizes the Secretary of the Army, acting through the Chief of Engineers, to issue permits, after notice and opportunity for public hearing, for discharge of dredged or fill material into navigable waters of the United States, including wetlands, at specified disposal sites. Selection of disposal sites will be in accordance with guidelines developed by the Administrator of the EPA in conjunction with the Secretary of the Army. Furthermore, the Administrator can prohibit or restrict use of any defined area as a disposal site whenever she/he determines, after notice and opportunity for public hearings, that discharge of such materials into such areas will have an unacceptable adverse effect on municipal water supplies, shellfish beds, fishery areas, wildlife, or recreational areas.

Fish and Wildlife Act of 1956 (70 Stat. 1119; 16 U.S.C. 742a–742j), as amended: Establishes a comprehensive fish and wildlife policy and directs the Secretary of the Interior to provide continuing research; and extension and conservation of fish and wildlife resources.

Fish and Wildlife Conservation Act of 1980 (PL 96-366, September 29, 1980, 16 U.S.C. 2901–2911, as amended 1986, 1988, 1990, and 1992): Creates a mechanism for federal matching funding of the development of state conservation plans for nongame fish and wildlife. Subsequent amendments to this law require that the Secretary monitor and assess migratory nongame birds, determine the effects of environmental changes and human activities, identify birds likely to be candidates for endangered species listing, and identify conservation actions that would prevent this from being necessary. In 1989, Congress also directed the Secretary to identify lands and waters in the Western Hemisphere, the protection, management, or acquisition of which would foster conservation of migratory nongame birds. All of these activities are intended to assist the Secretary in fulfilling the Secretary's responsibilities under the Migratory Bird Treaty Act and the Migratory Bird

Conservation Act, and provisions of the Endangered Species Act implementing the Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere.

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.

Fish and Wildlife Improvement Act of 1978: Improves the administration of fish and wildlife programs and amends several earlier laws including the Refuge Recreation Act, the National Wildlife Refuge System Administration Act, and the Fish and Wildlife Act of 1956. It authorizes the Secretary to accept gifts and bequests of real and personal property on behalf of the United States. It also authorizes the use of volunteers for Service projects and appropriations to carry out volunteer programs.

Historic Sites, Buildings and Antiquities Act (16 U.S.C. 461–462, 464–467): The act of August 21, 1935 (49 Stat. 666), popularly known as the "Historic Sites Act," as amended by PL 89-249, approved October 9, 1965 (79 Stat. 971), declares it a national policy to preserve historic sites and objects of national significance, including those located at refuges. It provides procedures for designation, acquisition, administration, and protection of such sites. Among other things, National Historic and Natural Landmarks are designated under authority of this act. As of January 1989, 31 national wildlife refuges contained such sites.

Land and Water Conservation Fund Act of 1965: Provides funds from leasing bonuses, production royalties, and rental revenues for offshore oil, gas, and sulphur extraction to the Bureau of Land Management, the USDA Forest Service, the U.S. Fish and Wildlife Service, and state and local agencies for purchase of lands for parks, open space, and outdoor recreation.

Migratory Bird Conservation Act of 1929 (16 U.S.C. 715–715d, 715e, 715f–715r): Establishes the Migratory Bird Conservation Commission, which consists of the Secretaries of the Interior (chair), Agriculture, and Transportation; two members from the House of Representatives; and an ex-officio member from the state in which a project is located. The commission approves acquisition of land and water, or interests therein, and sets the priorities for acquisition of lands by the Secretary of the Interior for sanctuaries or for other management purposes. Under this act, to acquire lands or interests therein, the state concerned must consent to such acquisition by legislation. Such legislation has been enacted by most states.

Migratory Bird Conservation Act of 1929 (16 U.S.C. 715s, 45 Stat. 1222), as amended: Authorizes acquisition, development, and maintenance of migratory bird refuges; cooperation with other agencies in conservation; and investigations and publications on North American birds. Authorizes payment of 25% of net receipts from administration of national wildlife refuges to the country or counties in which such refuges are located.

Migratory Bird Hunting and Conservation Stamp Act of 1934 (16 U.S.C. 718–718h; 48 Stat. 51), as amended: The "Duck Stamp Act," as this March 16, 1934 authority is commonly called, requires each waterfowl hunter 16 years of age or older to possess a valid federal hunting stamp. The act authorized the requirement of an annual stamp for the hunting of waterfowl. Proceeds go towards the purchase of habitat for waterfowl and other wildlife. Duck stamps are also purchased: (1) for entry into some refuges; (2) by conservationists; and (3) for stamp collections. Receipts from the sale of the stamp are deposited in a special Treasury account known as the Migratory Bird Conservation Fund and are not subject to appropriations.

Migratory Bird Treaty Act of 1918 (16 U.S.C. 703–711; 50 CFR subchapter B), as amended: Implements treaties with Great Britain (for Canada) and Mexico for protection of migratory birds whose welfare is a federal responsibility. The act provides for regulations to control taking, possession, selling, transporting, and importing of migratory birds and provides penalties for violations. This act enables the setting of seasons and other regulations (including the closing of areas, federal or nonfederal) related to the hunting of migratory birds.

National and Community Service Act of 1990 (42 U.S.C. 12401; 104 Stat. 3127): PL 101-610, signed November 16, 1990, authorizes several programs to engage citizens of the United States in full and part-time projects designed to combat illiteracy and poverty, provide job skills, enhance educational skills, and fulfill environmental needs. The act will make grants to states for the creation of programs for citizens over 17 years of age. Programs must be designed to fill unmet educational, human, environmental, and public safety needs. Initially, participants will receive postemployment benefits of up to $1,000 per year for part-time and $2,500 for full-time participants.

Several provisions are of particular interest to the Service:

> *American Conservation and Youth Service Corps:* As a federal grant program established under subtitle C of the law, the corps offers an opportunity for young adults between the ages of 16 and 25, or in the case of summer programs, between 15 and 21, to engage in approved human and natural resources projects that benefit the public or are carried out on federal or Indian lands. To be eligible for assistance, natural resources programs will focus on improvement of wildlife habitat and recreational areas, fish culture, fishery

assistance, erosion, wetlands protection, pollution control, and similar projects. A stipend of not more than 100% of the poverty level will be paid to participants. A commission established to administer the Youth Service Corps will make grants to states, the Secretaries of Agriculture and Interior, and the Director of ACTION to carry out these responsibilities.

Thousand Points of Light: Creates a nonprofit Points of Light Foundation to administer programs to encourage citizens and institutions to volunteer to solve critical social issues, discover new leaders, and develop institutions committed to serving others.

National Environmental Policy Act of 1969 (PL 91-190, 42 U.S.C. 4321–4347, January 1, 1970, 83 Stat. 852) as amended by PL 94-52, July 3, 1975, 89 Stat. 258, and PL 94-83, August 9, 1975, 89 Stat. 424: 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 the implementation of all actions, federal agencies must integrate the act with other planning requirements, and to prepare appropriate documents to facilitate better environmental decision making (40 CFR 1500). The act declares national policy to encourage a productive and enjoyable harmony between humans and their environment.

Section 102 of that act directs that "to the fullest extent possible

the policies, regulations, and public laws of the United States shall be interpreted and administered in accordance with the policies set forth in this act, and

all agencies of the Federal Government shall ... insure that presently unquantified environmental amenities and values may be given appropriate consideration in decision making along with economic technical considerations."

Section 102(2)c of the NEPA requires all federal agencies, with respect to major federal actions significantly affecting the quality the quality of the human environment, to submit to the Council on Environmental Quality a detailed statement of

the environmental impact of the proposed action;

any adverse environmental effect that cannot be avoided should the proposal be implemented;

alternatives to the proposed action;

the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity;

any irreversible and irretrievable commitments of resources that would be involved in the proposed action, should it be implemented.

National Historic Preservation Act of 1966 (16 U.S.C. 470–470b, 470c–470n): PL 89-665, approved October 15, 1966 (80 Stat. 915), and repeatedly amended, provides for preservation of significant historical features (buildings, objects, and sites) through a grants-in-aid program to the states. It establishes the National Register of Historic Places and a program of matching grants under the existing National Trust for Historic Preservation (16 U.S.C. 468–468d). The act establishes the Advisory Council on Historic Preservation, which was made a permanent independent agency in PL 94-422, approved September 28, 1976 (90 Stat. 1319). That act also creates the Historic Preservation Fund. Federal agencies are directed to take into account the effects of their actions on items or sites listed or eligible for listing in the National Register. As of January 1989, 91 historic sites at national wildlife refuges have been placed on the National Register.

National Wildlife Refuge System Administration Act of 1966 (PL 89-669; 80 Stat. 929; 16 U.S.C. 668dd–668ee), as amended: This act defines the Refuge System as including wildlife refuges, areas for protection and conservation of fish and wildlife that are threatened with extinction, wildlife ranges, game ranges, wildlife management areas, and waterfowl production areas. The Secretary is authorized to permit any use of an area provided such use is compatible with the major purposes for which such area was established. The purchase considerations for rights-of-way go into the Migratory Bird Conservation Fund for the acquisition of lands. By regulation, up to 40% of an area acquired for a migratory bird sanctuary may be opened to migratory bird hunting unless the Secretary finds that the taking of any species of migratory game birds in more than 40% of such area would be beneficial to the species. The act requires an act of Congress for the divestiture of lands in the system, except for (1) lands acquired with Migratory Bird Conservation Commission funds, and (2) lands that can be removed from the system by land exchange, or if brought into the system by a cooperative agreement, then pursuant to the terms of the agreement.

National Wildlife Refuge System Improvement Act of 1997 (PL 105-57, October 9, 1997, Amendment to the National Wildlife Refuge System Administration Act of 1966): Sets the mission and the administrative policy for all refuges in the Refuge System. Clearly 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; establishes the responsibilities of the Secretary of the Interior for managing and protecting the Refuge System; and requires a CCP for each refuge by the year 2012. This act amended portions of the Refuge Recreation Act and the National Wildlife Refuge System Administration Act of 1966.

Key provisions include the following:

> a requirement that the Secretary of the Interior ensures maintenance of the biological integrity, diversity, and environmental health of the Refuge System;
>
> the definition of compatible wildlife-dependent recreation as "legitimate and appropriate general public use of the [National Wildlife Refuge] System";
>
> the establishment of hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation as "priority public uses" where compatible with the mission and purpose of individual national wildlife refuges;
>
> the refuge managers' authority to use sound professional judgment in determining which public uses are compatible at national wildlife refuges and whether or not they will be allowed (a formal process for determining "compatible use"" is currently being developed);
>
> the requirement of open public involvement in decisions to allow new uses of national wildlife refuges and renew existing ones, as well as in the development of CCPs for national wildlife refuges.

National Wildlife Refuge Regulations (50 CFR 25-35, 43 CFR 3103.2 and 3120.3–3): Provides regulations for administration and management of national wildlife refuges including mineral leasing, exploration, and development.

> *Rights-of-way General Regulations (50 CFR 29.21; 34 FR 19907, December 19, 1969):* Provides for procedures for filing applications. Provides terms and conditions under which rights-of-way over, above, and across lands administered by the Service may be granted.
>
> *Wilderness Preservation and Management (50 CFR 35; 78 Stat. 890; 16 U.S.C. 1131-1136; 43 U.S.C. 1201):* Provides procedures for establishing wilderness units under the Wilderness Act of 1964 at units of the Refuge System.

National Wildlife Refuge System Volunteer and Community Partnership Enhancement Act of 1998: The purposes of this act are: (1) to encourage the use of volunteers to assist the Service in the management of refuges within the Refuge System; (2) to facilitate 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 those resources; and (3) to encourage donations and other contributions by persons and organizations to the Refuge System (PL 105-242; 112 Stat. 1575).

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.

North American Wetlands Conservation Act (103 Stat. 1968; 16 U.S.C. 4401–4412): PL 101-233, enacted December 13, 1989: An act to conserve North American wetland ecosystems, waterfowl and other migratory birds, fish, and wildlife that depend on such habitats. The act established a council to review project proposals and provided funding for the projects. The act provides funding and administrative direction for implementation of the North American Waterfowl Management Plan and the Tripartite Agreement on wetlands between Canada, United States, and Mexico. The act converts the Pittman–Robertson account into a trust fund, with the interest available without appropriation through the year 2006 to carry out the programs authorized by the act, along with an authorization for annual appropriation of $15 million plus an amount equal to the fines and forfeitures collected under the Migratory Bird Treaty Act. Available funds may be expended, upon approval of the Migratory Bird Conservation Commission, for payment of not to exceed 50% of the United States share of the cost of wetlands conservation projects in Canada, Mexico, or the United States (or 100% of the cost of projects on federal lands). At least 50% and no more than 70% of the funds received are to go to Canada and Mexico each year.

Refuge Recreation Act of 1962: Authorizes the Secretary of the Interior to administer refuges, hatcheries, and other conservation areas for recreational use, when such uses do not interfere with the areas' primary purposes. It authorizes construction and maintenance of recreational facilities and the acquisition of land for incidental fish and wildlife oriented recreational development or protection of natural resources. It also authorizes the charging of fees for public uses.

Refuge Recreation Act of 1966 (PL 87-714; 76 Stat. 653–654; 16 U.S.C. 460k et seq.): Authorizes appropriate, incidental, or secondary recreational use at conservation areas administered by the Secretary of the Interior for fish and wildlife purposes.

Refuge Revenue Sharing Act (16 U.S.C. 715s): Section 401 of the act of June 15, 1935 (49 Stat. 383) provides for payments to counties in lieu of taxes, using revenues derived from the sale of products from refuges.

> *PL 88-523, approved August 30, 1964 (78 Stat. 701):* Makes major revisions by requiring that all revenues received from refuge products such as animals, timber and minerals, or from leases or other privileges, be deposited in a

special Treasury account and net receipts distributed to counties for public schools and roads.

PL 93-509, approved December 3, 1974 (88 Stat. 1603): Requires that moneys remaining in the fund after payments be transferred to the Migratory Bird Conservation Fund for land acquisition under provisions of the Migratory Bird Conservation Act.

PL 95-469, approved October 17, 1978 (92 Stat. 1319): Expands the revenue-sharing system to include national fish hatcheries and Service research stations. It also includes in the Refuge Revenue Sharing Fund receipts from the sale of salmonid carcasses. Payments to counties were established as follows:

On acquired land, the greatest amount calculated on the basis of 75 cents per acre, ¾ of 1% of the appraised value, or 25% of the net receipts produced from the land.

On land withdrawn from the public domain, 25% of net receipts and basic payments under PL 94-565 (31 U.S.C. 1601–1607, 90 Stat. 2662), payment in lieu of taxes on public lands.

This amendment also authorizes appropriations to make up any difference between the amount in the fund and the amount scheduled for payment in any year. The stipulation that payments be used for schools and roads was removed, but counties were required to pass payments along to other units of local government within the county that suffer losses in revenues due to the establishment of Service areas.

Refuge Revenue Sharing Act of 1978 [PL 95-469, October 17, 1978, (amended 16 U.S.C. 715s); 50 CFR, part 34]: Changes the provisions for sharing revenues with counties in a number of ways. It makes revenue sharing applicable to all lands administered by the Service, whereas previously it was applicable only to areas in the Refuge System. The new law makes payments available for any governmental purpose, whereas the old law restricted the use of payments to roads and schools. For lands acquired in fee simple, the new law provides a payment of 75 cents per acre, ¾ of 1% of fair market value or 25% of net receipts, whichever is greatest, whereas the old law provided a payment of ¾ of 1% adjustment cost or 25% of net receipts, whichever was greater. The new law makes reserve (public domain) lands entitlement lands under PL 94-565 (16 U.S.C. 1601–1607, and provides for a payment of 25% of net receipts. The new law authorizes appropriations to make up any shortfall in net receipts, to make payments in the full amount for which counties are eligible. The old law provided that if net receipts were insufficient to make full payment, payment to each county would be reduced proportionality.

Refuge Trespass Act of June 28, 1906 (18 U.S.C. 41; 43 Stat. 98, 18 U.S.C. 145): Provides the first federal protection for wildlife at national wildlife refuges. This act makes it unlawful to hunt, trap, capture, willfully disturb, or kill any bird or wild animal, or take or destroy the eggs of any such birds, on any lands of the United States set apart or reserved as refuges or breeding grounds for such birds or animals by any law, proclamation, or executive order, except under rules and regulations of the Secretary. The act also protects government property on such lands.

Refuge Trespass Act of June 25, 1948 (18 U.S.C. 41. Stat 686), section 41 of the Criminal Code, title 18: Consolidates the penalty provisions of various acts from January 24, 1905 (16 U.S.C. 684–687; 33 Stat. 614), through March 10, 1934 (16 U.S.C. 694–694b; 48 Stat. 400) and restates the intent of Congress to protect all wildlife within federal sanctuaries, refuges, fish hatcheries, and breeding grounds.

The act provides that anyone (except in compliance with rules and regulations promulgated by authority of law) who hunts, traps, or willfully disturbs any wildlife on such areas, or willfully injures, molests, or destroys any property of the United States on such lands or waters, shall be fined, imprisoned, or both.

Rehabilitation Act of 1973 (29 U.S.C. 794), as amended: Title 5 of PL 93-112 (87 Stat. 355), signed October 1, 1973, prohibits discrimination on the basis of handicap under any program or activity receiving federal financial assistance.

Rivers and Harbors Act (1899): Section 10 of this act requires the authorization of USACE prior to any work in, on, over, or under navigable waters of the United States.

Transfer of Certain Real Property for Wildlife Conservation Purposes Act of 1948: Provides that, upon determination by the Administrator of the General Services Administration, real property no longer needed by a federal agency can be transferred without reimbursement to the Secretary of the Interior if the land has particular value for migratory birds, or to a state agency for other wildlife conservation purposes.

Wilderness Act of 1964 [PL 88-577, September 3, 1964]: Directs the Secretary of the Interior, within 10 years, to review every roadless area of 5,000 or more acres and every roadless island (regardless of size) within the Refuge System and National Park Service for inclusion in the National Wilderness Preservation System.

Laws and Executive Orders that Regulate Recreational Use on the Refuge System

Alaska National Interest Lands Conservation Act of 1980 [16 U.S.C. 410 hh3233] [43 U.S.C. 1602–1784]

Alaska Native Claims Settlement Act [43 U.S.C. 1601–1624]

Antiques Act of 1906 [16 U.S.C. 431–433]

Archaeological and Historic Preservation Act of 1960 [16 U.S.C. 469–469c], as amended

Archaeological Resources Protection Act of 1979 [16 U.S.C. 470aa–470mm]

Comprehensive Environmental Responses, Compensation and Liability Act of 1980

Endangered Species Act of 1973 [16 U.S.C. 1531–1544], as amended

The Fish and Wildlife Act of 1956 [16 U.S.C. 742f(a)(4)], as amended

Fish and Wildlife Conservation Act [16 U.S.C. 2901–2911], as amended

The Fish and Wildlife Coordination Act [16 U.S.C. 661(1)–662(c)]

Fish and Wildlife Improvement Act of 1978 [16 U.S.C. 7421]

Historic Sites, Building and Antiquities Act of 1935 [16 U.S.C. 461–462, 464–467]

Land and Water Conservation Fund [16 U.S.C. 460(l–4)–(l–11)], as amended.

Migratory Bird Conservation Act of 1929 [16 U.S.C. 715–715d, 715e, 715f–715r], as amended

National Wildlife Refuge System Administration Act of 1966 [16 U.S.C. 668dd–669ee], as amended

National Wildlife Refuge System Improvement Act of 1997

Natural Historic Preservation Act of 1966 [16 U.S.C. 470–470b, 470c–470n], as amended

Refuge Recreation Act of 1962 [16 U.S.C. 460k–460k4], as amended

Refuge Recreation Act of 1969 [16 U.S.C. 460k–460k4], as amended

Uniform Relocation Assistance and Real Property Acquisition Policy Act of 1970, as amended

Wild and Scenic Rivers Act [16 U.S.C. 1271–1287], as amended

Wilderness Act of 1964 [16 U.S.C. 1131–1136]

EO 11593—Protection and Enhancement of the Cultural Environment; Protection of Historical, Archaeological, and Scientific Properties

EO 11644—Use of Off-road Vehicles on Public Lands

EO 11988—Floodplain Management

EO 11990—Protection of Wetlands

EO 12372—Intergovernmental Review of Federal Program

Laws and Executive Orders that Regulate Recreational Use on the Refuge System
EO 12962—Recreational Fisheries
EO 12996—Management and General Public Use of the National Wildlife Refuge System
EO 13006—Locating Federal Facilities On Historic Properties In Our Nation's Central Cities
EO 13007—Indian Sacred Sites
EO 13287—Preserve America

Appendix B
Contributors

This draft CCP and EA is the result of extensive, collaborative, and enthusiastic efforts by the 18 members of the Souris River basin refuges planning team below. Many others contributed insight and support.

Planning Team

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Bob Murphy and Todd Grant (wildlife biologists for Des Lacs NWR Complex and J. Clark Salyer NWR Complex, respectively) were principle authors of the biological portions of this draft CCP and EA, in addition to their overall team participation.

Contributors

The Service would like to acknowledge the efforts of the following individuals toward the completion of this draft CCP and EA. The diversity, talents, and knowledge contributed by these individuals dramatically improved the vision and completeness of this document.

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Galen Green	Fire ecologist, *retired*	USFWS
Lloyd Jones	Regional compatibility coordinator	USFWS
Linda Kelly	*Former* branch chief, comprehensive conservation planning	USFWS
Jim Kelton	Regional fire management specialist	USFWS
Wayne King	Regional biologist	USFWS
Lynne Koontz	Economist	USGS, Fort Collins Science Center
Rod Krey	Refuge supervisor; North Dakota, South Dakota	USFWS
Murray Laubhan	Biologist	USGS, Northern Prairie Wildlife Research Center
Rachael Laubhan	Biologist	USFWS
Johnida Martin	*Former* wildlife biologist, Upper Souris NWR	USFWS
Rich Meyer	Tribal member	Three Affiliated Tribes
Bruce Nadeau	Tribal member	Turtle Mountain Band of Chippewa
Steve Odegaard	Resource manager	USACE
Deb Parker	Writer-editor	USFWS
Davis Redhorse	Native American liaison	USFWS
Cory Rubin	*Former* wildlife biologist, Upper Souris NWR	USFWS
Natalie Sexton	Wildlife biologist	USGS, Fort Collins Science Center
Michael Spratt	Division chief, division of refuge planning	USFWS
Jeffery Towner	Field supervisor, ecological services, Bismarck, ND	USFWS
Connie Young-Dubovsky	Regional NEPA coordinator	USFWS

Appendix C
Public Involvement

Public scoping began January 17, 2003, with publication of an NOI in the Federal Register to prepare comprehensive conservation plans and associated environmental documents for the three Souris River basin refuges.

In March 2003, a planning update was sent to each individual, organization, and government representative on the CCP mailing list (see list below). The planning update provided information on the history of the Refuge System and the CCP process, along with an invitation and schedule to upcoming open houses.

Open houses were announced in local newspapers, radio, and television stations. Flyers were posted at local businesses throughout the region, and announcements were made at meetings of local organizations including Minot City Council, Bottineau County Wildlife Club, and Bottineau Rotary Club.

Six public open houses were held in local communities throughout the Souris River basin area March 24–27, 2003. At the start of each meeting, the CCP planner or refuge personnel gave a presentation on the history of the program, along with an overview of the CCP and NEPA processes. Attendees were encouraged to ask questions and offer comments. The turnout was mixed, from a few attendees to 18 individuals at a single-refuge meeting. In addition to scoping meetings, postage-paid comment forms were sent to everyone on the mailing list.

A second planning update was distributed in November 2003. This update provided information about the on-going public involvement effort and a summary of public comments that were received during the public open houses.

A total of 57 comments were received during the scoping effort. Input obtained from open houses, letters, comment forms, and planning updates was considered in developing this draft CCP. These comments identified biological, social, and economic concerns regarding refuge management.

The planning team's response to public comments will be completed prior to final approval of the CCP.

The following list of recipients was developed for this draft CCP.

Federal Officials

U.S. Representative Earl Pomeroy, Washington DC
Rep. Pomeroy's Area Director, Bismarck, ND

U.S. Senator Kent Conrad, Washington DC
Sen. Conrad's Area Director, Minot, ND

U.S. Senator Byron Dorgan, Washington DC
Sen. Dorgan's Area Director, Minot, ND

Federal Agencies

USACE, Fargo, ND

U.S. Fish and Wildlife Service, Bismarck, ND

U.S. Fish and Wildlife Service, Ecological Services, Bismarck, ND

U.S. Fish and Wildlife Service, Region 6 Missouri River Fish and Wildlife Management Office, Bismarck, ND

USGS, Northern Prairie Wildlife Research Center, Jamestown, ND

USGS, Fort Collins Science Center, Fort Collins, CO

Tribal Officials

Fort Peck Tribal Executive Board, Popular, MT

Sisseton–Wahpeton Sioux Tribe, Agency Village, SD

Spirit Lake Tribal Council, Fort Totten, ND

Standing Rock Sioux Tribe, Fort Yates, ND

Three Affiliated Tribes, New Town, ND

Turtle Mountain Band of Chippewa, Belcourt, ND

State Officials

Governor John Hoeven, Bismarck, ND

Representative Glen Froseth, Kenmare, ND

Representative Bob Hunskor, Newburg, ND

Senator David O'Connell, Lansford, ND

State Agencies

NDGF, Bismarck, ND

NDGF, Minot, ND

NDGF, Riverdale, ND

North Dakota State Water Commission, Bismarck, ND

Local Government

Callahan Township Chairman, Carpio, ND

Council Chair, Carpio, ND

Grassland Township Chairman, Lansford, ND

Grover Township Chairman, Tolley, ND

Hamlet Township Chairman, Mohall, ND

Lockwood Township Chairman, Lansford, ND

Mayland Township Chairman, Carpio, ND

Mayor of Berthold, ND

Mayor of Burlington, ND

Mayor of Carpio, ND

Mayor of Des Lacs, ND

Mayor of Donnybrook, ND

Mayor of Glenburn, ND

Mayor of Grano, ND

Mayor of Kenmare, ND

Mayor of Lansford, ND

Mayor of Minot, ND

Mayor of Mohall, ND

Mayor of Tolley, ND

Mayor of Sherwood, ND

McKinney Township Chairman, Tolley, ND

Mouse River Park Board, Sherwood and Tolley, ND

Muskego Township Chairman, Lansford, ND

Plain Township Chairman, Carpio, ND

Renville County Agent, Mohall, ND

Renville County Auditor, Mohall, ND

Renville County Commissioners, Mohall, ND

Renville County District Conservationist, Mohall, ND

Renville County Historical Society, Sherwood, ND

Renville County Sheriff's Office, Mohall, ND

Renville County Soil Conservation Technician, Mohall, ND

Renville County Water Board Chairman, Mohall, ND

Renville County Water Board, Glenburn and Kenmare, ND

Renville County Weed Board Chairman, Kenmare, ND

Roosevelt Township Chairman, Sherwood, ND

St. Mary's Township Chairman, Berthold, ND

Ward County Commissioners, Minot, ND

Ward County Engineer, Minot, ND

Ward County Historical Society, Minot, ND

Ward County Sheriff's Office, Minot, ND

Ward County Water Resource Board, Minot, ND

Ward County Weed Control Officer, Minot, ND

Local Fire Departments

Carpio Rural Fire District, Carpio, ND

Lansford Rural Fire District, Lansford, ND

Mohall Rural Fire District, Mohall, ND

Tolley Fire Department, Kenmare, ND

Universities, Schools, and Libraries

Glenburn School Board President, Glenburn, ND

Kenmare School Board President, Kenmare, ND

Mohall, Lansford, and Sherwood (MLS) School District #1, Mohall, ND

United School District Board President, Des Lacs, ND

Organizations

Berthold Sportsman Club, Berthold, ND

Hooterville Flying Lions, Minot, ND

The Humane Society of the United States, Washington, DC

Kenmare Chamber of Commerce, Kenmare, ND

Kenmare Goosefest, Kenmare, ND

Minot Area Chamber of Commerce, Minot, ND

Minot Convention and Visitors Bureau, Minot, ND

Minot Pheasants for the Future, Minot, ND

Mouse River Basin Longbeards, Granville, ND

Mouse River Pheasants, Mohall, ND

North Dakota Wildlife Federation, Minot, ND

Rolling Plains Sportsman Club, Stanley, ND

Roosevelt Park Zoo, Minot, ND

Souris Valley Bird Club, Minot, ND

Theodore Roosevelt Nature and History Association, Medora, ND

Vets Gaming Board, Kenmare, ND

The Wilderness Society, Washington DC

Newspapers

Renville County Farmer, Mohall, ND

Minot Daily News, Minot, ND

Radio and Television Stations

KCJB Radio, Minot, ND

KMOT TV, Minot, ND

KXMC TV, Minot, ND

North Dakota Public Radio, Bismarck, ND

Individuals

141 persons

Appendix D
Plants of the Souris River Basin Refuges

This list includes 410 plant species for which specimens were collected from the Souris River basin refuges during 1998–2005. For each, at least one specimen was mounted, its taxonomy was verified by expert botanists, and specimen(s) were permanently stored in a herbarium at one or more of the three refuges. This is not an exhaustive list of plant species found in the Souris River basin refuges and some omissions are likely.

Nomenclature follows that of the Great Plains Flora Association (1986).

Polypodiaceae *(True Fern Family)*
- *Cystopteris fragilis*—fragile fern

Equisetaceae *(Horsetail Family)*
- *Equisetum arvense*—common horsetail
- *Equisetum laevigatum*—smooth scouring rush

Selaginellaceae *(Spikemoss Family)*
- *Selaginella densa*—clubmoss

Cupressaceae *(Cypress Family)*
- *Juniperus scopulorum*—Rocky Mountain juniper

Alismataceae *(Waterplantain Family)*
- *Alisma gramineum*—grass water plantain
- *Alisma plantago-aquatica*—water plantain
- *Sagittaria cuneata*—arrowhead

Juncaginaceae *(Arrowgrass Family)*
- *Triglochin maritima*—arrowgrass
- *Triglochin palustris*—arrowgrass

Potamogetonaceae *(Pondweed Family)*
- *Potamogeton pectinatus*—sago pondweed
- *Potamogeton richardsonii*—claspingleaf pondweed

Zannichelliaceae *(Horned Pondweed Family)*
- *Zannichellia palustris*—horned pondweed

Juncaceae *(Rush Family)*
- *Juncus balticus*—Baltic rush
- *Juncus interior*—inland rush
- *Juncus torreyi*—Torrey's rush

Cyperaceae *(Sedge Family)*
- *Carex atherodes*—slough sedge
- *Carex brevior*—fescue sedge
- *Carex douglassii*—Douglas's sedge
- *Carex duriuscula* (+*Carex eleocharis*)—needleleaf sedge
- *Carex emoryi*—Emory's sedge
- *Carex filifolia*—threadleaf sedge
- *Carex gravida*—heavy sedge
- *Carex hallii*—Hall's sedge
- *Carex inops* subsp. *heliophila* (+*Carex heliophilia*)—sun sedge
- *Carex lacustris*—unnamed sedge
- *Carex laeviconica*—glabrous sedge
- *Carex lanuginosa*—woolly sedge
- *Carex obtusata*—unnamed sedge
- *Carex pellita*—woolly sedge
- *Carex praegracilis*—clustered field sedge
- *Carex rosea*—unnamed sedge
- *Carex sartwellii*—Sartwell's sedge
- *Carex sprengelii*—long-beaked sedge
- *Carex sychnocephala*—dense long-beaked sedge
- *Carex tetanica*—unnamed sedge
- *Cyperus schweinitzii*—Schweinitz's flatsedge
- *Eleocharis acicularis*—needle spikesedge
- *Eleocharis erythropoda*—spikesedge
- *Eleocharis obtusata*—blunt spikesedge
- *Elocharis palustris*—common spikerush
- *Schoenoplectus acutus* (+*Scirpus acutus*)—hardstem bulrush
- *Scirpus americanus*—three-square
- *Scirpus fluviatilis*—river bulrush
- *Scirpus heterochaetus*—slender bulrush
- *Scirpus maritimus* var. *paludosus*—prairie bulrush
- *Scirpus nevadensis*—Nevada bulrush
- *Scirpus tabernaemontani*—softstem bulrush

Poaceae *(Grass Family)*
- *Agropyron caninum*—slender wheatgrass
- *Agropyron caninum* subsp. *majus* var. *unilaterale*—bearded wheatgrass
- *Agropyron cristatum*—crested wheatgrass
- *Agropyron repens*—quackgrass
- *Agropyron smithii*—western wheatgrass
- *Agrostis scabra*—ticklegrass
- *Alopecurus aequalis*—short-awn foxtail

Alopecurus arundinaceus—creeping foxtail
Andropogon gerardii—big bluestem
Andropogon hallii—sand bluestem
Andropogon scoparius—little bluestem
Aristida purpurea—three-awn
Beckmannia syzigachne—American sloughgrass
Bouteloua curtipendula—sideoats grama
Bouteloua gracilis—blue gramma
Bromus inermis—smooth brome
Buchloe dactyloides—buffalo grass
Calamovilfa longifolia—prairie sandreed
Dichanthelium wilcoxianum—Wilcox dichanthelium
Distichlis spicata var. *stricta*—inland saltgrass
Echinochloa muricata—barnyard grass
Elymus canadensis—Canada wild rye
Eragrostis cilianensis—stinkgrass
Festuca ovina—sheep's fescue
Glyceria grandis—American mannagrass
Glyceria striata—fowl mannagrass
Helictotrichon hookeri—spike oat
Hierochloe odorata—sweetgrass, vanilla grass
Hordeu jubatum—foxtail barley
Koeleria pyramidata—Junegrass
Muhlenbergia asperifolia—scratchgrass
Muhlenbergia cuspidate—plains muhly
Panicum capillare—witchgrass
Panicum virgatum—switchgrass
Phalaris arundinacea—canarygrass
Phleum pratense—timothy
Phragmites australis—common reed
Poa arida—plains bluegrass
Poa cusickii—early bluegrass
Poa juncifolia—bluegrass
Poa pratensis—Kentucky bluegrass
Poa sandbergii—Sandberg bluegrass
Puccinellia nuttalliana—Nuttall's alkaligrass
Schizachne purpurascens—false melic
Scholochloa festucacea—whitetop
Setaria viridis—green foxtail
Spartina gracilis—alkali cordgrass
Spartina pectinata—prairie cordgrass
Sporobolus cryptandrus—sand dropseed
Sporobolus heterolepis—prairie dropseed
Stipa comata—needle and thread
Stipa spartea—porcupine grass
Stipa viridula—green needlegrass

Sparganiaceae *(Bur-reed Family)*
Sparganium eurycarpum—giant bur-reed

Typhaceae *(Cattail Family)*
Typha angustifolia—narrowleaf cattail
Typha anqustifolia × *latifolia*—hybrid cattail
Typha latifolia—common cattail

Lemnaceae *(Duckweed Family)*
Lemna trisulca—star duckweed
Lemna turionifera—duckweed

Commelinaceae *(Spiderwort Family)*
Tradescantia bracteata—spiderwort

Liliaceae *(Lily Family)*
Allium stellatum—pink wild onion
Allium textile—white wild onion, textile onion
Asparagus officinalis—asparagus
Hypoxis hirsuta—yellow stargrass
Lilium philadelphicum—wild lily
Maianthemum canadense—lily-of-the-valley
Smilacina stellata—spikenard
Zigadenus elegans—white camas

Smilacaceae *(Catbrier Family)*
Smilax herbacea—carrion flower

Iridaceae *(Iris Family)*
Sisyrinchium montanum—blue-eyed grass

Orchidaceae *(Orchid Family)*
Cypripedium calceolus—yellow ladyslipper

Salicaceae *(Willow Family)*
Populus balsamifera—balsam poplar
Populus deltoides—cottonwood
Populus tremuloides—aspen
Salix amygaloides—peachleaf willow
Salix bebbiana—beaked willow
Salix discolor—pussy willow
Salix eriocephala—diamond willow
Salixexigua subsp. i*nterior*—sandbar willow
Salix humilis var. *microphylla*—prairie willow
Salix lutea—yellow willow
Salix petiolaris—meadow willow

Fagaceae *(Beech/Oak Family)*
Quercus macrocarpa—bur oak

Ulmaceae *(Elm Family)*
Ulmus americana—American elm

Cannabaceae *(Hemp Family)*
Humulus lupulus—common hops

Urticaceae *(Nettle Family)*
Laportea canadensis—wood nettle
Urtica dioica—stinging nettle

Santalaceae *(Sandalwood Family)*
Commandra umbellata—bastard toadflax

Polygonaceae *(Buckwheat Family)*
Eriogonum flavum—yellow wild buckwheat
Polygala alba—white milkwort
Polygonum amphibium var. *emursum*—marsh smartweed
Polygonum amphibium var. *stipulaceum*—water smartweed
Polygonum coccineum—marsh smartweed
Polygonum lapathifolium—pale smartweed
Polygonum ramosissimum—knotweed
Rumex crispus—curled dock
Rumex maritimus—golden dock
R*umex stenophyllus*—dock

Chenopodiaceae *(Goosefoot Family)*
Atriplex nuttallii—moundscale
Atriplex subspicata—spearscale
Chenopodium album—lamb's quarters
Chenopodium leptophyllum—narrow-leaved goosefoot
Kochia scoparia—kochia, fireweed
Salsola iberica—Russian thistle

Amaranthaceae *(Amaranth Family)*
Amaranthus retroflexus—pigweed

Nyctaginaceae *(Four O'clock Family)*
Mirabilis nyctaginea—wild four o'clock

Portulacaceae *(Purslane Family)*
Portulaca oleracea—common purslane

Caryophyllaceae *(Pink Family)*
Cerastium arvense—prairie chickweed
Cerastium nutans—nodding chickweed
Gypsophila paniculata—baby's breath
Silene pratensis—white campion
Stellaria crassifolia—fleshy stichwort

Ceratophyllaceae *(Hornwort Family)*
Ceratophyllum demersum—coontail

Ranunculaceae *(Buttercup Family)*
Actea rubra—baneberry
Anemone canadensis—Canada anemone, meadow anemone
Anemone cylindrica—candle anemone
Anemone patens—pasqueflower
Ranunculus abortivus—early wood buttercup
Ranunculus cymbalaria—shore buttercup
Ranunculus flabellaris—yellow water-crowfoot
Ranunculus longirostris—white water-crowfoot
Ranunculus macounii—Macoun's buttercup
Ranunculus pensylvanicus—bristly crowfoot
Ranunculus sceleratus—cursed crowfoot
Ranunculus subrigidus—white water-crowfoot
Thalictrum venulosum—early meadowrue

Menispermaceae *(Moonseed Family)*
Menispermum canadense—moonseed

Brassicaceae *(Mustard Family)*
Arabis divaricarpa—rock cress
Arabis holboellii—rock cress
Berteroa incana—hoary false alyssum
Brassica kaber—charlock
Capsella bursa-pastoris—shepherd's purse
Descurainia sophia—flixweed
Draba nemorosa—yellow whitlowort
Erysimum asperum—western wallflower
Lepidium densiflorum—peppergrass
Lesquerella ludoviciana—bladderpod
Rorripa plaustris—bog yellow cress
Sisymbrium altissimum—tumble mustard
Sisymbrium loeselli—tall hedge mustard
Thlaspi arvense—field pennycress

Capparidaceae *(Caper Family)*
Cleome serrulata—Rocky Mountain bee plant

Saxifragaceae *(Saxifrage Family)*
Heuchera richardsonii—alumroot
Ribes americanum—wild black current

Rosaceae *(Rose Family)*
Agrimonia striata—striate agrimony
Amelanchier alnifolia—Saskatoon serviceberry
Chamaerhodos erecta—little ground rose
Crataegus rotundifolia—northern hawthorn
Frageria virginiana—wild strawberry
Geum triflorum—torch flower
Potentilla anserina—silverweed
Potentilla arguta—tall cinquefoil
Potentilla norvegica—Norwegian cinquefoil
Potentilla paradoxa—bushy cinquefoil
Potentilla pensylvanica—cinquefoil
Prunus americana—wild plum
Prunus pensylvanica—pin cherry
Prunus virginiana—chokecherry
Rosa arkansana—prairie wild rose

Rosa woodsii—western wild rose, Woods' rose
Rubus idaeus—red raspberry
Spirea alba—meadow-sweet

Fabaceae *(Bean Family)*
Amorpha canescens—leadplant
Amorpha nana—dwarf wild indigo
Astragalus adsurgens var. *robustior*—standing milk-vetch
Astragalus agrestis—field milkvetch
Astragalus bisulcatus—two-grooved vetch
Astragalus canadensis—Canada milkvetch
Astragalus crassicarpus—ground-plum
Astragalus flexuosus—pliant mildvetch
Astragalus missouriensis—Missouri milkvetch
Astragalus pectinatus—narrow-leaved poinsonvetch
Astragalus tenellus—pulse milkvetch
Caragana araborescens—Siberian pea-shrub
Dalea candida—white prairie clover
Dalea purpurea—purple prairie clover
Dalea villosa—silky prairie clover
Glycyrrhiza lepidota—wild licorice
Lathyrus ochroleucus—yellow vetchling
Lathyrus venosus—bushy vetchling
Medicago lupulina—black medic
Medicago sativa—alfalfa
Melilotus alba—white sweetclover
Melilotus officianalis—yellow sweetclover
Oxytropis campestris—plains loco
Oxytropis campestris var. *gracilis*—slender locoweed
Oxytropis lambertii—purple locoweed
Oxytropis splendens—showy locoweed
Psoralea argophylla—silver-leaf scurf pea
Psoralea esculenta—breadroot scurf-pea
Thermopsis rhombifolia—prairie buckbean
Vicia americana minor—American vetch

