

Comprehensive Conservation Plan

Arrowwood National Wildlife Refuge

August 2007

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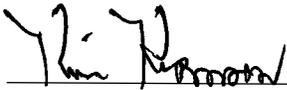
8/22/07

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Abbreviations

Administration Act	National Wildlife Refuge System Administration Act
AGNPS	agricultural nonpoint source (model)
CCC	Civilian Conservation Corps
CCP	comprehensive conservation plan
CFR	Code of Federal Regulations
cfs	cubic feet per second
DNC	dense nesting cover
EA	environmental assessment
EIS	environmental impact statement
EPA	Environmental Protection Agency
FMP	fire management plan
FWS	U.S. Fish and Wildlife Service
GS	general pay schedule
HMP	habitat management plan
HUA	hydrologic unit area
Improvement Act	National Wildlife Refuge System Improvement Act of 1997
IPM Plan	Integrated Pest Management Plan for the Arrowwood NWR Complex
JAKES	Juniors Acquiring Knowledge, Ethics & Skills
MMRE	Mainstream Missouri River ecosystem
NEPA	National Environmental Policy Act
NDGF	North Dakota Department of Game and Fish
NOA	notice of availability
NRCS	Natural Resources Conservation Service
NWR	national wildlife refuge
OWLS	outdoor wildlife learning site
PL	public law
Reclamation	Bureau of Reclamation
Refuge System	National Wildlife Refuge System
SAMMS	Service Asset Maintenance Management System
Service	U.S. Fish and Wildlife Service
SWG	state wildlife grant
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UWA	North Dakota Unified Watershed Assessment
VOR	visual observation reading
WG	wage grade pay schedule
WMD	wetland management district
WPA	Works Progress Administration
WUI	wildland–urban interface

Summary

The U.S. Fish and Wildlife Service has developed this comprehensive conservation plan as the foundation for management and use of the Arrowwood National Wildlife Refuge in North Dakota. The purposes of the plan are as follows:

- to identify the role that the refuge will play in support of the mission of the National Wildlife Refuge System
- to provide guidance for management of refuge programs and activities during the next 15 years

This summary briefly describes the refuge, comprehensive conservation plan, and planning process.

THE REFUGE

The refuge was established in 1935 as a refuge and breeding ground for migratory birds and other wildlife. President Franklin D. Roosevelt signed Executive Order 7168 on September 4, 1935, “establishing Arrow-wood Migratory Waterfowl Refuge.” Now known as Arrowwood National Wildlife Refuge, the 15,973-acre refuge is in east-central North Dakota. The refuge covers 14 miles of the James River Valley in Foster and Stutsman counties, approximately 30 miles north of Jamestown.

The purposes for the refuge, summarized here, are set out in the authorities for acquisition. Arrowwood National Wildlife Refuge was established for the following:

- use by migratory birds, with emphasis on waterfowl and other waterbirds
- the conservation of fish and wildlife resources
- use as an inviolate sanctuary, or for any other management purpose, for migratory birds. (Migratory Bird Conservation Act of 1929)
- a refuge and breeding ground for migratory birds and other wildlife (Executive Order 7168)

Habitat

The refuge lies on the Central Flyway migration corridor and is an important stopover for many species of birds as they journey north and south during annual migrations. Prairie grassland and wetland complex habitats at the refuge and surrounding private lands provide nesting and feeding habitat for waterfowl in the spring and summer. In addition, hundreds of thousands of

waterfowl migrate through the area and use these wetlands in the spring and fall for feeding and resting.

The refuge contains approximately 6,000 acres of native prairie; 5,340 acres of seeded grasses; 3,850 acres of wetlands (420 acres of natural wetlands); 660 acres of wooded ravines and riparian woodlands; and 125 acres of planted trees including shelterbelts.

The prairie ecosystem, of which the refuge is a part, evolved under constantly changing conditions. Grazing by large herds of animals, trampling, fire, and drought—with varied timing and intensity—resulted in diverse plant and animal communities in various successional stages. Today, large herds of grazing animals no longer exist. Tracts of prairie have been broken into smaller pieces and new habitats have been introduced (including croplands, woodlands, and brush lands).

Many of the sensitive native plant communities are suppressed with nonnative plants including smooth brome, Kentucky bluegrass, or invasive plants such as leafy spurge and Canada thistle. However, these sites still contain native plant seed sources and dormant native plants with the potential for tremendous biological diversity. These grasslands provide important breeding habitat to a variety of ground-nesting birds, especially the declining grassland-dependent songbirds.

Approximately 3,430 acres of wetlands are in managed impoundments and pools. The remaining acres are either natural wetlands or instream wetlands created by low-head dikes on tributaries flowing into the refuge. Historically, the managed impoundments were naturally occurring riverine lakes; these lakes were modified to improve water management capabilities.



The canvasback is a common duck at the refuge.

Administrative History

In the 1930s, the Civilian Conservation Corps developed refuge impoundments designed to store water rather than facilitate drawdowns and shallow water management.

The Flood Control Act of 1944 authorized construction of the Jamestown Dam, roughly 30 miles south of the refuge, in 1954. The purpose of the dam was to provide flood control for the city of Jamestown. The reservoir filled for the first time in 1965 and backed water onto the Arrowwood National Wildlife Refuge, preventing water management in most years. Several years later, operating levels of the reservoir were increased by 3 feet to accommodate recreation and to allow for the release of pollutant-flushing flows through Jamestown. This increased water level backed even more water onto the refuge and further eliminated water management options.

The Garrison Diversion Unit Reformulation Act of 1986 required mitigation for the adverse impacts to the refuge caused by the Garrison Diversion Unit project. An environmental impact statement, signed in 1997, analyzed the need to provide the refuge with water management capability to mitigate for high water levels imposed by the Jamestown Reservoir.

The preferred alternative selected from the environmental impact statement consisted of the following: downstream channel improvements; new water control structures; fish barriers; a bypass channel around Mud Lake, Jim Lake, and Depuy Marsh; a dike and water control structure at Stony Brook; and subimpoundments within Mud and Jim lakes. In addition, the alternative called for the reduction of the Jamestown Reservoir operating elevation by 1.8 feet. These features of the Arrowwood National Wildlife Refuge mitigation project are intended to mitigate past, present, and future impacts of the Jamestown Reservoir.

Visitor Services

Public use and recreation at the refuge includes the six priority wildlife-dependent uses: hunting, fishing, wildlife observation, photography, interpretation, and education. Hunters are allowed to pursue deer, upland game birds, cottontail rabbits, and fox. Fishing is allowed on all refuge impoundments; however, current fishing opportunities are temporary and sporadic due to the predominantly low water levels in managed impoundments. The auto tour route, the Warbler Woodland Watchable Wildlife Area, and an adjacent nature trail offer numerous wildlife-viewing opportunities. The entire refuge is open to walk-in access. Interpretation consists of refuge brochures, maps, and signs. In addition, the refuge offers tours and environmental education programs for school groups, scouts, and special events.

In addition, the refuge allows recreational trapping, commercial fishing for carp and bigmouth buffalo, recreational wild food gathering, and biking and horseback riding on designated trails.

COMPREHENSIVE CONSERVATION PLAN

The plan includes detailed objectives and strategies to carry out the vision and goals for the Arrowwood National Wildlife Refuge (described below).