Oxalidaceae *(Woodsorrel Family)*
Oxalis stricta—yellow wood sorrel

Linaceae *(Flax Family)*
Linum perenne—blue flax
Linum rigidum var. *compactum*—compact stiffstem flax
Linum rigidum var. *rigidum*—stiffstem flax
Linum sulcatum—grooved flax

Euphorbiaceae *(Spurge Family)*
Euphorbia esula—leafy spurge
Euphorbia glyptosperma—ridge-seeded spurge

Rhamnaceae *(Buckthorn Family)*
Rhamnus cathartica—common buckthorn

Callitrichaceae *(Water Starwort Family)*
Callitriche hermaphroditica—water starwort

Anacardiaceae *(Sumac Family)*
Rhus glabra—smooth sumac
Toxicodendron radicans—poison ivy

Aceraceae *(Maple Family)*
Acer negundo—boxelder

Balsaminaceae *(Balsam Family)*
Impatiens capensis—spotted touch-me-not

Vitaceae *(Grape Family)*
Parthenocissus quinquefolia—Virginia creeper
Vitis riparia—river-bank grape

Malvaceae *(Mallow Family)*
Sphaeralcea coccinea—red false mallow

Violaceae *(Violet Family)*
Viola adunca—hook-spurred violet
Viola canadensis—tall white violet
Viola nuttallii—Nuttall's violet
Viola pedatifida—prairie violet
Viola rugulosa—tall white violet

Cactaceae *(Cactus Family)*
Coryphantha vivipara—pincushion cactus
Opuntia fragilis—little prickly pear
Opuntia polycantha—plains prickly pear

Elaeagnaceae *(Oleaster Family)*
Elaeagnus angustifolia—Russian olive
Elaeagnus commutata—silverberry
Shepherdia argentea—buffaloberry

Onagraceae *(Evening Primrose Family)*
Calylophus serrulatus—plains yellow primrose
Epilobium angustifolium—fireweed
Epilobium ciliatum subsp. *glandulosum*—willow herb
Gaura coccinea—scarlet gaura
Oenothera biennis—common evening primrose
Oenothera nuttallii—white-stemmed evening primrose

Haloragaceae *(Water Milfoil Family)*

Myriophyllum exalbescens—water milfoil

Araliaceae *(Ginseng Family)*

Aralia nudicaulis—wild sarsaparilla

Apiaceae *(Parsley Family)*

Cicuta maculata—common water hemlock
Heracleum sphondylium—cow parsnip
Musineon divaricatum—wild parsley
Osmorhiza longistylis—anise root
Sanicula marilandica—black snakeroot
Sium suave—water parsnip
Zizia aptera—meadow parsnip

Cornaceae *(Dogwood Family)*

Cornus stolonifera—redosier dogwood

Ericaceae *(Heath Family)*

Arctostaphylos uva-ursi—bearberry

Primulaceae *(Primrose Family)*

Androsace occidentalis—western rock jasmine
Dodecatheon pulchellum—shooting star
Lysimachia ciliata—fringed loosestrife
Lysimachia hybrida—loosestrife
Lysimachia thyrsiflora—tufted loosestrife

Oleaceae *(Olive Family)*

Fraxinus pennsylvanica—green ash
Syringa vulgarus—lilac

Gentianaceae *(Gentian Family)*

Gentiana affinis—northern gentian

Apocynaceae *(Dogbane Family)*

Apocynum androsaemifolium—spreading dogbane

Asclepiadaceae *(Milkweed Family)*

Asclepias incarnata—swamp milkweed
Asclepias involucrate—dwarf milkweed
Asclepias ovalifolia—ovalleaf milkweed
Asclepias syriaca—common milkweed
Asclepias verticillata—whorled milkweed
Asclepias viridiflora—green milkweed

Convolvulaceae *(Morning-glory Family)*

Convolvulus arvensis—field bindweed
Calystegia sepium subsp. *angulata*—hedge bindweed

Cuscutaceae *(Dodder Family)*

Cuscuta gronovii—Gronovius' dodder

Polemoniaceae *(Phlox Family)*

Collomia linearis—collomia
Phlox hoodii—Hood's phlox

Boraginaceae *(Borage Family)*

Hackelia deflexa—stickseed
Lithospermum canescens—hoary puccoon
Lithospermum incisum—narrow leaved puccoon
Mertensia lanceolata—lungwort, wild forget-me-not
Onosmodium molle var. *occidentale*—false gromwell

Verbenaceae *(Verbena Family)*

Verbena bracteata—prostrate vervain
Verbena hastate—swamp vervain

Lamiaceae *(Mint Family)*

Agastache foeniculum—lavender hyssop
Hedeoma hispida—rough false pennyroyal
Lycopus americanus—American bugleweed
Lycopus asper—rough bugleweed
Mentha arvensis—field mint
Monarda fistulosa—wild bergamot
Nepeta cataria—catnip
Physostegia parviflora—obedient plant
Scutellaria galericulata—marsh skullcap
Scutellaria lateriflora—blue skullcap
Stachys palustris—hedge nettle
Teucrium canadense—American germander

Hippuridaceae *(Mare's-tail Family)*

Hippuris vulgaris—common mare's-tail

Solanaceae *(Nightshade Family)*

Physalis virginiana—Virginia ground cherry
Solanum triflorum—cut-leaved nightshade

Scrophulariaceae *(Figwort Family)*

Castilleja sessiliflora—downy paintbrush
Limmosella aquatica—mudwort
Linaria vulgaris—butter and eggs
Orthocarpus luteus—owl clover
Penstemnon albidus—white beardtongue
Penstemon angustifolius—narrow beardtongue
Penstemon gracilis—slender beardtongue

Lentibulariaceae *(Bladderwort Family)*

Utricularia vulgaris—common bladderwort

Plantaginaceae *(Plantain Family)*

Plantago major—common plantain
Plantago rugelii—Rugel's plantain

Rubiaceae *(Madder Family)*

Galium boreale—northern bedstraw
Hedyotis longifolia—slender-leaved bluet

Caprifoliaceae *(Honeysuckle Family)*

Lonicera dioica—limber honeysuckle
Lonicera tatarica—tartarian honeysuckle
Symphoricarpos occidentalis—western snowberry
Viburnum lentago—nannyberry

Cucurbitaceae *(Gourd Family)*

Echinocystis lobata—wild cucumber

Campanulaceae *(Bluebell Family)*

Campanula rotundifolia—harebell
Lobelia kalmii—Kalm's lobelia

Asteraceae *(Aster Family)*

Achillea millefolium—yarrow
Agoseris glauca—false dandelion
Ambrosia psilostachya—western ragweed
Antennaria microphylla—pink pussy-toes
Antennaria neglecta—field pussytoes
Antennaria parvifolia—pussy-toes
Arctium minus—common burdock
Artemisia absinthium—wormwood
Artemisia cana—dwarf sagebrush
Artemisia dracunculus—silky wormwood
Artemisia frigida—fringed sage
Artemisia longifolia—long-leaved sage
Artemisia ludoviciana—white sage
Aster ericoides—white aster
Aster falcatus—smallflower aster
Aster hesperius—marsh aster
Aster laevis—smooth blue aster
Aster oblongifolia—aromatic aster
Aster simplex—panicled aster
Bidens comosa—beggar-ticks
Bidens frondosa—beggar-ticks
Bidens vulgate—beggar-ticks
Centaurea maculosa—spotted knapweed
Chrysopsis villosa—golden aster
Chrysothamnus nauseosus—rabbit brush
Cirsium arvense—Canada thistle
Cirsium flodmanii—Floodman's thistle
Cirsium undulatum—wavy-leaf thistle
Cirsium vulgare—bull thistle
Conyza Canadensis—horse-weed
Crepis runcinata—hawksbeard
Echinacea angustifolia—purple coneflower
Erigeron strigosus—daisy fleabane
Euthamia graminifolia—narrow-leaved goldenrod
Gaillardia aristata—blanket flower
Grindelia squarrosa—curly-top gumweed
Gutierrezia sarothrae—snakeweed
Haplopappus spinulosus—ironplant
Helianthus annus—common sunflower
Helianthus maximilianii –Maximilian sunflower
Helianthus nuttallii subsp. *rydbergii*—Nuttall's sunflower
Helianthus petiolaris—plains sunflower
Helianthus rigidus—stiff sunflower
Iva xanthifolia—marsh elder
Lactuca oblongifolia—blue lettuce
Liatris ligulistylis—gay-feather
Liatris punctata—blazing star
Lygodsmia juncea—skeletonweed
Matricaria chamomile—false chamomile
Matricaria maritime—wild chamomile
Matricaria matricarioides—pineapple weed
Ratibida columnifera—prairie coneflower
Rudbeckia hirta—black-eyed susan
Senecio canus—gray ragwort
Senecio integerrimus—lambstongue groundsel
Senecio platensis—prairie ragwort
Solidago canadensis—Canada goldenrod
Solidago gigantea—late goldenrod
Solidago missouriensis—prairie goldenrod
Solidago mollis—soft goldenrod
Solidago nemoralis—gray goldenrod
Solidago ptarmicoides—sneezewort aster
Solidago rigida—rigid goldenrod
Sonchus arvensis—field sow thistle
Tanacetum vulgare – common tansy
Taraxacum officinale—dandelion
Tragopogon dubius—goat's beard, western salsify
Vernonia fasciculate—ironweed

Appendix E

Plant Group Types of Upland Vegetation at the Souris River Basin Refuges

This appendix describes the hierarchical listing of plant group types (modified from Grant et al. 2004b) used for belt transect surveys of upland vegetation that occurs at the Souris River basin refuges and surrounding areas in North Dakota. One of the below types is recorded for each 0.3 x 1.5-foot segment along an outstretched measuring tape, based on >50% dominance by canopy cover unless otherwise indicated. Scientific names are listed in appendix D.

Shrub and Tree Types

Low Shrub (generally <5 feet tall except in one to few postdisturbance years)

11 snowberry dense (other low shrub species total 0–25%); other plants few or none

12 snowberry (and other low shrub species); remainder mostly native grass–forb types

13 snowberry (and other low shrub species); remainder mostly Kentucky bluegrass

14 snowberry (and other low shrub species); remainder mostly smooth brome (or quackgrass)

15 silverberry prominent, remainder mostly native or invaded native grass-forb types

16 silverberry prominent; remainder mostly Kentucky bluegrass

17 silverberry prominent; remainder mostly smooth brome (or quackgrass)

Tall Shrub (generally 5–16 feet tall) or tree (>16 feet tall)

21 chokecherry, Juneberry, hawthorn, willow, dogwood

22 shrub-stage aspen

23 exotic shrub (for example, caragana, honeysuckle, Russian olive)

31 aspen tree

32 burned-over aspen tree (dead or dying postfire snags)

33 shade-tolerant woodland tree (green ash, boxelder, elm)

Native Grass–Forb and Forb Types

(>95% dominance by native herbaceous plants*)

41 dry cool-season plants (sedges, green needlegrass, needle and thread, wheatgrass species, prairie Junegrass, forbs; often blue grama and some other warm-season plant species)

42 dry warm-season plants (little bluestem, prairie sandreed, plains muhly, fescue species, blue grama, forbs)

43 mesic warm–cool mix (big bluestem, switchgrass, little bluestem, porcupine grass; mat muhly, prairie dropseed, forbs)

46 subirrigated wet meadow microsite within upland (fowl bluegrass, foxtail barley, northern reedgrass, coarse sedge species, baltic rush, dock, prairie cordgrass)

47 cactus

48 clubmoss

**Prairie rose is considered a native forb in this classification.*

Exotic and Invaded Native Grass–Forb Types

51 Kentucky bluegrass >95%

52 Kentucky bluegrass and native grass-forbs, bluegrass 50–95%

53 native grass-forbs and Kentucky bluegrass, bluegrass 5–50%

61 smooth brome (or quackgrass) >95%

62 smooth brome (or quackgrass) and native grass-forbs, brome 50–95%

63 native grass-forbs and smooth brome (or quackgrass), brome 5–50%

71 crested wheatgrass >95%

72 crested wheatgrass and native grass-forbs, crested wheatgrass 50–95%

73 native grass-forbs and crested wheatgrass, crested wheatgrass 5–50%

78 tall, intermediate, or pubescent wheatgrass

Noxious Weed Types

81 leafy spurge

85 Canada thistle

88 other noxious weeds (user defined)

Other

91 barren, unvegetated (for example, rock, anthill, bare soil)

98 tall exotic legume (sweetclover or alfalfa)

00 wetland basin (temporary, seasonal, or semipermanent wetland [Stewart and Kantrud 1971])

Appendix F

Birds of the Souris River Basin Refuges

Bird species found at the three Souris River basin refuges since 1935 total 308 , of which 30 are "accidentals" and 1 is extirpated. About 170 species are known to have nested at the refuges, and 150 of these nest regularly. The following list is adapted from that produced for the refuges by G. Berkey and R. Martin, updated January 2001, as published in the Service publication "National Wildlife Refuges, Along the Souris River Loop, Bird List."

Seasons of Occurrence

- ***Sp*** spring (March–May)
- ***S*** summer (June–July)
- ***F*** fall (August–November)
- ***W*** winter (December–February)

Abundance Categories

The following abundance categories indicate the peak daily and seasonal totals of birds that may be seen by an active, experienced observer spending at least 8 hours per week sampling all types of habitat at a refuge.

a	abundant=	>125 per day, >600 per season
c	common=	25–125 per day, 125–600 per season
f	fairly common=	5–25 per day, 25–125 per season
u	uncommon=	1–5 per day, 5–25 per season
r	rare=	1–5 per season
o	occasional=	small numbers seen at intervals of 2–10 years
•	nested=	species that have nested
(i)	irregular=	indicates a species that is irregular; the abundance category indicates the numbers expected in peak years
(1)	extirpated as a breeding species	
(2)	last observed 1956	

Loons	***Sp***	***S***	***F***	***W***
common loon	*r*	*o*	*r*	—
Grebes	***Sp***	***S***	***F***	***W***
pied-billed grebe•	*f*	*f*	*f*	—
horned grebe•	*f*	*r*	*u*	—
red-necked grebe•	*o*	*o*	*o*	—
eared grebe•	*a*	*a*	*a*	—
western grebe•	*c*	*c*	*c*	—
Clark's grebe	*r*	*r*	*r*	—
Pelicans and Cormorants	***Sp***	***S***	***F***	***W***
American white pelican	*c*	*c*	*c*	—
double-crested cormorant	*c*	*c*	*c*	—
Bitterns, Herons, and Egrets	***Sp***	***S***	***F***	***W***
American bittern•	*u*	*u*	*u*	—
least bittern	*o*	*o*	*o*	—
great blue heron•	*f*	*f*	*f*	—
great egret	*o*	*o*	*o*	—
snowy egret•	*o*	*o*	*o*	—
little blue heron•	*o*	*o*	*o*	—
cattle egret•*(i)*	*f*	*f*	*f*	—
black-crowned night-heron•	*f*	*f*	*f*	—
Ibises and Spoonbills	***Sp***	***S***	***F***	***W***
white-faced ibis	*o*	*o*	*o*	—
New World Vultures	***Sp***	***S***	***F***	***W***
turkey vulture	*r*	—	*r*	—
Swans, Geese, and Ducks	***Sp***	***S***	***F***	***W***
greater white-fronted goose	*f*	—	*f*	—
snow goose	*a*	*o*	*a*	*o*
Ross' goose	*u*	—	*u*	—
Canada goose•	*a*	*c*	*a*	*o*
trumpeter swan*(1)*	—	*o*	*o*	—
tundra swan	*c*	*o*	*a*	—
wood duck•	*f*	*f*	*f*	—
gadwall•	*a*	*c*	*a*	—
American wigeon•	*c*	*u*	*c*	—
American black duck•	*o*	*o*	*r*	—
mallard•	*a*	*c*	*a*	*o*
blue-winged teal•	*a*	*c*	*a*	—
cinnamon teal	*o*	*o*	—	—
northern shoveler•	*a*	*c*	*a*	—
northern pintail•	*a*	*c*	*c*	*o*

Swans, Geese, and Ducks (continued)	Sp	S	F	W
green-winged teal•	f	u	c	o
canvasback•	c	f	c	—
redhead•	c	f	a	—
ring-necked duck•	f	r	f	—
greater scaup	r	—	r	—
lesser scaup•	a	u	a	o
surf scoter	—	—	r	—
white-winged scoter	—	—	r	—
black scoter	—	—	o	—
long-tailed duck	—	—	r	—
bufflehead•	c	r	c	—
common goldeneye	c	—	c	—
hooded merganser•	f	f	f	—
common merganser	c	—	f	—
red-breasted merganser	o	—	o	—
ruddy duck•	a	c	a	—

Osprey, Kites, Hawks, and Eagles	Sp	S	F	W
osprey	r	—	r	—
bald eagle	f	o	f	r
northern harrier•	c	f	c	o
sharp-shinned hawk•	f	f	f	r
Cooper's hawk•	u	u	u	—
northern goshawk	o	—	r	r
broad-winged hawk•	u	o	u	—
Swainson's hawk•	f	u	f	—
red-tailed hawk•	c	f	c	o
ferruginous hawk•	r	o	r	—
rough-legged hawk	u	—	u	r
golden eagle	r	—	r	r

Falcons and Caracaras	Sp	S	F	W
American kestrel•	f	u	f	—
merlin	r	—	u	u
gyrfalcon	—	—	o	o
peregrine falcon	r	o	r	o
prairie falcon	o	—	r	r

Gallinaceous Birds	Sp	S	F	W
gray partridge•	u	u	u	u
ring-necked pheasant•	f	f	f	f
ruffed grouse•	u	u	u	u
sharp-tailed grouse•	f	f	f	f
greater prairie-chicken*(1)(2)*	—	—	—	—
wild turkey•	u	u	u	u

Rails	Sp	S	F	W
yellow rail•	r	o	r	—
Virginia rail•	u	u	u	—
sora•	c	c	c	—
American coot•	a	a	a	—

Cranes	Sp	S	F	W
sandhill crane•	a	r	a	—
whooping crane	o	—	o	—

Plovers	Sp	S	F	W
black-bellied plover	f	—	f	—
American golden-plover	f	—	f	—
semipalmated plover	u	u	u	—
piping plover•	o	o	o	—
killdeer•	c	c	c	—

Stilts and Avocets	Sp	S	F	W
American avocet•	c	f	c	—

Sandpipers and Phalaropes	Sp	S	F	W
greater yellowlegs	f	f	f	—
lesser yellowlegs	c	c	c	—
solitary sandpiper	u	u	u	—
willet•	f	f	f	—
spotted sandpiper•	f	f	f	—
upland sandpiper•	f	f	u	—
Hudsonian godwit	u	o	o	—
marbled godwit•	f	f	f	—
ruddy turnstone	r	o	o	—
red knot	o	o	o	—
sanderling	u	u	u	—
semipalmated sandpiper	a	c	a	—
western sandpiper	o	o	o	—
least sandpiper	c	f	c	—
white-rumped sandpiper	a	f	o	—
Baird's sandpiper	c	f	c	—
pectoral sandpiper	c	f	c	—
dunlin	u	—	o	—
stilt sandpiper	f	c	c	—
buff-breasted sandpiper	o	—	o	—
short-billed dowitcher	f	f	f	—
long-billed dowitcher	c	c	a	—
common snipe•	f	u	c	—
Wilson's phalarope•	c	a	a	—
red-necked phalarope	a	a	a	—

Skuas, Jaegers, Gulls, and Terns	Sp	S	F	W
Franklin's gull•	a	a	a	—
Bonaparte's gull	r	r	u	—
ring-billed gull•	a	c	a	—
California gull•	u	r	u	—
herring gull	u	—	u	—
common tern•	f	r	f	—
Forster's tern•	f	f	f	—
black tern•	a	c	a	—

Pigeons and Doves	Sp	S	F	W
rock dove•	u	u	u	u
mourning dove•	c	c	a	o

Cuckoos and Anis	Sp	S	F	W
black-billed cuckoo•	u	u	r	—
yellow-billed cuckoo	o	—	—	—

Typical Owls	Sp	S	F	W
eastern screech-owl•	r	r	r	r
great horned owl•	f	f	f	f
snowy owl	r	—	r	r
burrowing owl•	o	o	o	—
long-eared owl•(i)	u	u	r	o
short-eared owl•(i)	u	u	u	r
boreal owl	—	—	—	o
northern saw-whet owl	o	—	o	o

Goatsuckers	Sp	S	F	W
common nighthawk•	u	r	u	—
common poorwill•	o	o	o	—
whip-poor-will	o	o	—	—

Swifts	Sp	S	F	W
chimney swift	o	—	o	—

Hummingbirds	Sp	S	F	W
ruby-throated hummingbird•	r	r	r	—

Kingfishers	Sp	S	F	W
belted kingfisher•	u	u	u	o

Woodpeckers	Sp	S	F	W
red-headed woodpecker•	r	o	r	—
yellow-bellied sapsucker•	u	u	u	—
downy woodpecker•	u	u	u	u
hairy woodpecker•	u	u	u	u
northern flicker•	f	f	f	o

Tyrant Flycatchers	Sp	S	F	W
olive-sided flycatcher	r	r	r	—
western wood-pewee	o	o	o	—
eastern wood-pewee•	f	f	f	—
yellow-bellied flycatcher	o	—	o	—
alder flycatcher•	u	r	r	—
willow flycatcher•	f	f	f	—
least flycatcher•	c	c	c	—
eastern phoebe•	r	r	r	—
Say's phoebe•	r	r	r	—
great crested flycatcher•	f	f	u	—
western kingbird•	c	c	c	—
eastern kingbird•	c	c	c	—

Shrikes	Sp	S	F	W
loggerhead shrike•	r	r	r	o
northern shrike	u	—	u	u

Vireos	Sp	S	F	W
yellow-throated vireo•	u	u	u	—
blue-headed vireo	u	—	u	—
warbling vireo•	f	f	f	—
Philadelphia vireo	r	o	r	—
red-eyed vireo•	c	c	c	—

Crows, Jays, and Magpies	Sp	S	F	W
blue jay•	f	u	f	u
black-billed magpie•	f	f	f	f
American crow•	a	f	a	u
common raven•	r	r	o	o

Larks	Sp	S	F	W
horned lark•	a	f	a	f

Swallows	Sp	S	F	W
purple martin•	f	f	f	—
tree swallow•	c	f	u	—
northern rough-winged swallow•	f	f	r	—
bank swallow•	a	c	a	—
cliff swallow•	a	a	a	—
barn swallow•	a	c	a	—

Titmice and Chickadees	Sp	S	F	W
black-capped chickadee•	f	f	f	f

Nuthatches	Sp	S	F	W
red-breasted nuthatch•(i)	u	r	u	r
white-breasted nuthatch•	u	u	u	u

Creepers	Sp	S	F	W
brown creeper	u	—	u	r

Wrens	Sp	S	F	W
rock wren•	r	r	r	—
house wren•	c	c	c	—
winter wren	—	—	o	—
sedge wren•(i)	c	c	c	—
marsh wren•	c	c	c	—

Kinglets	Sp	S	F	W
golden-crowned kinglet	f	—	f	r
ruby-crowned kinglet	f	—	f	—

Thrushes	Sp	S	F	W
eastern bluebird•	u	u	u	—
mountain bluebird•	u	u	u	—
Townsend's solitaire	o	—	o	o
veery•	f	f	u	—
gray-cheeked thrush	f	—	r	—
Swainson's thrush	c	—	f	—
hermit thrush	u	—	u	—
American robin•	a	c	a	r

Mimic Thrushes	Sp	S	F	W
gray catbird•	f	f	f	—
northern mockingbird	o	o	o	—
brown thrasher•	f	f	f	—

Starlings	Sp	S	F	W
European starling•	c	f	a	u

Wagtails and Pipits	Sp	S	F	W
American pipit	u	—	f	—
Sprague's pipit•	f	f	u	—

Waxwings	Sp	S	F	W
Bohemian waxwing(i)	c	—	c	c
cedar waxwing•	f	c	c	u

Wood Warblers	Sp	S	F	W
Tennessee warbler	c	r	f	—
orange-crowned warbler•	f	r	c	—
Nashville warbler	u	—	u	—
northern parula	o	—	o	—
yellow warbler•	c	c	c	—
chestnut-sided warbler	o	—	r	—
magnolia warbler	u	—	u	—
Cape May warbler	o	—	o	—
black-throated blue warbler	o	—	o	—
yellow-rumped warbler	a	o	a	—
black-throated green warbler	o	—	r	—
Blackburnian warbler	o	—	r	—
palm warbler	u	—	u	—
bay-breasted warbler	o	—	r	—
blackpoll warbler	c	—	f	—
black-and-white warbler•	f	u	f	—
American redstart•	f	u	f	—
ovenbird•	f	f	u	—
northern waterthrush•	f	r	u	—
Connecticut warbler	r	o	o	—
mourning warbler	u	o	r	—
MacGillivray's warbler	o	—	o	—
common yellowthroat•	c	c	c	—
Wilson's warbler	u	—	f	—
Canada warbler	r	—	r	—
yellow-breasted chat•	r	r	o	—

Tanagers	Sp	S	F	W
scarlet tanager•	o	o	—	—
western tanager	—	—	o	—

Towhees and Sparrows	Sp	S	F	W
spotted towhee•	f	f	f	—
eastern towhee	o	—	o	—
American tree sparrow	a	—	a	u
chipping sparrow•	c	u	c	—
clay-colored sparrow•	a	a	a	—
field sparrow•	r	r	r	—
vesper sparrow•	c	c	c	—
lark sparrow•	u	u	r	—
lark bunting•(i)	u	u	u	—
Savannah sparrow•	a	c	a	—
grasshopper sparrow•(i)	c	c	c	—
Baird's sparrow•(i)	f	f	f	—
Le Conte's sparrow•(i)	f	f	f	—

Towhees and Sparrows (continued)	Sp	S	F	W
song sparrow•	c	f	c	o
Lincoln's sparrow	f	—	f	—
swamp sparrow•	f	r	f	—
white-throated sparrow	c	—	c	o
Harris' sparrow	c	—	c	o
white-crowned sparrow	f	—	f	—
dark-eyed junco	a	o	a	r
McCown's longspur•	o	o	o	—
Lapland longspur	a	—	a	u
Smith's longspur	r	—	r	—
chestnut-collared longspur•	u	u	u	—
snow bunting	c	—	a	c
Nelson's sharp-tailed sparrow•	f	f	f	—
fox sparrow	r	—	u	—

Cardinals, Grosbeaks, and Allies	Sp	S	F	W
rose-breasted grosbeak•	f	f	f	—
black-headed grosbeak•	r	r	o	—
lazuli bunting•	r	r	r	—
indigo bunting•	r	r	r	—
dickcissel•	o	o	o	—

Blackbirds and Orioles	Sp	S	F	W
bobolink•	c	c	f	—
red-winged blackbird•	a	a	a	o
western meadowlark•	a	a	a	o
yellow-headed blackbird•	a	a	a	o
rusty blackbird	r	—	f	o
Brewer's blackbird•	c	f	a	o
common grackle•	a	c	a	o
brown-headed cowbird•	a	a	u	—
orchard oriole•	f	f	o	—
northern oriole•	f	f	f	—

Finches	Sp	S	F	W
pine grosbeak(i)	u	—	u	f
purple finch	u	—	u	r
house finch•	u	u	u	f
red crossbill•(i)	u	o	u	f
white-winged crossbill(i)	o	—	o	o
common redpoll(i)	a	—	c	a
hoary redpoll	o	—	—	o
pine siskin•(i)	c	o	c	f
American goldfinch•	c	c	c	u
evening grosbeak	o	—	o	o

Old World Sparrows	Sp	S	F	W
house sparrow•	f	f	f	f

The following birds are rarely seen at the refuges and are out of their normal ranges:

Pacific loon
brown pelican
tricolored heron
green heron
yellow-crowned night-heron
white ibis
fulvous whistling-duck
Eurasian wigeon
harlequin duck
red-shouldered hawk
black-necked stilt
whimbrel
long-billed curlew
American woodcock
glaucous gull
black-legged kittiwake
barn owl
barred owl
scissor-tailed flycatcher
violet-green swallow
sage thrasher
Townsend's warbler
prothonotary warbler
hooded warbler
Henslow's sparrow
golden-crowned sparrow
Bullock's oriole
lesser goldfinch

Appendix G

Birds of Conservation Concern in the United States Prairie Pothole Region

The following bird species occur in “Bird Conservation Region Number 11” (prairie potholes–U.S. portion only), as listed in “Birds of Conservation Concern: the 2002 List” (USFWS 2002).

An asterisk (*) denotes species that currently breed in the Souris River basin in North Dakota. Others migrate through the area.

American bittern*
northern harrier*
Swainson's hawk*
ferruginous hawk*
peregrine falcon
yellow rail*
solitary sandpiper
willet*
upland sandpiper*
long-billed curlew
Hudsonian godwit
marbled godwit*
sanderling
white-rumped sandpiper
buff-breasted sandpiper
Wilson's phalarope*
black-billed cuckoo*
burrowing owl*
short-eared owl*
red-headed woodpecker*
loggerhead shrike*
Sprague's pipit*
grasshopper sparrow*
Baird's sparrow*
Henslow's sparrow
Le Conte's sparrow*
Nelson's Sharp-tailed sparrow*
McCown's longspur
chestnut-collared longspur*

Appendix H
Mammals of the Souris River Basin Refuges

Mammal species that have been documented at the Souris River basin refuges, before and after establishment of the refuges, total 62 species including 6 that have been largely extirpated from the area (Jones et al. 1983, Kadrmas 2005). Some species likely have been overlooked, especially secretive, rare, or nocturnal species such as some species of bats. Voucher specimens of most small mammal species are stored at the University of North Dakota's biology department.

ORDER INSECTIVORA

Family Soricidae

Sorex cinereus—masked shrew
Sorex arcticus—Arctic shrew
Microsorex hoyi—pigmy shrew
Blarina brevicauda—short-tailed shrew

ORDER CHIROPTERA

Family Vespertilionidae

Myotis lucifugus—little brown myotis
Myotis septentrionalis—northern myotis
Myotis evotis—long-eared myotis
Lasionycteris noctivagans—silver-haired bat
Eptesicus fuscus—big brown bat
Lasiurus borealis—red bat
Lasiurus cinereus—hoary bat

ORDER LAGOMORPHA

Family Leporidae

Sylvilagus floridanus—eastern cottontail
Sylvilagus audubonii—desert cottontail
Lepus americanus—snowshoe hare
Lepus townsendii—white-tailed jackrabbit

ORDER RODENTIA

Family Sciuridae

Eutamius minimus—least chipmunk
Marmota monax—woodchuck
Spermophilus richardsonii—Richardson's ground squirrel
Spermophilus tridecemlineatus—thirteen-lined ground squirrel
Spermophilus franklinii—Franklin's ground squirrel
Sciurus carolinensis—gray squirrel
Sciurus niger—fox squirrel
Tamiasciurus hudsonicus—red squirrel

Family Geomyidae

Thomomys talpoides—northern pocket gopher

Family Heteromyidae

Perognathus fasciatus—olived-backed pocket mouse
Perognathus flavescens—plains pocket mouse

Family Heteromyidae

Castor canadensis—beaver

Family Cricetidae

Peromyscus maniculatus—deer mouse
Peromyscus leucopus—white-footed mouse
Onychomys leucogaster—northern grasshopper mouse
Clethrionomys gapperi—southern red-backed vole
Microtus pennsylvanicus—meadow vole
Microtus ochrogaster—prairie vole
Ondatra zibethicus—muskrat

Family Muridae

Rattus norvegius—Norway rat
Mus musculus—house mouse

Family Zapodidae

Zapus hudsonius—meadow jumping mouse
Zapus princeps—western jumping mouse

Family Erethizontidae

Erethizon dorsatum—porcupine

ORDER CARNIVORA

Family Canidae

Canis latrans—coyote
Canis lupus—gray wolf*
Vulpes vulpes—red fox
Vulpes velox—swift fox*

Family Ursidae

Ursus americanus—black bear

Family Procyonidae

Procyon lotor—raccoon

**Largely extirpated from the area.*

Family Mustelidae

Mustela erminea—ermine
Mustela nivalis—least weasel
Mustela frenata—long-tailed weasel
Mustela vison—mink
Taxidea taxus—badger
Mephitis mephitis—striped skunk
Lutra canadensis—river otter*

Family Felidae

Felis concolor—mountain lion*
Felis lynx—lynx*
Felis rufus—bobcat

ORDER ARTIODACTYLA

Family Cervidae

Cervus elaphus—elk*
Odocoileus hemionus—mule deer
Odocoileus virginianus—white-tailed deer
Alces alces—moose

Family Antilocapridae

Antilocapridae americana—pronghorn

Family Bovidae

Bison bison—bison*

**Largely extirpated from the area.*

Appendix I
Reptiles and Amphibians of the Souris River Basin Refuges

Reptile and amphibian species that have been documented in the Souris River basin include at least the 16 species listed here (Beachy, unpublished data; Wheeler and Wheeler 1966).

CLASS REPTILIA

ORDER CHELONIA

Family Chelydridae

Chelydra serpentina—common snapping turtle

Family Emydidae

Chrysemys picta belli—western painted turtle

ORDER SQUAMATA

Family Colubridae

Pituophis catenifer—bullsnake
Thamnophis sirtalis (subsp. *parietalis*)—red-sided garter snake
Thamnophis radix—plains garter snake
Storeria occipitomaculata—redbelly snake
Opheodrys vernalis—smooth green snake
Heterdon nasicus—western hognose snake

CLASS AMPHIBIA

ORDER CAUDATA

Family Ambystomidae

Ambystoma tigrinum—tiger salamander

ORDER SALIENTIA

Family Pelobatidae

Scaphiopus bombifrons—plains spadefoot

Family Bufonidae

Bufo hemiophrys—Canadian toad
Bufo cognatus—Great Plains toad
Bufo woodhousei—Woodhouse's toad

Family Hylidae

Pseudacris triseriata—western chorus frog

Family Ranidae

Rana pipiens—northern leopard frog
Rana sylvatica—wood frog

Appendix J
Fishes of the Souris River Basin Refuges

Fishes include about 26 species that occurred in the Souris River basin system circa the 1980s. Most of these species probably still occur at the three Souris River basin refuges, but several may be extirpated from the river system. The following list was compiled by Wade King, USFWS–Bismarck, North Dakota (personal communication), based on unpublished data (sampling records).

Family Esocidae
Esox lucius—northern pike

Family Cyprinidae
Hybognathus hankinsoni—brassy minnow
Notemigonus crysoleucas—golden shiner
Notropis blennius—river shiner
Notropis cornutus—common shiner
Notropis atherinoides—emerald shiner
Notropis dorsalis—bigmouth shiner
Notropis hudsonius—spottail shiner
Notropis stramineus—sand shiner
Pimephales promelas—fathead minnow
Rhinichthys atratulus—blacknose dace
Rhinichthys cataractae—longnose dace
Semotilus atromaculatus—creek chub

Family Catostomidae
Catostomus catostomus—longnose sucker
Catostomus commersoni—white sucker
Moxostoma anisurum—silver redhorse

Family Ictaluridae
Ictalurus melas—black bullhead
Noturus gyrinus—tadpole madtom

Family Percopsidae
Percopsis omiscomaycus—trout-perch

Family Gasterosteidae
Culaea inconstans—brook stickleback

Family Percidae
Etheostoma exile—Iowa darter
Etheostoma nigrum—Johnny darter
Perca flavescens—yellow perch
Percina maculata—blackside darter
Stizostedion vitreum—walleye

Family Centrarchidae
Micropterus dolomieui—smallmouth bass

At least five other fish species once occurred at the refuges through stocking programs during the 1940s.

Pomoxis nigromaculatus—black crappie
Lepomis macrochirus—bluegill
Micropterus salmoides—largemouth bass
Ictalurus punctatus—channel catfish
Ictalurus natalis—yellow bullhead

AGREEMENT

BETWEEN

THE GOVERNMENT OF CANADA

AND THE GOVERNMENT OF THE UNITED STATES OF AMERICA

FOR WATER SUPPLY AND FLOOD CONTROL

IN THE SOURIS RIVER BASIN

October 26, 1989

Canadian Embassy — Ambassade du Canada

501 Pennsylvania Avenue, N.W.
Washington, D.C. 20001

October 26, 1989

Mr. Robert W. Page
Assistant Secretary of the
Army for Civil Works
The Pentagon
Room 2E570
Washington, D.C.
20310-0103

Dear Mr. Page,

I wish to express formally my Government's satisfaction with the signature today of the Agreement Between the United States of America and Canada for Water Supply and Flood Control in the Souris River Basin. We believe that the Accord will help to satisfy the needs of Basin residents for flood control and assured water supply, as well as encourage closer co-operation among the various interested jurisdictions in dealing with matters of common concern.

Canada and the United States share a mutual objective of ensuring that Souris waters are used fairly and wisely. We look forward to continuing to work with you in pursuit of this goal.

Yours sincerely,

Michael Kergin
Minister

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, DC 20310-0103

26 OCT 1989

Mr. Michael Kergin
Minister
Embassy of Canada
501 Pennsylvania Avenue, N. W.
Washington, D. C. 20001

Dear Mr. Kergin:

On behalf of the Government of the United States of America, I wish to respond to your letter of today's date respecting the Agreement Between the United States of America and Canada for Water Supply and Flood Control in the Souris River Basin. We share your view that the Agreement will contribute to meeting the needs of American and Canadian residents of the Souris Basin and foster closer cooperation among the jurisdictions of both countries in dealing with matters of common concern. That the waters of the Basin are used wisely and fairly is indeed in the best interests of both our nations. We would be pleased to continue our joint endeavors toward this shared objective.

Yours sincerely,

John Doyle, Deputy

for Robert W. Page
Assistant Secretary of the Army
(Civil Works)

AGREEMENT BETWEEN THE GOVERNMENT OF CANADA AND THE GOVERNMENT OF THE UNITED STATES OF AMERICA FOR WATER SUPPLY AND FLOOD CONTROL IN THE SOURIS RIVER BASIN

The Government of Canada and the Government of the United States of America, hereinafter referred to as "the Parties;"

DESIRING to provide for development of the Souris River Basin to increase the general welfare of the people of the United States and Canada;

NOTING that significant benefits will accrue to the Parties by construction, operation, and maintenance of reservoir projects in the Souris River Basin in Canada for the purposes of flood control in the United States of America and for water supply in Canada;

FURTHER NOTING that the Government of the United States of America and the Government of Canada are parties to the Treaty between the Government of the United States of America and the Government of the United Kingdom Concerning Boundary Waters and Questions Arising Along the Boundary between the United States of America and Canada, signed on January 11, 1909, hereinafter referred to as the "Boundary Waters Treaty", and to the Convention Between the Government of the United States of America and the Government of the United Kingdom for the Protection of Migratory Birds in the United States of America and Canada, signed on August 16, 1916, hereinafter referred to as the "Migratory Birds Convention", and desire in connection with the development contemplated in this Agreement to fulfill their rights and obligations under these instruments, and any agreements or orders which implement them;

INTENDING that the Souris River Basin be developed for flood control benefits in the United States of America and water supply benefits in Canada in a manner that is consistent with the Boundary Waters Treaty and the Migratory Birds Convention;

NOW, THEREFORE, hereby agree to the following plan for development of the Souris River Basin:

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ARTICLE I

1. In this Agreement, the term:

   a. "Alameda Dam" means the dam which will be constructed on Moose Mountain Creek in the Province of Saskatchewan approximately four kilometers upstream from its confluence with the Souris River;

   b. "Boundary Dam" means an existing dam located on Long Creek approximately seven kilometers in a southwesterly direction from the City of Estevan in the Province of Saskatchewan;

   c. "Boundary Diversion Channel" means a channel that will be constructed in the Province of Saskatchewan with a maximum capacity of 60 cubic meters per second (2,100 cubic feet per second) to allow the conveyance of water from the Boundary reservoir to the impoundment behind Rafferty Dam;

   d. "Boundary Reservoir" means the impoundment of water behind Boundary Dam;

   e. "construction costs" means expenditures made by Canada for construction of Rafferty Dam and Alameda Dam and reservoirs. Such costs shall include expenditures for engineering, design, construction, land acquisition, and operation and maintenance prior to completion of construction;

   f. "flood control storage" means the volume below the maximum allowable water level in a reservoir to store flood event runoff;

   g. "improvement" means a dam, reservoir or related facility to which this Agreement applies;

   h. "Lake Darling Dam" means an existing structure which is part of the Upper Souris National Wildlife Refuge located on the Souris River approximately 25 kilometers in a northwesterly direction from the city of Minot in the State of North Dakota;

   i. "maintenance curtailment" means an interruption or curtailment of operations under the Operating Plan which is necessary for purposes of repairs, replacements, installation of equipment, performance of other maintenance work, investigations, or inspections;

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j. "Operating Plan" means the plan of operation which is attached to this Agreement as Annex A and which is an integral part of this Agreement, for certain dams, reservoirs, and related works on the Souris River;

k. "Rafferty Dam" means the dam which is under construction at a location on the Souris River approximately six kilometers upstream in a northwesterly direction from the City of Estevan in the Province of Saskatchewan;

l. "Reservoir Regulation Manual" means a document which is used as a guide in the day-to-day operation of a reservoir by the agency responsible for the operation of the reservoir. The manual shall contain a description of the project and its history, and discuss watershed characteristics, data collection and communication networks, hydrologic forecasts, the water control plan, and water control management;

m. "substantially destroyed" means when the cost of repairs or rehabilitation to an improvement to rectify damages to that improvement would exceed 50 percent of the replacement value of the improvement at the time the damage is sustained;

n. "uncontrollable force" means any force or cause beyond the control of the party affected, including, but not limited to, war, riot, civil disturbance, sabotage, earthquake, catastrophic storm event, and restraint by court order, which by exercise of due care and foresight, such party could not reasonably have been expected to avoid;

o. "useful life" means the time remaining until an improvement is permanently retired from service because it no longer effectively serves its intended purpose, as defined in this Agreement and the Operating Plan, notwithstanding good maintenance, or because it is substantially destroyed by uncontrollable force;

p. "water quality monitoring" means the collection, analysis and interpretation of water quality conditions, whether obtained through systematic surveys or special studies;

q. "water quality objective" means a concentration level, other measure, or narrative goal which is intended to support the designated uses of water at a specific site; and

r. "water supply in Canada" means the use of reservoir storage in Canada for the purposes of: cooling water for electric generating plants, irrigation, domestic use, municipal and industrial use, agricultural use, recreation, conservation, flood protection in Canada, or such other uses as the Government of Canada shall designate.

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2. Both the United States of America system of measurement and the Système international (metric system) are equally valid where used in this Agreement. The conversion table in the Operating Plan shall be used to convert values in one measurement system to values in the other measurement system.

3. The terms defined in this Agreement shall have the same meaning when used in the Operating Plan.

ARTICLE II

1. The Government of Canada shall expeditiously provide the Government of the United States of America with a minimum of 466,000 cubic decameters (377,800 acre-feet) of flood storage by:

   a. Completing construction of Rafferty Dam and including in that improvement a minimum of 327,100 cubic decameters (265,200 acre-feet) of flood control storage; and

   b. Constructing Alameda Dam and including in that improvement a minimum of 138,900 cubic decameters (112,600 acre-feet) of flood control storage.

2. The Government of Canada shall design and construct Rafferty Dam and Alameda Dam in accordance with accepted engineering standards. Before the Government of the United States of America shall make any payment pursuant to Article IV of this Agreement, the Government of Canada shall ensure, to the satisfaction of the Government of the United States of America, that Rafferty Dam and Alameda Dam will be designed to have a 100-year project life, and will be capable of operation in accordance with the Operating Plan.

ARTICLE III

1. The Government of Canada shall operate and maintain Rafferty Dam and Alameda Dam at no cost to the Government of the United States of America, except for those costs referred to in Article IV of the Agreement, in accordance with the Operating Plan or in accordance with any subsequent mutually agreed upon change to the Operating Plan for the term of this Agreement. Operation and maintenance of Rafferty Dam and Alameda Dam in accordance with the Operating Plan shall commence immediately upon completion of construction of each dam.

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The Government of Canada shall operate and maintain the Boundary Reservoir at no cost to the Government of the United States of America in accordance with the Operating Plan or in accordance with any subsequent mutually agreed upon change to the Operating Plan for the remainder of the useful life of the Boundary Reservoir. Operation and maintenance of the Boundary Reservoir in accordance with the Operating Plan shall commence immediately upon entry into force of this Agreement.

3. The Government of Canada shall operate the Boundary Diversion Channel and any future water resources development or flood control projects constructed after entry into force of this Agreement for the term of this Agreement at no cost to the Government of the United States of America in a manner which will not adversely affect the stream flow in the Souris River so as to reduce the flood control benefits provided by the Rafferty Dam and Alameda Dam and the Operating Plan;

4. The Government of the United States of America shall operate and maintain the improvements located in the United States for the remainder of their useful life at no cost to the Government of Canada and in accordance with the Operating Plan or any subsequent mutually agreed upon change to the Operating Plan.

5. The Parties shall notify one another of any maintenance curtailment that is proposed at any project addressed in the Operating Plan and the probable duration thereof, and take such action as is appropriate to minimize the effects of such maintenance curtailments on operations under the Operating Plan, to include providing one year's notice of such maintenance curtailments when possible.

ARTICLE IV

1. The Government of the United States of America shall pay the Government of Canada $26.7 million (United States currency, based on October 1985 price levels) for the flood control storage provided at Rafferty Dam.

2. The Government of the United States of America shall pay the Government of Canada an additional $14.4 million (United States currency, based on October 1985 price levels) for the flood control storage provided at Alameda Dam.

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3. The amount of the contributions specified in Paragraphs 1 and 2 were determined by an allocation of construction costs based on the proportionate use of the Rafferty Dam and Alameda Dam for flood control in the United States of America and water supply in Canada. Such contributions shall be subject to adjustment for cost changes by the United States of America pursuant to Section 902(2) of Public Law 99-662 and shall fluctuate to reflect changes in the rate of exchange for currency between the United States of America and Canada that occurred between October 1985 and the time such contributions are made.

4. At the end of each calendar month, the Government of Canada shall issue a progress billing to the Government of the United States of America for its share of project construction costs, which shall be determined by an allocation of joint construction costs to flood control and water supply purposes. The Government of the United States of America shall review such billing and, if not disputed, make payment of the amount billed within thirty days of receipt of the bill for the amount due. If the Government of the United States of America disputes any billing or portion of such billing, it shall specify its reasons for disputing the billing and pay any undisputed amount. Disputed billings or disputed portions of billings shall be discussed by the Parties. Disputes concerning amounts billed that are not resolved by discussion may be settled in accordance with Article XII.

5. Records shall be established and maintained to permit identification of the exact nature and amounts of costs of the Rafferty Dam and Alameda Dam. The records established and maintained pursuant to this paragraph shall be subject to audit at the request of the Government of the United States of America at any reasonable time during the construction of the dams and for five years thereafter, following reasonable notice to the Government of Canada.

6. The Government of Canada shall furnish quarterly status reports to the Government of the United States of America on the progress of construction on the Rafferty Dam and Alameda Dam, the total amount of funds expended on the dams at the time of the report, and the anticipated costs to be billed to the United States for the remainder of the United States of America Government fiscal year, which ends on September 30, and for each following United States of America Government fiscal year.

ARTICLE V

1. The Parties shall cooperate and consult on the matters addressed in this Agreement. The Parties shall exchange such information as is appropriate to ensure timely and beneficial fulfillment of obligations under this Agreement.

2. The Parties shall prepare the Reservoir Regulation Manuals required by the Operating Plan. In preparing such Manuals, the Parties shall consult with interested states and provinces.

3. The Parties shall jointly review the Operating Plan at five-year intervals, or as mutually agreed, in an effort to maximize the provision of flood control and water supply benefits that can be provided consistent with the terms of this Agreement. The Parties shall cooperate and consult, as necessary, with interested states, provinces, and agencies on the review of the Operating Plan and recommended changes in the Operating Plan.

4. Subject to the consent of the Government of Canada, officials of the Government of the United States of America may enter on lands in Saskatchewan acquired for construction of Rafferty, Alameda, and Boundary Dams for the purpose of inspection to ensure that such improvements are being constructed, operated, and maintained in accordance with the terms of this Agreement.

5. The Parties shall consult with interested states and provinces upon request, as appropriate, and so far as is practicable, concerning the supply of water throughout the Souris River Basin.

ARTICLE VI

1. The Parties shall ensure that all activities pursued under the terms of this Agreement are consistent with applicable provisions of the Boundary Waters Treaty, particularly those of Article IV paragraph two.

2. The Parties shall establish a Joint Water Quality Monitoring Program ("the Program") in the relevant portions of the Souris River Basin.

3. The Parties shall establish, within six months of the entry into force of this Agreement, a Bilateral Water Quality Monitoring Group ("the Group"). The Group shall be composed of six members, three appointed by each Party, and be co-chaired by a Canadian and a United States of America member. Each Party may also identify advisors to the Group to assist its respective members.

4. The initial United States of America members of the Group shall include a representative of each of the United States Environmental Protection Agency, the North Dakota Department of Health and Consolidated Laboratories, and the United States Geological Survey. A representative of the United States Fish and Wildlife Service, the United States Department of the Army, and the North Dakota State Engineer shall serve as the initial advisors to the United States of America members of the Group.

5. The initial Canadian members of the Group shall include a representative of each of the Government of Canada, the Government of Saskatchewan, and the Government of Manitoba.

6. The Group shall:

   a. develop recommendations for the Parties on the Program and on water quality objectives;

   b. on a regular basis, exchange data provided by the Program;

   c. collate, interpret, and analyze the data provided by the Program;

   d. review the Program and the water quality objectives at least every five years and recommend to the Parties, as appropriate, any modifications to improve the Program and the water quality objectives; and

   e. prepare an annual report to be submitted to the Parties containing:

      i. a summary of the principal activities of the Group during the year;

      ii. a summary of the principal activities affecting water quality in the Souris River Basin during the year;

      iii. a summary of the collated, interpreted, and analyzed data provided by the Program;

      iv. a summary of the water quality of the Souris River at the two locations at which it crosses the International Boundary between Canada and the United States;

      v. a section summarizing any definitive changes in the monitored parameters and the possible causes of such changes;

      vi. a section discussing whether the water quality objectives as established pursuant to Paragraph 7 have been attained;

      vii. a section summarizing other significant water quality changes and the possible causes of such changes; and

      viii. recommendations on new water quality objectives or on how existing water quality objectives can be met, including suggestions on water quality as it relates to water quantity during periods of low flow, in the event that the annual report indicates that the water quality objectives have not been attained as a result of activities pursued under this Agreement.

7. The Parties shall, by April 1, 1991, establish water quality objectives for the Souris River at the Saskatchewan/North Dakota boundary and at the North Dakota/Manitoba boundary.

8. The Parties shall make reasonable efforts, consistent with then existing legal authorities, to implement the recommendations of the Group and, where reasonably practicable, to improve water quality in the Souris River Basin.

9. If the annual report of the Group indicates that the water quality objectives are not being attained, the Parties shall commence consultations to determine how the water quality objectives can be met, revised or otherwise addressed. Such consultations shall include participation by interested states, provinces, and agencies.

ARTICLE VII

The Parties agree that paragraph 1 of the 1959 Interim Measures, which were approved by the Government of the United States of America and the Government of Canada, shall be modified as shown in Annex B attached hereto.

ARTICLE VIII

1. Should operation of any improvement result in flood damages in either the United States of America or Canada in excess of the flood damages that would have occurred had the improvement not been in operation, the Parties shall, upon the request of either Party, commence consultations on how such flood damages can be avoided in the future and what mitigation and compensatory measures may be appropriate, including possible changes to the Operating Plan. Such consultations shall include participation by interested states, provinces and agencies.

2. Notwithstanding Article XI, paragraph 2, nothing in this Article shall preclude either Party from asserting any rights it may have against the other Party for flood damages resulting from the actions of the other Party.

ARTICLE IX

All obligations of the Government of the United States of America to be carried out under the terms of this Agreement shall be subject to the laws and regulations of the United States of America. All obligations of the Government of Canada to be carried out under the terms of this Agreement shall be subject to the laws and regulations of Canada.

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ARTICLE X

1. The Government of Canada designates the Government of Saskatchewan as the Canadian entity responsible for the construction, operation, and maintenance of the improvements mentioned in this Agreement and located in Canada. Such entity shall issue the progress billings and receive the payments referred to in Article IV.

2. The Government of the United States of America designates the Department of the Army as the entity responsible for receiving billings and making the payments for flood control storage referred to in Article IV and for operating the improvements mentioned in this Agreement and located in the United States of America in accordance with the Operating Plan during periods of flood. The Government of the United States of America designates the Department of the Interior as the entity responsible for operating the improvements mentioned in this Agreement and located in the United States of America in accordance with the Operating Plan during non-flood periods.

ARTICLE XI

1. The Parties shall be liable to each other and, shall make appropriate compensation to each other with respect to any act, failure to act, omission or delay amounting to a breach of this Agreement. For the purposes of this Agreement, any act, failure to act, omission or delay occurring by reason of uncontrollable force shall not constitute a breach of this Agreement.

2. The Parties do not intend to create in this Agreement any private right of action. Except as provided by Paragraph 1 of the Article, neither Party shall be liable to the other or to any person in respect of any injury, damage, or loss occurring in the territory of the other caused by an act, failure to act, omission or delay under this Agreement whether the injury, damage, or loss results from negligence or otherwise.

3. Neither Party shall have any obligation under this Agreement to rebuild or further operate or maintain any improvement to be constructed under this Agreement that is destroyed by uncontrollable force.

4. Neither Party shall have any obligation under this Agreement to take any act to extend the life of any improvement mentioned in this Agreement beyond its normal useful life.

ARTICLE XII

1. The Parties shall seek to resolve any dispute concerning the interpretation or application of this Agreement through consultations undertaken in good faith. As part of this consultation process, the Parties may refer any dispute concerning the interpretation or application of this Agreement to the International Joint Commission for advice and recommendations if mutually agreed. In making such a referral, the Parties shall request that the International Joint Commission provide its advice and recommendations within 90 days of the referral.

2. Any dispute concerning the interpretation or application of this Agreement which cannot be resolved through good faith consultations shall, upon the request of either Party, be referred to a neutral tribunal for review and examination and issuance of advice and recommendations. The tribunal shall consist of two members appointed by the Government of Canada, two members appointed by the Government of the United States of America, and a member jointly appointed by the Parties, who shall be chairman of the tribunal.

3. The Parties shall give prompt and sympathetic consideration to the advice and recommendations of the International Joint Commission and the tribunal.

4 The expenses of the International Joint Commission and the tribunal shall be shared equally by the Parties.

5. These procedures may be supplemented or modified by mutual agreement of the Parties.

ARTICLE XIII

1. This Agreement shall enter into force upon signature.

2. This Agreement may be amended by mutual agreement of the Parties.

3. This Agreement shall remain in force for a period of one hundred years or until the Parties agree that the useful life of the Rafferty and Alameda Dams has ended, whichever is first to occur.

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4. If either Party fails to receive appropriations or other revenues in amounts sufficient to meet anticipated obligations under this Agreement, that Party shall so notify the other Party. Ninety calendar days after providing such notice, either Party may elect to terminate this Agreement or to defer future performance under this Agreement. Termination or deferral of future performance shall not affect existing obligations of the Parties under this Agreement or relieve the Parties of liability for any obligation previously incurred. In the event that either Party terminates or suspends future performance under this Agreement pursuant to this provision, the Government of the United States of America and the Government of Canada shall make appropriate adjustments in the Operating Plan to maximize the flood control and water supply benefits that can be obtained in the United States of America and Canada from the construction accomplished at the time of termination or suspension.

IN WITNESS WHEREOF the undersigned, duly authorized by their respective Government, have signed this Agreement.

DONE at Washington DC in duplicate, this 24th day of [illegible], 1989 in the English and French languages, each text being equally authentic.

For Canada:

For the United States of America:

ANNEX A

OPERATING PLAN

FOR

RAFFERTY, ALAMEDA, BOUNDARY, AND LAKE DARLING RESERVOIRS

OPERATING PLAN FOR
RAFFERTY, ALAMEDA, BOUNDARY, AND LAKE DARLING RESERVOIRS

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INTRODUCTION

Purpose: This Operating Plan was developed pursuant to the Agreement between the Government of the United States of America and the Government of Canada for water supply and flood control in the Souris River Basin (hereinafter referred to as "the subject Agreement.")

It provides for operation of the Souris Basin Project and sets forth a framework for completing project specific Reservoir Regulation Manuals.

Scope: The Operating Plan is limited to the operation of the Souris Basin Project in the Souris River Basin in Saskatchewan, Canada, and North Dakota, United States of America, in accordance with the subject Agreement.

Objectives: The objectives of the Operating Plan are:

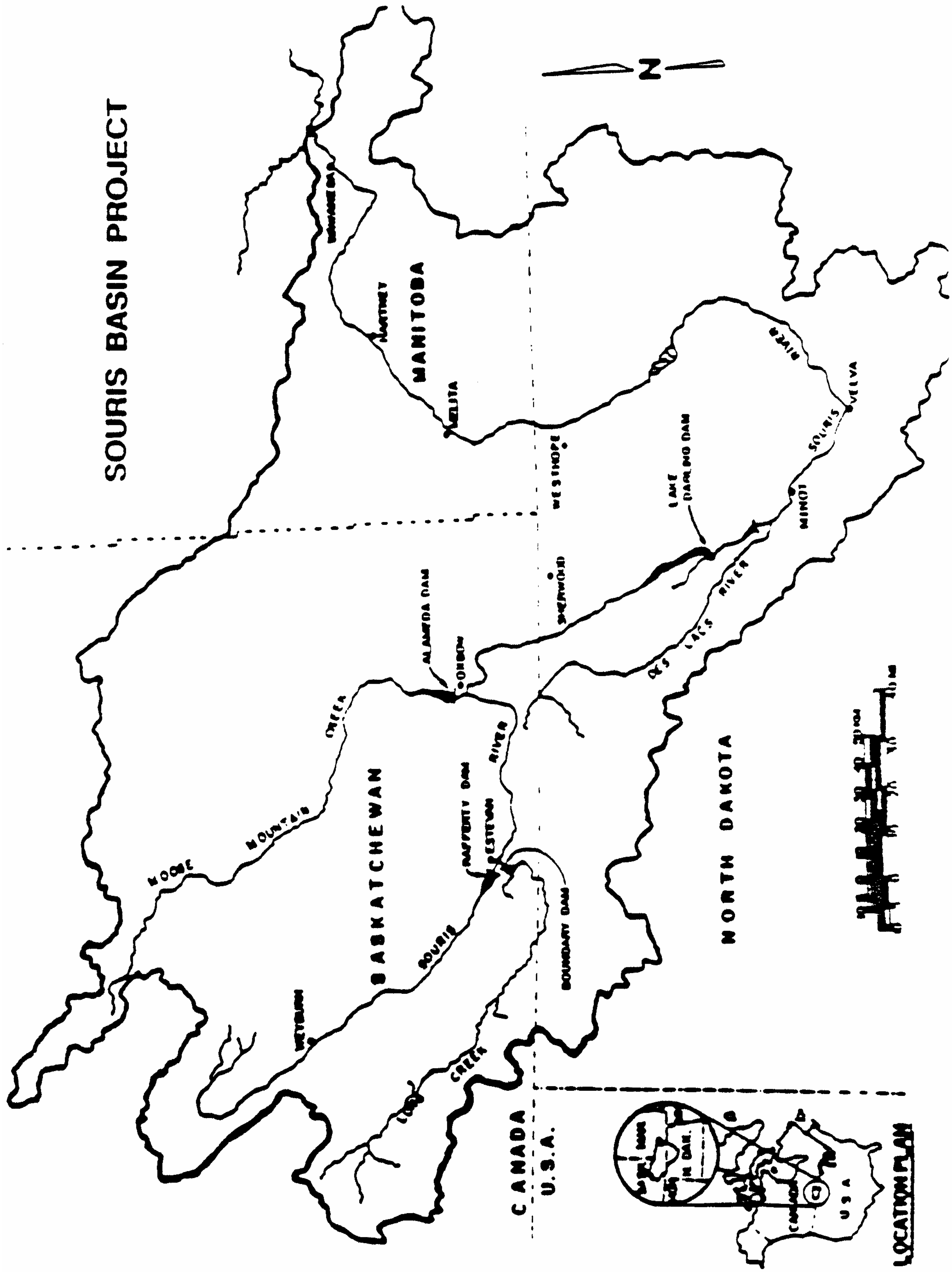
- To provide 1-percent (100-year) flood protection at Minot, North Dakota;

- To provide flood protection to urban and rural areas downstream from Rafferty Dam, Alameda Dam, and Lake Darling Dam;

- To ensure, to the extent possible, that the existing benefits from the supply of water in the Souris River Basin and the supply of water to the Souris Basin Project are not compromised.

Document: This Operating Plan establishes guidelines for operation of the Souris Basin Project. It also includes the following information on the operation of the Souris Basin Project: data on the physical characteristics of the dams and reservoirs, rules for flood and non-flood operation, and procedures for communication and exchange of information. This Operating Plan was developed based on computer simulation of floods having temporal and spatial characteristics of those actually experienced in floods of 1969, 1974, 1975, 1976, 1979, and 1982. It is recognized that this Operating Plan may not cover all possible flood circumstances, and it may be necessary to jointly agree on changes to the Operating Plan. It will be necessary for agencies directly responsible for the daily operation of each improvement covered by this Operating Plan to develop detailed Reservoir Regulation Manuals to operate the reservoirs in accordance with the terms of the subject Agreement. A Basin map is shown in figure A-1.

Forecasting: The ability to provide increased flood protection (including the ability to limit flows at Minot to 5,000 cfs for floods up to the 1-percent event) while optimizing the potential supply of water in the Souris River Basin is dependent upon the accuracy of the estimates of runoff provided to the agencies responsible for the daily operation of each improvement (Section 4.3.1). The runoff estimates used in this Operating Plan are: runoff volume, 30-day; runoff volume, 90-day; Sherwood Crossing uncontrolled runoff volume; and runoff volume, 90-percent, 90-day. Data used to develop the runoff estimates are gathered by Environment Canada and Saskatchewan Water Corporation in Canada and the National Weather Service in the United States. As noted in Section 2.4, new estimating techniques will be developed. If the new estimating techniques cannot be developed for the four items listed above, (with sufficient accuracy to meet the dual objectives of flood control and water conservation), then the Operating Plan will be modified to use existing methods of estimating runoff.


SOURIS BASIN PROJECT
N
MANITOBA
HARTNEY
MELITA
WESTHOPE
SHERWOOD
LAKE DARLING DAM
MINOT
SOURIS
VELVA
DES LACS RIVER
ALAMEDA DAM
OXBOW
MOOSE MOUNTAIN CREEK
SASKATCHEWAN
RAFFERTY DAM
ESTEVAN
RIVER
SOURIS
BOUNDARY DAM
WEYBURN
LONG CREEK
NORTH DAKOTA
CANADA
U.S.A.
LOCATION PLAN
CANADA
U S A

A-3

1.0 TERMINOLOGY

1.1 Glossary of Terms and Definitions

Alameda Dam	The dam which will be constructed on Moose Mountain Creek in the Province of Saskatchewan approximately four kilometres upstream from its confluence with the Souris River.
Authority	The Souris Basin Development Authority.
Bankfull capacity	The maximum flow that a given watercourse can convey in a specified reach without the water level rising above the level of either bank.
Boundary Dam	An existing dam located on Long Creek approximately seven kilometres in a southwesterly direction from the City of Estevan in the Province of Saskatchewan.
Boundary Diversion Channel	A channel that will be constructed in the Province of Saskatchewan with a maximum capacity of 60 m^3/s (2,100 cfs) to allow the conveyance of water from the Boundary Reservoir to the impoundment behind Rafferty Dam.
Canadian reservoirs	A collective term for Rafferty Reservoir, Boundary Reservoir, and Alameda Reservoir.
Control point	A streamflow gaging station or dam which is used to develop operating decisions for Rafferty Reservoir, Alameda Reservoir, Boundary Reservoir, and Lake Darling Reservoir.
Controlled volume	The volume of runoff that can be controlled by using available flood control storage.
Drawdown	The physical act of lowering the pool level of a reservoir through controlled releases.
Estimate	A value based on the best judgment of qualified personnel using all available data.

Flood control storage	The volume below the maximum allowable water level in a reservoir to store flood event runoff.
Full Supply Level (FSL)	The maximum elevation that the reservoir pool is allowed to attain when operations are not directed at achieving flood control benefits.
Lake Darling Dam	An existing structure which is part of the Upper Souris National Wildlife Refuge located on the Souris River approximately 25 kilometres in a northwesterly direction from the City of Minot in the State of North Dakota.
Local flow	The runoff that occurs between two given locations.
Maximum allowable flood level	The highest level a reservoir is allowed to reach while storing water for flood control purposes. When a reservoir reaches this level, any flows into the reservoir must be spilled.
Maximum level prior to spring runoff	The reservoir level which must not be exceeded prior to the spring runoff, regardless of the predicted volume of runoff.
Minimum supply level	The lowest level at which water can be released from a reservoir (invert of conduits).
Natural flow	The volume of runoff determined by the International Souris River Board of Control.
1-percent flood (100-year flood)	A runoff event which is estimated to generate a total 30-day continuous flow volume equal to 721,000 cubic decametres (584,500 acre-feet) as determined at Sherwood Crossing based on data recorded at that station prior to 1986.
Rafferty Dam	The dam which is under construction at a location on the Souris River approximately six kilometres upstream in a northwesterly direction from the City of Estevan in the Province of Saskatchewan.
Releases	The controlled discharge of water from a reservoir other than spills.

Reservoir level	The static water surface elevation of a reservoir.
Reservoir Regulation Manual	A document which is to be used as a guide by the responsible agency in the day to day operation of a reservoir. The manual shall discuss the following topics: description of the project, history of the project, watershed characteristics, data collection and communication networks, hydrologic forecasts, the water control plan, and water control management.
Runoff	The flow of water in a watercourse in response to rainfall or snowmelt or a combination of rainfall and snowmelt.
Runoff volume, 30-day (30-day volume)	Maximum 30-consecutive-day runoff volume that occurs in any water year.
Runoff volume, 90-day (90-day volume)	Maximum 90-consecutive-day runoff volume that occurs in any water year.
Runoff volume, 90-percent, 90-day	The estimated 90-day volume of unregulated runoff with a 90-percent probability of being equalled or exceeded by the actual runoff.
Saskatchewan works	The works described in Article III of the subject Agreement in Saskatchewan, Canada, to include Rafferty Dam, Alameda Dam, and the Boundary Diversion Channel.
Sherwood Crossing	The International gaging station, number 05114000 (05ND007), latitude 48:59:24, longitude 101:57:28, on the Souris River, 0.8 mile downstream of the International boundary.
Sherwood Crossing uncontrolled runoff volume	The uncontrolled volume from the Canadian Reservoirs, if any, and the local flow between the Canadian Reservoirs and Sherwood Crossing.
Souris Basin Project (Project)	The development and operation of the Saskatchewan works in Canada; the operation of the existing Boundary Reservoir in Saskatchewan and the operation of the existing Lake Darling Reservoir in North Dakota in the United States.
Spills	The uncontrolled discharge of water from a reservoir.

Target drawdown level	A pool level to which a reservoir should be lowered in response to estimated spring runoff so that the desired level of flood protection will be provided.
Target flow	The instantaneous flow at a given location that should not be exceeded during a given flood event as a result of releases from a reservoir or reservoirs.
Temporary target flow	A target flow at Sherwood Crossing that has been modified to take into account available storage in Lake Darling.
Uncontrolled volume	The volume of runoff that cannot be controlled by the available flood control storage.
Unregulated flow at Sherwood Crossing	That flow that would occur at Sherwood Crossing if Rafferty Dam and Alameda Dam were not in place.
Water year	October 1 to September 30.
Westhope Crossing	The International gaging station, number 05NF012 (15124000), latitude 48:59:47, longitude 100:57:29, on the Souris River 1.6 kilometres upstream of the International boundary.

1.2 Abbreviations and Symbols

Following is a list of abbreviations and symbols used in this Operating Plan:

ac-ft - acre-feet

cfs - cubic feet per second

dam^3 - cubic decametre

ft - feet

m - metre

m^3/s - cubic metres per second

km - kilometre

1.3 Conversion Factors

As provided in the subject agreement, the following table may be used to convert measurements in the English (United States) system of units to the SI or metric (Canadian) system of units.

Multiply English Units	by	To obtain SI Units
	Length	
inch (in)	25.4	millimetre (mm)
foot (ft)	0.3048	metre (m)
mile (mi)	1.609344	kilometre (km)
	Area	
square mile (mi^2)	2.590	square kilometre (km^2)
acre (ac)	4046.9	square metre (m^2)
	Flow	
cubic foot per second (cfs)	0.02831685	cubic metre per second (m^3/s)
	Volume	
acre-foot (ac-ft)	1.233482	cubic decametre (dam^3)
	Velocity	
foot per second (ft/s)	0.3048	metre per second (m/s)
	Slope	
foot per mile (ft/mi)	0.1894	metre per kilometre (m/km)

1 ha = 10,000 m^2 == ha x 2.471054 = acre

1 dam^3 = 1,000 m^3 == dam^3 x 0.811 = ac-ft

2.0 HYDROMETEOROLOGICAL DATA NETWORK

2.1 General

The collection and distribution of hydrologic and meteorological data in the Souris River basin involves government agencies in the United States and Canada. The data collection network is vital to the successful operation of Rafferty Reservoir, Boundary Reservoir, and Alameda Reservoir in Canada and Lake Darling in the United States. The network may be modified from time to time. The data collection network is operated by the following agencies.

Canada

In Canada, the Water Resources Branch operates and maintains a network of hydrometric stations to record streamflow and water levels and the Atmospheric Environment Service operates and maintains a network of meteorological stations. Both the Water Survey of Canada and the Atmospheric Environment Service are part of Environment Canada, a Federal government agency. In addition, the Saskatchewan Water Corporation, a Provincial Crown Corporation, operates a number of snow course stations in the basin. The purpose of the snow course measurements is to provide additional data for estimating spring runoff.

United States

In the United States, the U.S. Geological Survey operates and maintains a network of hydrometric stations to record streamflow and water levels, and the National Weather Service operates and maintains a network of meteorological stations. Both organizations are Federal agencies. In addition to the meteorological stations, the National Weather Service undertakes aerial gamma surveys to provide additional snow data for estimating spring runoff.

The networks operated by these agencies are shown on the map in figure A-2 and are described in the following section.

2.2 Station Networks

The existing hydrometric station networks are shown on Table 2.1 for Canada and on Table 2.2 for the United States.

The existing meteorological station networks are shown on Table 2.3 for Canada and on Table 2.4 for the United States.

2.3 Additional Stations

Gages and methods will be established to measure inflow, pool levels, and downstream flows for Rafferty Reservoir and for Alameda Reservoir. Additional gaging stations may be added to ensure the appropriate operation of the Project.

2.4 Data Collection, Estimating, and Coordination

Close coordination and exchange of data will be maintained by the Government of the United States and the Government of Canada to facilitate Project operation, with particular reference to pre-flood drawdown. Other items will be detailed in the Reservoir Regulation Manual.

Improved estimating techniques will be developed by the Parties to the subject Agreement. These estimating techniques will be based on the mutual agreement of the Parties and will be included as part of the Reservoir Regulation Manuals, which will be written at a later date.

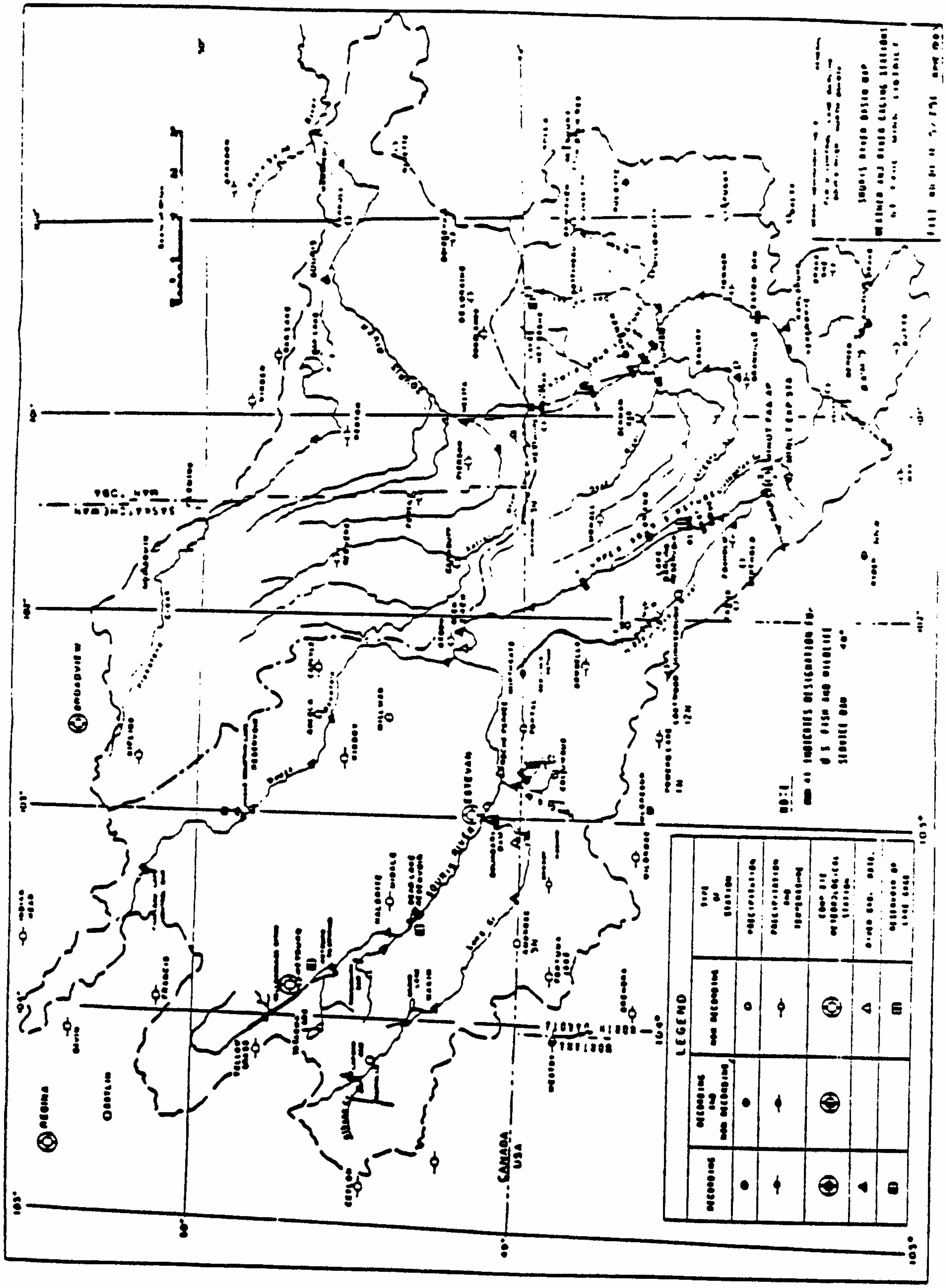


FIGURE A-2

30 July 1987

Revised 04 Sep 1987

TABLE 2.1
HYDROMETRIC STATION NETWORK FOR SOURIS BASIN IN SASKATCHEWAN

Station No.	Station Name	Location Latitude	Location Longitude	Type
05NA003 (05113360)	Long Creek at Western Crossing	49 00 01	103 21 08	Flow; auto recorder Telemark
05NA004	Long Creek near Maxim	49 15 32	103 57 22	Flow; auto recorder seasonal
05NA005	Gibson Creek near Radville	49 29 02	104 20 11	Flow; auto recorder seasonal
05NA006	Larson Reservoir near Radville	49 28 30	104 16 50	Water level; auto recorder
05NB001	Long Creek near Estevan	49 06 15	103 00 48	Flow; auto recorder
05NB009	Souris River nr. Roche Percee	49 04 34	102 45 53	Flow; auto recorder
05NB011	Yellow Grass ditch near Yellow Grass	49 47 11	104 02 16	Flow; auto recorder seasonal
05NB012	Boundary Res. near Estevan	49 05 49	103 01 28	Water level; auto recorder
05NB014	Jewel Creek nr. Goodwater	49 23 10	103 42 42	Flow; auto recorder seasonal
05NB016	Roughbark Res. near Weyburn	49 30 08	103 43 07	Water level; auto recorder
05NB017	Souris River nr. Halbrite	49 29 37	103 39 44	Flow; auto recorder seasonal
05NB018	Tatagwa Lake Dr. near Weyburn	49 35 58	103 56 50	Flow; auto recorder seasonal
05NB020	Nickle Lake nr. Weyburn	49 36 33	103 47 28	Water level; auto recorder
05NB021 (05113800)	Short Creek nr. Roche Percee	49 01 52	102 50 57	Flow; auto recorder
05NB022	Dead Lake Res. near Midale	49 17 23	103 26 40	Water level; auto recorder
05NB025	Souris River near Lewvan	49 58 37	104 04 33	Flow; auto recorder seasonal

TABLE 2.1 (cont.)
HYDROMETRIC STATION NETWORK FOR SOURIS BASIN IN SASKATCHEWAN

Station	Station Name	Location Latitude	Location Longitude	Type	No.
05NB029	Dead Lake - Souris River	49 17 23	103 26 40	Water level; auto recorder	
05NB030	Souris River near McTaggart	49 46 10	104 00 54	Flow; auto recorder; seasonal	
05NB031	Souris River near Bechard	49 59 20	104 11 24	Flow; auto recorder; seasonal	
05NC001	Moose Mountain Creek below Moose Mountain Lake	49 52 23	103 00 54	Flow; auto recorder; seasonal	
05NC002	Moose Mountain Reservoir nr. Corning	49 53 29	103 01 58	Water level; auto recorder	
05ND001	Souris River nr. Glen Ewen	49 11 02	102 01 42	Flow; auto recorder	
05ND004	Moose Mountain Creek nr. Oxbow	49 13 58	102 13 41	Flow; auto recorder; seasonal	
05NF006	Lightning Creek near Carnduff	49 13 17	101 43 06	Flow; auto recorder; seasonal	
05NF010	Antler River near Wauchope	49 35 03	101 50 52	Flow; auto recorder; seasonal	
05NF013	Gainsborough Creek near Starthoaks	49 24 51	101 31 36	Flow; auto recorder; seasonal	
24-131	Souris River at #18 Highway	49 07 42	103 01 17	Flow; manual recorder; Extreme flow only	
24-132	Souris River at #47 Highway	49 07 11	102 59 32	Flow; manual recorder; Extreme flow only	
24-133	Souris River at Oxbow	49 13 04	102 11 08	Flow; manual recorder; Extreme flow only	
	Souris River at Pulfer's Farm	49 40 50	103 54 09	Flow; manual recorder; Extreme flow only	

TABLE 2.2
HYDROMETRIC STATION NETWORK FOR SOURIS BASIN IN NORTH DAKOTA

Station No.	Station Name	Location Latitude	Location Longitude	Type
05114000	Souris River nr. Sherwood	48 59 24	101 57 28	Flow; auto recorder; Telemark
05115500	Lake Darling near Foxholm	48 27 27	101 35 14	Water level; auto recorder
05116000	Souris River near Foxholm	48 22 20	101 30 18	Flow; auto recorder; Telemark
05116500	Des Lacs River near Foxholm	48 22 14	101 34 11	Flow; auto recorder; Telemark
05117500	Souris River above Minot	48 14 45	101 22 15	Flow; auto recorder; Telemark
05120000	Souris River near Verendrye	48 09 35	100 43 45	Flow; auto recorder
05120500	Wintering River near Karlsruhe	48 10 14	100 32 20	Flow; auto recorder
05122000	Souris River near Bantry	48 30 20	100 26 04	Flow; auto recorder; Telemark
05123000	Lake Metigoshe near Bottineau	48 59 05	100 20 52	Water level; auto recorder
05123400	Willow River near Willow City	48 35 20	100 26 30	Flow; auto recorder
05123500	Deep River near Upham	48 35 03	100 51 44	Flow; auto recorder; Telemark
05123900	Boundary Creek near Landa	48 48 46	100 51 46	Flow; auto recorder
05124000	Souris River near Westhope	48 59 47	100 57 29	Flow; auto recorder

TABLE 2.3
METEOROLOGICAL STATION NETWORK FOR SOURIS BASIN IN SASKATCHEWAN

Station Name	Station	Location Latitude	Location Longitude	TE	PR	HW	RR	ST	EV	SU	SS	NS	WS
				Observing Programs *									
Alameda		49 24	102 16								X		
Amulet	4010150	49 37	104 44	X	X								
Arcola COA	4010240	49 38	102 32		X								
Bechard	4010540	50 03	104 13	X	X								
Broadview	4010879	50 23	102 35	X	X	X	X	X	X	X	X	X	
Carlyle	4011160	49 38	102 17	X	X								
Carlyle		49 39	102 16								X		
Carlyle C-7		49 39	102 20								X		
Carnduff	4011250	49 13	101 45		X								
Ceylon	4011441	49 24	104 39	X	X								
Davin	4012162	50 24	104 11		X								
Davin	4012165	50 22	104 09		X								
Davin	4012166	50 23	104 10	X	X		X		X				
Estevan		49 05	102 59								X		
Estevan A	4012400	49 04	103 00	X	X	X	X	X	X	X	X	X	
Estevan C-9		49 08	102 56								X		
Fertile	4012485	49 20	101 27	X	X								
Fleming S.	4012525	50 02	101 35		X								
Francis	4012720	50 07	103 55	X	X								
Frobisher		49 13	102 09								X		
Gainsborough	4012790	49 18	101 32		X								
Glenavon		50 12	103 08								X		
Handsworth	4013098	48 51	102 52	X	X								
Handsworth		49 53	103 02								X		
Heward	4013221	49 45	103 09	X	X								
Hitchcock		49 15	103 10								X		
Hume		49 40	103 37								X		
Indian Head CDA	4013480	50 32	103 40	X	X			X				X	
Indian Head PFRA	4013490	50 31	103 41	X	X			X	X	X			X
Kipling	4014040	50 12	102 44	X	X								
Kisbey		49 40	102 45								X		

*TE - Temperature
PR - Precipitation
HW - Hourly Weather
RR - Rate of Rainfall
ST - Soil Temperature
EV - Evaporation
SU - Sunshine
SS - Snow Survey
NS - Nipher Snow Measurements
WS - Windspeed

TABLE 2.3 (cont.)
METEOROLOGICAL STATION NETWORK FOR SOURIS BASIN IN SASKATCHEWAN

Station Name	Station	Location		Observing Programs *									
		Latitude	Longitude	TE	PR	HW	RR	ST	EV	SU	SS	NS	WS
Macoun	4014870	49 14	103 14		X								
Maryfield	4015045	49 50	101 32	X	X								
Maxim		49 19	103 57								X		
Midale	4015160	49 24	103 25	X	X								
Moose Mountain Reservoir	4015344	49 53	103 02	X	X				X				
Moosomin	4015360	50 09	101 40	X	X								
Neptune		49 22	104 06								X		
Neptune S.		49 19	104 02								X		
Noonan N.D.		48 57	103 03								X		
Odessa	4015648	50 20	103 41	X	X								
Oungre		49 09	103 45								X		
Oxbow	4015800	49 19	102 07	X	X								
Oxbow		49 14	102 07								X		
Radville CDA	4016400	49 30	104 17			X							
Redvers	4016522	49 32	101 42	X	X								
Torquay	4018105	49 05	103 30		X								
Trossachs N.E.		49 36	104 11								X		
Trossachs S.		49 34	104 17								X		
Wapella - Newfinland	4018508	50 27	101 56	X	X								
Wawota	4018678	49 56	101 58	X	X			X	X	X			X
Weyburn		49 40	103 53								X		
Weyburn 2	4018762	49 40	103 51		X								
Willmar	4018960	49 25	102 30		X								
Yellow Grass	4019040	49 48	104 10	X	X								

*TE - Temperature
PR - Precipitation
HW - Hourly Weather
RR - Rate of Rainfall
ST - Soil Temperature
EV - Evaporation
SU - Sunshine
SS - Snow Survey
NS - Nipher Snow Measurements
WS - Windspeed

TABLE 2.4
METEOROLOGICAL STATION NETWORK FOR SOURIS BASIN IN NORTH DAKOTA

Station Name	Location Latitude	Location Longitude	Observing Programs * PR	TE	SS	HW	SU	EV
Ambrose	49 00	103 28	X		X			
Belcourt	48 50	99 45	X	X	X			
Berthold	48 19	101 44	X		X			
Bottineau	48 50	100 27	X	X	X			
Bowbells	48 48	102 15	X	X	X			
Butte	47 50	100 40	X	X	X			
Columbus	48 55	102 50	X		X			
Crosby	48 54	103 18	X	X	X			
Drake 8NE	48 02	100 17	X	X	X			
Fortuna 1W	48 55	103 49	X	X	X			
Foxholm 7N	48 20	101 33	X	X	X			
Granville	48 16	100 51	X	X	X			
Kenmare	48 40	102 06	X	X	X			
Lake Metigoshe	48 59	100 21	X		X			
Max	47 49	101 18	X	X	X			
Minot FAA	48 16	101 17	X	X	X	X		
Minot Exp. St.	48 11	101 18	X	X	X		X	X
Mohall	48 48	101 31	X	X	X			
Rolla 3NW	48 54	99 40	X	X	X			
Rugby	48 21	100 00	X	X	X			
Sherwood 3N	49 00	101 38	X		X			
Tagus	48 20	101 56	X		X			
Tower NE	48 21	100 24	X	X	X			
Upham 3N	48 37	100 44	X	X	X			
Westhope	48 55	101 22	X	X	X			

*PR - Precipitation
TE - Temperature
SS - Snow Survey
HW - Hourly Weather
SU - Sunshine
EV - Evaporation

3.0 CONTROL POINTS

3.1 Rafferty Dam

The relevant data for this control point are presented on Tables 3.1 and 3.2. The elevation-area-capacity curves are shown on Plate A-7. In the event of a discrepancy, the tabulated values will be used.