Vision

The following vision describes what the refuge will be and what the Service plans to do. The vision is based primarily on the mission of the National Wildlife Refuge System and specific purposes of the refuge.

Provide quality habitat for threatened and endangered species, waterfowl, other migratory birds, and other wildlife in the Prairie Pothole Region of North Dakota. The refuge will provide an environment where a diversity of riparian, native prairie, grassland, and wetland habitats and their associated wildlife can be observed and explored. People will be able to learn about and appreciate the natural environment of the refuge and enjoy opportunities for wildlife-dependent recreation.

Goals

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

These goals—derived from the purposes and vision for the refuge—characterize the contributions of Arrowwood National Wildlife Refuge to the National Wildlife Refuge System. The goals reflect the core mission of the U.S. Fish and Wildlife Service to protect fish, wildlife, and plant resources while providing compatible opportunities for the public to appreciate and enjoy the natural environment of the region.

Upland Goal

Provide a diversity of grassland types that emulate the range of natural variation characteristic of the Prairie Pothole Region to benefit trust resources including waterfowl, grassland birds, and songbirds.

Wetland Goal

Provide a diversity of wetland types that emulate the range of natural variation characteristic of the Prairie Pothole Region to benefit threatened and endangered species, waterfowl, shorebirds, wading birds, and other wetland birds.

Visitor Services Goal

Visitors of all abilities will enjoy a refuge visit and increase their knowledge and appreciation of the prairie ecosystem and the refuge's history by participating in compatible wildlife-dependent recreation.

Outcomes of the Plan

Management actions in this CCP emphasize wildlife and habitat management for migratory birds and species of concern. Maximized biological potential for wetland and upland habitats at the refuge will support a well-balanced and diverse flora and fauna representative of the Prairie Pothole Region. The Arrowwood National Wildlife Refuge mitigation project will be used to achieve wetland habitat objectives.

A science-based monitoring program will be developed as part of the habitat management plan (a step-down plan) and carried out to monitor the responses of habitat and wildlife populations to management activities.



Arrowwood Lake.

A plan to improve water quality entering the refuge and reduce peak flows in the upper James River watershed during spring runoff and summer rainfall events will be prepared. The watershed management component will include working closely with private landowners through the U.S. Fish and Wildlife Service's Partners for Fish and Wildlife Program and other federal, state, and private conservation programs. The focus will be to

protect and restore wetlands and grasslands, and reduce the impacts on water quality from cropland and livestock operations. Improving the health of the upper James River watershed will not only benefit wildlife habitat in the watershed and at the refuge, it will also benefit Jamestown Reservoir and all downstream users.

Public use will be enhanced with the improvement and expansion of wildlife-dependent recreation. Opportunities to increase hunting and fishing will be reviewed and facilities constructed as funding becomes available. Refuge-specific regulations regarding access into the refuge for wildlife observation, photography, and other wildlife-dependent recreational uses will be clarified and, where appropriate, modified to eliminate or minimize potential conflicts between refuge user groups.

In addition to hunting and fishing, new facilities and programs will be developed to enhance wildlife observation, photography, environmental education, and interpretation.

PLANNING PROCESS

The comprehensive conservation planning process is a series of steps that, along with environmental analysis and documentation, are conducted simultaneously. The U.S. Fish and Wildlife Service engaged the public in the planning process to provide a forum for ideas and issues to be shared, reviewed, and evaluated among agency staff and the public.

Based on the results of the planning process, the following decisions have been made by the U.S. Fish and Wildlife Service's regional director for region 6:

- the type and extent of management and public access that will occur on the Arrowwood National Wildlife Refuge
- whether or not the management and public access on the Arrowwood National Wildlife Refuge will have a significant impact on the quality of the human environment

Through the environmental analysis process, the Service selected as the preferred alternative for the final plan, alternative 3 from the environmental assessment published February 2007.

Implementation of the comprehensive conservation plan will be monitored throughout its 15-year effective period (2007–2022). The U.S. Fish and Wildlife Service will annually monitor accomplishment of plan objectives. The objectives will be examined at a minimum of every 5 years to determine if revisions, additions, or deletions are necessary.

1 Purpose and Need



Tim Bowman/USFWS

Nesting Canada goose.

This document presents the final comprehensive conservation plan (CCP) for Arrowwood National Wildlife Refuge (NWR) in North Dakota (see vicinity map , figure 1).

NOTE: The Arrowwood National Wildlife Refuge Complex includes Arrowwood NWR, Arrowwood Wetland Management District (WMD), Chase Lake WMD, and Valley City WMD. This CCP does not address management of areas other than Arrowwood NWR. One or more CCPs will be developed to guide management of the districts and their inclusive waterfowl production areas and refuges.

This chapter provides agency guidance, an overview of the refuge, and the purpose and need for the plan.

1.1 AGENCY GUIDANCE

This section describes agency guidance—laws and policies—that affects national wildlife refuges. This includes guidance that requires and directs development of a CCP for a national wildlife refuge.

The Service is the principal agency responsible for conservation of the United States' fish, wildlife, and plant resources. The Service shares this responsibility with other federal agencies and state and tribal governments.

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

The Service manages a diverse network of more than 540 national wildlife refuges within the Refuge System, which encompasses 95 million acres of lands and waters. Arrowwood NWR is one of 60 national wildlife refuges in North Dakota and was the 70th national wildlife refuge established.