Table 3.1
DATA FOR RESERVOIRS

Description	Elevation	Total Storage
Rafferty Reservoir		
Maximum allowable flood level	554.00 m (1817.59 ft)	633,000 dam^3 (513,000 ac-ft)
Full supply level	550.50 m (1806.10 ft)	439,600 dam^3 (356,400 ac-ft)
Normal level prior to spring runoff	549.50 m (1802.82 ft)	394,000 dam^3 (319,000 ac-ft)
Minimum supply level	537.50 m (1763.45 ft)	13,000 dam^3 (10,000 ac-ft)
Boundary Reservoir		
Full supply level	560.83 m (1840.00 ft)	61,500 dam^3 (49,800 ac-ft)
Minimum supply level	553.21 m (1815.00 ft)	24,900 dam^3 (20,800 ac-ft)
Alameda Reservoir		
Maximum allowable flood level	567.00 m (1860.24 ft)	189,600 dam^3 (153,710 ac-ft)
Full supply level	562.00 m (1843.83 ft)	105,500 dam^3 (85,530 ac-ft)
Normal level prior to spring runoff	561.00 m (1840.55 ft)	94,245 dam^3 (76,400 ac-ft)
Minimum supply level	555.85 m (1823.65 ft)	50,700 dam^3 (41,100 ac-ft)
Lake Darling Reservoir		
Maximum allowable flood level	1601.00 ft (487.98 m)	148 553 158,600 ac-ft 183 238 (195,630 dam^3)
Full supply level	1597.00 ft (486.77 m)	108 894 110,000 ac-ft (136,000 dam^3) 134 344
Minimum supply level	1577.00 ft (480.67 m)	3,500 ac-ft (4,300 dam^3) 178

Table 3.2
SUMMARY OF RAFFERTY ELEVATION-AREA-CAPACITY DATA

Elevation metres	Elevation feet	Storage dam^3	Storage ac-ft	
547.5	1796.26	305287	247500	Maximum required drawdown (1)
549.5	1802.82	392371	318100	Normal drawdown (2)
550.5	1806.10	439613	356400	FSL
554.0	1817.59	632776	513000	Maximum storage level

Elevation metre	Elevation feet	Surface Area ha	Surface Area acres	Storage dam^3	Storage ac-ft
535.0	1755.25	0	0	0	0
537.0	1761.81	807	1992	4737	3840
538.0	1765.09	1464	3614	16159	13100
540.0	1771.65	2495	6159	56370	45700
545.0	1788.06	3574	8822	209075	169500
546.0	1791.34	3795	9367	245833	199300
547.0	1794.62	4022	9928	284811	230900
547.5	1796.26	4134	10205	305287	247500
549.0	1801.18	4480	11060	369675	299700
549.5	1802.82	4599	11353	392371	318100
550.0	1804.46	4719	11649	416547	337700
550.5	1806.10	4881	12048	439613	356400
551.0	1807.74	5045	12454	464406	376500
551.5	1809.38	5212	12866	490062	397300
552.0	1811.02	5407	13347	516582	418800
552.5	1812.66	5605	13836	543966	441000
553.0	1814.30	5807	14334	572459	464100
553.5	1815.94	6012	14841	602063	488100
554.0	1817.59	6222	15360	632776	513000
555.0	1820.87	6651	16418	697041	565100

1. Assuming starting elevation of 547.5 metres, flood control storage available would be 632,776 (513,000) - 305,287 (247,500) = 327,489 dam^3 (265,500 ac-ft) {FSL = 550.5{.

2. Assuming starting elevation of 549.5 metres, flood control storage available would be 632,776 (513,000) - 392,371 (318,100) = 240,405 dam^3 (194,900 ac-ft) {FSL = 550.5{.

3.2 Boundary Dam

The relevant data for this control point are shown on Tables 3.1 and 3.3.

Table 3.3
SUMMARY OF BOUNDARY ELEVATION-AREA-CAPACITY DATA

Elevation		Storage		
metre	feet	dam^3	ac-ft	
557.8	1830.0	44725	36259	Max required drawdown (1)
560.8	1840.0	61480	49845	FSL, Normal, & Max.

Elevation		Surface Area		Storage	
metre	feet	ha	acres	dam^3	ac-ft
554.7	1820.0	407	1005	30691	24882
555.5	1822.5	425	1049	33970	27540
556.3	1825.0	445	1098	37400	30320
557.0	1827.5	486	1200	41000	33240
557.8	1830.0	506	1249	44725	36259
558.5	1832.5	546	1348	48625	39420
559.3	1835.0	547	1350	52670	42700
560.1	1837.5	607	1498	56910	46140
560.8	1840.0	688	1698	61480	49845

1. At maximum required drawdown level of 557.8 metres (1830 feet), storage available would be 61,480 (49,845) - 44,725 (36,259) = 16,755 dam^3 (13,586 == 13,600 ac-ft). This necessary storage may also be obtained by drawing Rafferty below required levels and diverting the 16,755 dam^3 (13,600 ac-ft) to Rafferty Reservoir.

3.3 Alameda Dam

The relevant data for this control point are shown on Tables 3.1 and 3.4. The elevation-area-capacity curves are shown on Plate A-8.

Table 3.4
SUMMARY OF ALAMEDA ELEVATION-AREA-CAPACITY DATA

Elevation metres	Elevation feet	Storage dam^3	Storage ac-ft	
555.85	1823.65	50700	41100	Maximum required drawdown (1)
561.0	1840.55	94245	76400	Normal drawdown (2)
562.0	1843.83	105500	85530	FSL
567.0	1860.24	189600	153710	Maximum storage level

Elevation metres	Elevation feet	Surface Area ha	Surface Area acres	Storage dam^3	Storage ac-ft
528.0	1732.28	0	0	0	0
530.0	1738.84	11	27	110	90
532.0	1745.41	27	67	490	400
534.0	1751.97	41	101	1170	950
536.0	1758.53	58	143	2160	1750
538.0	1765.09	77	190	3500	2840
540.0	1771.65	93	230	5200	4215
542.0	1778.21	124	306	7370	5975
544.0	1784.78	156	385	10170	8245
546.0	1791.34	200	494	13700	11110
548.0	1797.90	253	625	18260	14805
550.0	1804.46	318	785	23970	19430
552.0	1811.02	386	953	31000	25130
554.0	1817.59	495	1222	39800	32265
555.85	1823.65	624	1540	50700	41100
556.0	1824.15	635	1567	51100	41425
558.0	1830.71	770	1900	65160	52825
560.0	1837.27	1010	2493	82990	67280
561.0	1840.55	1125	2777	94245	76400
562.0	1843.83	1240	3061	105500	85530
564.0	1850.39	1520	3752	133200	107990
566.0	1856.96	1940	4789	167800	136040
567.0	1860.24	2180	5381	189600	153710
568.0	1863.52	2420	5974	211400	171385
569.0	1866.80	2660	6566	236800	191980

1. Assuming starting elevation of 555.85 metres, flood control storage available would be 189,600 (153,710) - 50,700 (41,100) = 138,900 dam 3 (112,608 ac-ft) {FSL = 562.0{.

2. Assuming starting elevation of 561.0 metres, flood control storage available would be 189,600 (153,710) - 94,245 (76,400) = 95,355 dam^3 (77,305 ac-ft) {FSL = 562.0{.

3.4 Lake Darling Dam

The relevant data for this control point are shown on Tables 3.2 and 3.5. The elevation-area-capacity curves are shown on Plate A-9.

Table 3.5
SUMMARY OF LAKE DARLING ELEVATION-AREA-CAPACITY DATA

Elevation feet	Elevation metres	Storage ac-ft	Storage dam^3	
1591	484.94	53,000	65,375	Maximum drawdown (1)
1596	486.46	99,000	122,115	Normal drawdown (2)
1597	486.77	110,100	135,800	Normal pool
1601	487.98	158,600	195,063	Existing maximum

Elevation feet	Elevation metres	Surface Area acres	Surface Area ha	Storage ac-ft	Storage dam^3
1591.0	484.94	7,431	3,010	53,000	65,375
1592.0	485.24	8,200	3,322	60,800	75,000
1593.0	485.55	8,910	3,610	69,400	85,600
1594.0	485.85	9,650	3,910	78,600	96,950
1595.0	486.16	10,220	4,140	88,600	109,290
1596.0	486.46	10,800	4,375	99,000	122,115
1597.0	486.77	11,270	4,566	110,100	135,800
1598.0	487.07	11,750	4,760	121,600	150,000
1599.0	487.38	12,150	4,922	133,600	164,790
1600.0	487.68	12,550	5,084	145,900	179,965
1601.0	487.98	12,900	5,226	158,600	195,630

Service spillway crest at 1598.0 feet.

1. Assuming a starting elevation of 1591 feet, flood control storage available would be 158,600 (195,630) - 53,000 (65,375) = 105,600 ac-ft (130,255 dam^3)

2. Assuming a starting elevation of 1596 feet, flood control storage available would be 158,600 (195,630) - 99,000 (122,115) = 59,600 ac-ft (73,515 dam^3)

3.5 Souris River near Sherwood Crossing

This control point is the International gaging station, number 05114000, latitude 48:59:24, longitude 101:57:28, on the Souris River, 0.8 mile downstream of the International boundary.

3.6 Souris River above Minot

The control point, Souris River above Minot, is a flow gaging station operated by the U.S. Geological Survey and maintained by the North Dakota State Water Commission. The station number is 05117500.

The station is located approximately 3.5 miles (5.8 km) west of Minot, North Dakota, and approximately 7 miles (11 km) downstream from the confluence of the Souris and Des Lacs Rivers. The coordinates of the station are latitude 48:14:45, longitude 101:22:15.

3.7 Souris River near Westhope Crossing

This control point is the International gaging station, number 05NF012, latitude 48:59:47, longitude 100:57:29, on the Souris river 1.6 kilometres upstream of the International boundary near Westhope, North Dakota.

3.8 Boundary Diversion Channel

Boundary Diversion Channel may be used for flood control provided that storage is available in Rafferty Reservoir in excess of the amount required to meet United States flood control requirements in that year, by the amount of volume to be diverted.

3.9 Other Considerations

This Operating Plan for the Canadian reservoirs and Lake Darling Reservoir requires that flood protection be provided for urban and rural downstream areas. The operation of the Project for flood

flows will consider the approximate bankfull channel capacities of urban and rural reaches. Release rates will be based on reducing flood damages as much as possible. An indication of the flows at which flooding occurs is provided in Table 3.6, for various reaches of the Souris River, Long Creek and Moose Mountain Creek. These flows should be considered as approximate only.

Table 3.6
APPROXIMATE BANKFULL CHANNEL CAPACITY

Description of Reach	Bankfull Capacity
Long Creek	
Boundary Dam to Souris River	25 m^3/s (900 cfs)
Moose Mountain Creek	
Alameda Dam to Souris River	50 m^3/s (1,800 cfs)
Souris River	
Rafferty Dam to Long Creek	14 m^3/s (500 cfs)*
Long Creek to Shand	85 m^3/s (3,000 cfs)
Shand to Moose Mountain Creek	60 m^3/s (2,000 cfs)
Souris River at Oxbow	90 m^3/s (3,200 cfs)
Souris River at Sherwood Crossing	90 m^3/s (3,200 cfs)
Sherwood to Upper Souris Refuge	60 m^3/s (2,000 cfs)
Upper Souris Refuge to Lake Darling Dam	Reservoir pool
Lake Darling Dam to Minot	2,500 cfs (70 m^3/s)
Souris River at Minot	5,000 cfs (215 m^3/s)
Minot to Logan	2,500 cfs (70 m^3/s)
Logan to Velva	1,400 cfs (40 m^3/s)
Velva to Verendrye	1,400 cfs (40 m^3/s)
Verendrye to Wintering River	1,500 cfs (42 m^3/s)
Wintering River to Towner	600 cfs (17 m^3/s)
Towner to Coulter	200 cfs (6 m^3/s)
Coulter to Melita	600 cfs (17 m^3/s)
Melita to Hartney	1,100 cfs (31 m^3/s)

*With proposed channel improvements.

4.0 PROJECT OPERATION

4.1 Objectives and Procedures

The objectives to be implemented by this Operating Plan include the following: (1) provide 1-percent (100-year) flood protection at Minot, North Dakota; (2) provide flood protection to urban and rural areas downstream from Rafferty Dam, Alameda Dam, and Lake Darling Dam; and (3) ensure, to the extent possible, that the existing benefits from the supply of water in the Souris River Basin and the supply of water to the Souris Basin Project are not compromised.

In order to ensure that these objectives are met, it is necessary to distinguish between flood and nonflood operation. To meet the flood and nonflood Operating Plan objectives, the following procedure will be used to identify the proper mode of operation while complying with the terms of the 1959 Interim Measures as modified.

Flood Operation

If a February 1 or subsequent spring runoff estimate shows a reasonable chance (50 percent) of a runoff volume at Sherwood Crossing being equal to or greater than a 10-percent (1 in 10 years) flood, then operations will proceed on the basis of the flood Operating Plan. Flood operation will cease when flood volumes have been discharged and streamflows are at or below 500 cfs at Minot.

Nonflood Operation

If a February 1 or subsequent spring runoff estimate shows a reasonable chance (50 percent) of a runoff event less than a 10-percent (1 in 10 years) flood, then operations will proceed on the basis of the nonflood Operating Plan.

4.2 Consistency with Interim Measures

As set out in the 1959 Interim Measures as modified, under certain conditions, a portion of the North Dakota share will be in the form of evaporation from Rafferty Reservoir and Alameda Reservoir. During years when these conditions occur, the minimum amount of flow actually passed to North Dakota will be 40 percent of the natural flow at Sherwood Crossing. This lesser amount is in recognition of Saskatchewan's agreement to operate both Rafferty Dam and Alameda Dam for flood control and for evaporation as a result of the Project. Therefore, this is deemed to be in compliance with all applicable obligations. The volume of natural flow will be determined by the International Souris River Board of Control ("the Board").

The following rules determine the percentage of the natural flow at Sherwood Crossing which is to be passed to North Dakota.

a. If the level of Lake Darling Reservoir is below an elevation of 1592.0 feet (485.24 metres) on October 1 in any calendar year, Saskatchewan will pass 50 percent of the natural flow at Sherwood Crossing in that year and in succeeding years until the level of Lake Darling Reservoir is above an elevation of 1593.0 feet (485.55 metres) on October 1.

b. If the natural flow at Sherwood Crossing is equal to or less than 20,000 acre-feet (24,700 cubic decametres) prior to October 1 of that year, then Saskatchewan will pass 50 percent of that natural flow to North Dakota in that calendar year.

c. If the conditions specified in subparagraphs 4.2(a) and 4.2(b) do not appply, then Saskatchewan will pass at least 40 percent of the natural flow at Sherwood Crossing to North Dakota.

d. If releases are delayed, they may be called for at any time before October 1. If they are not called for before October 1, the water may be retained for use in Saskatchewan.

Lake Darling Reservoir and the Canadian reservoirs will be operated (insofar as is compatible with the Project's purposes and consistent with past practices) to ensure that the pool elevations, which determine conditions for sharing evaporation losses, are not artificially altered. The triggering elevation of 1592.0 feet (485.24 metres) for Lake Darling Reservoir is based on existing water uses in North Dakota, including refuges operated by the U.S. Fish and Wildlife Service. Each year, operating plans for the refuges on the Souris River will be presented to the Board. Barring unforeseen circumstances, operations will follow said plans during each given year. Lake Darling Reservoir will not be drawn down for the sole purpose of reaching the elevation of 1592.0 feet (485.24 metres) on October 1.

Late season releases will not be made by Saskatchewan Water Corporation from the Canadian reservoirs for the sole purpose of raising the elevation of Lake Darling Reservoir above 1593.0 feet (485.55 metres) on October 1.

Flow releases to the United States should occur (except in flood years) in the pattern which would have occurred in a state of nature. To the extent possible and in consideration of potential channel losses and operating efficiencies, releases from the Canadian dams will be scheduled to coincide with periods of beneficial use in North Dakota. Normally, the period of beneficial use in North Dakota coincides with the timing of the natural hydrograph, and that timing should be a guide to releases of the United States portion of the natural flow. The flow release to the United States may be delayed when the State of North Dakota determines and notifies Saskatchewan through the Board that the release would not be of benefit to the State at that time. The delayed release may be retained for use in Saskatchewan, notwithstanding the minimum release limits, unless it is called for by the State of North Dakota through the Board before October 1 of each year. The delayed release shall be measured at the point of release and the delivery at Sherwood Crossing shall not be less than the delayed release minus the conveyance losses that would have occurred under natural conditions between the point of release and the Sherwood Crossing. Prior to these releases being made, consultations shall occur between the Saskatchewan Water Corporation, the U.S. Fish and Wildlife Service, and the State of North Dakota. All releases will be within the specified target flows at the control points.

4.3 Flood Operation

General

This section sets forth the Operating Plan for Rafferty Reservoir, Alameda Reservoir, Boundary Reservoir, and Lake Darling Reservoir for flood control. In general, the purpose is as follows: the three reservoirs in Canada are to be operated in such a manner so that, along with Lake Darling Reservoir, it will be possible to obtain 1-percent (100-year) level of protection at Minot. The 1-percent level of protection at Minot allows a maximum discharge of 5,000 cfs. After the spring estimate of streamflow is received, if a 1-percent or greater flood volume is anticipated, it will be necessary to draw Lake Darling Reservoir down to an elevation of 1591.0 feet, to draw Rafferty Reservoir down to an elevation of 547.5 metres, to draw Alameda Reservoir down to an elevation of 555.85 metres, and to draw Boundary Reservoir down to an elevation of 557.8 metres given that the estimated 90-day volume as set forth in Plates A-1 to A-3 and the estimated 30-day volume in Plate A-4 will require the maximum required drawdown levels. As discussed in Section 3.2, additional drawdown in Rafferty Reservoir may be used in lieu of drawdown of Boundary Reservoir. The manner in which this is to be accomplished and the reasons for doing so are presented in the following sections. In those cases where the flood event is greater than a 1-percent (100-year) event, the Project will be operated as set forth in the Reservoir Regulation Manuals to attempt to reduce downstream damages without endangering the structures themselves. This may require flows greater than 5,000 cfs at Minot for the period before June 1, and may also require flows greater than 500 cfs (which could also exceed 5,000 cfs) after June 1.

The Canadian reservoirs will be operated for Sherwood Crossing giving due consideration to the level at Lake Darling Reservoir and the flow at Minot. It is not possible to obtain 1-percent (100-year) flood protection at Minot unless Rafferty Reservoir, Alameda Reservoir, Boundary Reservoir, and Lake Darling Reservoir are operated as a complete system.

This section will be used when the estimated 30-day unregulated volume at Sherwood Crossing equals or exceeds a 10-percent (10-year) event, which is equal to 175,200 ac-ft (216,110 dam^3); and/or when the local 30-day volume at Sherwood Crossing is expected to equal or exceed 30,000 acre-feet (37,000 dam^3). From the period of record at Sherwood Crossing, 1930 to 1988, 58 years, the Operating Plan would have been used approximately 6 times, or about 10 percent of the time.

The flood Operating Plan is divided into four separate phases in accordance with the annual hydrograph. These phases relate to:

a. Operations to lower reservoirs prior to spring runoff.
b. Operations during spring runoff.
c. Operations after runoff to restore reservoirs to full supply level.
d. Operations during the summer, fall, and winter.

4.3.1 Drawdown Prior to Spring Runoff

The drawdown of Rafferty Reservoir, Boundary Reservoir, Alameda Reservoir and Lake Darling Reservoir in response to a given predicted flood event is an integral part of the Operating Plan. The extent of drawdown will depend on the estimated spring runoff volume for each as shown on the curves in Plates A-1 to A-4.

Any releases from Lake Darling Reservoir must take into consideration inflows resulting from releases from the Canadian reservoirs and any local inflow between the Canadian reservoirs and Lake Darling Reservoir.

Regardless of the estimated volumes of runoff, the reservoirs will be operated to ensure that each is at or below the following pool levels by February 1.

a. Rafferty Reservoir - 549.50 m. (1802.82 ft.)
b. Alameda Reservoir - 561.00 m. (1840.55 ft.)
c. Lake Darling Reservoir - 1596.00 ft. (486.46 m.)

The reservoirs will be drawn down, as appropriate, over the summer, fall, and winter months, and release rates will take into consideration channel and ice conditions. Release rates will be set to ensure that the maximum controlled flow at Sherwood Crossing will not exceed the following rates, provided Lake Darling Reservoir is at or below full supply level:

a. June 1 to August 31 - 11 m^3/s (400 cfs)
b. September 1 to January 31 - 14 m^3/s (500 cfs)
c. February 1 to March 15 - 60 m^3/s (2,120 cfs)
d. March 16 to May 31 - 90 m^3/s (3,200 cfs; up to 50-yr)
113 m^3/s (4,000 cfs; over 50-yr)

Estimates of spring runoff will be made initially on February 1 and thereafter on the 15th and last day of each month until runoff occurs. The target drawdown levels will be as shown on Plates A-1 through A-4. For the Canadian reservoirs, these levels are based on the 90-percent 90-day spring runoff volume for each reservoir. Using this parameter will ensure that operating the Canadian reservoirs for flood control will not compromise the potential for the supply of water. For Lake Darling Reservoir, the target drawdown level is based on the estimated Sherwood Crossing uncontrolled runoff volume and a sliding scale relating the runoff volume to a Lake Darling Reservoir level as shown on

Plate A-4. As the estimated spring runoff volume is updated during the spring, the Lake Darling Reservoir target level will also change.

Should the level of any reservoir on February 1 be higher than its target drawdown level, releases will be made as described below. Should the level for a reservoir on February 1 be equal to or lower than the target drawdown level, no releases need be made from that reservoir.

Channel Ice Effects

The Reservoir Regulation Manuals will include features that will directly address the ice problems that may occur.

Rafferty Reservoir and Alameda Reservoir

The drawdown of Rafferty Reservoir and Alameda Reservoir will be the responsibility of the Saskatchewan Water Corporation. Releases from each reservoir will be made to achieve its target drawdown level. While the reservoirs are being drawn down, the total flow at Sherwood Crossing should not exceed the peak target flow from Plate A-5.

The release rate will take into consideration ice and channel conditions between the Canadian reservoirs and Lake Darling Reservoir. Such releases will be reviewed and adjusted as necessary on a regular basis, at a minimum after each estimate of the spring runoff volume.

Releases will be established to achieve the target drawdown levels prior to the occurrence of spring runoff to the reservoirs.

Boundary Reservoir and Boundary Diversion Channel

Boundary Reservoir and the Boundary Diversion Channel will be operated within the limits of the drawdown curves. Boundary Reservoir will be drawn down to the elevation shown on Plate A-2 provided that the associated drawdown volume shown on Plate A-2 is equal to the estimated 90-percent 90-day runoff volume. To operate the Boundary Diversion Channel, there must be excess capacity available in Rafferty Reservoir to store the diverted amount. This excess capacity must be in addition to the capacity that would be made available as per Plate A-1. The operation of each will attempt to maximize flood reduction within the constraints of the requirements for water supply in Canada. The operation of each will be such to ensure that the resulting peak flow at Sherwood Crossing during runoff is not greater than the peak that would have occurred without the operation of Boundary Reservoir and Boundary Diversion Channel; and that flood control be provided as set forth above.

Preflood Lake Darling Spring Drawdown

Drawdown of the Lake Darling Reservoir prior to a given flood event is an integral part of the overall Operating Plan. Lake Darling Reservoir drawdown is the first step in the Operating Plan and is important because the extent of drawdown has a direct relationship to the amount of storage available for flood control. Drawdown is dependent upon the runoff volume (uncontrolled) at Sherwood Crossing, the rate of drawdown, and the time available for drawdown between March 1 and spring breakup. In addition, it must include the release of water from the Canadian reservoirs if needed, or it could be reduced based on reservoir levels in Canada lower than what is needed for flood control based on the estimated 30-day volume. The rate of drawdown shall be reviewed and adjusted on a regular schedule, as the winter progresses, to ensure that the Lake Darling Reservoir will be at or below the target elevation by April 1. Any drawdowns required after April 1 shall be made after consultation with Manitoba.

4.3.2. Spring Runoff

If the estimated uncontrolled volume is sufficient to raise Lake Darling Reservoir to its full supply level of 1597.0 feet, then the Canadian dams will store water until they have reached their respective full supply levels of 550.5 metres for Rafferty Reservoir and 562.0 metres for Alameda Reservoir. Once a reservoir has reached its full supply level, excess water will be released at a controlled rate in accordance with the terms of the Operating Plan.

If target drawdown levels for Rafferty Reservoir and Alameda Reservoir were not reached prior to the spring runoff, then the volume in the reservoir above the target drawdown level on February 1 will be released within the specified target flows at control points, and they will be coordinated with the U.S. Fish and Wildlife Service and the State of North Dakota.

Saskatchewan Water Corporation may draw down the level of the Canadian reservoirs below their target drawdown level. Releases resulting from said drawdown shall remain within the specified target flows at control points, however, and will be coordinated with the representatives of the United States Department of the Army.

The U.S. Fish and Wildlife Service may draw down the level of Lake Darling Reservoir below its target drawdown level to meet fish and wildlife needs. Releases resulting from said drawdown will remain within the specified target flows at control points; however, they will be coordinated with the Saskatchewan Water Corporation, Manitoba Department of Natural Resources, and the U.S. Department of the Army.

Sherwood Crossing Target Flow

The Sherwood Crossing target flow is a function of the Lake Darling Reservoir level which is itself a function of the target flow at Minot. To enable the operation of the total system for those objectives set forth in Section 4.1, it is necessary to vary the target flows at Sherwood Crossing as given on Plate A-5.

The maximum target flow at Sherwood Crossing will be as provided in Plate A-5, except that, under certain conditions, the target flow may be temporarily lowered. Once Lake Darling Reservoir levels are lowered to a level which allows the Minot target flow to be maintained, the Sherwood Crossing target flow can be increased to the starting value as was determined from Plate A-5. If releases from the Canadian reservoirs are not increased, then the Lake Darling Dam operator must be notified immediately and releases from Lake Darling Reservoir reduced accordingly. The maximum target flow will continue while water remains above FSL in either Rafferty Reservoir or Alameda Reservoir and Lake Darling Reservoir is below 1597 feet. By having a varying target flow at Sherwood Crossing, the summer release period would decrease, as well as the problems which occur with long summer releases.

Lake Darling Level

The release of the maximum target flow at Sherwood Crossing will allow Lake Darling Reservoir to release water at the Minot target level which may be above the Sherwood Crossing maximum target level resulting in the lowering of the Lake Darling Reservoir below 1597 feet. The need to draw Lake Darling Reservoir below 1597 feet will only occur when there is sufficient water in Rafferty Reservoir and Alameda Reservoir above their FSL's to fill Lake Darling Reservoir back to 1597 feet and will enable releases of excess water during the period before May 15 and at reduced levels before June 1. The drawing of Lake Darling Reservoir below 1597 feet will allow the summer release period to be shortened and in some cases it will not be needed.

4.3.3 Drawdown after Spring Runoff

If any of the reservoirs are above full supply level after the spring runoff has occurred, the reservoir or reservoirs will be brought down to full supply level using the methods outlined in Section 4.3.2. It should be noted that at no time will releases from the Canadian reservoirs cause the flows at Sherwood

Crossing to exceed the target flow from Plate A-5 unless the flow cannot be controlled by the reservoirs.

Post-Peak Flood Storage Release

After the peak stage has been reached in Lake Darling Reservoir, target releases are maintained until the pool has returned to full supply level, with the following exceptions:

a. After June 1, 500 cfs or less is maintained.

b. After May 15, but before June 1, the target flow at Minot is maintained at a level not to exceed 2,500 cfs until pool levels reach FSL, unless the 5,000 cfs target must be extended to enable the desired reservoir levels to be reached by February 1 of the following year.

4.3.4 Significant Spring and Summer Rainfall

If significant rainfall occurs during the spring or summer flood recession, the Reservoir Regulation Manual will provide for discharging the rainfall runoff based on following the unregulated flow recession. All rainfall inflow to Lake Darling Reservoir above FSL is discharged until the unregulated flow recession at Minot reaches 500 cfs. All rainfall runoff upstream of Lake Darling Reservoir which would cause flows in excess of 500 cfs at Minot would be stored, but not to exceed a reservoir elevation of 1598 feet. (Des Lacs flow could at times cause flows higher than 500 cfs at Minot.)

4.3.5 Flood System Operation Steps

The following operating steps would be used when the February 1 flow estimate exceeds the limits as set forth in Section 4.3.

OPERATING PLAN STEPS

These steps use English Units only to avoid confusion.

I. PRE-FLOOD (February 1 to start of runoff)

A. Determine Sherwood Crossing 30-day volume

B. Determine Rafferty Reservoir 30-day volume

C. Determine Alameda Reservoir 30-day volume

D. Determine local Sherwood Crossing 30-day volume:

1. Subtract Rafferty Reservoir 30-day volume from Sherwood Crossing 30-day volume {I.A - I.B = I.D.1{

2. Subtract Alameda Reservoir 30-day volume from result of above {I.D.1 - I.C = I.D.3{

3. This result is the Sherwood Crossing local 30-day volume

E. Determine 30-day volume not controlled by Rafferty Dam and Alameda Dam

1. Determine Rafferty Reservoir starting storage value in ac-ft

Based on the estimated runoff volume and Plate A-1, determine what level Rafferty Reservoir should be at or below.

a. If the actual reservoir level is below that level required, use the actual level in the following steps.

b. If the actual reservoir level is above the level required, use the level shown on Plate A-1 in the following steps.

2. Subtract starting storage from 513,000 ac-ft (513,000 - I.E.1=I.E.2)

3. Determine if 30-day volume is controlled:

a. if result from E.2 above is larger than 30-day volume, there is no excess (I.E.2 I.B).

b. if not, subtract E.2 amount from 30-day value, this is the Rafferty Reservoir excess (I.B - I.E.2 I.E.3b)

4. Determine Alameda Reservoir starting storage value in ac-ft

Based on the estimated runoff volume and Plate A-3, determine what level Alameda Reservoir should be at or below.

a. If the actual reservoir level is below that level required, use the actual level in the following steps.

b. If the actual reservoir level is above the level required, use the level shown on Plate A-3 in the following steps.

5. Subtract starting storage from 153,710 ac-ft (153,710 - I.E.4 = I.E.5)

6. Determine if 30-day volume is controlled:

a. if result from E.5 above is larger than 30-day volume, there is no excess (I.E.5 I.C)

b. if not, subtract E.5 amount from 30-day value; this is the Alameda Reservoir excess (I.C - I.E.5 = I.E.6b)

7. If it is determined that the estimated 30-day volumes from Rafferty Reservoir and Alameda Reservoir will not exceed their FSL's and therefore minimum releases are

expected, the Lake Darling Dam operator MUST be informed, so that Lake Darling Reservoir can be at full supply level after flood

(If (I.B - (356,400 - I.E.1)) 0 and
(I.C - (85,530 - I.E.4)) 0, then call)

F. Determine the uncontrolled 30-day volume at Sherwood Crossing by adding the Rafferty Reservoir and Alameda Reservoir excesses, if any, to the Sherwood Crossing local 30-day volume found above (I.D.3 + I.E.3.b + I.E.6.b = I.F)

G. Using result from "F" above, determine Lake Darling Reservoir starting level from Plate A-4 (I.F + Plate A-4 == I.G)

H. Determine starting Sherwood Crossing target flow by using Plate A-5 and the total Sherwood Crossing 30-day volume from "A" above (I.A + Plate A-5 == I.I)

I. Determine Minot target flow by using Plate A-6 and the total Sherwood Crossing 30-day volume from "A" above (I.A - Plate A-6 == I.H)

J. Determine Boundary Reservoir 30-day volume

K. Determine if Boundary Reservoir storage must be used from Plate A-2

L. Determine if Boundary Diversion Channel will be used

M. Adjust estimate of 30-day volume at Sherwood Crossing based on use of Boundary Reservoir and Boundary Diversion Channel

II. DURING FLOOD (March 16 to May 31)

A. Using data as is available from within basin, estimate the peak discharge to be expected at Sherwood Crossing:

1. if discharge is less than target flow at Sherwood Crossing, releases can be made from Rafferty Reservoir and Alameda Reservoir which increase the peak to, but not greater than, target

2. if discharge is greater than target flow at Sherwood Crossing, releases are not to be made from Rafferty Reservoir and Alameda Reservoir which will add to the peak flow at Sherwood Crossing

B. Sherwood Crossing Target (After peak at Sherwood Crossing)

After the peak flow has occurred at Sherwood Crossing, estimate the average daily flows expected at Sherwood Crossing from the uncontrolled areas. Using this flow, the current Lake Darling Reservoir elevation, and the local flows at Minot, estimate future Lake Darling Reservoir elevations. Using this data, to include the Sherwood Crossing target flows, make releases to drawdown Rafferty Reservoir and Alameda Reservoir within the target flows in Plate A-5. Plate A-9 contains storage data for Lake Darling Reservoir to aid in the estimates.

Repeat this operation as needed to reduce reservoir levels to FSL.

Note: The same starting Sherwood Crossing target flow is used for the entire flood event, UNLESS, the estimated 30-day volume at Sherwood Crossing is adjusted based on updated data.

C. To aid in the operation of ALL reservoirs ALL operators must communicate on a regular basis.

D. Based on reservoir levels, determine if the Minot target date of May 15 must be extended so that the 500 cfs maximum at Minot after June 1 will not be exceeded.

III. POST FLOOD (June 1 to January 31)

A. Following the operating guidelines, release allowable flows to bring the reservoirs to their FSL's.

B. Review actions taken during flood and note problems which occurred.

C. If flood was a large event, prepare a Post Flood Report.

4.4 Nonflood Operation

Primary emphasis is given to operations during years of flood runoff; i.e., when the spring runoff volume exceeds a 10-percent flood. Nonflood operations are guided primarily by the Board. This Operating Plan sets forth the understanding between the Parties regarding flows in nonflood years, and provides guidance on the implementation of that understanding. It is recognized, however, that the actual implementation of the Operating Plan will be dependent upon the close coordination of the Parties during the hydrologic year.

4.4.1. Nonflood Project Operation Steps

1. The flow passed to North Dakota shall be either 40 percent or 50 percent of the natural flow at Sherwood Crossing according to the 1959 Interim Measures as modified.

2. An apportionment balance will be estimated at the spring meeting of the Board.

3. If additional releases are needed to meet the apportionment balance, North Dakota will assess its needs. If the releases would not be of benefit at that time, they may be delayed.

4. If releases are delayed, they may be called for by North Dakota at any time before October 1. If they are not called for before October 1, the water may be retained for use in Saskatchewan.

5. If delayed releases are called for, the delayed release shall be measured at the point of release and the delivery at Sherwood Crossing shall not be less than the delayed release minus the conveyance losses that would have occurred under natural conditions between the point of release and the Sherwood Crossing.

6. On October 1, a final apportionment balance will be determined. Any portion of the North Dakota apportionment remaining in Saskatchewan on October 1 shall be added arithmetically to the storage in Lake Darling Reservoir on October 1 to determine the October 1 level of Lake Darling Reservoir for purposes of Section 4.2.a.

4.5 Operating Provisions During Construction and Filling

The Parties agree to use their best efforts to provide flood protection during construction of the Project.

5.0 REPORTS

Reports will be prepared each year on behalf of the United States and Canada by both the Saskatchewan Water Corporation and the U.S. Fish and Wildlife Service describing the operation of the Project. The reports will be issued to the Board and at a minimum will include a description of the operation of the reservoirs including any problems encountered, a summary of water levels, inflows and releases from each reservoir, and an estimate of reservoir levels, inflows and releases for the remainder of the calendar year. In any year in which flood operations occur, the U.S. Army Corps of Engineers will prepare a post-flood report. This report will then become a part of the U.S. Fish and Wildlife Service report.

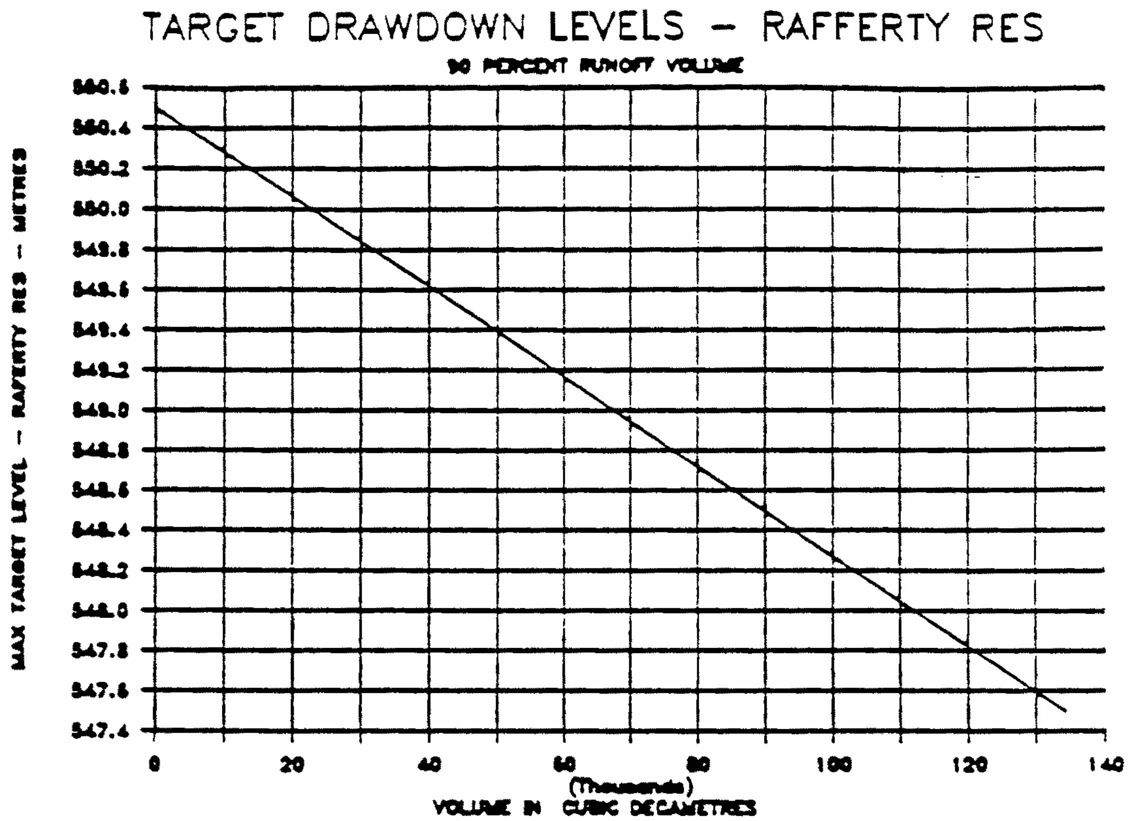
6.0 LIAISON

The Government of Saskatchewan, the Department of the Army, and the U.S. Fish and Wildlife Service within the Department of the Interior shall appoint a liaison person with whom interested States, Provinces, and Agencies may consult from time to time as to the operation of the improvements constructed and operated under the terms of the subject Agreement.

Representatives of the U.S. Department of the Army, Saskatchewan Water Corporation, U.S. Fish and Wildlife Service, and the North Dakota State Engineer will be responsible for monitoring the Operating Plan. It is expected that the reservoir operations will need to be closely monitored for the first several years after the project goes into operation.

7.0 DATA AND COMMUNICATION

The Parties shall exchange all desired data collected with respect to the management of water in the Souris River Basin and will use their best efforts to keep all interested States, Provinces, and Agencies adequately informed of all activities related to this Operating Plan.


TARGET DRAWDOWN LEVELS – RAFFERTY RES
90 PERCENT RUNOFF VOLUME
MAX TARGET LEVEL – RAFFERTY RES – METRES
550.6
550.4
550.2
550.0
549.8
549.6
549.4
549.2
549.0
548.8
548.6
548.4
548.2
548.0
547.8
547.6
547.4
0
20
40
60
80
100
120
140
(Thousands)
VOLUME IN CUBIC DECAMETRES

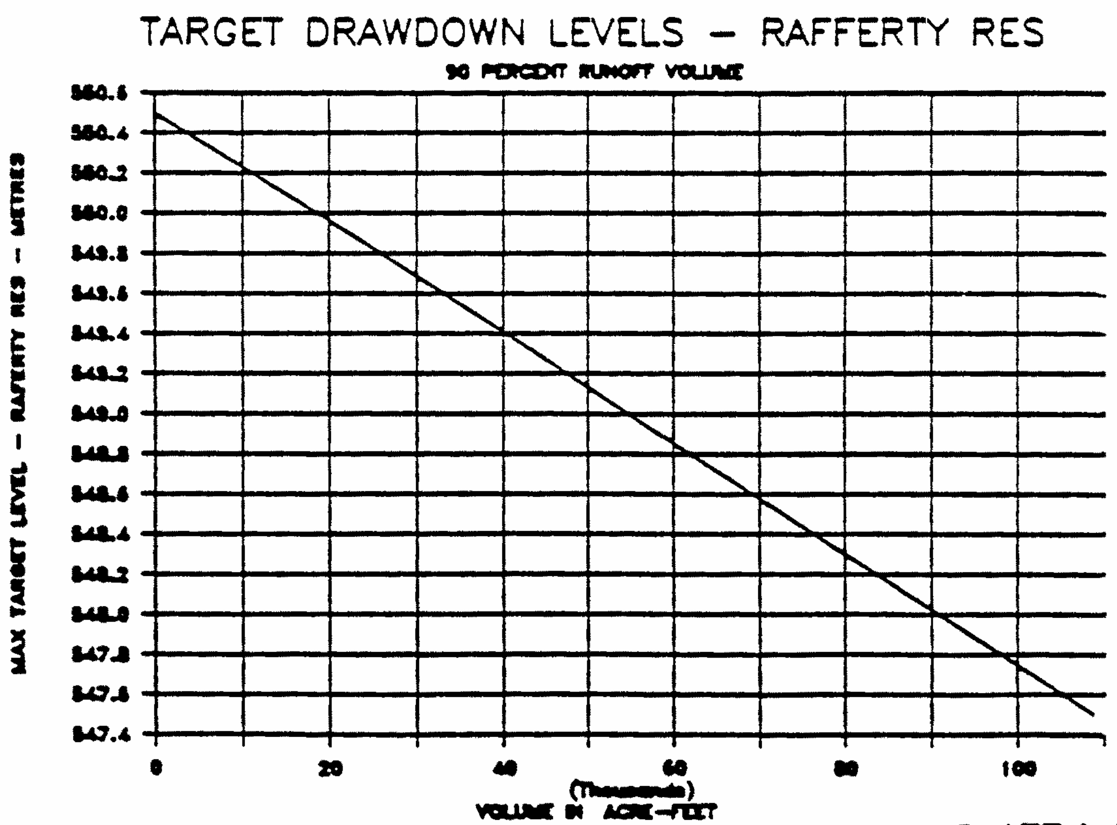
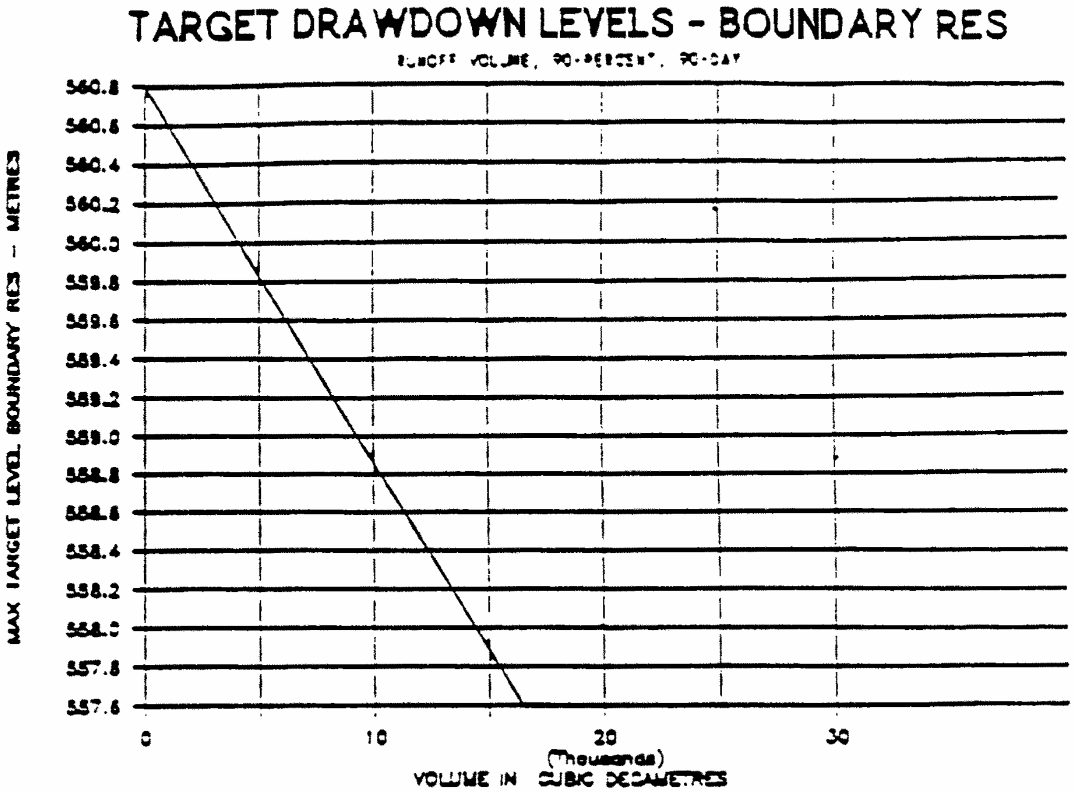

TARGET DRAWDOWN LEVELS – RAFFERTY RES
90 PERCENT RUNOFF VOLUME
MAX TARGET LEVEL – RAFFERTY RES – METRES
550.6
550.4
550.2
550.0
549.8
549.6
549.4
549.2
549.0
548.8
548.6
548.4
548.2
548.0
547.8
547.6
547.4
0
20
40
60
80
100
(Thousands)
VOLUME IN ACRE–FEET

PLATE A-1


TARGET DRAWDOWN LEVELS - BOUNDARY RES
MAX TARGET LEVEL BOUNDARY RES - METRES
560.8
560.6
560.4
560.2
560.0
559.8
559.6
559.4
559.2
559.0
558.8
558.6
558.4
558.2
558.0
557.8
557.6
0
10
20
30
(Thousands)
VOLUME IN CUBIC DECAMETRES

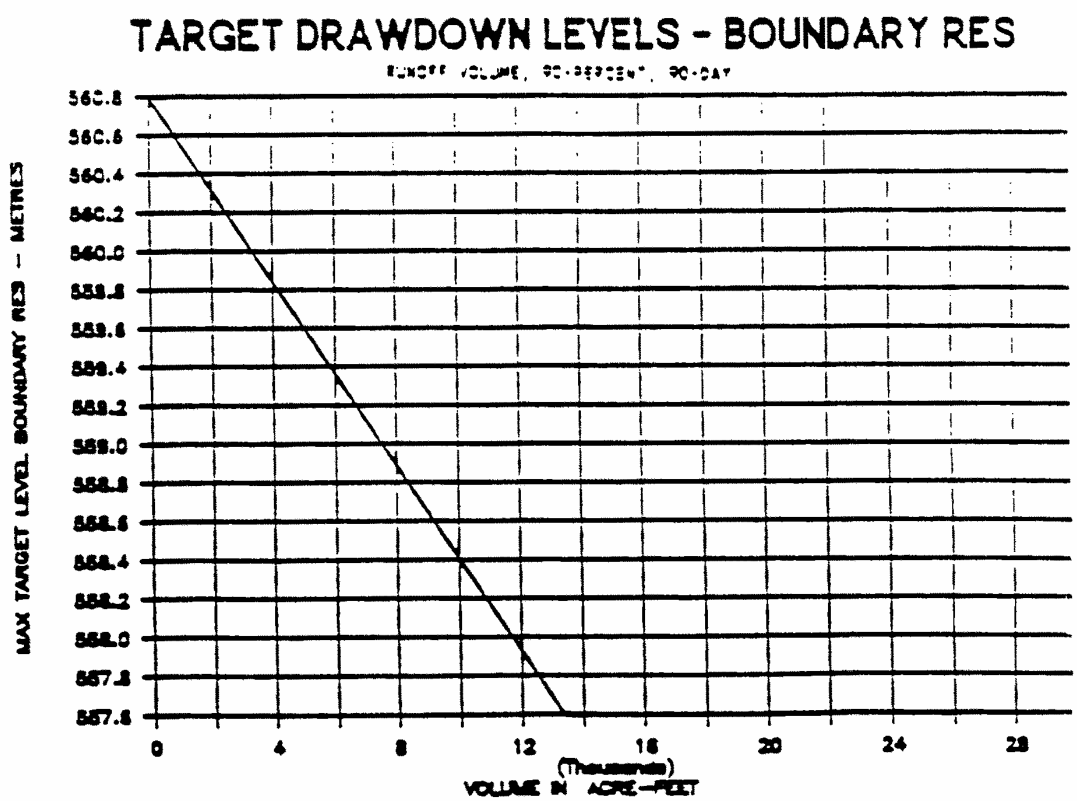
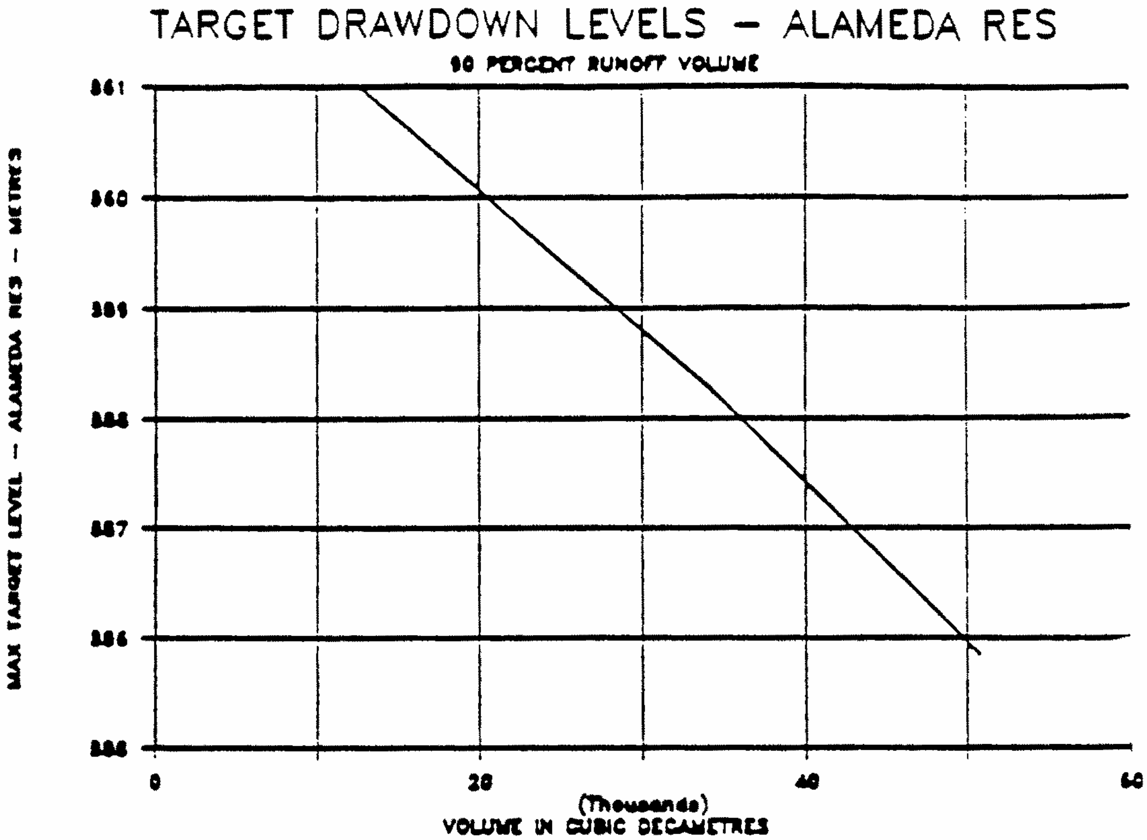

TARGET DRAWDOWN LEVELS - BOUNDARY RES
MAX TARGET LEVEL BOUNDARY RES - METRES
560.8
560.6
560.4
560.2
560.0
559.8
559.6
559.4
559.2
559.0
558.8
558.6
558.4
558.2
558.0
557.8
557.6
0
4
8
12
16
20
24
28
(Thousands)
VOLUME IN ACRE—FEET

PLATE A


TARGET DRAWDOWN LEVELS – ALAMEDA RES
90 PERCENT RUNOFF VOLUME
MAX TARGET LEVEL – ALAMEDA RES – METRES
0
20
40
60
(Thousands)
VOLUME IN CUBIC DECAMETRES

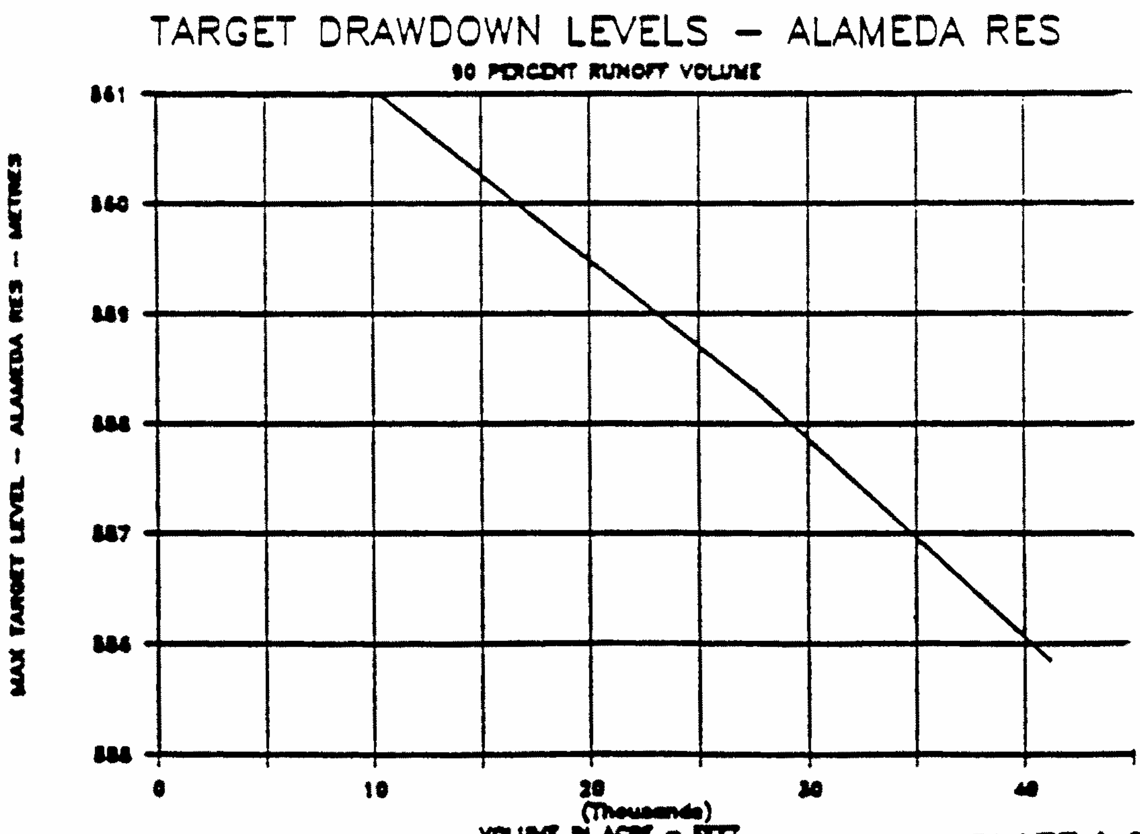
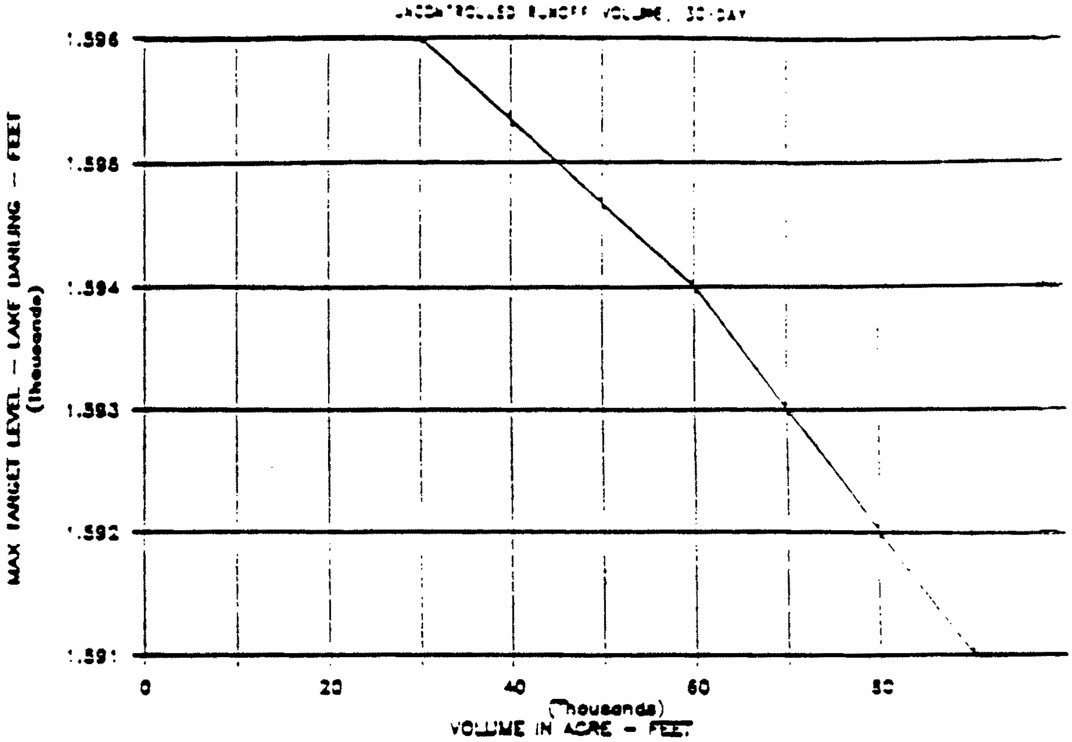

TARGET DRAWDOWN LEVELS – ALAMEDA RES
90 PERCENT RUNOFF VOLUME
MAX TARGET LEVEL – ALAMEDA RES – METRES
0
10
20
30
40
(Thousands)
VOLUME IN ACRE – FEET

PLATE A-3

TARGET DRAWDOWN LEVELS - LAKE DARLING



TARGET DRAWDOWN LEVELS - LAKE DARLING

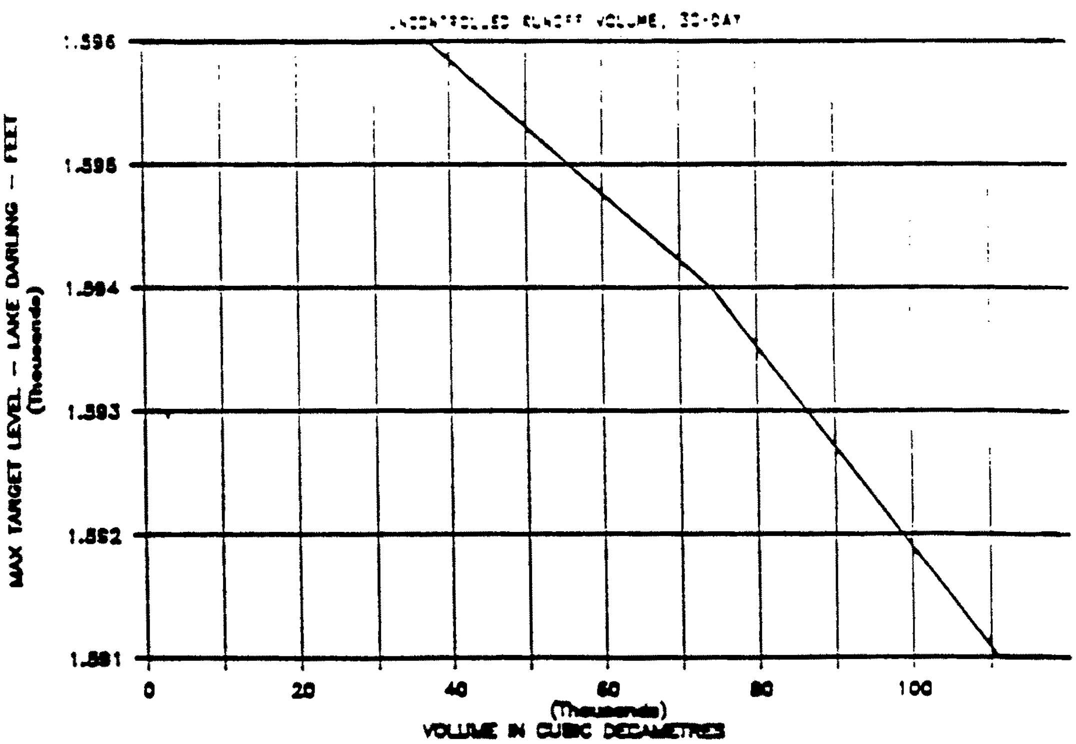
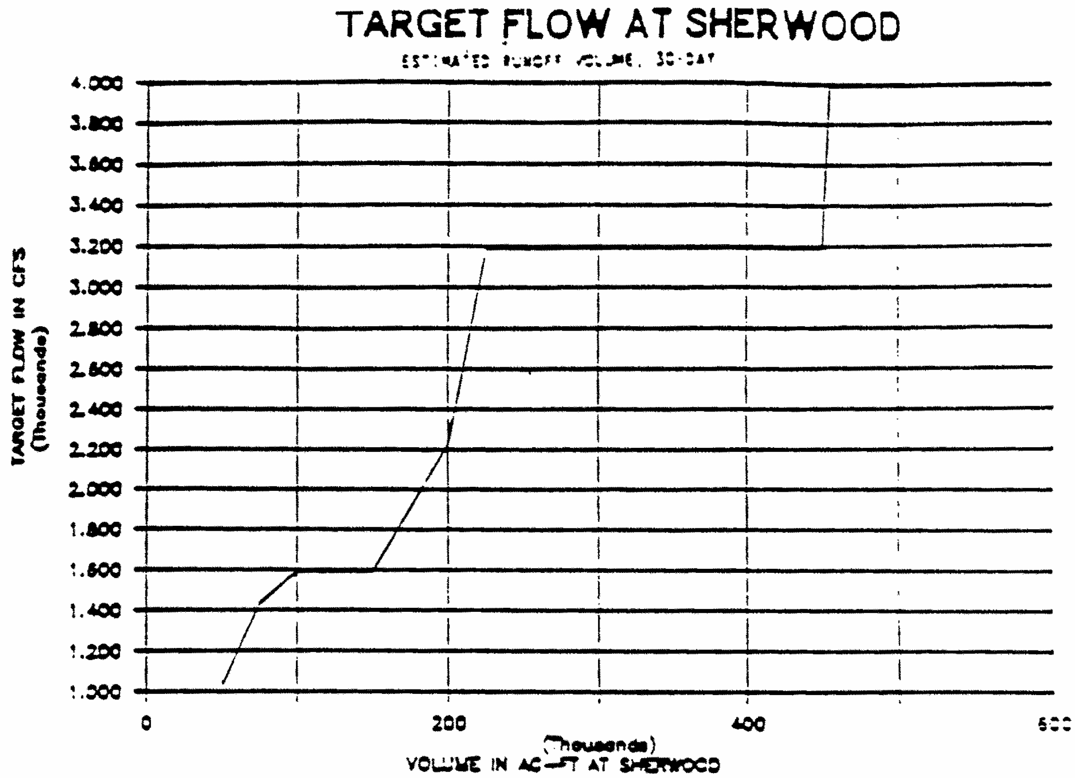


PLATE A-


TARGET FLOW AT SHERWOOD
ESTIMATED RUNOFF VOLUME, 30-DAY
TARGET FLOW IN CFS
(Thousands)
4.000
3.800
3.600
3.400
3.200
3.000
2.800
2.600
2.400
2.200
2.000
1.800
1.600
1.400
1.200
1.000
0
200
400
600
(Thousands)
VOLUME IN AC-FT AT SHERWOOD

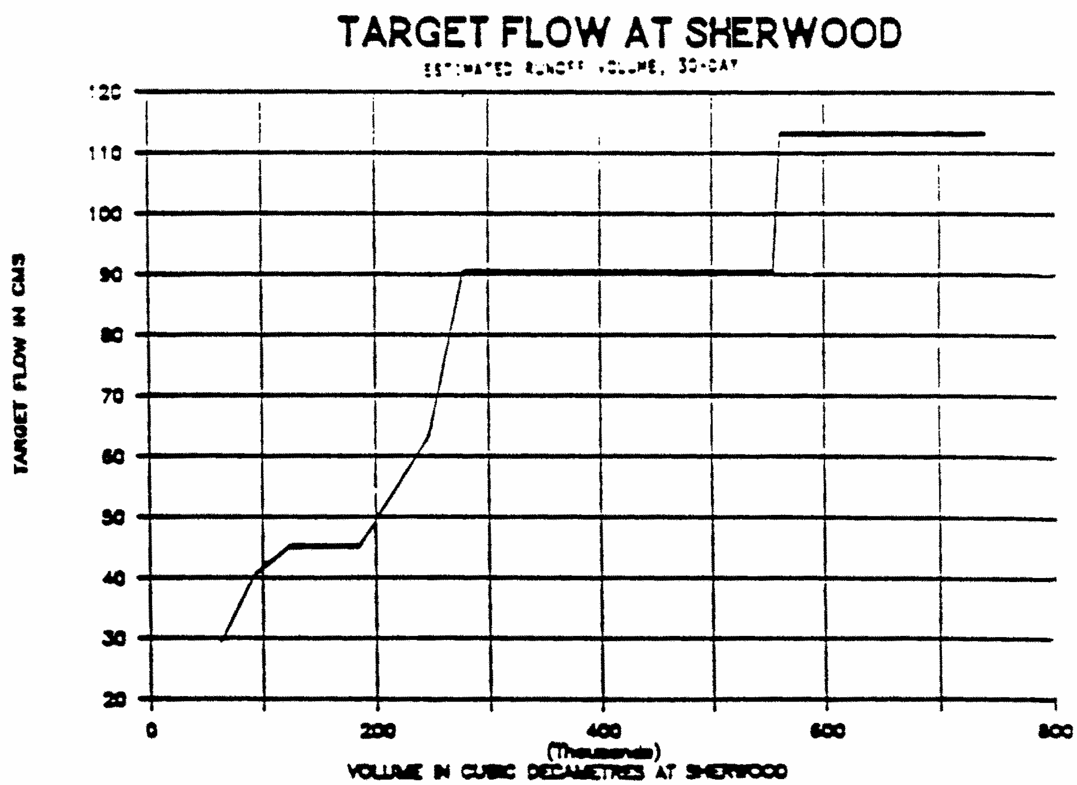
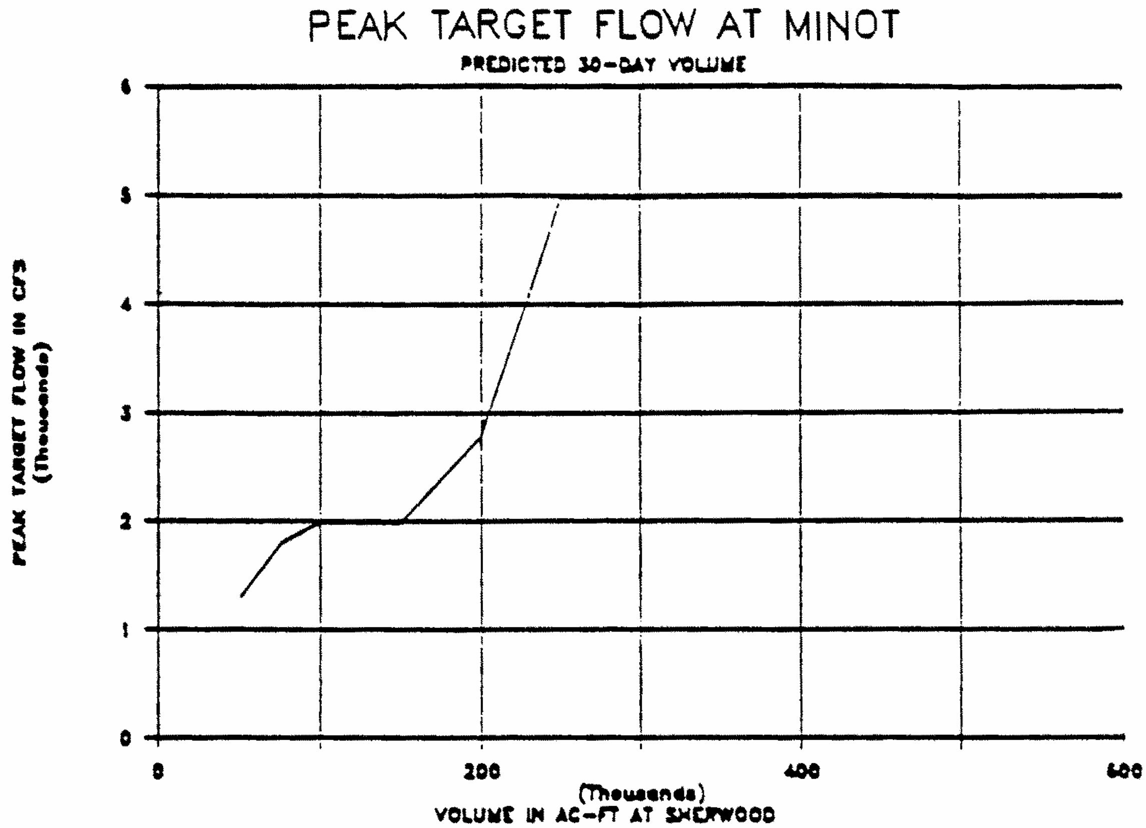

TARGET FLOW AT SHERWOOD
ESTIMATED RUNOFF VOLUME, 30-DAY
TARGET FLOW IN CMS
120
110
100
90
80
70
60
50
40
30
20
0
200
400
600
800
(Thousands)
VOLUME IN CUBIC DECAMETRES AT SHERWOOD

PLATE A-


PEAK TARGET FLOW AT MINOT
PREDICTED 30-DAY VOLUME
PEAK TARGET FLOW IN CFS (Thousands)
0
1
2
3
4
5
6
0
200
400
600
(Thousands)
VOLUME IN AC-FT AT SHERWOOD

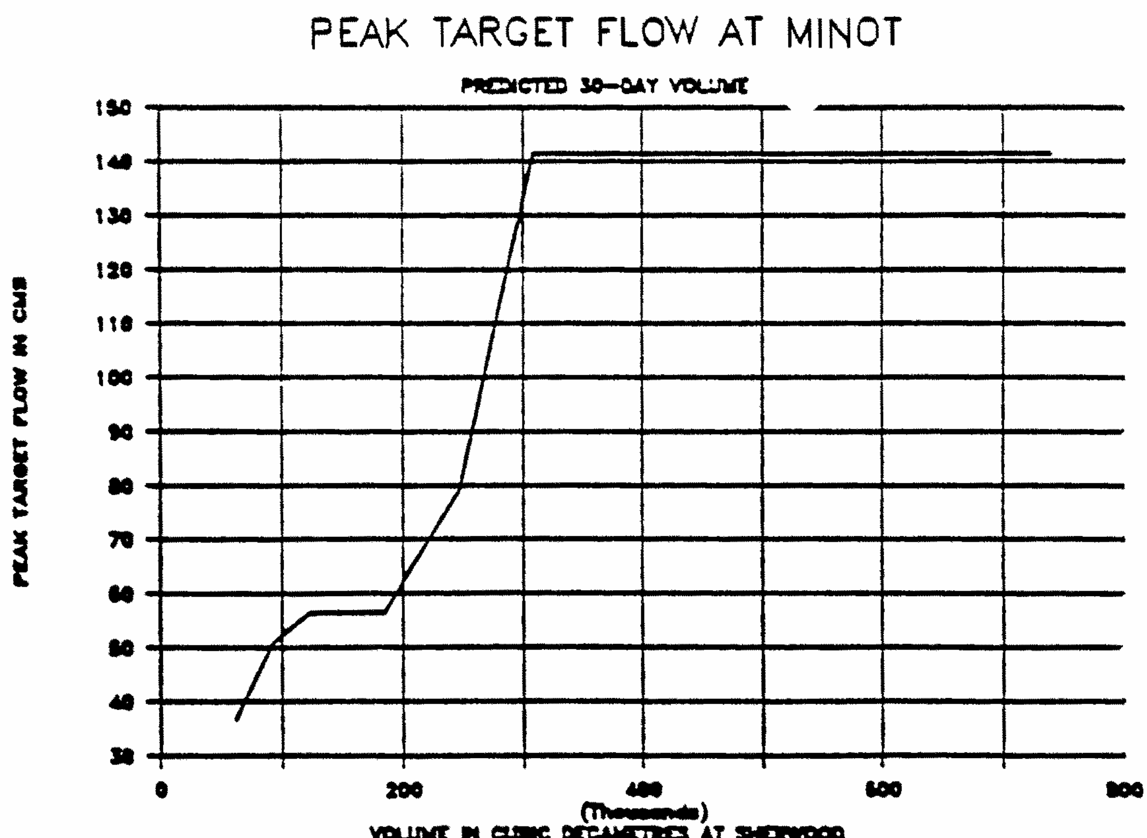
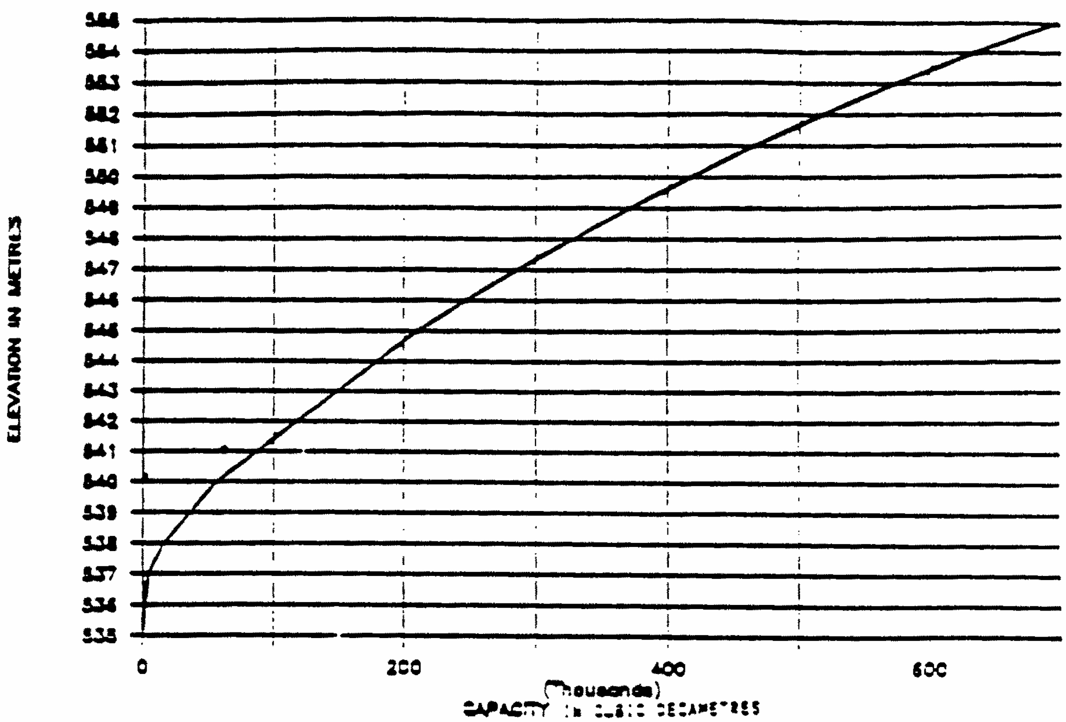

PEAK TARGET FLOW AT MINOT
PREDICTED 30-DAY VOLUME
PEAK TARGET FLOW IN CMS
30
40
50
60
70
80
90
100
110
120
130
140
150
0
200
400
600
800
(Thousands)
VOLUME IN CUBIC DECAMETRES AT SHERWOOD

PLATE A-6

RAFFERTY ELEVATION–CAPACITY



RAFFERTY ELEVATION–AREA

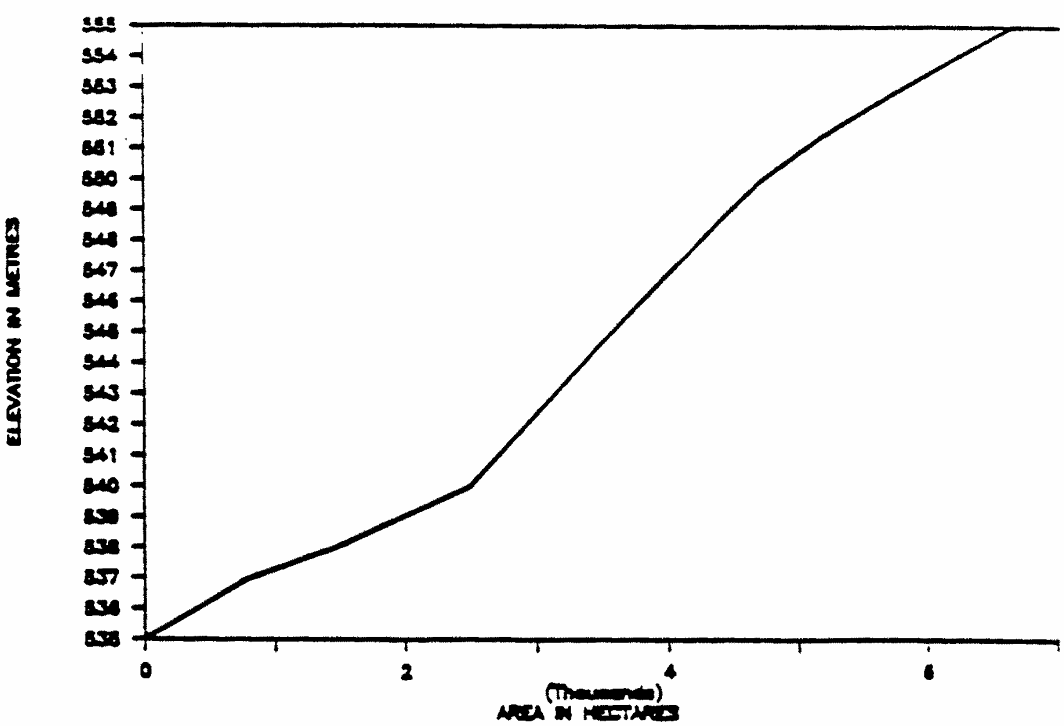
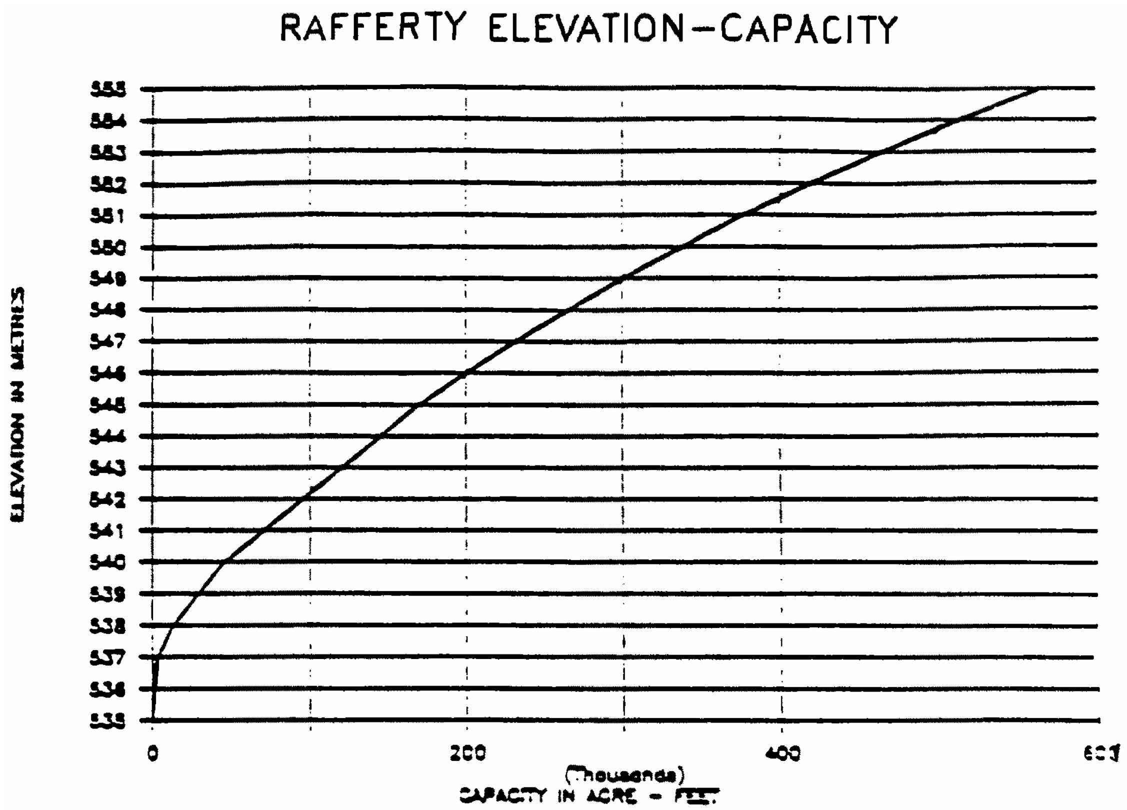