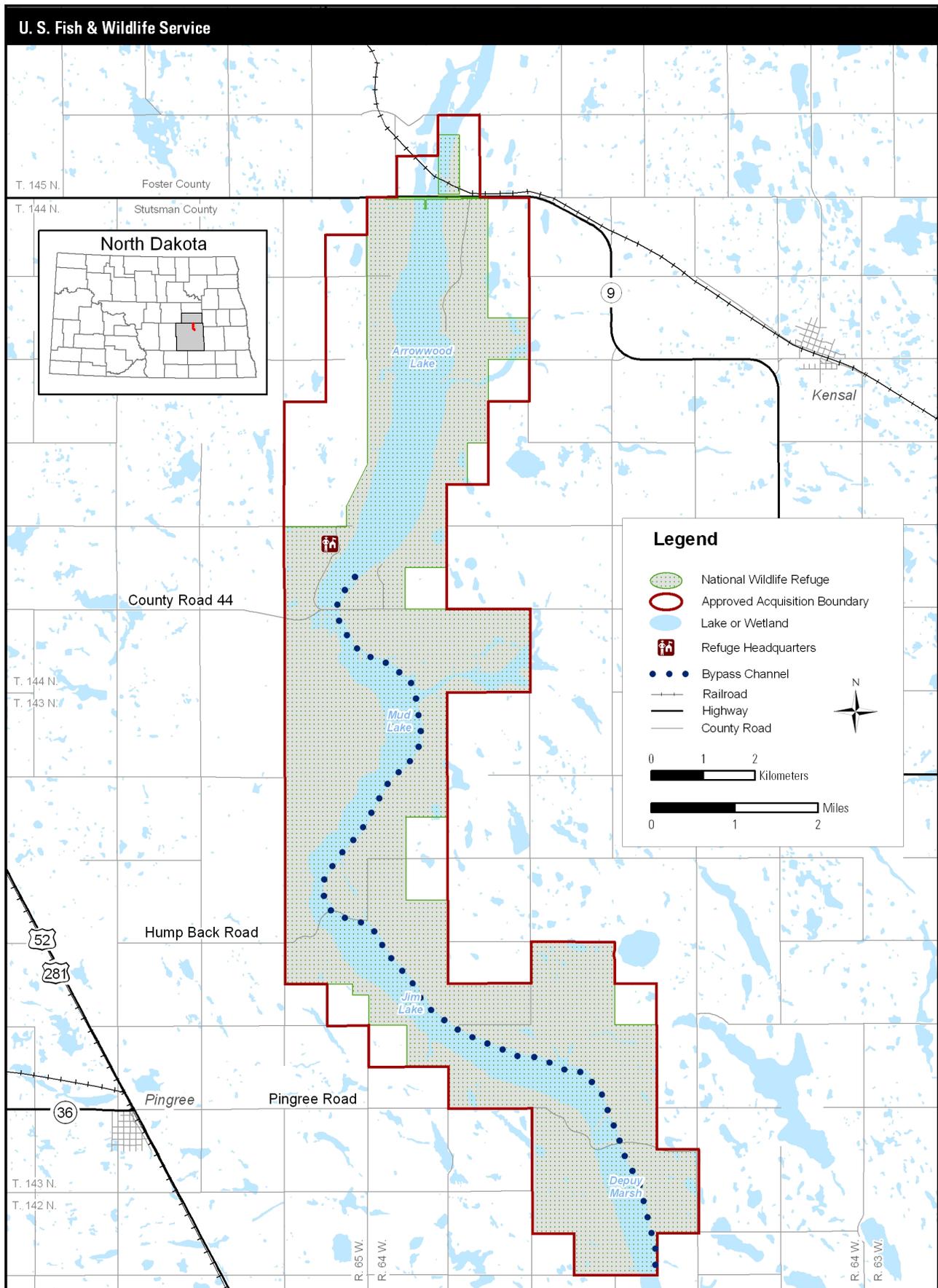


Figure 1. Vicinity map for Arrowwood NWR, North Dakota.

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

Laws

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

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

Policies

All national wildlife refuges are established with the following goals (“The Fish and Wildlife Service Manual,” 601 FW 1, 1.8):

- Conserve a diversity of fish, wildlife, and plants and their habitats, including species that are endangered or threatened with becoming endangered.
- Develop and maintain a network of habitats for migratory birds, anadromous and interjurisdictional fish, and marine mammal populations that is strategically distributed and carefully managed to meet important life history needs of these species across their ranges.
- Conserve those ecosystems, plant communities, wetlands of national or international significance, and landscapes and seascapes that are unique, rare, declining, or underrepresented in existing protection efforts.
- Provide and enhance opportunities to participate in compatible wildlife-dependent recreation (hunting, fishing, wildlife observation, photography, environmental education, and interpretation).
- Foster understanding and instill appreciation of the diversity and interconnectedness of fish, wildlife, and plants and their habitats.

These goals help step down the Refuge System mission and the principles of the 1997 amendments to the Administration Act. These goals articulate the foundation for stewardship of the Refuge System and define the unique niche it occupies among various federal land systems.

There are four guiding principles for management and general public use of the Refuge System established by Executive Order 12996 (appendix A):

Public Use—The Refuge System provides important opportunities for compatible wildlife-dependent recreational uses involving hunting, fishing, wildlife observation, photography, interpretation, and environmental education.

Habitat—Fish and wildlife will not prosper without high-quality habitat and, without fish and wildlife, traditional uses of refuges cannot be sustained. The Refuge System will continue to conserve and enhance the quality and diversity of fish and wildlife habitat within refuges.

Partnerships—America’s sportsmen and women were the first partners who insisted on protecting valuable wildlife habitat within wildlife refuges. Conservation partnerships with other federal agencies, state agencies, tribes, organizations, industry, and the general public can make significant contributions to the growth and management of the Refuge System.

Public Involvement—The public should be given a full and open opportunity to participate in decisions regarding acquisition and management of our national wildlife refuges.

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

- The Service adopted an ecosystem approach to conservation to enable it to fulfill its federal trust resource responsibility with greater efficiency and effectiveness. Through this holistic approach to resource conservation, the Service can accomplish its mission.
- An ecosystem approach to fish and wildlife conservation means protecting or restoring functions, structure, and species composition of an ecosystem, while providing for its sustainable socioeconomic use. Key to carrying out this approach is recognizing that partnerships are an essential part of a diverse management to accomplish ecosystem health.
- The Service has adopted watersheds as the basic building blocks for ecosystem conservation. Arrowwood NWR is located in the “main stem Missouri River ecosystem” (MMRE), which includes North Dakota, South Dakota, and northeastern Montana (figure 2). Ecosystem planning for the MMRE sets forth visions and

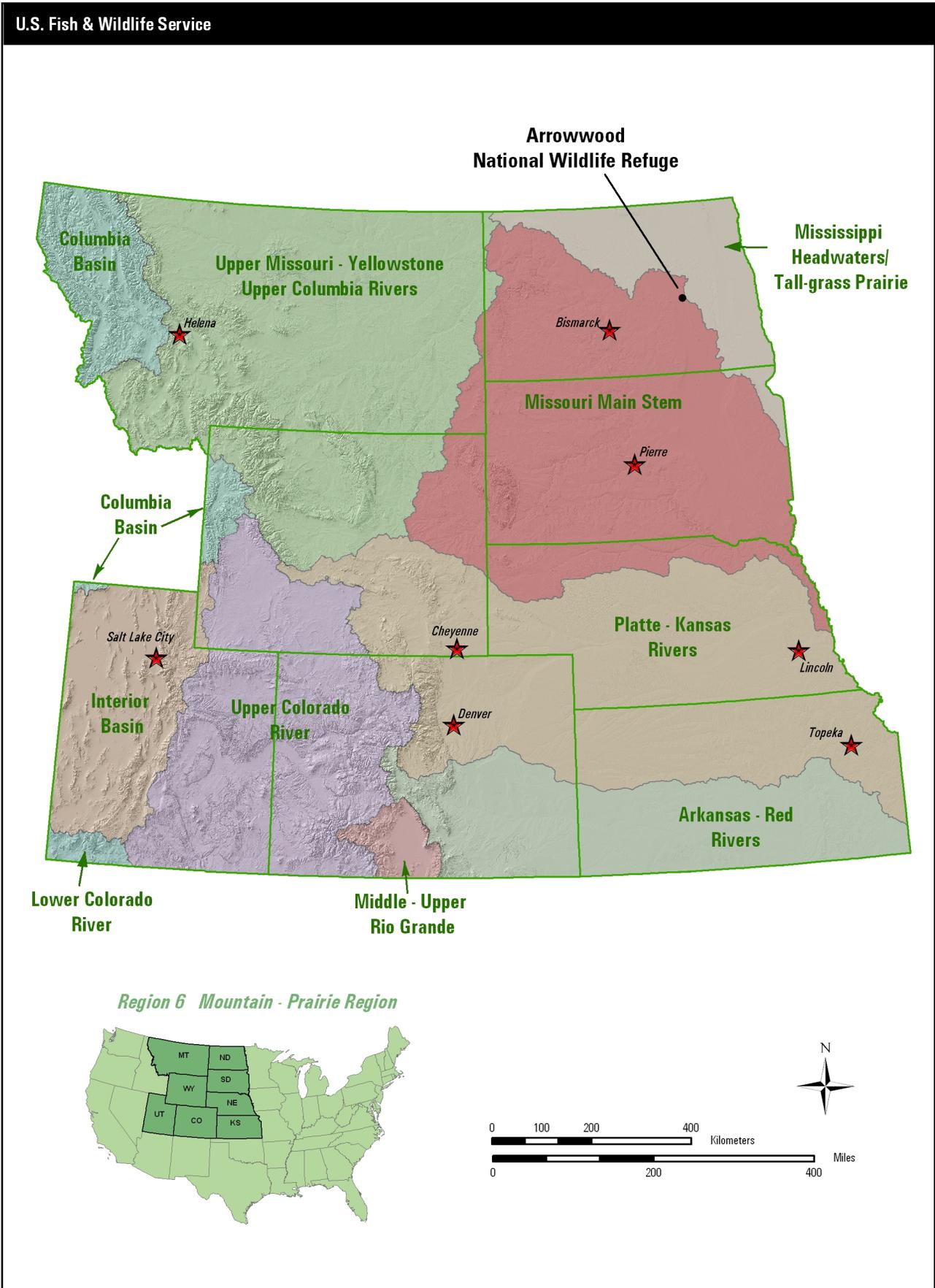


Figure 2. Main stem Missouri River ecosystem.

goals for prairie, wetland, and rivers to conserve fish and wildlife by protecting and restoring the natural ecosystem (appendix B). The habitat and wildlife goals and objectives for Arrowwood NWR contribute to the mission of the MMRE.

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

Guidance for Planning

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

A CCP does the following:

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

The Improvement Act calls for making opportunities for wildlife-dependent recreation, as long as they are compatibly managed with other purposes and do not conflict with other use. Service policy allows recreational uses that are determined compatible. A compatible use is “a proposed or existing wildlife-dependent recreational use or any other use of a national wildlife refuge, that based on sound professional judgment, would not materially interfere with or detract from the fulfillment of the National Wildlife Refuge System mission or the purpose(s) of the national wildlife refuge” (50 Code of Federal Regulations [CFR] 25.12).

A compatible use generally does one or more of the following:

- contributes to the Refuge System mission, the refuge’s major purposes, or refuge goals or objectives
- is a public priority use (fishing, hunting, wildlife observation, photography, interpretation, or environmental education)

- supports the safe and effective conduct of a priority public use

1.2 REFUGE OVERVIEW

This overview presents descriptions of the establishment of the refuge, the history of the refuge area, and the Garrison Diversion Unit project.

Refuge Establishment

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

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

- Executive Order 7168—“as a refuge and breeding ground for migratory birds and other wild life.”
- Migratory Bird Conservation Act—“for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.”
- The Fish and Wildlife Act—“for the development, advancement, management, conservation, and protection of fish and wildlife resources.”
- National Wildlife Refuge System Administration Act—“conservation, management, and ... restoration of the fish, wildlife, and plant resources and their habitats ... for the benefit of present and future generations of Americans.”
- The Refuge Recreation Act—“for (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species.”

On September 4, 1935, President Franklin D. Roosevelt signed Executive Order 7168, establishing Arrow-wood Migratory Waterfowl Refuge. The order stated, “To effectuate the purposes of the Migratory Bird Conservation Act, it is ordered that the following described lands ... are hereby, reserved and set apart ... as a refuge and breeding ground for migratory birds and other wildlife.” In a news release dated October 30, 1935 and titled “Two More ‘Safety Islands’ for Ducks in North Dakota,” the Department of Agriculture stated, “Arrow-wood still offers annual nesting and resting attractions to large concentrations of ducks, largely canvasbacks, redheads, mallards and pintails. Canada geese, swans and white pelicans also inhabit the area ... Water ... caught (impounded) and held would be seasonably distributed to create favorable conditions for aquatic-plant production and the growth of nesting cover ... In addition to creating an ideal nesting condition for waterfowl, this development would also provide for control of flood waters of the James River.”

History

The refuge and surrounding area were not settled until the late 1870s. Prior to that time, it was an important location along the Fort Totten Trail, a freight trail from Jamestown to Fort Totten, located near Devils Lake. Several watering stops were located along the valley and fuel wood was obtained from numerous wooded ravines.

The first Europeans to establish residence were ranchers. However, following the turn of the century, homesteaders flocked into the area and the native prairie was put to the plow. The irregular terrain prevented some of what is now refuge land from being broken; the more level portions were in crop production prior to establishment. Most of the former cropland was heavily infested with smooth brome by the time of establishment and the first refuge manager immediately “retired” many of these fields. Although a few of these areas were seeded to introduced grasses, most of them were allowed to revert or “go back” by natural succession.

During the drought years of the thirties, extensive croplands lay idle and reverted slowly from annual weeds, forbs, and sweetclover to perennial grasses. Since the grasslands were extensively overgrazed prior to establishment of the refuge, very limited grazing of native grasslands was allowed until the early forties. At that time, it was deemed that the grasslands had recovered from the previous years of misuse. Demands for grazing land increased following World War II, and many new grazing units were set up to satisfy local needs. The stocking rates and season lengths later proved to be excessive and refuge grasslands continued to deteriorate in species composition and value for wildlife.

Soon after the refuge was established, CCC and Works Progress Administration (WPA) camps were set up on the southeast side of Arrowwood Lake. The United States was just coming out of the 1930s Dust Bowl period. Arrowwood NWR was created in response to the drought, low waterfowl numbers, and an economic downturn. The CCC immediately set out to develop the refuge for water management and to benefit people. The CCC and WPA employed many local men and lasted until 1942.

Efforts of the first refuge managers led to enhancement of the three natural water areas and creation of a fourth. Two of these (Arrowwood and Jim lakes) were relatively deep, while the other two (Mud Lake and Depuy Marsh) were shallow marshes. The initial CCC development work took place during a drought, leading to the assumption that too much water would not be a problem. Consequently, refuge impoundments were designed to store water rather than facilitate drawdowns and dewatering to manage pools. While valid during the drought, this operation was later discovered to be impractical for obtaining



Jim Lake.

maximum waterfowl use; higher water levels were not conducive to production of vegetation preferred by waterfowl.

Prior to 1945, haying activity at the refuge was limited. However, as beef prices increased and more private lands were put into crop production, the demand for hay increased and extensive acreages of refuge grasslands were cut for hay. In addition, Kentucky bluegrass seed was harvested for 10 years (1947–1957). This practice was very detrimental to nesting waterfowl since it was conducted during peak nesting season.

Management at the refuge went from more than 11,700 upland acres idle in 1935 to only about 1,000 acres by 1953. The adverse effect on wildlife production was noted and management changes were made, as follows:

- bluegrass stripping was eliminated
- hayed acres were decreased by half in 1958 and virtually eliminated by 1960
- cropped acres peaked in 1957, but were reduced by 75% soon after
- grazed acres increased and peaked at more than 9,000 acres in 1963

Garrison Diversion Unit

In 1944, Congress passed the Flood Control Act, which was later renamed the Pick-Sloan Missouri Basin Program. This act authorized construction of a series of dams, power plants, irrigation projects, municipal water systems, and other water control features to manage the Missouri River for flood control, navigation, and power. The Garrison Diversion Unit was developed as part of this massive public works project. An early feature of the project was the Jamestown Dam, which was completed in 1954 for flood control. The Jamestown Reservoir filled for the first time in 1965; since then, backwater effects have resulted in higher water levels at Arrowwood NWR. In 1972, the summer operating

level of the reservoir was raised by 3 feet to accommodate recreation and allow for the release of flushing flows through the city of Jamestown to prevent stagnation. The increase in the reservoir operating level eliminated water management options at the refuge in most years.