PLATE A–77


RAFFERTY ELEVATION—CAPACITY
ELEVATION IN METRES
(Thousands)
CAPACITY IN ACRE - FEET

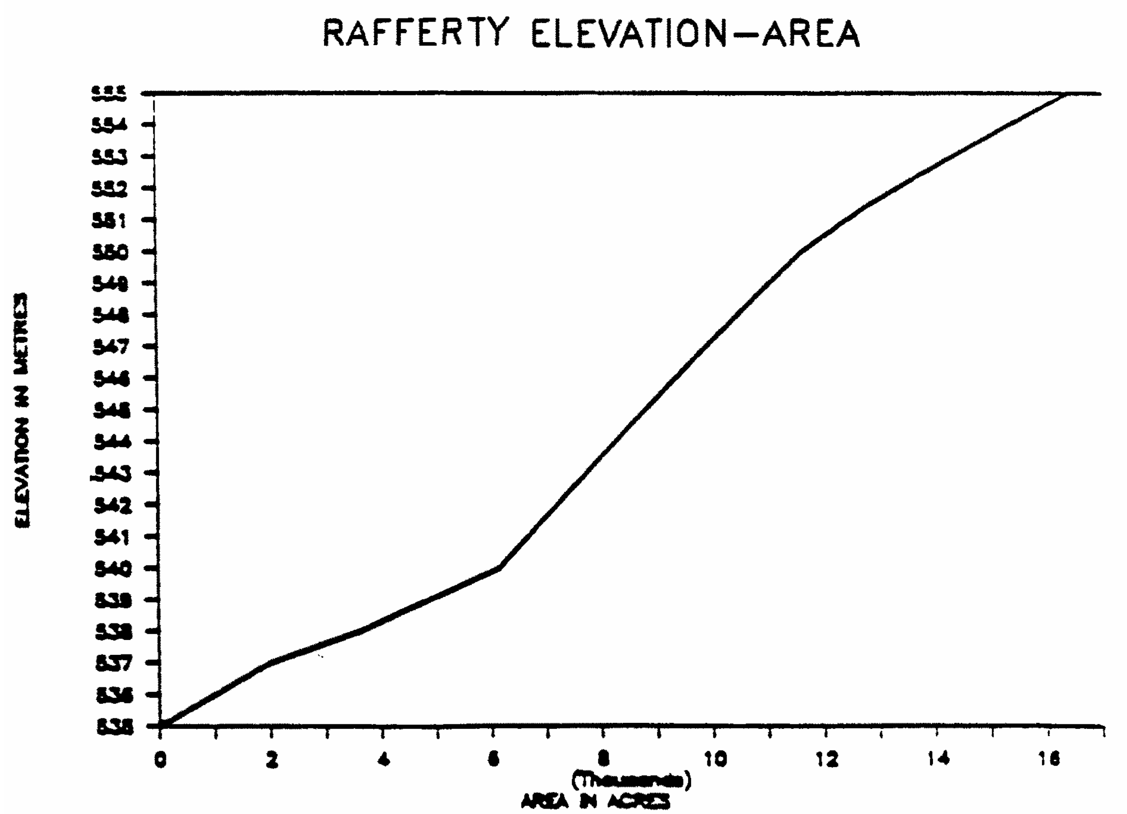
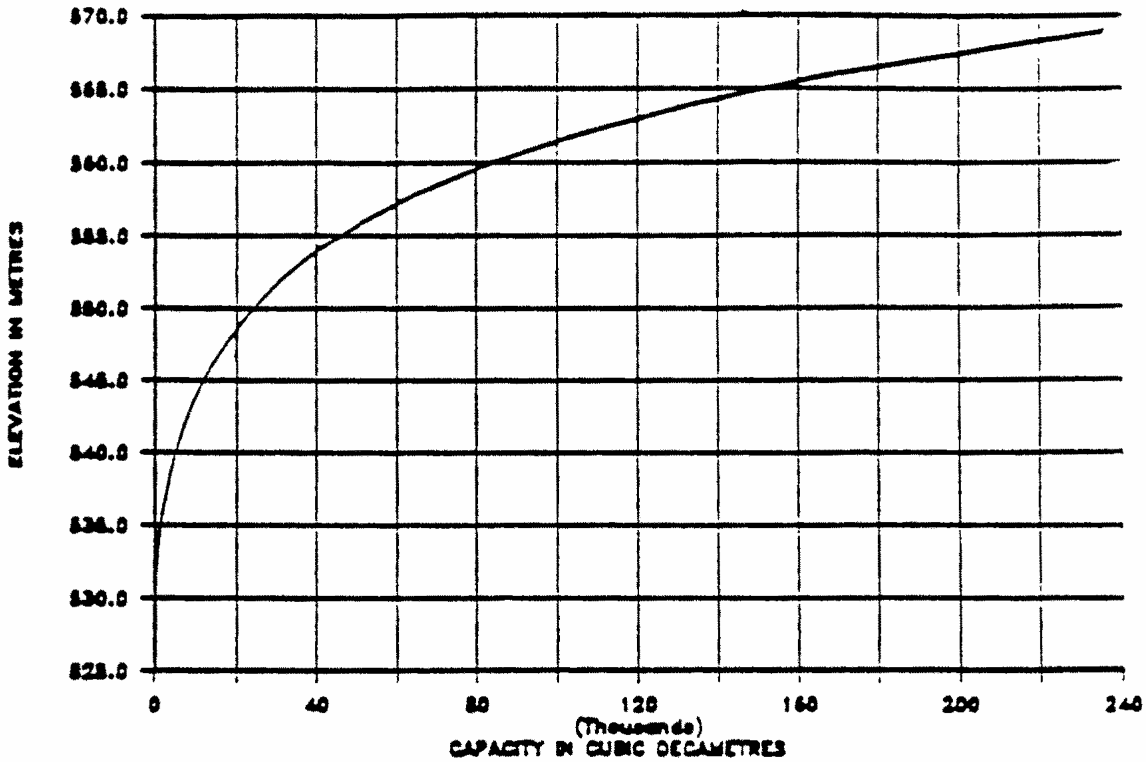

RAFFERTY ELEVATION—AREA
ELEVATION IN METRES
(Thousands)
AREA IN ACRES

PLATE-7

ALAMEDA ELEVATION—CAPACITY



ALAMEDA ELEVATION—AREA

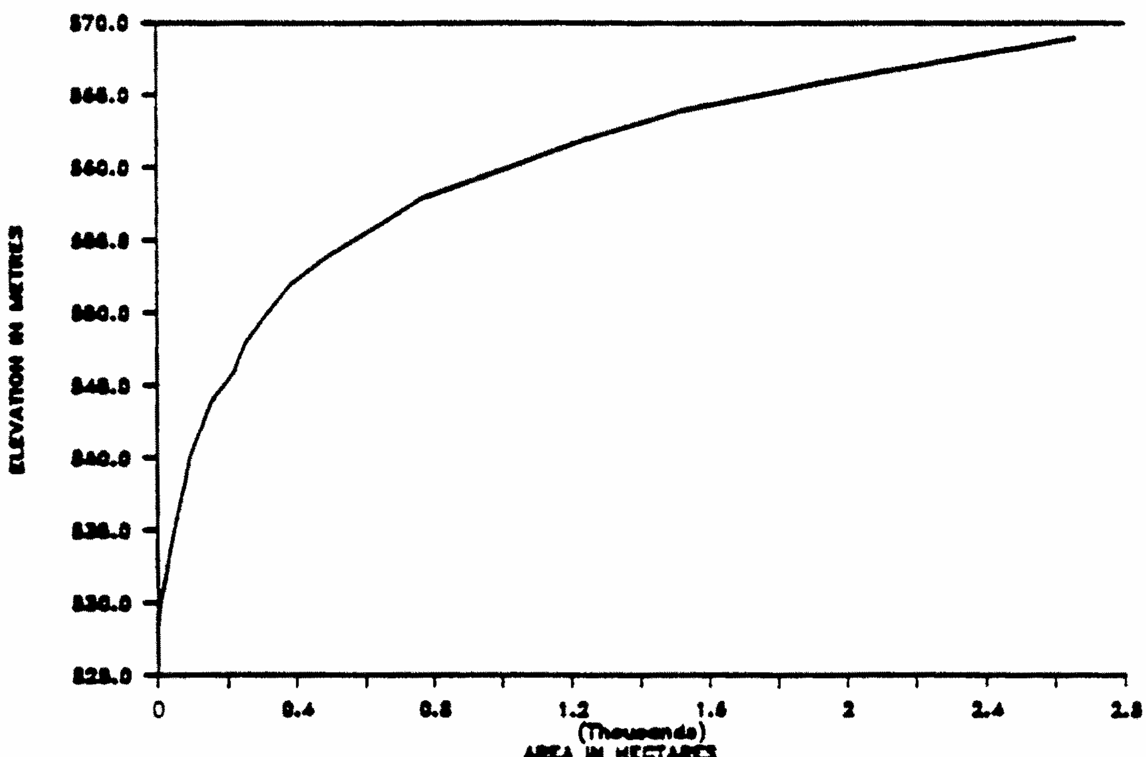
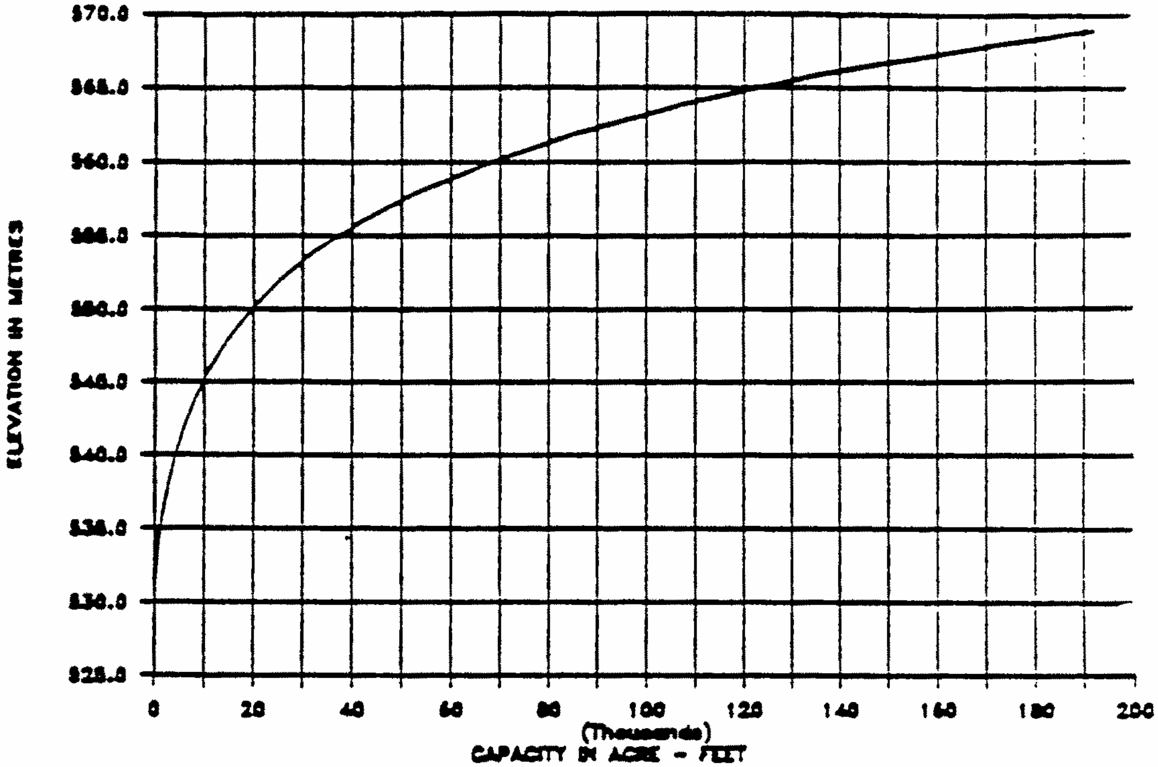


PLATE A-8A

ALAMEDA ELEVATION—CAPACITY



ALAMEDA ELEVATION—AREA

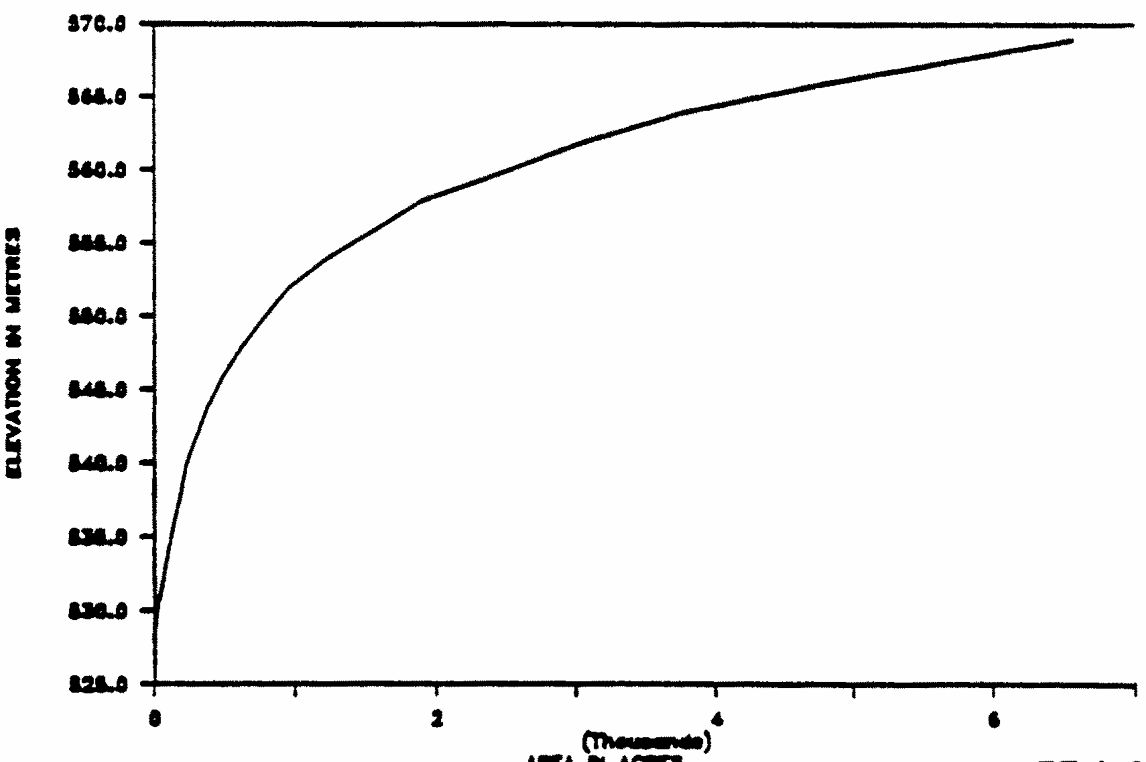
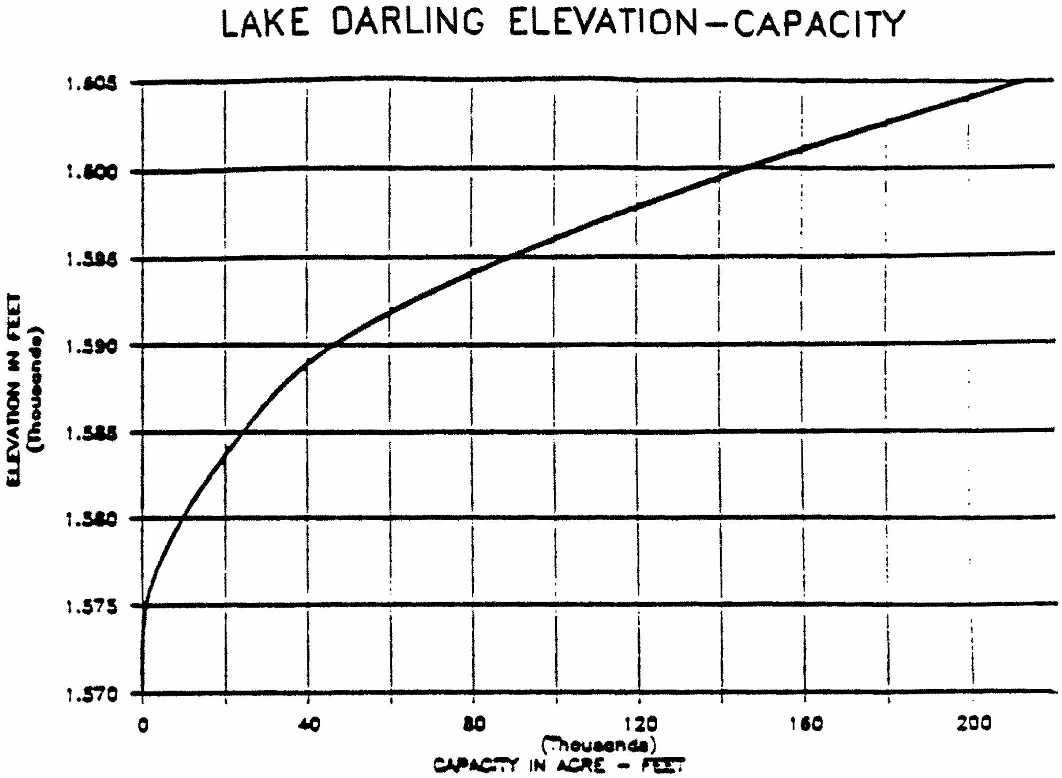


PLATE A-8B


LAKE DARLING ELEVATION—CAPACITY
ELEVATION IN FEET
(Thousands)
1.605
1.600
1.595
1.590
1.585
1.580
1.575
1.570
0
40
80
120
160
200
(Thousands)
CAPACITY IN ACRE – FEET

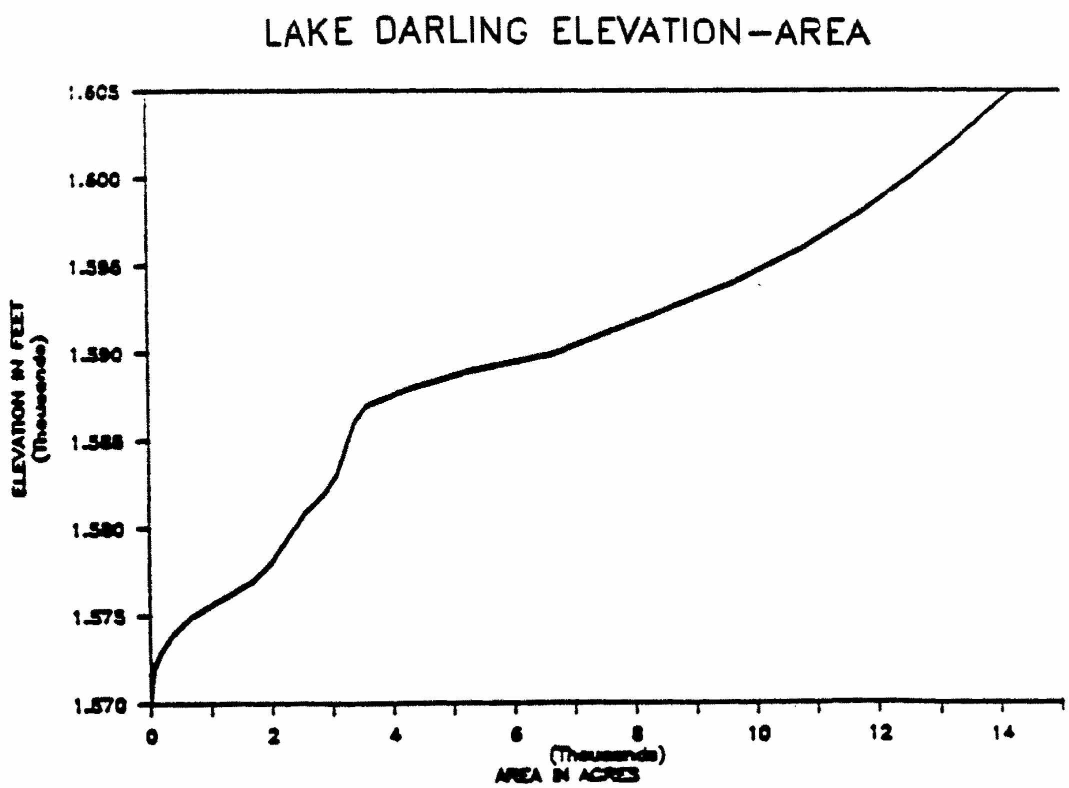
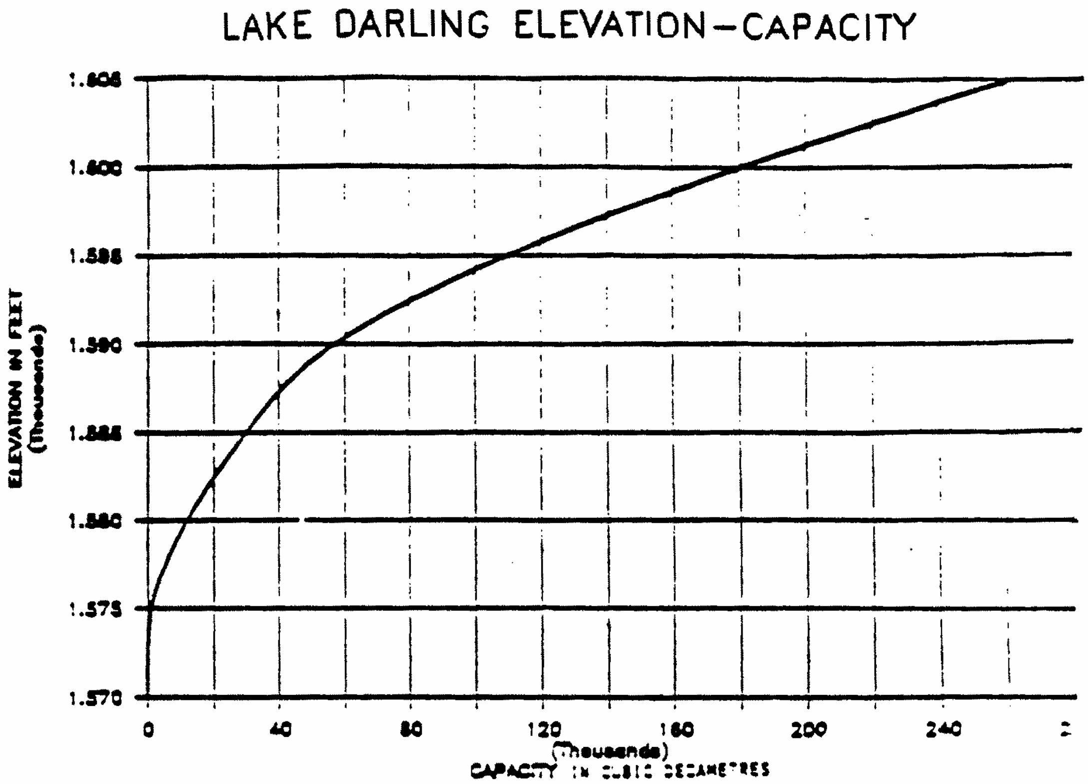

LAKE DARLING ELEVATION—AREA
ELEVATION IN FEET
(Thousands)
1.605
1.600
1.595
1.590
1.585
1.580
1.575
1.570
0
2
4
6
8
10
12
14
(Thousands)
AREA IN ACRES

PLATE A-9


LAKE DARLING ELEVATION—CAPACITY
ELEVATION IN FEET
(Thousands)
1.605
1.600
1.595
1.590
1.585
1.580
1.575
1.570
0
40
80
120
160
200
240
(Thousands)
CAPACITY IN CUBIC DECAMETRES

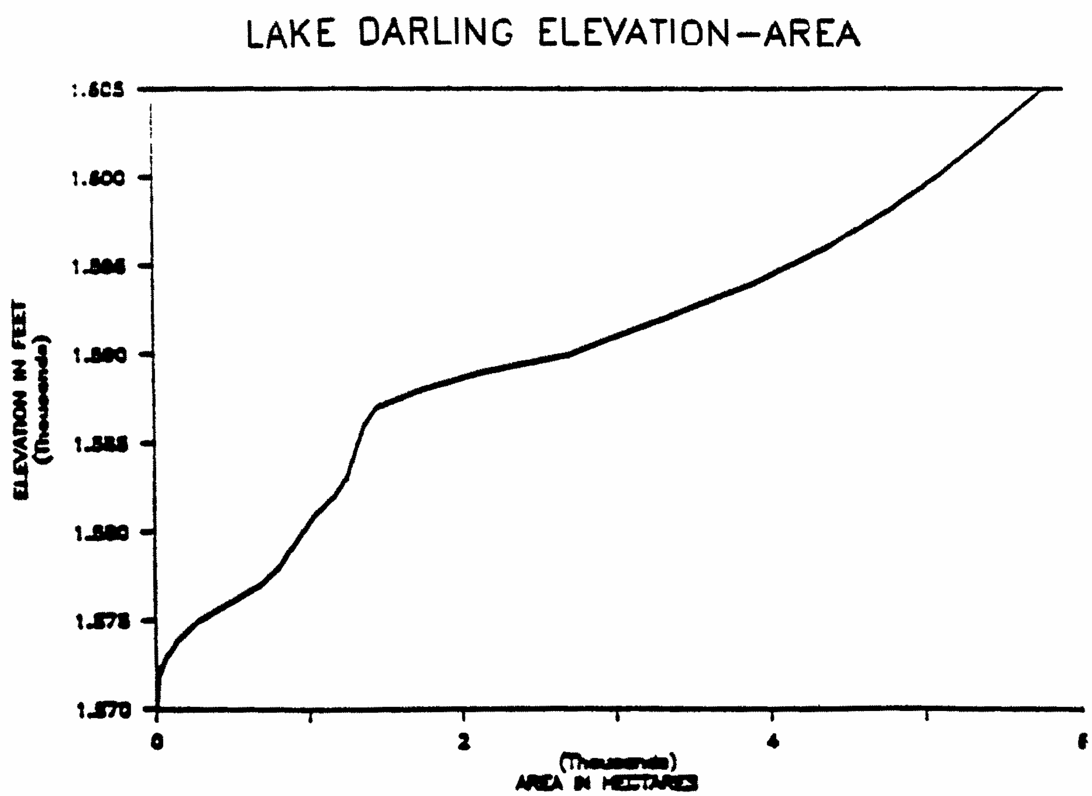

LAKE DARLING ELEVATION—AREA
ELEVATION IN FEET
(Thousands)
1.605
1.600
1.595
1.590
1.585
1.580
1.575
1.570
0
2
4
6
(Thousands)
AREA IN HECTARES

PLATE A-c

ANNEX B

1. The Province of Saskatchewan shall have the right to divert, store, and use waters which originate in the Saskatchewan portion of the Souris River Basin, provided that such diversion, storage, and use shall not diminish the annual flow of the river at the Sherwood Crossing more than 50 percent of that which would have occurred in a state of nature, as calculated by the Board. For the benefit of riparian users of water between the Sherwood Crossing and the upstream end of Lake Darling, the Province of Saskatchewan shall, so far as is practicable, regulate its diversions, storage, and uses in such a manner that the flow in the Souris River channel at the Sherwood Crossing shall not be less than 0.113 cubic meters per second (4 cubic feet per second) when that much flow would have occurred under the conditions of water use development prevailing in the Saskatchewan portion of the Souris River Basin prior to construction of the Boundary Dam, Rafferty Dam and Alameda Dam.

(a) Under certain conditions, a portion of the North Dakota share will be in the form of evaporation from Rafferty and Alameda Reservoirs. During years when these conditions occur, the minimum amount of flow actually passed to North Dakota will be 40 percent of the natural flow at the Sherwood Crossing. This lesser amount is in recognition of Saskatchewan's operation of Rafferty Dam and Alameda Dam for flood control.

The following rules determine the percentage of the natural flow at Sherwood Crossing which is to be passed to North Dakota:

i. If the level of Lake Darling is below an elevation of 485.24 meters (1592.0 feet) on October 1 in any calendar year, Saskatchewan will pass 50 percent of the natural flow at Sherwood Crossing in that year and in succeeding years until the level of Lake Darling is above an elevation of 485.55 meters (1593.0 feet) on October 1.

ii. If the natural flow at the Sherwood Crossing is equal to or less than 24,670 cubic decameters (20,000 acre-feet) prior to October 1 of that year, then Saskatchewan will pass 50 percent of the natural flow to North Dakota in that calendar year.

iii. If the conditions specified in subparagraphs 1(a)(i) and 1(a)(ii) do not apply, then Saskatchewan will pass at least 40 percent of the natural flow at the Sherwood Crossing to North Dakota.

(b) Flow releases to the United States should occur (except in flood years) in the pattern which would have occurred in a state of nature. To the extent possible and in consideration of potential channel losses and operating efficiencies, releases from the Canadian dams will be scheduled to coincide with periods of beneficial use in North Dakota. Normally, the period of beneficial use in North Dakota coincides with the timing of the natural hydrograph, and that timing should be a guide to releases of the United States portion of the natural flow. The flow release to the United States may be delayed when the State of North Dakota determines and notifies Saskatchewan through the Board that the release would not be of benefit to the State at that time. The delayed release may be retained for use in Saskatchewan, notwithstanding the minimum release limits, unless it is called for by the State of North Dakota through the Board before October 1 of each year. The delayed release shall be measured at the point of release and the delivery at Sherwood Crossing shall not be less than the delayed release minus the conveyance losses that would have occurred under natural conditions between the point of release and the Sherwood Crossing. A determination of the annual apportionment balance shall be made by the Board on or about October 1, of each year. Any shortfall that exists as of that date shall be delivered by Saskatchewan prior to December 31, if North Dakota requests the delivery.

SEVERE DROUGHT CONDITIONS

(Accepted by the Souris River Board of Control May 7, 1963, Minute 63B-8)

Recommendation 3(b) of the March, 1958, report by the International Joint Commission to the governments of the United States and Canada dealt with severe drought in the Souris watershed as follows:

> "In periods of severe drought when it becomes impracticable for the State of North Dakota to provide the foregoing regulated flows, the responsibility of the State of North Dakota in this connection shall be limited to the provision of such flows as may be practicable, in the opinion of the said Board of Control, in accordance with the objective of making water available for human and livestock consumption and for household use -------- ."

In order to carry out this directive, the Souris River Board of Control finds it necessary to (a) agree upon certain operating and administrative procedures in the event of severe drought and to (b) define "severe drought."

(a) Operating and Administrative Procedures

The United States member of the Souris River Board of Control will give the Board earliest possible advice, (advance notice of preferably 10 days or more), concerning the onset of "severe drought" conditions. The Board will then decide on the size of a practicable release under severe drought conditions taking into account general hydrologic conditions and the objective of making water available for human and livestock consumption and for household use.

Releases of water from Dam #357 will be subject to the above restrictions until impoundments in North Dakota recover from "severe drought" conditions. "Severe drought" conditions and "recovery" from same are defined below.

It will be the responsibility of the United States and Canadian members of the Board to make their decisions known to the appropriate agencies in their respective countries.

(b) Definition of "Severe Drought" and "Recovery" from Same

The Board will recognize that, for the purposes of interpreting recommendation 3 (b), severe drought conditions exist when the total amount of water in storage in North Dakota at Dam 87 (Lake Darling) and at Dams 320, 326, 332, 341, and 357 (Lower Refuges) is 54,000 acre-feet.

"Severe drought" conditions will prevail until storage in the above, reservoirs recovers so that the total amount of water in storage is 57,000 acre-feet.

The figure 54,000 acre-feet has been determined from reservoir levels as listed on Table I. "Severe drought" is related to aggregate storage as described above rather than individual reservoir levels.

TABLE I

Reservoir	Water Surface Elevation		Amount of Water in Storage
Lake Darling (Dam 87)	1589.0		40,000 acre-feet
Lower Souris Refuge			
Dam #320	1420.2	580)	
Dam #326	1418.0	380)	
Dam #332	1417.0	5400) –	13,860 acre-feet
Dam #341	1415.0	3300)	
Dam #357	1411.0	4200)	
	Total		53,860 acre-feet
		Say	54,000 acre-feet

DRAFT dated August 5, 2006

DIRECTIVE TO THE INTERNATIONAL SOURIS RIVER BOARD

The International Souris River Board was created by the International Joint Commission (hereafter referred to as the Commission) in April 2000 when it amalgamated the Souris River basin responsibilities previously assigned to the Commission in two separate references by the governments of Canada and the United States. The two references were the International Souris River Board of Control Reference (1959) and the Souris-Red Rivers Engineering Board Reference (1948). The International Souris River Board's mandate changed further through an exchange of diplomatic notes on June 9, 2005 assigning water quality functions and the oversight for flood forecasting and operations as described in Section 4 below. The consolidation of water quantity, water quality, and the oversight for flood forecasting and operations is a step in the evolution of the International Souris River Board as it moves towards an integrated approach to transboundary water issues in the Souris River basin.

This directive sets out the mandate under which the International Souris River Board will operate.

1. Pursuant to the Boundary Waters Treaty of 1909 and related agreements, responsibilities have been conferred on the Commission to ensure compliance with apportionment measures for the waters of the Souris River, to investigate and report on water requirements and uses as they impact the transboundary waters of the Souris River basin, and to assist in the implementation and review of the Joint Water Quality Monitoring Program pursuant to the 1989 Canada-United States Agreement for Water Supply and Flood Control in the Souris River Basin.

2. The apportionment measures derive from the approvals given by the governments of Canada and the United States, by letters of March 20, 1959 and April 3, 1959 respectively, to the recommendations made by the Commission in paragraph 22 of its report to the governments of March 19, 1958. Subsequently, with the signing of the Canada-United States Agreement for Water Supply and Flood Control in the Souris River basin on October 26, 1989 (hereafter referred to as the 1989 Agreement), the Interim Measures for apportionment of the Souris River at the Saskatchewan-North Dakota boundary were revised as described in Annex B of the Agreement. By letters of February 28, 1992, the Commission was requested to monitor compliance with the measures as modified in the Agreement. By letters of December 22, 2000, the governments amended Annex B of the 1989 Agreement. The attached Appendix A is a consolidation of the apportionment measures against which the Commission is to monitor compliance.

3. By letters of January 12, 1948, the governments requested the Commission to undertake investigations of water requirements and uses arising out of existing dams and other works or projects in the mid-continent portion of the Canada-United States boundary, including the Souris River basin, and to make advisory recommendations.

4. By exchange of diplomatic notes between the governments of Canada and the United States dated January 14 and June 9, 2005, the 1989 Canada-United States Agreement for Water Supply and Flood Control in the Souris River Basin was formally revised to include a reference pursuant to Article IX of the Boundary Waters Treaty which assigned the water quality responsibilities contained in the 1989 Agreement to the Commission. The Commission was requested to assist with the implementation and review of the Joint Water Quality Monitoring Program. On Friday, October 21, 2005 at the October 2005 Commission's meeting with governments, the U.S. State Department read a statement into the Commission's formal record that the U.S. State Department is of the opinion the Commission has the authority and has obtained the notification it needs from the U.S. State Department to proceed with carrying out the flood related responsibilities for the Souris River. On Thursday, April 6, 2006 at the April 2006 Commission's meeting with governments, Foreign Affairs Canada indicated that the Board should be assigned these responsibilities. It is recognized that Article X of the 1989 Canada-United States Agreement for Water Supply and Flood Control in the Souris River basin designates the entities responsible for operation and maintenance of the improvements mentioned in the Agreement and that the operations will be in accordance with the Operating Plan shown in Annex A of the Agreement. The Department of Army is the entity designated responsible for flood operations within the United States. The Government of Saskatchewan is the Canadian entity designated responsible for flood operations within the Canadian Province of Saskatchewan.

5. This directive replaces the April 11, 2002 Directive to the former International Souris River Board.

6. The Board's mandate is to assist the Commission in carrying out the responsibilities assigned to it by the governments of the United States and Canada in the Souris River basin by performing the tasks identified in Clause 7 below.

7. The Board's duties shall be to:

   (i) Maintain an awareness of existing and proposed developments, activities, conditions, and issues in the Souris River basin that may have an impact on transboundary water levels, flows, water quality, and aquatic ecosystem health and inform the Commission about existing or potential transboundary issues.

   (ii) Oversee the implementation of compliance with the Interim Measures As Modified For Apportionment of the Souris River as described in Appendix A of this document by:
   - identifying an adequate hydro-climatic monitoring network to support the determination of natural flow and apportionment balance,
   - encouraging the appropriate authorities to establish and maintain hydro-climatic monitoring and information collection networks and reporting systems to ensure suitable information is available as required for the determination of natural flow and apportionment balance.

- informing the Commission, in a timely manner, of critical water supply or flow conditions in the basin,
- encouraging appropriate authorities to take steps to ensure that apportionment measures are met, and
- preparing an annual report and submitting it to the Commission.

(iii) Assist in the implementation and review of a Joint Water Quality Monitoring Program (referred to hereafter as “the Program”) by:

- developing recommendations on the Program and setting water quality objectives,
- exchanging data provided by the Program on a regular basis,
- collating, interpreting, and analyzing the data provided by the Program,
- reviewing the Program and the water quality objectives at least every five years,
- recommending, as appropriate, any modifications to improve the Program, and
- preparing an annual report containing:
  - a summary of the principal activities of the Board during the year with respect to the Program,
  - a summary of the principal activities affecting water quality in the Souris River Basin during the year,
  - a summary of the collated, interpreted, and analyzed data provided by the Program,
  - a summary of the water quality of the Souris River at the two locations at which it crosses the International Boundary
  - a section summarizing any definitive changes in the monitored parameters and the possible causes of such changes,
  - a section discussing the water quality objectives for the Souris River at the Saskatchewan/North Dakota boundary and at the North Dakota/Manitoba boundary as established pursuant to Agreement,
  - a section summarizing other significant water quality changes and the possible causes of such changes, and
  - recommendations on new water quality objectives or on how existing water quality objectives can be met, including suggestions on water quality as it relates to water quantity during periods of low flow, in the event that the annual report indicates that the water quality objectives have not been attained as a result of activities pursued under the Agreement.

(iv) Perform an oversight function for flood operations in cooperation with the designated entities identified in the 1989 Canada-United States Agreement for Water Supply and Flood Control in the Souris River Basin by:
- ensuring mechanisms are in place for coordination of data exchange, flood forecasts and communications related to flood conditions and operations;
- determining whether the operations under the Agreement should proceed based on the Flood Operation or Non-Flood Operation of the Operating Plan, which is Annex A to the Agreement, using its criteria and informing designated agencies of this determination;
- reporting to the Commission on any issues related to flood operations and management; and
- providing the Commission and the designated entities under the Agreement recommendations on how flood operations and coordination activities could be improved.

(v) Report on aquatic ecosystem health issues in the watershed and regularly inform the Commission on the state and implications of aquatic ecosystem health.

(vi) Carry out such other studies or activities as the Commission may, from time to time, request.

8. The Board shall provide opportunities for the public to be involved in its work, including at least one public meeting in the basin each year.