The James River has been called the flattest river of its length in North America. The river drops less than 0.5 foot per mile in the reach through and below the refuge. The low slope, coupled with water control structures initially designed to hold water, made elevation manipulations difficult at best. Operations of the Jamestown Reservoir further hampered refuge management.

The Garrison Diversion Unit Reformulation Act of 1986 requires mitigations for impacts to refuge operations caused by features of the Garrison Diversion Unit project. An interagency team assessed various measures to improve water management capabilities at the refuge during normal water years. An environmental impact statement (EIS), initiated in 1994 and signed in 1997, analyzed the need to provide the Arrowwood NWR with water management capability to mitigate for high water levels imposed by the Jamestown Reservoir. The EIS presents an incremental series of actions that can provide various levels of water management capability. The preferred alternative selected was the “Mud and Jim Lakes Bypass—Lower Joint Use Pool Alternative.” This alternative consists of downstream channel improvements, improved water control structures, fish barriers, a 2.5-mile channel around Jim Lake, a 7-mile channel around Mud Lake, a dike and water control structure at Stony Brook, and subimpoundments within Mud and Jim lakes. The alternative also calls for the reduction of the Jamestown Reservoir “Joint Use Pool” elevation by 1.8 feet. Once the mitigation project is completed, the features are expected to mitigate for past, current, and future impacts of the operations of the Jamestown Reservoir. The series of channels, capable of passing flood waters in 7 of 10 years, will also allow managers to perform water level manipulations on all pools independently of the other pools, both upstream and downstream.

1.3 PURPOSE OF AND NEED FOR THE PLAN

The Improvement Act directs the Service to manage national wildlife refuges in accordance with approved CCPs. These plans must include public involvement in their development. A CCP needs to set goals and objectives that meet the establishment purposes for the refuge, as well as contribute to the mission of the Refuge System. Wildlife has first priority in the management of national wildlife refuges.

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

The CCP, when fully implemented, should do the following:

- achieve the refuge purposes
- help fulfill the Refuge System mission
- maintain and, where appropriate, restore the ecological integrity of each refuge and the refuge System
- help achieve the goals of the National Wilderness Preservation System
- meet other mandates

Vision Statement

As part of the planning process (see chapter 2), the refuge staff and planning team developed the following vision statement for Arrowwood NWR.

Provide quality habitat for threatened and endangered species, waterfowl, other migratory birds, and other wildlife in the Prairie Pothole Region of North Dakota. The refuge will provide an environment where a diversity of riparian, native prairie, grassland, and wetland habitats and their associated wildlife can be observed and explored. People will be able to learn about and appreciate the natural environment of the refuge and enjoy opportunities for wildlife-dependent recreation.

Goals

A goal is a descriptive, broad statement of desired future conditions that conveys a purpose, but does not define measurable units. Goals will direct work at carrying out the refuge’s mandates and achieving the purposes. Each management alternative is designed to meet all the goals for the refuge.

These goals are derived from the purposes and vision statement for the refuge to reflect the refuge’s contribution to the Refuge System. The goals reflect the core mission of the Service to protect fish, wildlife, and plant resources while providing opportunities for the public to appreciate and enjoy the natural environment of the region.

Upland Goal

Provide a diversity of grassland types that emulate the range of natural variation characteristic of the Prairie Pothole Region to benefit trust resources including waterfowl, grassland birds, and songbirds.

Wetland Goal

Provide a diversity of wetland types that emulate the range of natural variation characteristic of the Prairie Pothole Region to benefit threatened and endangered species, waterfowl, shorebirds, wading birds, and other wetland birds.

Visitor Services Goal

Visitors of all abilities will enjoy a refuge visit and increase their knowledge and appreciation of the prairie ecosystem and the refuge's history by participating in compatible wildlife-dependent recreation.

2 Planning Process

The Service followed the planning steps listed below—in a thorough manner that meets requirements of the National Environmental Policy Act (NEPA) and Service policies—to determine the future management of Arrowwood NWR.

The CCP process is a series of steps that are displayed sequentially (see figure 3). However, CCP planning, along with the associated environmental analysis and documentation, occurred simultaneously. Although public involvement is listed as part of two steps, the Service took public input throughout the following planning process:

- Preplan (form a planning team, review available data, organize efforts).
- Initiate public involvement and scoping (public input gathered on issues).
- Develop draft vision and goal statements.
- Develop and analyze alternatives including a proposed action with draft objectives.
- Prepare documentation of the environmental analysis, including the draft CCP (proposed action alternative).
- Conduct internal review (the Service, other federal, state, and tribal partners) and gather public input on the draft CCP and environmental assessment (EA).
- Analyze and respond to public comments.
- Select one of the alternatives to become the final CCP.
- Make revisions as necessary and prepare the final CCP.
- Approve and carry out the CCP.
- Monitor and evaluate actions and results.

The planning team (appendix C) is comprised of representatives from various Service programs, including the refuge staff, has prepared this final CCP. Coordination with the North Dakota Department of Game and Fish (NDGF), the public, local groups, and other agencies has been essential in developing a realistic, meaningful plan.

After reviewing a wide range of public comments and management needs, the Service selected its preferred alternative for the final CCP (alternative 3 from the environmental assessment published in February 2007). This CCP addresses all significant issues while determining how best to achieve the intent and purposes of the refuge.

The following section describes the decisions to be made about management of Arrowwood NWR. In



The purple coneflower is one of the colorful, native prairie plants at Arrowwood NWR.

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addition, this chapter includes descriptions of public involvement and other coordination activities, followed by the issues related to management of the refuge. The CCP revision process is described.

2.1 DECISIONS TO BE MADE

Based on the environmental analysis documented in the EA, the following decisions have been made by the Service's regional director for region 6, headquartered in Lakewood, Colorado.

- The type and extent of management and public access that will occur on the Arrowwood National Wildlife Refuge.
- Whether or not the management and public access on the Arrowwood National Wildlife Refuge will have a significant impact on the quality of the human environment.

As part of the decision-making process, the Service developed an EA in accordance with the NEPA.