9. The Board shall coordinate and collaborate with other agencies and institutions both within and outside the Souris River basin as may be needed or desirable, and facilitate the timely dissemination of pertinent information within the basin.

10. The Board shall have an equal number of members from each country. The Commission shall normally appoint each member for a three-year term. Appointments may be renewed for additional terms. Members shall act in their personal and professional capacity, and not as representatives of their countries, agencies or institutions. The Commission shall appoint Canadian and United States co-chairs of the Board and will strive to appoint chairs with complementary expertise that encompasses a broad spectrum of basin issues.

11. The co-chairs of the Board shall be responsible for maintaining proper liaison between the Board and the Commission, and among the Board members.

12. The co-chairs shall ensure that members of the Board are informed of all instructions, inquiries, and authorizations received from the Commission and also of activities undertaken by or on behalf of the Board, progress made, and any developments affecting such progress.

13. The co-chairs may appoint secretaries of the Board who, under the general supervision of the co-chairs, shall carry out such duties as are assigned by the co-chairs or the Board as a whole.

14. The Board may establish such committees and working groups as may be required to fulfill its responsibilities in a knowledgeable and effective manner. The Commission shall be kept informed of the duties and composition of any committee or working group.

15. Unless other arrangements are made with the Commission, members of the Board, committees, or working groups shall make their own arrangements for reimbursement of necessary expenditures for travel or other related expenses.

16. The Board shall inform the Commission in advance of plans for any meetings, or other means of involving the public in Board deliberations, and shall report to the Commission, in a timely manner, on these and any other presentations or representations made to the Board.

17. The Board shall conduct its public outreach activities in accordance with the Commission's public information policies and shall maintain files in accordance with the Commission policy on segregation of documents.

18. Prior to their release, the Board shall provide the text of media releases and other public information materials to the Secretaries of the Commission for review by the Commission's Public Information Officers.

19. The Board shall submit an annual report covering all of its activities, including the annual report regarding the Program, as described in Section 7 (ii) and (iii) above, to the Commission, at least three weeks in advance of the Commission's fall semi-annual meeting, and the Board shall submit other reports as the Commission may request or the Board may feel appropriate in keeping with this Directive. Reports shall be submitted in a format suitable for public release and electronic copies shall be provided to each of the Commission's section offices.

20. Reports, including annual reports, minutes and correspondence of the Board shall, normally, remain privileged and be available only to the Commission and to members of the Board and its committees until their release has been authorized by the Commission. The Board shall provide minutes of Board meetings to the Commission within 45 days of the close of the meeting in keeping with the Commission's April 2002 Policy Concerning Public Access to Minutes of Meetings. The minutes will subsequently be put on the Commission's web site.

21. If, in the opinion of the Board or of any member, any instruction, directive, or authorization received from the Commission lacks clarity or precision, the matter shall be referred promptly to the Commission for appropriate action.

22. The Board shall operate by consensus. In the event of any disagreement among the members of the Board which they are unable to resolve, the Board shall refer the matter forthwith to the Commission for decision.

23. The Commission may amend existing instructions or issue new instructions to the Board at any time.

Signed this ______day of __________, 2006

Elizabeth Bourget	Murray Clamen
Secretary	Secretary
United States Section	Canadian Section

Appendix A
to the
Directive to the International Souris River Board

Interim Measures As Modified For
Apportionment of the Souris River

By letters dated March 20, 1959 and April 3, 1959, respectively, the Commission was advised that the governments of Canada and the United States approved the apportionment arrangements for the Souris River contained in paragraph 22 of the March 19, 1958 report to the Governments of the United States and Canada concerning the Souris River. The measures became known as the 1959 Interim Measures, and the Commission was assigned responsibility for ensuring compliance with them. Article VII of the 1989 Agreement Between the Government of Canada and the Government of the United States of America For The Water Supply And Flood Control In The Souris River modified paragraph 1 of the 1959 Interim Measures. The measures were further modified by the governments in December 2000. The 'Interim Measures As Modified' are as follows:

From Canada-United States Exchange of Letters December 22, 2000:

1. The Province of Saskatchewan shall have the right to divert, store, and use waters which originate in the Saskatchewan portion of the Souris River basin, provided that such diversion, storage, and use shall not diminish the annual flow of the river at the Sherwood Crossing more than 50 percent of that which would have occurred in a state of nature, as calculated by the International Souris River Board of Control[1] (the Board). For the purpose of these calculations, any reference to "annual" and "year" is intended to mean the period January 1 through December 31.

   For the benefit of riparian users of water between the Sherwood Crossing and the upstream end of Lake Darling, the Province of Saskatchewan shall, so far as is practicable, regulate its diversion, storage, and uses in such a manner that the flow in the Souris River channel at the Sherwood Crossing shall not be less than 0.113 cubic metres per second (4 cubic feet per second) when that much flow would have occurred under the conditions of water use development prevailing in the Saskatchewan portion of the Souris River basin prior to construction of the Boundary Dam, Rafferty Dam and Alameda Dam.

   Under certain conditions, a portion of the North Dakota share will be in the form of evaporation from Rafferty and Alameda Reservoirs. During years when these conditions occur, the minimum amount of flow actually passed to North Dakota will be 40 percent of the annual natural flow volume at the Sherwood Crossing. This lesser amount is in recognition of Saskatchewan's operation of Rafferty Dam and Alameda Dam for flood control in North Dakota and of evaporation as a result of the project.

[1] In April 2000, the International Joint Commission renamed the Board the International Souris River Board. Any reference hereafter to the International Souris River Board of Control refers to the International Souris River Board.

(a) Saskatchewan will deliver a minimum of 50 percent of the annual natural flow volume at the Sherwood Crossing in every year except in those years when the conditions given in (i) or (ii) below apply. In those years, Saskatchewan will deliver a minimum of 40 percent of the annual natural flow volume at the Sherwood Crossing.

(i) The annual natural flow volume at Sherwood Crossing is greater than 50 000 cubic decametres (40 500 acre-feet) and the current year June 1 elevation of Lake Darling is greater than 486.095 metres (1594.8 feet); or

(ii) The annual natural flow volume at Sherwood Crossing is greater than 50 000 cubic decametres (40 500 acre-feet) and the current year June 1 elevation of Lake Darling is greater than 485.79 metres (1593.8 feet), and since the last occurrence of a Lake Darling June 1 elevation of greater than 486.095 metres (1594.8 feet) the elevation of Lake Darling has not been less than 485.79 metres (1593.8 feet) on June 1.

(b) Notwithstanding the annual division of flows that is described in (a), in each year Saskatchewan will, so far as is practicable as determined by the Board, deliver to North Dakota prior to June 1, 50 percent of the first 50 000 cubic decameters (40 500 acre-feet) of natural flow which occurs during the period January 1 to May 31. The intent of this division of flow is to ensure that North Dakota receives 50 percent of the rate and volume of flow that would have occurred in a state of nature to try to meet existing senior water rights.

(c) Lake Darling Reservoir and the Canadian reservoirs will be operated (insofar as is compatible with the Projects' purposes and consistent with past practices) to ensure that the pool elevations, which determine conditions for sharing evaporation losses, are not artificially altered. The triggering elevation of 485.79 metres (1593.8 feet) for Lake Darling Reservoir is based on existing water uses in North Dakota, including refuges operated by the U.S. Fish and Wildlife Service. Each year, operating plans for the refuges on the Souris River will be presented to the Board. Barring unforeseen circumstances, operations will follow said plans during each given year. Lake Darling Reservoir will not be drawn down for the sole purpose of reaching the elevation of 485.79 metres (1593.8 feet) on June 1.

Releases will not be made by Saskatchewan Water Corporation from the Canadian reservoirs for the sole purpose of raising the elevation of Lake Darling Reservoir above 486.095 metres (1594.8 feet) on June 1.

(d) Flow releases to the United States should occur (except in flood years) in the pattern which would have occurred in a state of nature. To the extent possible and in consideration of potential channel losses and operating efficiencies, releases from the Canadian dams will be scheduled to coincide with periods of beneficial use in North Dakota. Normally, the period of beneficial use in North Dakota coincides with the timing of the natural hydrograph, and that timing should be a guide to releases of the United States portion of the natural flow.

(e) A determination of the annual apportionment balance shall be made by the Board on or about October 1, of each year. Any shortfall that exists as of that date shall be delivered by Saskatchewan prior to December 31.

(f) The flow release to the United States may be delayed when State of North Dakota determines and notifies Saskatchewan through the Board that the release would not be of benefit to the State at that time. The delayed release may be retained for use in Saskatchewan, notwithstanding the 0.113 cubic metres per second (4 cubic feet per second) minimum flow limit, unless it is called for by the State of North Dakota through the Board before October 1 of each year. The delayed release shall be measured at the point of release and the delivery at Sherwood Crossing shall not be less than the delayed release minus the conveyance losses that would have occurred under natural conditions between the point of release and the Sherwood Crossing. Prior to these releases being made, consultations shall occur between the Saskatchewan Water Corporation, the U.S. Fish and Wildlife Service, and the State of North Dakota. All releases will be within the specified target flows at the control points.

From paragraph 22 of March 19, 1958 IJC report:

2. Except as otherwise provided herein with respect to delivery of water to the Province of Manitoba, the State of North Dakota shall have the right to divert, store, and use the waters which originate in the North Dakota portion of the Souris River basin together with the waters delivered to the State of North Dakota at the Sherwood Crossing under Recommendation (1) above; provided, that any diversion, use, or storage of Long Creek water shall not diminish the annual flow at the eastern crossing of Long Creek into Saskatchewan below the annual flow of said Creek at the western crossing into North Dakota.

3. (a) In addition to the waters of the Souris River basin which originate in the Province of Manitoba, that Province shall have the right, except during periods of severe drought, to receive for its own use and the State of North Dakota shall deliver from any available source during the months of June, July, August, September, and October of each year, six thousand and sixty-nine (6,069) acre-feet of water at the Westhope Crossing regulated so far as practicable at the rate of twenty (20) cubic feet per second except as set forth hereinafter: provided, that in delivering such water to Manitoba no account shall be taken of water crossing the boundary at a rate in excess of the said 20 cubic feet per second.

(b) In periods of severe drought when it becomes impracticable for the State of North Dakota to provide the foregoing regulated flows, the responsibility of the State of North Dakota in this connection shall be limited to the provision of such flows as may be practicable, in the opinion of the said Board of Control, in accordance with the objective of making water available for human and livestock consumption and for household use. It is understood that in the circumstances contemplated in this paragraph the State of North Dakota will give the earliest possible advice to the International Souris River Board of Control with respect to the onset of severe drought conditions.

4. In event of disagreement between the two sections of the International Souris River Board of Control, the matters in controversy shall be referred to the Commission for decision.

5. The interim measures for which provision is herein made shall remain in effect until the adoption of permanent measures in accordance with the requirements of questions (1) and (2) of the Reference of January 15 1940, unless before that time these interim measures are qualified or modified by the Commission.

COMPATIBILITY DETERMINATION
for
Prescribed Grazing on
National Wildlife Refuges and Waterfowl Production Areas
for Management Purposes

Use: Prescribed grazing on National Wildlife Refuges and Waterfowl Production Areas in North and South Dakota.

Station Names:

South Dakota Refuges and Wetland Management Districts:

Lake Andes NWR and WMD, SD
Madison WMD, SD
Huron WMD, SD
Waubay NWR and WMD, SD
Sand Lake NWR and WMD, SD
LaCreek NWR and WMD, SD

North Dakota Refuges and Wetland Management Districts:

Tewaukon NWR and WMD, ND
Kulm WMD, ND
Arrowwood NWR and WMD, ND
Valley City WMD, ND
Chase Lake NWR and WMD, ND
Audubon NWR and WMD, ND
Long Lake NWR and WMD, ND
J Clark Salyer NWR and WMD, ND
Devils Lake WMD, ND
Lostwood NWR and WMD, ND
Crosby WMD, ND
Des Lacs NWR, ND
Upper Souris NWR, ND

Establishing and Acquisition Authorities:

Arrowwood NWR; Executive Order (E.O.) 7168, Sept. 4, 1935
Audubon NWR; 16 USC $664 (Fish and Wildlife Coord. Act)
Chase Lake NWR; E.O. 932, Aug. 28, 1908
Des Lacs NWR; E.O. 7154-A, Aug. 22, 1935
Florence Lake NWR; E.O. 8119, May 10, 1939

Kellys Slough NWR; E.O. 7320, Mar. 19, 1936
Lake Alice NWR; 16 USC $ 715d (Mig. Bird Cons. Act)
Lake Ilo NWR; E.O. 8154, June 12, 1939
Lake Nettie NWR; E. O. 8155, June 12, 1939
Lake Zahl NWR; E. O. 8158, June 12, 1939
Long Lake NWR; E.O. 5808, Feb. 25, 1932
Lostwood NWR; E.O. 7171, Sept. 4, 1935
McLean NWR; 16 USC $ 715d (Mig. Bird Cons. Act)
Slade NWR; 16 USC 715d (Mig. Bird Cons. Act)
Sullys Hill NGP; E. O. 3596, Dec. 22, 1921
Tewaukon NWR; Public Land Order (PLO) 286, June 26, 1945
Upper Souris NWR; E.O. 7161, Aug. 27, 1935

LaCreek NWR; E.O. 7160, Aug. 26, 1935
Lake Andes NWR; E. O. 7292, Feb. 14, 1936
Sand Lake NWR; E. O. 7169, Sept. 4, 1935
Waubay NWR; E. O. 7245, Dec. 10, 1935

Waterfowl Production Areas, Wetland Easements, Grassland Easements - The Migratory Bird Hunting and Conservation Stamp Act, March 16, 1934, (16 USC Sec. 718-718h, 48 Stat. 452) as amended August 1, 1958, (PL 85-585; 72 Stat. 486) for acquisition of "Waterfowl Production Areas"; the Wetlands Loan Act, October 4, 1961, as amended (16 USC 715k-3 - 715k-5, Stat. 813), funds appropriated under the Wetlands Loan Act are merged with duck stamp receipts in the fund and appropriated to the Secretary for the acquisition of migratory bird refuges under the provisions of the Migratory Bird Conservation Act, February 18, 1929, (16 USC Sec. 715, 715d - 715r, as amended.

Refuge Purpose(s):

The Executive Orders for most of the refuges state the purpose "as a refuge and breeding ground for migratory birds and other wildlife."

"...as Waterfowl Production Areas" subject to "...all of the provisions of such Act [Migratory Bird Conservation Act] ...except the inviolate sanctuary provisions..." 16 USC 718(c) (Migratory Bird Hunting and Conservation Stamp)

"...for any other management purpose, for migratory birds." 16 USC 715d (Migratory Bird Conservation Act)

National Wildlife Refuge System Mission:

"The Mission of the National Wildlife Refuge System is to administer a national network

"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" (National Wildlife Refuge System Administration Act of 1966, as amended) [16 USC 668(dd)-668(ee)].

Description of Use:

Prescribed grazing is the use of livestock, usually cattle, to remove standing vegetation, reduce vegetative litter, suppress woody vegetation or noxious weeds, open up vegetation-choked wetlands, or open up areas to sunlight and encourage native grass seedlings and growth. Prescribed grazing is carefully timed, and usually of short duration (usually 2-4 weeks), to target certain species for grazing impacts in order to benefit other species for growth after the competing vegetation has been removed.

The prescribed grazing period generally will take place between April and September. Early spring grazing (mid-April through late May) is targeted at cool season exotic species and encourages warm season native grasses and forbs. Mid-season grazing (June and July), especially on non-native grasslands, stimulates fall regrowth. Late-season grazing (August and September) removes litter and encourages spring growth of cool season natives or other cool season species.

Fence construction and maintenance, often temporary electric fence, and control and rotation of the livestock, are the responsibility of cooperating private party. Market rate grazing fees are determined by the Regional Office, but may include standard deductions for fence construction and maintenance, frequent livestock rotations, construction of water gaps, or hauling/providing additional water in dry pastures.

The frequency and duration of prescribed grazing on any Refuge or WPA will be based on site-specific evaluations of the grassland being managed.

Availability of Resources:

Developing grazing plans and Special Use Permits (SUPs) and monitoring compliance and biological effects requires some Service resources. Most grazing management costs; fencing labor, monitoring and moving the livestock, hauling water; are provided by the cooperator or permittee. Evaluating the grasslands for grazing prescriptions and grassland response is already a part of the stations grassland management responsibilities. Some alternative form of grassland management, prescribed burning or haying, may be used if the areas are not treated with prescribed grazing. Managing grasslands through permitted haying has comparable costs to managing a prescribed grazing program. Managed mowing is more expensive since all the labor costs are assumed by the Service. Prescribed burning can be an effective grassland management tool, but there are personnel and weather limitations on a burning program, as well the fact the some tracts are just not suited to burning management. In addition, there is an ecological benefit to rotating grassland management techniques, such as grazing, burning, and haying, at different seasons, rather than just relying on one technique.

Anticipated Impacts of the Use:

Grazing by domestic livestock has the short-term effect of removing some or much of the standing vegetation from a tract of grassland. Properly prescribed, the effect of this removal of vegetation increases the vigor of the grassland, stimulates the growth of desired species of grass and forbs, and reduces the abundance of targeted species such as cool season exotics, woody species, noxious weeds or invasive species, or cattails. Grazing in the spring may cause the loss of some bird nests due to trampling, and may cause some birds not to nest in areas being grazed. Grazing on public wildlife lands can create an aesthetic issue of concern for some people or visitors who do not understand grassland management. Prescribed grazing is usually of short duration and enhanced, most diverse and vigorous grassland habitats are the end result. Grazing livestock may create a minor and temporary disturbance to wildlife but generally do no harm. There is a slight potential for conflict between the visiting public and the livestock or the permittee, particularly during fall hunting seasons. These situations can be limited by having the livestock removed by the anticipated beginning of fall hunting seasons.

In 2004, prescribed grazing occurred on approximately 17,500 acres of Refuges and WPAs in South Dakota (202,000 fee acres). During the 1996-2000 period, approximately 39,700 acres of grasslands on North Dakota Refuges and WPAs (470,000 fee acres) were treated annually by prescribed grazing treatments.

To eliminate any appearance of favoritism or impropriety, managers should follow Refuge Manual procedures for cooperator or permittee selection.

Public Review and Comment:

The period of public review and comment began May 1, 2005 and ended on May 14, 2005.

Notices were posted in public places at each of the field stations listed on this Compatibility Determination. This method was selected because the proposed activity is considered minor, incidental, infrequent, with only short-term disturbance.

Determination:

Compatibility Threshold: As this activity is an economic use, it must meet the compatibility threshold of "contributing to the Mission and Purposes" of the Refuge System and the Refuge Area. Prescribed grazing is used to improve and manage grassland habitats on Refuges and Waterfowl Production Areas and the migratory birds and other wildlife that use these habitats.

__________ Use is Not Compatible

__XXX____Use is Compatible with the Following Stipulations

Stipulations Necessary to Ensure Compatibility:

1. SUPs will specify the stocking rate, dates of use, and timing for each unit or grazing cell on the Refuge or WPA.

2. The standard grazing fee, as determined for each state by the Regional Office. and any standard deductions for any labor or work done on the Service lands will be included on the SUP.

3. Grazing permittees must comply with all applicable State Livestock Health laws.

4. No supplemental feeding will be allowed without authorization from the Project Leader/Manager.

5. Control and confinement of livestock will be the responsibility of the permittee.

6. The permit is issued subject to the revocation and appeals procedure contained in Title 50, Part 25 of the Code of Federal Regulations.

Justification:

Controlled grazing by domestic livestock will not materially interfere or detract from the purposes for which these NWRS lands were acquired or established. Prescribed livestock grazing creates temporary disturbances to vegetation. Many of these disturbances are desirable for grassland management. Grazing produces an undesirable but short-term impact to grassland nesting birds and site aesthetics. In the long-term, prescribed grazing increases grassland vigor, species diversity, and habitat quality. Prescribed grazing is an alternative management tool that can be used to replace or complement prescribed burning, mowing, or haying of Service grasslands. Without periodic disturbance caused by haying, burning, or grazing, the health of the grassland community would decline, as would an areas potential for waterfowl and other migratory bird nesting.

Mandatory 10-Year Reevaluation Date: 10 years from the date of APPROVAL signature

Signatures:

Submitted:

Michael Bryant 4/26/05

Michael Bryant, Project Leader
Lake Andes Complex
Date

Thomas R. Tornow 4-26-05

Tom Tornow, Project Leader
Madison WMD
Date

Harris J. Hoistad 4-26-05

Harris Hoistad, Project Leader
Huron WMD
Date

Larry D. Martin 26 april 2005

Larry Martin, Project Leader
Waubay Complex
Date

Eugene Williams 4-26-05

Gene Williams, Project Leader
Sand Lake Complex
Date

Tom Koerner 4-26-05

Tom Koerner, Project Leader
LaCreek Complex
Date

Jack Lalor 4/26/05

Jack Lalor, Acting Project Leader
Tewaukon Complex
Date

David A. Azure 4/26/05

Dave Azure, Acting Project Leader
Kulm WMD
Date

Kim Hanson 4/26/05

Kim D. Hanson, Project Leader
Arrowwood NWR
Chase Lake WMD
Valley City WMD
Date

Gary Williams, Acting Project Leader
Audubon Complex

Date 4/26/05

Paul Van Ningen, Project Leader
Long Lake Complex

Date 4/26/05

Tedd Gutzke, Project Leader
J Clark Salyer Complex

Date April 26, 2005

Roger Hollevoet, Project Leader
Devils Lake Complex

Date 4/26/05

Fred G. Giese, Project Leader
Des Lacs NWR
Lostwood WMD
Crosby WMD

Date 04/26/05

Dean Knauer, Project Leader
Upper Souris NWR

Date 4-27-05

Review:

Lloyd Jones
Regional Compatibility Coordinator

Date 4.27.05

Rod Krey
Refuge Supervisor, ND-SD

Date 4/28/05

Approval: Ron Shupe
Ronald D. Shupe, Region 6
Acting Chief of Refuges

May 15, 2005
Date

Appendix M

Compatibility Determination for Prescribed Haying

COMPATIBILITY DETERMINATION
for
Prescribed Haying of Grasslands
on National Wildlife Refuges and Waterfowl Production Areas
for Management Purposes

Use: Prescribed Haying of Grasslands on National Wildlife Refuges and Waterfowl Production Areas in North and South Dakota.

Station Names:

South Dakota Refuges and Wetland Management Districts:

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Madison WMD, SD
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Waubay NWR and WMD, SD
Sand Lake NWR and WMD, SD
LaCreek NWR and WMD, SD

North Dakota Refuges and Wetland Management Districts:

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Kulm WMD, ND
Arrowwood NWR and WMD, ND
Valley City WMD, ND
Chase Lake NWR and WMD, ND
Audubon NWR and WMD, ND
Long Lake NWR and WMD, ND
J Clark Salyer NWR and WMD, ND
Devils Lake WMD, ND
Lostwood NWR and WMD, ND
Crosby WMD, ND
Des Lacs NWR, ND
Upper Souris NWR, ND

Establishing and Acquisition Authorities:

Arrowwood NWR; Executive Order (E.O.) 7168, Sept. 4, 1935
Audubon NWR; 16 USC $664 (Fish and Wildlife Coord. Act)
Chase Lake NWR; E.O. 932, Aug. 28, 1908
Des Lacs NWR; E.O. 7154-A, Aug. 22, 1935
Florence Lake NWR; E.O. 8119, May 10, 1939

J. Clark Salyer NWR; E.O. 7170, Sept. 4, 1935
Kellys Slough NWR; E.O. 7320, Mar. 19, 1936
Lake Alice NWR; 16 USC $ 715d (Mig. Bird Cons. Act)
Lake Ilo NWR; E.O. 8154, June 12, 1939
Lake Nettie NWR; E. O. 8155, June 12, 1939
Lake Zahl NWR; E. O. 8158, June 12, 1939
Long Lake NWR; E.O. 5808, Feb. 25, 1932
Lostwood NWR; E.O. 7171, Sept. 4, 1935
McLean NWR; 16 USC $ 715d (Mig. Bird Cons. Act)
Slade NWR; 16 USC 715d (Mig. Bird Cons. Act)
Sullys Hill NGP; E. O. 3596, Dec. 22, 1921
Tewaukon NWR; Public Land Order (PLO) 286, June 26, 1945
Upper Souris NWR; E.O. 7161, Aug. 27, 1935

LaCreek NWR; E.O. 7160, Aug. 26, 1935
Lake Andes NWR; E. O. 7292, Feb. 14, 1936
Sand Lake NWR; E. O. 7169, Sept. 4, 1935
Waubay NWR; E. O. 7245, Dec. 10, 1935

Waterfowl Production Areas, Wetland Easements, Grassland Easements - The Migratory Bird Hunting and Conservation Stamp Act, March 16, 1934, (16 USC Sec. 718-718h, 48 Stat. 452) as amended August 1, 1958, (PL 85-585; 72 Stat. 486) for acquisition of "Waterfowl Production Areas"; the Wetlands Loan Act, October 4, 1961, as amended (16 USC 715k-3 - 715k-5, Stat. 813), funds appropriated under the Wetlands Loan Act are merged with duck stamp receipts in the fund and appropriated to the Secretary for the acquisition of migratory bird refuges under the provisions of the Migratory Bird Conservation Act, February 18, 1929, (16 USC Sec. 715, 715d - 715r, as amended.

<u>Refuge Purpose(s)</u>:

The Executive Orders for most of the refuges state the purpose "as a refuge and breeding ground for migratory birds and other wildlife."

"...as Waterfowl Production Areas" subject to "...all of the provisions of such Act [Migratory Bird Conservation Act] ...except the inviolate sanctuary provisions..." 16 USC 718(c) (Migratory Bird Hunting and Conservation Stamp)

"...for any other management purpose, for migratory birds." 16 USC 715d (Migratory Bird Conservation Act)

<u>National Wildlife Refuge System Mission</u>:

"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" (National Wildlife Refuge System Administration Act of 1966, as amended) [16 USC 668(dd)-668(ee)].

Description of Use:

Haying is the cutting and removal, by baling and transport to an off-site location, of grass or other upland vegetation for the production of livestock forage. Haying for this purpose is typically done by a cooperating farmer acting under authority of a Cooperative Farming Agreement or Special Use Permit (SUP) issued by the Project Leader, Refuge Manager or Wetland District Manager.

Haying is an effective management tool as part of an overall grassland management plan to improve and maintain Fish and Wildlife Service (Service)-managed grasslands for the benefit of migratory birds and other wildlife. Grasslands require periodic renovation to maintain vigor, diversity, and the structure necessary for migratory bird nesting. Haying can be an alternative to prescribed burning or grazing, which are the two other methods used to manage grassland habitats. If local conditions preclude the use of prescribed fire, or livestock numbers are not available, removal of biomass through haying serves to reduce unwanted overstory, reduce woody plant invasion, and open the soil surface up to sunlight. Such removal of vegetation allows for more vigorous regrowth of desirable species following the haying although results are neither as dramatic nor positive as with fire or grazing.

Haying may also be used as part of a native grass seeding strategy on newly acquired lands or on tame grass stands on older lands needing renovation. To reduce weed or undesirable species competition and minimize herbicide applications, a cooperating farmer may be used to seed the native grass seed mix and interseed with a cover crop. As a requirement of the SUP, the cooperator would be required to cut. bale, and remove the cover crop before it matures and goes to seed. The resultant hay can be used for livestock feed and haying serves the biological purpose of releasing young native grass and forb seedlings for growth with minimal competition.

A third possible use of haying on FWS-managed grasslands involves the initial steps of removing unwanted vegetation prior to seeding the tract to native grasses. Haying of a nonnative cool season stand of grass is an effective step in advance of spraying the field with herbicide to kill all existing vegetation. Removal of the heavy grass overstory by haying allows the herbicide to more effectively reach and treat the remaining target plants. Better removal of the unwanted grasses will in turn ensure better success of the planted grasses and forbs whether they are interseeded into the sod or into the soil turned over and leveled prior to seeding.

Haying is sometimes used prior to a noxious weed treatment; the tract is hayed and after a period of time, the "flush" of noxious weeds is treated with a herbicide application. Removing the vegetation through haying allows the herbicide to more effectively reach and treat the target weeds.

A more limited application of haying on FWS-managed lands involves its use for establishing fire breaks for prescribed burning. A cooperative farmer would be permitted to hay the firebreak strips in the fall. That area would then have little standing dead vegetation in the early spring, or would green up earlier in the spring and allow use as a fire break.

Prescribed haying in North Dakota averaged about 13,500 acres per year (1996-2000). In South Dakota, FWS managers use prescribed haying on about 2450 acres annually (2004 estimates).

Availability of Resources:

Financial and staff resources are determined to be sufficient at each field station to administer these requests. Staff time will be needed to evaluate the proposed use, to prepare the site-specific SUPs, and to insure compliance with the permit authorization and stipulations necessary to insure compatibility.

To lessen any appearance of favoritism or impropriety, managers should follow Refuge Manual procedures for establishing rental rates and cooperator selection.

Anticipated Impacts of the Use:

Haying will result in short-term disturbances to wildlife and long-term benefits to grasslands and the wildlife species that use these grasslands. Short-term impacts will include disturbance and displacement of wildlife typical of any noisy heavy equipment operation. Cutting and removal of standing grass will result in the short-term loss (late-summer to mid-summer the following year of habitat for those species requiring taller grass for feeding and perching. Prescribed haying will typically be scheduled after July 31 to avoid impacts to most nesting birds. Long-term benefits will accrue due to the increased vigor of the regrown grasses or the establishment of highly desirable native grass and forb species, which will improve habitat conditions for the same species affected by the short-term removal of the cover. Longer-term negative impacts may occur to some resident wildlife species such as pheasant that may lose overwinter habitat in hayed areas. Strict time constraints, and limiting grass stands to no more than 50 percent being hayed at any one time will limit the anticipated impacts to these areas.

Public Review and Comment:

The period of public review and comment began May 1, 2005 and ended on May 14, 2005.

Notices were posted in public places at each of the field stations listed on this Compatibility Determination. This method was selected because the proposed activity is considered minor, incidental, infrequent, with only short-term disturbance.

Determination:

Compatibility Threshold: As this activity is an economic use, it must meet the compatibility threshold of "contributing to the Mission and Purposes" of the Refuge System and the Refuge Area. Prescribed haying is used to benefit Refuge and Waterfowl Production Area grasslands and the migratory birds and other wildlife that use these grasslands.

__________ Use is Not Compatible

__XXX____Use is Compatible with the Following Stipulations

Stipulations Necessary to Ensure Compatibility:

1. Prescribed haying will generally not take place before August 1 in any given year, unless there are documented management reasons for prescribing an earlier hay date.

2. The permit is issued subject to the revocation and appeals procedure contained in Title 50, Part 25 of the Code of Federal Regulations.

3. Generally, not more than 50 percent of a tract may be hayed in any one year, unless size restrictions or habitat conditions warrant haying of more than half of the area.

4. Prescribed haying can be coupled with a light discing or dragging operation, or an interseeding of desirable species of grass or legumes to further increase the vigor of the grass stand.

5. Bales or stacks must be removed from the area by September 10.

Justification:

Haying will not materially interfere with or detract from the purposes for which these NWRS lands were acquired or established. Haying creates temporary disturbance to vegetation. This disturbance is desirable for grassland management. Haying produces an undesirable but short-term impact to grassland nesting birds and site aesthetics. In the long-term, haying increases grassland vigor, species diversity, and habitat quality. Haying is an alternative management tool that can be used to replace or compliment prescribed burning, mowing, or grazing of Service grasslands. Without periodic disturbance caused by haying, burning, or grazing, the health of the grassland community would decline, as would an areas potential for waterfowl and other migratory bird nesting.

Mandatory 10-Year Reevaluation Date: 10 years from the date of APPROVAL signature

Signatures:

Submitted:

Michael Bryant, Project Leader Lake Andes Complex	4/26/05 Date
Tom Tornow, Project Leader Madison WMD	4-26-05 Date
Harris Hoistad, Project Leader Huron WMD	4-26-05 Date
Larry Martin, Project Leader Waubay Complex	26 April 2005 Date
Gene Williams, Project Leader Sand Lake Complex	4-26-05 Date
Tom Koerner, Project Leader LaCreek Complex	4-26-05 Date

4/26/05

Jack Lalor, Acting Project Leader
Tewaukon Complex — Date

4/26/05

Dave Azure, Acting Project Leader
Kulm WMD — Date

4/26/05

Kim D. Hanson, Project Leader
Arrowwood Complex
Chase Lake WMD
Valley City WMD — Date

4/26/05

Gary Williams, Acting Project Leader
Audubon Complex — Date

4/26/05

Paul Van Ningen, Project Leader
Long Lake Complex — Date

April 26, 2005

Tedd Gutzke, Project Leader
J Clark Salyer Complex — Date

4/26/05

Roger Hollevoet, Project Leader
Devils Lake Complex — Date

04/26/05

Fred G. Giese, Project Leader
Des Lacs NWR
Lostwood WMD
Crosby WMD — Date

04-27-05

Dean Knauer, Project Leader
Upper Souris NWR — Date

Review:

Lloyd Jones — 4-27-05
Lloyd Jones — Date
Regional Compatibility Coordinator

Rodney R. Krey — 4/28/05
Rod Krey — Date
Refuge Supervisor, ND-SD

Approval:

Ron Shupe — May 15, 2005
Ronald D. Shupe, Region 6 — Date
Acting Chief of Refuges

Appendix N

Compatibility Determination for the Cooperative Farming Program

COMPATIBILITY DETERMINATION
for
the Cooperative Farming Program on
National Wildlife Refuges and Waterfowl Production Areas
for Management Purposes

Use: Cooperative farming on National Wildlife Refuges and Waterfowl Production Areas in North and South Dakota.

Station Names:

South Dakota Wetland Management Districts:

Lake Andes NWR and WMD, SD
Madison WMD, SD
Huron WMD, SD
Waubay NWR and WMD, SD
Sand Lake NWR and WMD, SD
LaCreek NWR and WMD, SD

North Dakota Wetland Management Districts:

Tewaukon NWR and WMD, ND
Kulm WMD, ND
Arrowwood NWR and WMD, ND
Valley City WMD, ND
Chase Lake NWR and WMD, ND
Audubon NWR and WMD, ND
Long Lake NWR and WMD, ND
J Clark Salyer NWR and WMD, ND
Devils Lake WMD, ND
Lostwood NWR and WMD, ND
Crosby WMD, ND
Des Lacs NWR, ND
Upper Souris NWR, ND

Establishing and Acquisition Authorities:

Arrowwood NWR; Executive Order (E.O.) 7168, Sept. 4, 1935
Audubon NWR; 16 USC $664 (Fish and Wildlife Coord. Act)
Chase Lake NWR; E.O. 932, Aug. 28, 1908
Des Lacs NWR; E.O. 7154-A, Aug. 22, 1935
Florence Lake NWR; E.O. 8119, May 10, 1939
J. Clark Salyer NWR; E.O. 7170, Sept. 4, 1935

Kellys Slough NWR; E.O. 7320, Mar. 19, 1936
Lake Alice NWR; 16 USC $ 715d (Mig. Bird Cons. Act)
Lake Ilo NWR; E.O. 8154, June 12, 1939
Lake Nettie NWR; E. O. 8155, June 12, 1939
Lake Zahl NWR; E. O. 8158, June 12, 1939
Long Lake NWR; E.O. 5808, Feb. 25, 1932
Lostwood NWR; E.O. 7171, Sept. 4, 1935
McLean NWR; 16 USC $ 715d (Mig. Bird Cons. Act)
Slade NWR; 16 USC 715d (Mig. Bird Cons. Act)
Sullys Hill NGP; E. O. 3596, Dec. 22, 1921
Tewaukon NWR; Public Land Order (PLO) 286, June 26, 1945
Upper Souris NWR; E.O. 7161, Aug. 27, 1935

LaCreek NWR; E.O. 7160, Aug. 26, 1935
Lake Andes NWR; E. O. 7292, Feb. 14, 1936
Sand Lake NWR; E. O. 7169, Sept. 4, 1935
Waubay NWR; E. O. 7245, Dec. 10, 1935

Waterfowl Production Areas, Wetland Easements, Grassland Easements - The Migratory Bird Hunting and Conservation Stamp Act, March 16, 1934, (16 USC Sec. 718-718h, 48 Stat. 452) as amended August 1, 1958, (PL 85-585; 72 Stat. 486) for acquisition of "Waterfowl Production Areas"; the Wetlands Loan Act, October 4, 1961, as amended (16 USC 715k-3 - 715k-5, Stat. 813), funds appropriated under the Wetlands Loan Act are merged with duck stamp receipts in the fund and appropriated to the Secretary for the acquisition of migratory bird refuges under the provisions of the Migratory Bird Conservation Act, February 18, 1929, (16 USC Sec. 715, 715d - 715r, as amended.

Refuge Purpose(s):

The Executive Orders for most of the refuges state the purpose "as a refuge and breeding ground for migratory birds and other wildlife."

"...as Waterfowl Production Areas" subject to "...all of the provisions of such Act [Migratory Bird Conservation Act] ...except the inviolate sanctuary provisions..." 16 USC 718(c) (Migratory Bird Hunting and Conservation Stamp)

"...for any other management purpose, for migratory birds." 16 USC 715d (Migratory Bird Conservation Act)

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" (National Wildlife Refuge System Administration Act of 1966, as amended) [16 USC 668(dd)-668(ee)].

Description of Use:

Cooperative farming is the term used for cropping activities done by a third party on lands that are owned in fee-title by the U. S. Fish and Wildlife Service (Service) or controlled by the Service through a conservation easement (wetland, grassland, or FmHA). This activity is usually done on a short-term basis (3-4 years or less) to provide an optimum seed bed for the establishment of native grasses and forbs or other more desirable planted cover for wildlife. Cooperative farming may also be used on certain tracts to provide a fall food source for migratory waterfowl or a winter food source for resident wildlife.

The farming is done under the terms and conditions of a Cooperative Farming Agreement or Special Use Permit (SUP) issued by the Project Leader, Refuge Manager, or Wetland District Manager. Terms of the agreement insure that all current Service and District restrictions are followed.

Cooperative farming activities are generally limited to areas of former cropland or poor quality stands of tame or cool season exotic grasses. Service policies do not allow highly erodible soils to be tilled or cropped without an approved NRCS Conservation Plan. Waterfowl Production Areas (WPAs) in the Dakotas average about 200 acres in size. Generally, areas to be cooperatively farmed at one time prior to reseeding to more desirable plant species will not be more than 50 percent of the tract. Areas on WPAs and Refuges planted for food plots will be limited to the size needed to provide sufficient food for the targeted wildlife species.

Availability of Resources:

Staff time for development and administration of Cooperative Farming Agreements is already available. Most of the needed field work to prepare and plan for this use would be done as part of routine grassland management duties. The decision to use a cooperating farmer would occur as part of the overall strategy for managing lands on the Refuge or within the WMD. The additional time needed to coordinate issuance of the SUP or Cooperative Farming Agreement and oversight of the permit is relatively minor and within Refuge or WMD resources. In addition, the use of a cooperating farmer frees up other staff time from conducting the farming operation through force account.

Cooperative farming of Service lands in most cases is done on a share basis rather than for a fee. The Service typically receives its share as harvested grain used for other management purposes, as standing grain left for wildlife food, or as additional work such as weed control, cultivation, or additional seed bed preparation, or for supplies such as herbicide or grass seed to be used on the same tract of land. Any fees or cash income received by the Service would be deposited in the Refuge Revenue Sharing Account. The Service will receive fair market value consideration from cooperating farmers, but the generation of income is a secondary consideration when developing the terms and conditions of a cooperative farming agreement or SUP.

To lessen any appearance of favoritism or impropriety, managers should follow Refuge Manual procedures for establishing rental rates and cooperator selection.

Anticipated Impacts of the Use:

Cooperative farming to prepare suitable seed beds for planting better cover and habitat will result in short-term disturbances and long-term benefits to both resident and migratory wildlife using the Refuges, WPAs, and easements. Short-term impacts include disturbance and displacement of wildlife typical of any noisy heavy equipment operation, and the loss of poor quality cover while the tract is farmed. Wildlife may also use the farmed area as an additional food source for the period which it is farmed. Long-term benefits are extremely positive due to the establishment of diverse or more desirable habitat for nesting, escape cover, perching, or non-crop feeding activities. The resulting habitat will generally improve conditions for most of the species negatively affected by the short period of farming activity.

In 2004, approximately 2900 acres of Service lands were farmed under SUPs in South Dakota. North Dakota refuges and WPAs permitted an average of 6,400 acres of cooperative farming during the 1996-2000 period.

Public Review and Comment:

The period of public review and comment began May 1, 2005 and ended on May 14, 2005.

Notices were posted in public places at each of the field stations listed on this Compatibility Determination. This method was selected because the proposed activity is considered minor, incidental, infrequent, with only short-term disturbance.

Determination:

Compatibility Threshold: As this activity is an economic use, it must meet the compatibility threshold of "contributing to the Mission and Purposes" of the Refuge System and the Refuge Area. Cooperative farming is used to benefit Refuge and Waterfowl Production Area uplands and the migratory birds and other wildlife that use these lands.

__________ Use is Not Compatible

__XXX__ Use is Compatible with the Following Stipulations

Stipulations Necessary to Ensure Compatibility:

1. SUPs or Cooperative Farming Agreements will specify the type of crop to be planted and describe the refuges' share.

2. The SUP may specify any herbicide or agricultural restrictions of the tract.

3. The SUP may specify timing constraints to insure that the proper field work is completed at the appropriate time.

4. The permit is issued subject to the revocation and appeals procedure contained in Title 50, Part 25 of the Code of Federal Regulations.