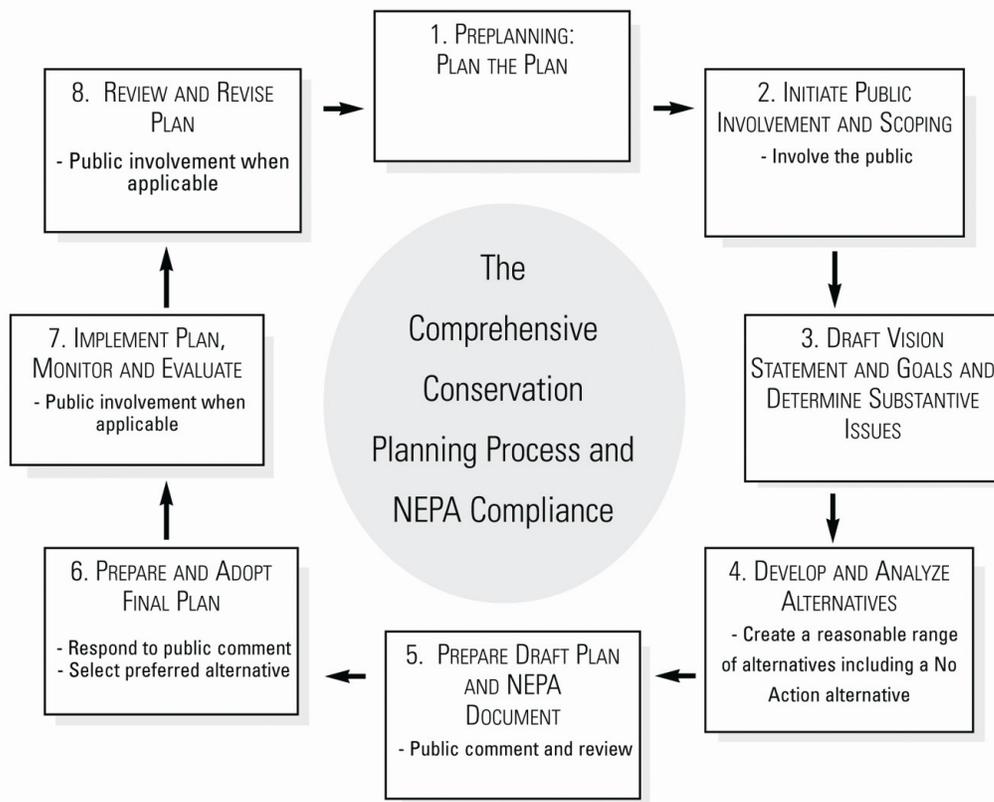


Figure 3. The planning process.

Three alternatives provided options for addressing management concerns and for resolving public issues. The draft CCP for the refuge was described in alternative 3 (the Service’s proposed action) of the EA.

This document displays the results of the CCP planning process. Appendix E, Environmental Compliance contains the “Environmental Action Statement” and “Finding of No Significant Impact.”

This final CCP describes the purpose and need for this plan, the decision-making process, refuge resources, management direction, and final compatibility determinations.

2.2 PUBLIC INVOLVEMENT

The Service used the NEPA process to engage the public in refuge planning, while determining whether the preferred alternative for management of Arrowwood NWR would have significant effects.

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

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

An issues workbook was made available to the public, beginning in August 2001, through mailings to interested parties and public open houses. On August 14 and 15, 2001, the Service held open house, scoping sessions in the communities of Kensal, Pingree, Carrington, and Jamestown, North Dakota. Approximately 40 people attended these meetings. Numerous written comments were received during the comment period. Comments received identified biological, social, and economic concerns regarding refuge management. Many of these comments were incorporated into the draft CCP and EA.

A “Notice of Availability” (NOA) was published in the *Federal Register* on March 22, 2007. The NOA announced the availability of the draft CCP and EA for Arrowwood NWR for public review and comment. An open house was held on April 13, 2007 at the Pingree Community Center, Pingree, North Dakota. Six people attended the open house. They provided a wide range of comments, concerns, and ideas. Many of these comments and ideas were incorporated and addressed in this final CCP.

A summary of those who participated in public involvement is in appendix D.

2.3 COORDINATION WITH OTHERS

The Service coordinated with tribes, other federal agencies, and state agencies as part of the planning process. The Service provided a planning update to relevant federal, state, and county representatives (including all county chairpersons). The planning update introduced them to the CCP process for Arrowwood NWR and welcomed their comments. Interested agencies are on the planning mailing list (appendix D).

Tribal Coordination

In the preliminary phase of planning (April 2001), the Service's director of region 6 sent an invitation letter for participation in the CCP process to the following tribes:

- Assiniboine and Sioux Tribes of the Fort Peck Indian Reservation, Montana
- Cheyenne River Sioux Tribe, South Dakota
- Crow Creek Sioux Tribe, South Dakota
- Flandreau Santee Sioux Tribe, South Dakota
- Lower Brule Sioux Tribe, South Dakota
- Santee Sioux Tribe, Nebraska
- Sisseton-Wahpeton Sioux Tribe, South Dakota
- Spirit Lake Tribe, North Dakota
- Standing Rock Sioux Tribe, North Dakota
- Yankton Sioux Tribe, South Dakota

None of the tribes contacted expressed interest in participating in the planning process.

Federal Agency Coordination

Coordination with the Bureau of Reclamation (Reclamation) took place throughout the planning process. Reclamation representatives provided information pertinent to the development of the draft CCP and EA related to the ongoing mitigation project.

The planning team worked with representatives from the Northern Prairie Wildlife Research Center (Jamestown, North Dakota) of the U.S. Geological Survey (USGS).

State Coordination

The NDGF is charged with managing the state's natural resources. Their mission is to "protect, conserve, and enhance fish and wildlife populations and their habitats for sustained public consumptive

and nonconsumptive uses." The state manages more than 78,000 acres in support of wildlife, recreation, and fisheries.

The Service's director of region 6 sent an invitation letter for participation in the CCP process to the director of the NDGF. The local NDGF wildlife managers and the refuge staffs maintain excellent and ongoing working relations, preceding the start of the CCP process.

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.

The comprehensive wildlife conservation strategy (CWCS) for North Dakota was completed, with final revisions, in May 2006.

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.

2.4 PLANNING ISSUES

Internal and public scoping meetings, an internal management review, and a review of completed issues workbooks indicated seven major issues regarding the refuge.

Water Quantity

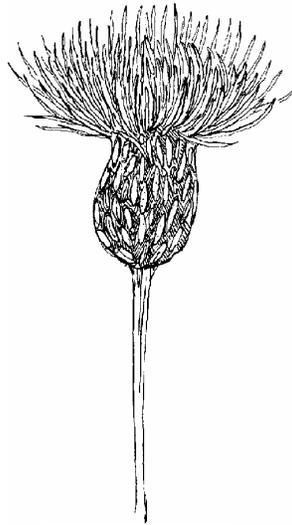
Jamestown Reservoir lies downstream of Arrowwood NWR on the James River in North Dakota. During high-water years, the reservoir backs up onto the refuge, floods pools, and eliminates or severely reduces water management capabilities at the refuge. The refuge has experienced increased flooding and water management problems since

Jamestown Reservoir filled to normal operating levels in 1965. High water levels preclude moist soil management and result in decreased productivity at the refuge during most years.

In addition, Jamestown Reservoir supports rough fish such as carp and big mouth buffalo that invade the refuge during high-water periods. Rough fish can cause extensive damage to aquatic resources important for migratory and nesting waterfowl. When wetland elevations are high, there may be no winterkill of the rough fish.

Invasive Plants

Invasive plants are an ongoing problem at the refuge and adjacent private agricultural lands. Invasive plants at the refuge degrade the quality of croplands, uplands, and hay harvested at the refuge by cooperative farmers. Since most refuge lands are not cropped, grazed, or mowed annually, these lands are viewed as weed sources that infest nearby private croplands.



Canada Thistle
© Cindie Brunner

Visitor Services

The refuge offers a wide variety of year-round, accessible, recreational opportunities that are wildlife dependent. There is a keen interest in wildlife-dependent recreation, especially hunting and fishing. There is also interest in trapping, photography, and wildlife observation. Activities that are not dependent on the presence of wildlife are also of interest, for example, picnicking, boating, canoeing, and kayaking.

All types of recreational opportunities should be universally accessible.

However, there was concern about letting public use go too far. Some residents felt recreation needs to be controlled and restricted to ensure it stays compatible with the wildlife mission of the refuge. Examples include not allowing all-terrain vehicles (ATVs), snowmobiles, or jet skis, as there are other areas nearby already developed for these activities.

Agricultural Practices

The refuge conducts cropping, grazing, and haying—usually by private cooperators—to meet management objectives. The refuge has steadily decreased its cropland acreage, which has decreased economic benefits to cooperators.

Wildlife Depredation

The refuge is located in a predominately small-grain, row-crop, agricultural area. Migratory birds and other wildlife such as deer feed on crops on private as well as on refuge lands; Canada geese are of particular concern. Neighboring farmers would like to see the refuge managed to attract and hold wildlife on refuge lands to keep depredation on private land crops to a minimum.

Naturalness

Some area residents expressed a desire for the primary mission of the refuge to be restoration and protection of the natural ecosystem, including less artificial management (for example, water management) in favor of natural processes. This may include reestablishing native prairie, big game species such as elk and bison. There is concern with habitat disturbance and vegetative damage such as that caused by the Arrowwood NWR mitigation project.

Economic Benefits

Foster and Stutsman counties, where the refuge is situated, receive annual payments under the Refuge Revenue Sharing Act. These payments are made to counties in lieu of taxes, using revenues derived from the sale of products from refuges. Local officials express concern and discontentment that the allocations are but a fraction of the entitlement.

Area farmers and ranchers benefit economically by acting as cooperators to crop, hay, or graze at the refuge. The refuge gains valuable and cost-effective habitat treatments to meet management goals while offering an additional source of income for these cooperators.

2.5 CCP REVISION

Plans are dynamic—management strategies need to be reviewed and updated periodically. The Service will review the final CCP at least annually to determine if the plan requires any revisions. The CCP and associated step-down plans will be modified whenever this review or other monitoring and evaluation determine changes are needed to achieve the refuge's purposes, vision, and goals.

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

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

3 Refuge Description



John and Karen Hollingsworth/USFWS

The western meadowlark is a Neotropical migrant that nests in upland habitats at Arrowwood NWR.

Located in the glacial drift plain of east-central North Dakota, the Arrowwood NWR lies in the center of the Prairie Pothole Region. The 15,973-acre refuge occupies 14 miles of the James River Valley in Foster and Stutsman counties. The refuge is in the Central Flyway migration corridor and is an important stopover for many species of birds as they journey north and south during annual migrations.

This chapter describes the refuge's setting, as follows:

- physical resources
- biological resources
- cultural resources
- special management areas
- visitor services
- aesthetics
- socioeconomic environment
- staffing
- partnerships and other public outreach

3.1 PHYSICAL RESOURCES

The climate, air, soils, minerals, and water resources at the refuge are described in this section.

Climate

The Arrowwood NWR has a continental climate characterized by relatively warm, short summers; long cold winters; and rapidly changing weather patterns. January is the coldest month and July is the warmest. The average growing season ranges from 98 to 106 days.

The average daily summer temperature is in the mid to upper 60s (°F), with the average high temperature in the upper 70s to low 80s. The average winter low temperature ranges from -1°F to -5°F. The coldest temperatures vary from -40°F to -60°F, with summertime highs up to 112°F. Annual temperature ranges can be as much as 150°F.

Average annual precipitation is 18.36 inches, more than half of which falls between May and July. Recorded amounts vary greatly, from less than 10 inches to more than 30 inches. The average annual snowfall ranges from 30 to 40 inches, but can vary from 7 inches to more than 100 inches. In the winter, snow and high winds bring frequent blizzard conditions to the area. The frost-free season generally runs from May 20 to September 15.

Air Quality

Visibility and clean air are primary resource values. Based on North Dakota's most current data, the state has relatively clean air. North Dakota is 1 of only 14 states to comply with all federal ambient air quality standards. The levels of ozone, sulfur, and nitrogen dioxide did not exceed federal or state standards at any monitoring site in 2004. In addition, levels of inhalable PM_{2.5} and inhalable continuous PM₁₀ did not exceed federal standards during the year.

Prescribed burning is the refuge management activity that has the greatest effect on air quality (find more information in the description of the fire management program in appendix F). The management of smoke is incorporated into planning prescribed burns and, to the extent possible, in suppression of wildfires. Sensitive areas are identified and precautions are taken to safeguard visitors and local residents. Smoke dispersal is a consideration in determining whether a prescribed burn is within prescription. Generally, the fine grass fuels and small burn size (80–600 acres) generate low volumes of smoke for short durations (4–5 hours).

Soils

Soils within Stutsman County have been inventoried and mapped, published copies of which are available. Arrowwood NWR contains soils formed in glacial drift. The advancing glacier picked up rocks and soil, ground and mixed them, and deposited the material as the ice melted from the receding glacier. Soils such as Barnes and Svea formed in unsorted material, or glacial till. Soils such as Bearden and Fargo formed in glaciolacustrine deposits, or glacial material deposited by water in glacial lakes. Other soils such as Divide and Sioux, were formed in glaciofluvial deposits or material deposited by glacial meltwater.

The soils in Stutsman County formed mainly under grassland vegetation. Grasses provide a plentiful supply of organic matter, which improves the chemical and physical properties of the soil. The fibrous roots of these grasses penetrate the soil to a depth of several feet, making it more porous and more granular. As a result of these changes in the

soil, less water runs off the surface and more moisture is available for increased microbiological activity.

The slope of the soils range from level to very steep. The degree of slope and the shape of the surface affect each soil type through their effects on runoff and internal drainage. On Buse and other soils on steep slopes, much of the precipitation is lost as runoff. Vegetation is sparse, leaching is restricted, and profile development is slow. Svea and other soils in the lower areas receive runoff from the Buse and other soils because of their position on the landscape.

Soils formed in depressions vary widely in profile development, depending on the degree of wetness. Tonka soils, which are in shallow depressions, exhibit an advanced degree of horizonation (distinct horizons or layers) because of the alternate wet and dry cycles that occur in depressions. Because of increased moisture in the depressions, Tonka soils exhibit properties much like soils in areas of much higher precipitation. Southam soils, which are in deep depressions, are nearly continuously wet and have a thick surface layer and carbonates throughout. The horizonation in these soils is mostly the result of sedimentary processes resulting from the glacier and depositions within the James River floodplain.

Approximately 10,000–12,000 years have passed since the glacier receded from Stutsman County. In geological terms, the soils in the county and at the refuge are young.

Mineral Resources and Reserved Rights

During the withdrawal of lands establishing the refuge in 1935, and as additional lands were acquired, there were reservations of surface or subsurface mineral rights outstanding to third parties on lands acquired in fee title by the federal government. Later purchase of additional land tracts were subject to outstanding mineral rights and existing rights-of-way at the time of acquisition. These rights-of-way include four road easements to the state of North Dakota.