Justification:

The cooperative farming of Service lands or easements is done to develop or reseed better wildlife cover and habitat than was previously on the area. Only areas that have been previously cropped, or are seeded to decadent stands of cool season grasses (brome or crested wheatgrass), or decadent tame grass-legume mixes will be included in a cooperative farming plan. Cooperative farming in most cases provides the fastest, most cost effective means to establish native grasses or re-seeded cover on the Service property. In many cases, tracts are located many miles away from the Refuge or WMD headquarters, making force account labor a very time-consuming effort. The long-term benefits of managed, quality cover offset the short-term impacts and disturbance while the tract is farmed prior to seeding or re-seeding.

Mandatory 10-Year Reevaluation Date: 10 years from the date of APPROVAL signature

Signatures:

Submitted: Michael Bryant 4/26/05

Michael Bryant, Project Leader
Lake Andes Complex

Date

Tom Tornow, Project Leader Madison WMD	4-26-05 Date
Harris Hoistad, Project Leader Huron WMD	4-26-05 Date
Larry Martin, Project Leader Waubay Complex	26 April 2005 Date
Gene Williams, Project Leader Sand Lake Complex	4-26-05 Date
Tom Koerner, Project Leader LaCreek Complex	4-26-05 Date
Jack Lalor, Acting Project Leader Tewaukon Complex	4/26/05 Date
Dave Azure, Acting Project Leader Kulm WMD	4/26/05 Date
Kim D. Hanson, Project Leader Arrowwood Complex Chase Lake WMD Valley City WMD	4/26/05 Date
Gary Williams, Acting Project Leader Audubon Complex	4/26/05 Date
Paul Van Ningen, Project Leader Long Lake Complex	4/26/05 Date

Tedd Gutzke, Project Leader — Date: April 26, 2005
J Clark Salyer Complex

Roger Hollevoet, Project Leader — Date: 4/26/05
Devils Lake Complex

Fred G. Giese, Project Leader — Date: 04/26/05
Des Lacs Complex

Dean Knauer, Project Leader — Date: 4-27-05
Upper Souris NWR

Review:

Lloyd Jones — Date: 4.27.05
Regional Compatibility Coordinator

Rod Krey — Date: 4/28/05
Refuge Supervisor, ND-SD

Approval:

Ronald D. Shupe, Region 6 — Date: May 15, 2005
Acting Chief of Refuges

Appendix O
Fire Management Program

The Service has administrative responsibility including fire management for the Souris River basin refuges, which cover approximately 110,292 acres in North Dakota.

Fire: A Critical Natural Process

In ecosystems in the prairie of the Great Plains, vegetation has evolved under periodic disturbance and defoliation from bison, fire, and drought. This periodic disturbance is what kept the ecosystem diverse and healthy while maintaining significant biodiversity for thousands of years.

Historically, natural fire and including Native American ignitions, have played an important disturbance role in many ecosystems by removing fuel accumulations, decreasing the impacts of insects and diseases, stimulating regeneration, cycling critical nutrients, and providing a diversity of habitats for plant species and wildlife.

When fire is excluded on a broad scale (over several decades) as it has been in many areas, the unnatural accumulation of living and dead fuel can contribute to degraded plant communities and wildlife habitats. These fuel accumulations often change fire regime characteristics. This has 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, water quality, and cultural resources.

Return of fire is essential for healthy vegetation and wildlife habitat in most ecosystems including grassland, wetland, woodland, and forest. 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 first be integrated into land and resource management plans and activities on a broad scale.

Reintroduced fire

- can improve waterfowl habitat, wetlands, and riparian areas by reducing the density of vegetation or by modifying the plant species;
- can improve deer and elk habitat, especially in areas with shortages such as winter habitat and on spring and fall transitional ranges;
- can sustain biological diversity;
- can improve access in woodland and shrubland;
- can improve soil fertility;
- can improve the quality and amount of livestock forage;
- can improve growth in immature woodland by reducing density;
- can remove excessive buildup of fuels;
- 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 eight 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 fires 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 on values to be protected, costs, and land and resource management objectives.
- FMPs and activities are based on the best available science.
- FMPs and activities incorporate public health and environmental quality consideration—

federal, state, tribal, local, interagency, and international coordination and cooperation are essential.

- Standardization of policies and procedures among federal agencies is an ongoing objective.

The fire management considerations, guidance, and direction should be addressed in the land use resource management plans (for example, the CCP). 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

The Souris River basin refuges will protect life, property, and other resources from wildland fire by safely suppressing all wildland fires. Prescribed fire and manual and mechanical fuel treatments 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 aspects of the fire management program would be conducted in a manner consistent with applicable laws, policies, and regulations. The Souris River basin refuge stations will maintain an FMP and carry out the plan to accomplish resource management objectives. Prescribed fire and manual and mechanical fuels treatments will be applied in a scientific way under selected weather and environmental conditions. These activities will occur on approximately 500–2,500 acres, over a 5-year average, for native and restored prairie habitat to accomplish habitat management objectives.

Fire Management Goal

Restore and enhance fire as an ecosystem process within prairie habitats. The return and maintenance of fire is essential for wildlife habitat in these ecosystems.

Fire Management Objective

Fire is an important management tool that can be used to accomplish habitat management objectives. If not used properly, fire is also a tool that can quickly damage or destroy natural resources, equipment, buildings, and property; and can hurt or kill those that work with it. Prescribed fire and manual and mechanical fuels treatments will be used to reduce hazardous fuels and on refuge lands to reduce the intensity and severity of wildland fires. Special attention will be given to WUI areas, both on Service-owned and adjacent lands to reduce the risk of wildland fires to communities and improvements.

Strategies

Strategies and tactics that consider public and firefighter safety as well as resource values at risk will be used. Wildland fire suppression, prescribed fire methods, manual and mechanical means, timing, and monitoring are all found in a more detailed list in a step-down FMP.

All management actions would use prescribed fire and manual and/or mechanical means to restore and maintain desired habitat conditions and control nonnative vegetation and the spread of woody vegetation within the diverse ecosystem habitats. The prescribed fire program will be outlined in the FMP for the refuges. Detailed prescribed burn plans will be developed, which describe the following:

- burn units and their predominant vegetation
- primary objectives for burn units
- 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
- postburn monitoring

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 fuels (for example, wildlife habitat improvement burns versus fuel reduction burns). The refuges will meet the Clean Air Act emission standards by adhering to the "North Dakota State Implementation Plan" requirements during all prescribed fire activities.

Fire Management Organization, Contacts, and Cooperation

Qualified fire management technical oversight and support for the refuges will be established by region 6 of the Service, using the fire management district approach. Under this approach, an appropriate fire management staffing organization will be determined by established modeling systems based on the fire management workload of a group of refuges, and possibly that of interagency partners. The fire management workload consists of historical wildland fire suppression activities and historical and planned fuels treatments.

Depending on budgets, fire management staffing and support equipment may be located at the station or at other refuges in the district and shared between all units. Wherever possible, fire management activities will be conducted in a coordinated and collaborative manner with federal and nonfederal partners.

On approval of the CCP, a new FMP would be developed for the Souris River basin national wildlife refuges as (1) a stand-alone FMP, (2) a FMP with two or three refuges (the three refuges in the fire management district), or (3) as an interagency FMP.

Appendix P
Draft Compatibility Determination for Recreational Hunting

Use: Recreational Hunting

Refuge Names: Des Lacs National Wildlife Refuge (NWR)

J. Clark Salyer NWR

Upper Souris NWR

Establishing and Acquisition Authorities

- Migratory Bird Conservation Act
- Executive Orders 7154-A, 7161, and 7170

Refuge Purposes

"As a refuge and breeding ground for migratory birds and other wild life."
[Executive Orders 7154-A, 7161, and 7170]

"For use as an inviolate sanctuary, or for any other management purpose, for migratory birds."
[16 U.S.C. § 715d (Migratory Bird Conservation Act)]

National Wildlife Refuge System Mission

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

Description of Proposed Use:
Recreational Hunting

All three refuges are open to recreational public hunting in accordance with state of North Dakota seasons and regulations established for each area. Visitation during 2004 for this activity was estimated at Des Lacs NWR (big game 800, upland game 175); at J. Clark Salyer NWR (big game 2,000; upland game 600); and at Upper Souris NWR (big game 2,200; upland game 50). Currently hunted or additional animals that may be hunted are listed below.

Des Lacs NWR

deer	sharp-tailed grouse
fox	ring-necked pheasant
moose	Hungarian partridge
rabbit	turkey

J. Clark Salyer NWR

deer	sharp-tailed grouse
fox	ring-necked pheasant
waterfowl	Hungarian partridge
turkey	

Upper Souris NWR

deer	sharp-tailed grouse
fox	ring-necked pheasant
moose	Hungarian partridge
turkey	

Specific areas are open to hunting during early seasons. Other areas at the refuges, with the exception of administrative areas, may open later in the season. Additional hunting information, regulations, and maps are found in hunting brochures specific to J. Clark Salyer NWR and Upper Souris NWR (available at information kiosks and administrative areas).

Hunting is a designated priority public use established for the Refuge System. The harvest of these species would be compensatory mortality, with minimal impact to the overall health of their populations.

Availability of Resources

Currently, sufficient resources are available to continue the existing recreational hunting programs. Implementing improvements or expanding hunting opportunities would be described in step-down management plans and addressed through future funding requests. The refuges would provide special accommodations for people with disabilities.

Anticipated Impacts of Use

The draft comprehensive conservation plan (CCP) recommends an annual review of the hunting program. This evaluation would determine what effect diverting funding and staff would have on the ability of the refuges to implement habitat management. Limited staff and funding would be directed toward habitat management first. Lack of funding and personnel may result in decreased opportunities and/or facilities.

Temporary disturbance would exist to wildlife in the vicinity of the activity. Animals surplus to populations would be removed by hunting. A temporary decrease in populations of wild animals would be experienced which may help ensure that carrying capacity (especially for big-game species) is not exceeded. Closed areas would provide some sanctuary for game and nongame species and minimize conflicts between hunters and other visitors and provide a safety zone around communities and administrative areas.

Public Review and Comment

Public review and comment will be solicited through public posting of notices at each refuge, notices in local newspapers, and public meetings held during the CCP process.

Determination

Recreational hunting is compatible.

Stipulations Necessary to Ensure Compatibility

Current hunting regulations would be retained. The following stipulations would apply to all three refuges:

- Hunting would be permitted in accordance with state regulations.
- Overnight camping and open fires would not be allowed.
- The areas around refuge offices, visitor centers, and residences would be posted closed to hunting. State law prohibits hunting within one-quarter mile of an occupied building.
- It would be unlawful to carry a loaded firearm in any vehicle on refuge lands or roads.
- Nontoxic shot would be required for hunting upland game and waterfowl. No other type of shot may be possessed while in the field.
- Collecting, injuring, disturbing, destroying, or harming any animal or plant except legally taken game animals would be prohibited.
- Searching for, disturbing, or collecting prehistoric or historic artifacts would be prohibited.
- Archery and gun seasons for deer hunting would coincide with state hunting seasons.
- A deer hunter would need a special state permit to hunt on a refuge during rifle season. A hunter with a state muzzleloader deer permit would be allowed to hunt without a refuge permit.
- Trash, including shell casings, would be required to be packed out so the areas would remain clean, natural, and enjoyable.
- Possession of fireworks would be prohibited.
- Possessing alcohol would be prohibited. Intoxicated and disorderly conduct would not be permitted. Open container of alcoholic beverage in a vehicle would be prohibited.

The following stipulations would apply only to J. Clark Salyer NWR:

- Nine designated areas would be open for hunting waterfowl, sharp-tailed grouse, partridge, pheasant, and deer.
- The entire refuge would be open for late-season sharp-tailed grouse, partridge, pheasant, and fox hunting following the close of firearm deer season, in accordance with state hunting seasons.
- Entry without a firearm to retrieve legally taken waterfowl would be permitted within 100 yards of exterior refuge boundaries and interior boundaries of designated public hunting areas.

The following stipulations would apply only to Upper Souris NWR:

- Vehicle travel would be restricted to public roads and recreation area parking lots. The use of all-terrain vehicles, snowmobiles, and other off-road vehicles would not be allowed.
- Horses would not be permitted.
- Weapons would not be allowed in boats and canoes.
- Preseason scouting for deer would be allowed only in open public use areas and areas marked "foot traffic only."
- Baiting for deer would not be allowed.
- Portable tree stands during deer hunting would be allowed, but daily removal would be required. Only strap-on steps or removable climbing ladders would be allowed.
- Hunters would be allowed to carry, drag, or use carts to remove their deer.
- Once hunters filled their deer tags, they would not be allowed to return to the refuge with weapons. However, they would be allowed to carry shotguns while hunting upland game birds in open bird-hunting areas.
- Land south of Lake Darling Dam would be closed to all upland game bird-hunting.
- Wearing of a blaze orange vest and cap would be required when hunting game birds during the deer firearm season.
- Dogs would be allowed during hunting of grouse, partridge, and pheasant.

Justification

Recreational public hunting is an historical wildlife-dependent use of the refuges, and is designated as one of the priority public uses in the National Wildlife Refuge System Improvement Act of 1997. Infrastructure is in place to support hunting programs, while current staffing levels and funding are adequate. Special regulations are in place to minimize negative impacts to the refuges and associated wildlife, and state of North Dakota law further controls hunter activities.

Hunting is a legitimate wildlife management tool that can be used to control wildlife populations. Hunting harvests a small percentage of the renewable resources, which is in accordance with wildlife management objectives and principals.

Mandatory 15-Year Reevaluation Date:

2021

Signature

Dan Severson
Refuge Manager
Des Lacs NWR
Kenmare, ND

Date

Gary Erickson
Refuge Manager,
J. Clark Salyer NWR
Upham, ND

Date

Tom Pabian
Refuge Manager,
Upper Souris NWR
Berthold, ND

Date

Review

Tedd Gutzke
Project Leader
Souris River Basin Complex
Upham, ND

Date

Lloyd Jones
Regional Compatibility Coordinator
NWRS, U.S. Fish and Wildlife Service,
Region 6, Coleharbor, ND

Date

Rod Krey
Refuge Supervisor (ND, SD,)
NWRS
Lakewood, CO

Date

Concurrence

Richard A. Coleman, Ph.D.
Assistant Regional Director, NWRS
U.S. Fish and Wildlife Service, Region 6
Lakewood, CO

Date

Appendix Q

Draft Compatibility Determination for Wildlife Observation, Wildlife Photography, Environmental Education, and Interpretation

Uses: Wildlife Observation, Wildlife Photography, Environmental Education, and Interpretation

Refuge Names: Des Lacs National Wildlife Refuge (NWR)

J. Clark Salyer NWR

Upper Souris NWR

Establishing and Acquisition Authorities

- Migratory Bird Conservation Act
- Executive Orders 7154-A, 7161, and 7170

Refuge Purposes

"As a refuge and breeding ground for migratory birds and other wild life."
[Executive Orders 7154-A, 7161, and 7170]

"For use as an inviolate sanctuary, or for any other management purpose, for migratory birds."
[16 U.S.C. § 715d (Migratory Bird Conservation Act)]

National Wildlife Refuge System Mission

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

Description of Proposed Uses:

Wildlife Observation, Wildlife Photography, Environmental Education, and Interpretation

All three refuges are currently open to public use in accordance with special refuge regulations developed for each refuge. Total estimated visits during 2004 for these activities were 10,675 visits for Des Lacs NWR, 14,830 visits for J. Clark Salyer NWR, and 67,712 visits for Upper Souris NWR. Entry into closed areas may be permitted by special use permit and special conditions; these would be evaluated on a case-by-case basis.

These activities may take place by foot, bicycle, automobile, boat, canoe, horse, cross-county skis, and snowshoes. Refuge staff would assist in activities when available. Organized groups such as school, scouts, 4-H, and others may have instructors or leaders who would use the refuges' habitats and facilities to conduct compatible programs. Ages of participants range from preschool to college and beyond.

Current activities for the refuges are listed below.

Des Lacs NWR

- 1 auto tour route (scenic backway)
- 4 hiking trails (1 national recreation trail)
- 1 canoe route
- 1 observation blind
- 3 annual environmental education events
- 1 interpretive kiosk
- 1 visitor contact station in headquarters building

The auto tour route is open daily from 5:30 a.m. to 10:00 p.m. Informational brochures are available at the kiosk located beside the refuge headquarters, which is open Monday–Friday (except on federal holidays) from 7:30 a.m. to 4:00 p.m.

J. Clark Salyer NWR

- 2 auto tour routes (both interpreted)
- 1 hiking trail
- 1 canoe route (national recreation trail)
- 1 observation blind
- 1 kiosk
- 1 visitor contact station in headquarters building

Specific areas are open daily to the public, from 5:00 a.m. to 10:00 p.m. Office hours are Monday–Friday (except on federal holidays) from 8:00 a.m. to 4:30 p.m. Regulations are available at information kiosks and administrative areas. In addition, a bird list is available.

Upper Souris NWR

- 1 auto tour route
- 5 hiking trails (1 is interpreted)
- 2 canoe routes
- 4 observation blinds
- 2 interpretive kiosks (2 additional kiosks are planned for 2006 construction)
- 1 visitor contact station in headquarters building

Specific areas are open to public, from 5:00 a.m. to 10:00 p.m., year-round. Visitor center hours are Monday–Friday (except on federal holidays) from 8:00 a.m. to 4:30 p.m. Regulations are available at information kiosks and administrative areas. In addition, lists for wildlife including birds and mammals are available.

Availability of Resources

Currently, sufficient resources are available to continue the existing public use programs. The refuges would provide special accommodations for people with disabilities.

The draft comprehensive conservation plan (CCP) recommends (1) expanding interpretation and environmental education, and (2) maintaining or decreasing development of wildlife observation programs and facilities. The interpretation and environmental education programs would emphasize the principles of natural plant and animal communities and ecological processes and restoration.

Implementing improvements or expanding public use opportunities would be addressed in future step-down management plans and through future funding requests. Program expansion would require increased funding for operations and maintenance. When funding is not adequate to operate and maintain programs, the public use would be reduced in scope or discontinued. Informational kiosks, interpretive signs, and other infrastructure are in place for the present level of public use.

Anticipated Impacts of Uses

No detrimental impacts are anticipated with the public use programs. Temporary disturbance would exist to wildlife in the vicinity of the activity. Closed areas would provide sanctuary for wildlife.

Public Review and Comment

Public review and comment will be solicited through public posting of notices at each refuge, notices in local newspapers, and public meetings held during the CCP process.

Determination

Wildlife observation, wildlife photography, environmental education, and interpretation are compatible.

Stipulations Necessary to Ensure Compatibility

Current regulations related to these wildlife-dependent uses would be retained. The following stipulations would apply to all three refuges:

- Collecting, injuring, disturbing, destroying, or harming any animal or plant would be prohibited.
- Searching for, disturbing, or collecting prehistoric or historic artifacts would be prohibited.
- Vehicles would be required to stay on designated roads.
- Trespassing in closed areas would not be permitted.
- Overnight camping and open fires would not be allowed.
- Trash would be required to be packed out so the areas would remain clean, natural, and enjoyable.
- Pets would be required to be leashed, except dogs used while hunting.
- Firearms would be prohibited except during appropriate hunting seasons.
- Possession of fireworks would be prohibited.
- Possessing alcohol would be prohibited. Intoxicated and disorderly conduct would not be permitted. Open container of alcoholic beverage in a vehicle would be prohibited.

The following stipulation would apply only to Des Lacs NWR:

- Swimming and motorized boating would be prohibited.

The following stipulations would apply only to Upper Souris NWR:

- Wildlife observation would be permitted year-round in all open areas, on nature trails, on the auto tour route, and in areas marked with “Foot Traffic Only” signs.
- Permission would be required to enter closed areas.
- Photo blinds for observing sharp-tailed grouse on their dancing grounds would be available in April by phone reservation.

- Two canoe trails would be available from May 1 to September. No swimming would be permitted on either the Beaver Lodge or Mouse River canoe trails.
- Swimming, water skiing, and sailing would not be allowed. Recreational boating and the use of jet boats or personal watercraft would not be allowed.
- The use of all-terrain vehicles, snowmobiles, and other off-road vehicles would not be allowed.
- The use of horses for wildlife viewing would be allowed with advanced permission from the refuge manager.
- Dog training would not be allowed.
- Guiding would be prohibited.
- Geocaching or similar activity would be prohibited.

Justification

Wildlife observation, wildlife photography, environmental education, and interpretation are historical wildlife-dependent uses of the refuges, and are designated as priority public uses in the National Wildlife Refuge System Improvement Act of 1997. Infrastructure is in place to support public use programs, while current staffing levels and funding are adequate. Special regulations are in place to minimize negative impacts to the refuges and associated wildlife.

Mandatory 15-Year Reevaluation Date:

2021

Signature

Dan Severson — Date
Refuge Manager
Des Lacs NWR
Kenmare, ND

Gary Erickson — Date
Refuge Manager,
J. Clark Salyer NWR
Upham, ND

Tom Pabian — Date
Refuge Manager,
Upper Souris NWR
Berthold, ND

Review

Tedd Gutzke — Date
Project Leader
Souris River Basin Complex
Upham, ND

Lloyd Jones — Date
Regional Compatibility Coordinator
NWRS, U.S. Fish and Wildlife Service,
Region 6, Coleharbor, ND

Rod Krey — Date
Refuge Supervisor (ND, SD,)
NWRS
Lakewood, CO

Concurrence

Richard A. Coleman, Ph.D. Assistant Regional Director, NWRS U.S. Fish and Wildlife Service, Region 6 Lakewood, CO	Date

Appendix R

Draft Compatibility Determination for Recreational Fishing

Use: Recreational Fishing

Refuge Names: J. Clark Salyer National Wildlife Refuge (NWR)

Upper Souris NWR

Establishing and Acquisition Authorities

- Migratory Bird Conservation Act
- Executive Orders 7154-A, 7161, and 7170

Refuge Purposes

"As a refuge and breeding ground for migratory birds and other wild life."
[Executive Orders 7154-A, 7161, and 7170]

"For use as an inviolate sanctuary, or for any other management purpose, for migratory birds."
[16 U.S.C. § 715d (Migratory Bird Conservation Act)]

National Wildlife Refuge System Mission

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

Description of Proposed Use:

Continued Historical Public Use Activity of Noncommercial Fishing

Public use areas such as parking areas, fishing areas, boat ramps, docks, jetties, piers, interpretive panels and signs, informational kiosks, and other structures would need to be maintained to facilitate this program. Seasonally sensitive areas at the refuge would remain closed to the the public. Public visitation at Upper Souris NWR may range from 30,000 to 150,000 visits annually for fishing, while at J. Clark Salyer annual visitation may range from 3,000 to 5,000 visits.

Only selected areas of each refuge would be open to fishing and would be posted accordingly. Special refuge regulations for fishing would be available in brochures at the refuge.

J. Clark Salyer NWR

At J. Clark Salyer NWR, there are 14 public fishing areas and each is posted with "Public Fishing Area" signs. Fishing is open year-round. The refuge is open daily from 5:00 a.m. until 10:00 p.m. Anglers are required to follow North Dakota state law and refuge regulations.

- Bank fishing at designated sites is allowed whenever there is open water.
- Boat fishing, without motors, is allowed in designated areas from May 1 through September 30.
- Ice fishing at designated areas is allowed when the ice is thick enough to support anglers. Only insured and licensed automobiles are allowed on the ice. The use of ice fishing shelters would be allowed in accordance with state law and special refuge regulations.

Upper Souris NWR

Fishing at Upper Souris NWR is allowed year-round from 5:00 a.m. to 10:00 p.m. daily. Anglers are required to follow North Dakota state law and refuge regulations. There are four developed boat ramps with associated parking areas, boat docks, and restroom facilities to support the summer boat fishing program.

- Bank fishing at designated sites is allowed whenever there is open water. Thirteen areas are open for bank fishing. Parking areas and several restroom facilities are available to bank anglers.
- Boat fishing is allowed from May 1 through September 30 at two designated areas of Lake Darling.
- Ice fishing is allowed when the ice is thick enough to support anglers. Several areas are designated for ice fishing access. Only properly insured and registered automobiles and pickups would be allowed to drive on the ice of Lake Darling. The use of ice fishing shelters would be allowed in accordance with state law and special refuge regulations.

- Fishing derbies may be allowed by issuing special use permits and special conditions. Permits would only be issued to nonprofit organizations. Ten percent of the entry fees would be returned to the refuge to maintain or replace fishing facilities. Typical special conditions governing fishing derbies are attached.

Availability of Resources

Currently, both refuges have adequate administrative and management staff to maintain their fishing programs. Implementing improvements or expanding fishing opportunities would be described in step-down management plans and addressed through future funding requests. The refuges would provide special accommodations for people with disabilities.

At Upper Souris NWR, boat ramps and docks are in place and all have been replaced within the last 5 years. Condition of these facilities is currently good to excellent.

Annual funding is needed for seasonal workforce salary and for supplies to maintain fishing facilities (including mowing, painting, repair, litter pickup, restroom cleaning, and periodic pumping costs of vaulted toilets). Funding is needed for a maintenance worker salary and equipment to maintain fishing areas and facilities.

Funding is needed for law enforcement staff salary, fuel costs, repair and maintenance of patrol vehicles, and associated costs to support the law enforcement program. Routine law enforcement patrols occur year-round. J. Clark Salyer NWR has two collateral duty law enforcement officers. Upper Souris NWR has one full-time law enforcement officer and two "collateral duty" law enforcement officers. Both refuges also receive assistance from local North Dakota state district wardens.

Anticipated Impacts of Use

The draft comprehensive conservation plan (CCP) recommends an annual review of the fishing program. This evaluation would determine what effect diverting funding and staff would have on the ability of the refuges to implement habitat management. Limited staff and funding would be directed toward habitat management first. Lack of funding and personnel may result in decreased opportunities, or facilities, or both.

Temporary disturbance of wildlife may occur in the vicinity of fishing activity. Fishing would temporarily decrease the fish population until natural reproduction or stocking replenishes the population. Frequency of use would be directly dependent on fish populations and their feeding activity. When fish populations are high and active, public use would climb and vice versa. No long-term negative impacts to the refuge or its resources are anticipated.

Public Review and Comment

Public review and comment will be solicited through public posting of notices at each refuge, notices in local newspapers, and public meetings held during the CCP process.

Determination

Recreational fishing is compatible.

Stipulations Necessary to Ensure Compatibility

Current fishing regulations would be retained. The following stipulations would apply to both refuges:

- Fishing would be permitted in accordance with state regulations.
- Use or possession of bait fish other than those listed in the North Dakota Fishing Guide would be prohibited.
- Collecting, injuring, disturbing, destroying, or harming any plant or animal (including minnows, frogs, crawfish, and worms) would be prohibited.
- Searching for, disturbing, or collecting prehistoric or historic artifacts would be prohibited.
- Overnight camping and open fires would not be allowed.
- Vehicles would be required to stay on designated roads.
- Trespassing in closed areas would not be permitted.
- Overnight camping and open fires would not be allowed.
- Trash would be required to be packed out so the areas would remain clean, natural, and enjoyable.
- Pets would be required to be leashed.
- Firearms would be prohibited except during appropriate hunting seasons.
- Possession of fireworks would be prohibited.
- Possessing alcohol would be prohibited. Intoxicated and disorderly conduct would not be permitted. Open container of alcoholic beverage in a vehicle would be prohibited.

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The following stipulation would apply only to J. Clark Salyer NWR:

- Ice fishing would be permitted on all refuge waters between December 15 and the end of the state fishing season.

The following stipulations would apply only to Upper Souris NWR:

- Fishing boats and canoes would be permitted on Lake Darling from May 1 to September 30 in designated fishing areas.
- Float tube fishing would be allowed where boat fishing is permitted.
- Releasing bait fish into any refuge or state waters would be prohibited.
- Operation of a boat in excess of idle speed in the Grano Boat Ramp Bay would be prohibited.
- Fishing would not be permitted on the Beaver Lodge Canoe Trail.
- Bow and spear fishing, including underwater spear fishing, would be prohibited.
- Use of designated spring, summer, and fall fishing areas would follow area-specific regulations described in the fishing brochure available at the refuge.
- The use of all-terrain vehicles and snowmobiles would not be allowed.
- Access to ice for ice-fishing would be permitted only at designated sites.
- Only cars and pickups would be allowed on the ice from Lake Darling Dam north to Carter Dam for ice-fishing purposes.
- At designated winter-fishing areas, ice-fishing shelters would be permitted and would be required to be removed on the date set by the state for ice-fishing shelter removal. Following the date for removal of permanent shelters, portable ones would be permitted but would need to be removed daily.
- At the remainder of the refuge, portable ice-fishing shelters would be permitted but would need to be removed daily.
- Fishing derbies would conform to event-specific conditions such as those specified in the attachment.

Justification

Recreational fishing is an historical wildlife-dependent use of each refuge, and is designated as one of the priority public uses in the National Wildlife Refuge System Improvement Act of 1997. Current staffing levels and funding resources are adequate. Special regulations are in place to minimize negative impacts to the refuges' habitats and associated wildlife.

Mandatory 15-Year Reevaluation Date:

2021

Signature

______________________________ ____________

Dan Severson — Date
Refuge Manager
Des Lacs NWR
Kenmare, ND

______________________________ ____________

Tom Pabian — Date
Refuge Manager,
Upper Souris NWR
Berthold, ND

______________________________ ____________

Gary Erickson — Date
Refuge Manager,
J. Clark Salyer NWR
Upham, ND

Review

Tedd Gutzke
Project Leader
Souris River Basin Complex
Upham, ND

Date

Lloyd Jones
Regional Compatibility Coordinator
NWRS, U.S. Fish and Wildlife Service,
Region 6, Coleharbor, ND

Date

Rod Krey
Refuge Supervisor (ND, SD,)
NWRS
Lakewood, CO

Date

Concurrence

Richard A. Coleman, Ph.D.
Assistant Regional Director, NWRS
U.S. Fish and Wildlife Service, Region 6
Lakewood, CO

Date

c

Attachment—Typical Special Conditions

Upper Souris NWR

Ice Fishing and Open-water Fishing Derbies

1. This permit will only be valid after a North Dakota Game and Fish Department (NDGF) fishing contest permit has been issued.
2. The permittee shall conduct and supervise this event by following the refuge and NDGF fishing contest rules and regulations and by following all required self-imposed tournament rules.
3. The permittee shall submit a report within 30 days after completion of the fishing contest to the refuge manager and to NDGF. The report should include the following: (1) number of contest participants; (2) quantity (number, total length, and weight) and species of fish taken in the contest; (3) gross and net proceeds for the tournament; (4) percentage of entry fees paid to participants as prizes; and (5) identification of the intended fishery conservation project to be accomplished at Upper Souris NWR. Failure to submit this report shall be justification for denial of future fishing contest permits.
4. The permittee shall provide readily visible and marked patrol vehicles staffed with volunteers to assist contestants having problems and to check for compliance with ice-fishing derby rules. One patrol vehicle per 50 teams is required during ice-fishing derbies.

   The permittee shall provide readily visible and marked patrol boats staffed with volunteers to assist contestants having problems and to check for compliance with open water fishing derby rules. The ratio of derby patrol boats to participant boats shall be at no time less than 1:20 in fishing contests involving 100 or fewer boats, and 1: 25 for contests involving more than 100 boats.
5. All areas where the derby is held shall be cleaned of litter before leaving for the day. All trash must be packed out. There are no fish cleaning facilities available.
6. Participants shall not interfere with other refuge visitor activities.
7. No entry or participation fees or prize winnings may be collected or distributed on federal property. No commercial products may be sold or distributed on federal property.
8. All fish brought to the check station to be measured or weighed shall be marked by cutting off one-half of the tailfin and the fish returned to the contestant. All fish must remain in the possession of the team that caught them.
9. Participants may use only one-half of the “Landing 1” parking lot during open water fishing derbies. The remainder of the parking lot is reserved for refuge visitors not fishing in the derby. Non-derby anglers should not have to wait in line to launch their boat. Derby sponsors shall provide volunteers to direct parking of participants and non-derby anglers. The overflow parking lot west of the township road may be used for derby vehicle and trailer parking.

Appendix S
RONS and SAMMS Projects, Des Lacs NWR

Refuge Operations Needs System

RONS amounts shown for Des Lacs NWR include a startup cost to carry out each program, with successive yearly costs that are significantly less.

RONS[1] Number	*Project Description*	*First-Year Need ($1,000s)*	*Recurring Annual Need ($1,000s)*	*Personnel (FTE[2])*
R–94009	Implement the geographic information system (computer specialist)	151	74	1.0
R–99009	Increase resource protection and security (law enforcement officer)	140	60	1.0
R–99013	Increase biological monitoring for adaptive resource management (biologist)	151	74	1.0
R–93007	Increase habitat management (refuge manager)	151	74	1.0
R–94001	Increase the integrated pest management program (biological technician)	106	50	1.0
R-93014	Protect and manage water rights	126	0	0
R–94005	Construct an equipment storage building	200	0	0
R–01002	Construct refuge housing for the law enforcement officer	228	0	0
R-99003	Construct water development to expand the grassland grazing program	155	0	0
R-99001	Conduct a cultural resource inventory	55	0	0

[1] *RONS=Refuge Operations Needs System.*
[2] *FTE=full-time equivalent.*

Service Asset Maintenance Management System

SAMMS Number*	*Description*	*Cost ($1,000s)*
Deferred Maintenance		
93106800	Replace the unit 4 water control structure	215
93106830	Replace the unit 5 water control structure	235
93106834	Replace the unit 6 water control structure and emergency spillway	280
01116014	Replace the unit 3 water control structure spillway/weir	250
01115455	Replace residence Q-4	280
Large Construction		
	Construct the fire equipment storage and cache	450
Road Rehabilitation		
03126148	Do preliminary engineering of auto tour route (routes 011, 012,103;12.3 miles)	313
03126149	Construct and asphalt the auto tour route (routes 011, 012,103;12.3 miles)	1,500
03126152	Do preliminary engineering of the Canada Goose Trail (route 102, 11.0 miles)	282
03126153	Construct the Canada Goose Trail (route 102, 11.0 miles)	2,700
Heavy Equipment		
97106791	Replace the 1978 Ford backhoe	110
99106837	Replace the 1978 JD 544 B front-end loader	181
01114123	Replace the 1979 IHC tractor	95
Small Equipment		
00106802	Replace the 1992 Dodge Dakota 4x4 pickup	30
01111766	Replace the 1990 Polaris 4x4 ATV	10
01111763	Replace the 1989 Dodge 4x4 pickup	30
01111766	Replace the 1989 Chevrolet 4x4 pickup	30
01114123	Replace the 1997 Ford 4x4 pickup	30
00106859	Replace the 1984 Type 4X fire engine	98

**SAMMS=Service Asset Maintenance Management System.*

Appendix T
RONS and SAMMS Projects, J. Clark Salyer NWR

Refuge Operations Needs System

RONS amounts shown for J. Clark Salyer NWR include a startup cost to carry out each program, with successive yearly costs that are significantly less.

RONS[1] Number	*Project Description*	*First-Year Need ($1,000s)*	*Recurring Annual Need ($1,000s)*	*Personnel (FTE[2])*
R-00001	Restore and enhance the prairie grassland and forest habitat (resource specialist)	125	75	1.0
R-99012	Improve marsh habitat management (refuge operations specialist)	139	75	1.0
R-99010	Improve habitat management, and population and habitat monitoring (biologist)	139	75	1.0
R-00002	Improve visitor services and outreach programs (administrative receptionist/clerk)	110	55	1.0
R-03001	Improve the resource protection capability (law enforcement officer)	136	55	1.0
R-97010	Enhance streamflow monitoring and the water management capability (refuge operations specialist)	97	55	1.0
R-97038	Develop a new area-capacity table for marsh impoundments	324	0	—

[1] RONS=Refuge Operations Needs System.
[2] FTE=full-time equivalent.

Service Asset Maintenance Management System

SAMMS Number*	*Description*	*Cost ($1,000s)*
Deferred Maintenance		
90106948	Replace the boundary fence	118
02121135	Repair the pool 320 dike and nesting islands	201
89106942	Rehabilitate the 6-stall storage building	28
99106956	Repair and rehabilitate quarters 40	223
01117727	Rehabilitate the office visitor area	34
Large Construction		
97109872	Construct a vehicle and equipment storage building	1,460
99109875	Improve water level management in pool 341	1,298
Small Construction		
99112488	Construct a wildfire response storage building	449
97123485	Construct an equipment storage yard	54
Road Rehabilitation		
88106960	Do preliminary engineering for the headquarters and a scenic trail	408
02121139	Construct a scenic trail	1,400
02121147	Construct the headquarters road and parking areas	396
10028965	Replace the Johnson Bridge	689
Heavy Equipment		
00106973	Replace the 1972 Caterpillar Grader	116
01115317	Replace the 1968 5-ton 6x6 fire truck	95
01117349	Replace the Case 680E loader/backhoe	95
01116659	Replace the 1972 White semi-tractor	105
01117375	Replace the 1972 John Deere 8630 tractor	126
01116987	Replace the 1982 dump truck	95
Small Equipment		
01113840	Replace the 1996 Honda ATV	7
01115730	Replace the 1991 Chevrolet Service truck	33
01113900	Replace the John Deere loader tractor	90
01116659	Replace the John Deere rotary mower	9
01116659	Replace the 1988 pickup	29

**SAMMS=Service Asset Maintenance Management System.*

Appendix U
RONS and SAMMS Projects, Upper Souris NWR

Refuge Operations Needs System

RONS amounts shown for Upper Souris NWR include a startup cost to carry out each program, with successive yearly costs that are significantly less.

RONS[1] Number	*Project Description*	*First-Year Need ($1,000s)*	*Recurring Annual Need ($1,000s)*	*Personnel (FTE[2])*
R-97008	Monitor adaptive management (biologist)	151.0	86	1.0
R-97001	Increase the environmental education and outreach efforts (public use specialist)	151.0	86	1.0
R-00002	Support the visitor service, educational, biological, and law enforcement functions (receptionist/typist)	63.5	26	0.5
R-98002	Initiate a comprehensive biological inventory (biological technician)	74.5	37	0.5
R-02001	Manage invasive species (range technician)	83.0	39	0.5
R-97005	Develop a fire management program	130.5	78	1.0
R-97004	Protect water rights and monitor water quality	193.0	140	0
R-01001	Compile and analyze the existing Souris River water quality data and its affect on the refuge	358.0	48	0.6
R-01004	Construct a shelter for environmental education activities	185.0	43	0.6
R-97019	Survey for archeological and historical sites	181.0	10	0

[1] RONS=Refuge Operations Needs System.
[2] FTE=full-time equivalent.

Service Asset Maintenance Management System

SAMMS* Number	Description	Cost ($1,000s)
Deferred Maintenance		
05139174	Expand quarters 7	118
01117654	Deepen the landing 1 boat channel	160
89106755	Rehabilitate the deteriorating dam 41 Oxbow Marshes	136
05139281	Replace unsafe bridges (1st, 2nd, and 3rd north of Highway 5 East)	129
05139389	Replace three unsafe bridges north of Highway 5 West	129
93106756	Replace a deteriorated bridge (1st north of dam 41 east)	43
05139360	Replace unsafe bridges (1st, 2nd, 3rd, and 4th north of Greene, West)	172
00106777	Replace 12 miles of boundary fence (Highway 28 to dam 41 west)	257
89106776	Replace 11 miles of boundary fence (Highway 28 to dam 41 east)	237
89106775	Replace 7 miles of boundary fence (Grano to Highway 28 West)	151
Small Construction		
97109865	Build a new equipment storage building	725
97123624	Construct two interpreted observation towers	164
98109866	Expand the refuge office's interpretive, educational, and office space	447
97123510	Create prairie wetlands and restore riparian wetlands	135
02121177	Replace two deteriorated mobile home trailers	354
Heavy Equipment		
01117777	Replace the 1979 Case backhoe	79
96106738	Replace the aging 1986 5-ton, White Freightliner truck tractor	182
01117780	Replace the 1981 GMC dump truck	116
Small Equipment		
01117696	Replace the worn-out 1985 blue Dodge pickup	32
97106744	Replace the aging 1990 Chevy 4x4 extended-cab pickup	29
97106745	Replace the aging 1991 Chevy 4x4 pickup	34
01117706	Replace the 1999 John Deere F911 riding lawn mower	14
01117711	Replace the 1991 Chevrolet fire engine	37
01117784	Replace the 1990 Wajax Pacific BB-4 fire pumper unit	13

SAMMS Number*	*Description*	*Cost ($1,000s)*
Road Rehabilitation		
02121052	Construct the landing 1 parking lot (916)	156
98106752	Construct the Outlet Fishing Area road and parking (route 101, parking lot 908-9; 0.5 mile)	272
98106750	Do the preliminary engineering for landings 2 and 3 roads, parking, and spillway road and parking (routes 12, 102; 1.72 miles; parking lots 900 and 908-917)	136
98106768	Construct landings 2 and 3 roads, parking, and the spillway road and parking (routes 12, 102; 1.72 miles; parking lots 900 and 908-917)	1,100
02121048 02121049	Pave the Overlook Viewing Trail parking lot (Federal Highway Administration [FHWA] Route 910); regravel the Lake Darling Interpretive Overlook (FHWA Route 913); and pave the Lake Darling Dam pullout (FHWA 911)	108

**SAMMS=Service Asset Maintenance Management System.*

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