Water Resources

Figure 4 shows the water resources of Arrowwood NWR. The refuge has four major water impoundments, which cover 3,064 acres:

Arrowwood Lake (1,671 acres)

Mud Lake (359 acres)

Jim Lake (723 acres)

Depuy Marsh, which is comprised of two units: Depuy Marsh (230 acres) and North Depuy subimpoundment (81 acres)

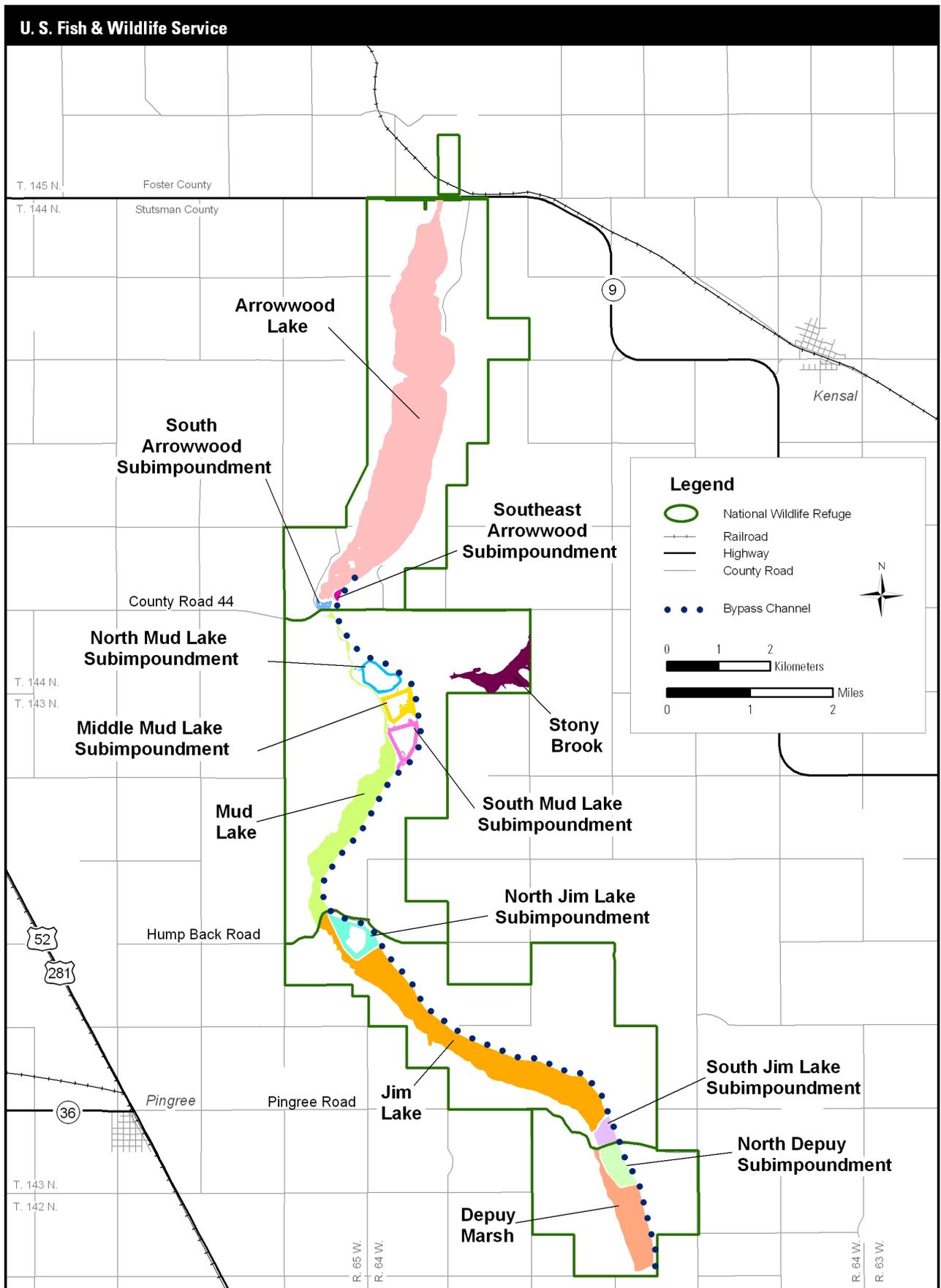


Figure 4. Water impoundments at Arrowwood NWR, North Dakota.

With completion of the Arrowwood NWR mitigation project, there are eight other managed water subimpoundments:

- South Arrowwood (11 acres)
- Southeast Arrowwood (6 acres)
- Mud Lake North (28 acres)
- Mud Lake Middle (47 acres)
- Mud Lake South (44 acres)
- North Jim Lake (69 acres)
- South Jim Lake (37 acres)
- Stony Brook (125 acres)

The three northernmost pools (Arrowwood, Mud, and Jim lakes) are natural lakes that were modified by the CCC with low-level dikes and water control structures to retain more water. Depuy Marsh, on the south end of the refuge, was also a CCC project to create additional wetlands. The Arrowwood NWR mitigation project constructed a bypass channel that starts at the south end of Arrowwood Lake. The channel runs along the east side of Mud Lake, Jim Lake, and Depuy Marsh to the southern boundary of the refuge. There is a water control structure located at the southern end of the channel that controls the water level in the channel. A second water control structure located at the head of the bypass channel controls the amount of water entering the channel. There are water control turnouts and outlets in each impoundment that allow water elevations to be controlled independently of other impoundments.



The view looking north over Jim Lake shows the bypass channel hugging the eastern edge of the lake.

Based on historical runoff records, this system of water control structures and the bypass channel allows managers to reach target elevations an average of 7 out of 10 years. The other 30% of the time will be flood years when water levels overtop water control structures and dikes and the refuge would not be able to manage water until the Jamestown Reservoir level was lowered.

Hydrology

The James River, a tributary of the Missouri River, originates in central North Dakota. The headwaters flow generally eastward to the town of New Rockford and then southward to the South Dakota border. Arrowwood NWR is part of the upper James River watershed (figure 5). Most runoff occurs between March and July with very little runoff occurring between November and February, so average monthly stream flows vary widely throughout the year.

The upper James River watershed consists of a poorly defined series of small ponds and marshes. In the rest of the watershed, the 20- to 40-foot-wide river channel meanders across a flat-bottomed, steep-sided valley. The river valley varies from a few hundred feet to approximately 2 miles wide. Channel capacity varies from 30 cubic feet per second (cfs) in the upper reaches to 10,000 cfs in the lower reaches in South Dakota. In the headwaters of the James River, the maximum bankfull flow is 250 cfs with an average velocity of 0.87 foot per second. Rocky Run Creek, Kelly Creek, and Juanita Lake are the only tributaries to the upper James River. (Bureau of Reclamation 1997)

Winter snowmelt and spring rains often combine in March and April to form the runoff that replenishes refuge impoundments and wetland basins. Intense thunderstorms occur frequently in summer.

Water Quality

Before Arrowwood NWR was established, shallow, slowly draining wetlands served as natural wildlife areas in this flat terrain. The primary factors affecting water quality were hydrology and natural impediments to drainage. After construction of the dikes and water control structures, deeper and more permanent wetlands formed. The pools are eutrophic (depleted of oxygen by decay of organic matter) and highly productive. External nutrient inputs include agricultural runoff, bird droppings, decaying plants, and rough fish. At times, the refuge traps nutrients; however, during high-water events, the opposite is true and the refuge “exports” excess nutrients to Jamestown Reservoir.

Backwater effects of Jamestown Reservoir became apparent after the reservoir filled in 1965, resulting in further increases in refuge pool depths. In particular, flood control operations result in prolonged periods of high water at the refuge during the spring and early summer. This is undesirable since this period is critical for the establishment of submerged aquatic plants such as sago pondweed. High water, in combination with turbidity, limits light availability for plant growth. Blue-green algae usually dominate in years when submergent plants do not become well established.

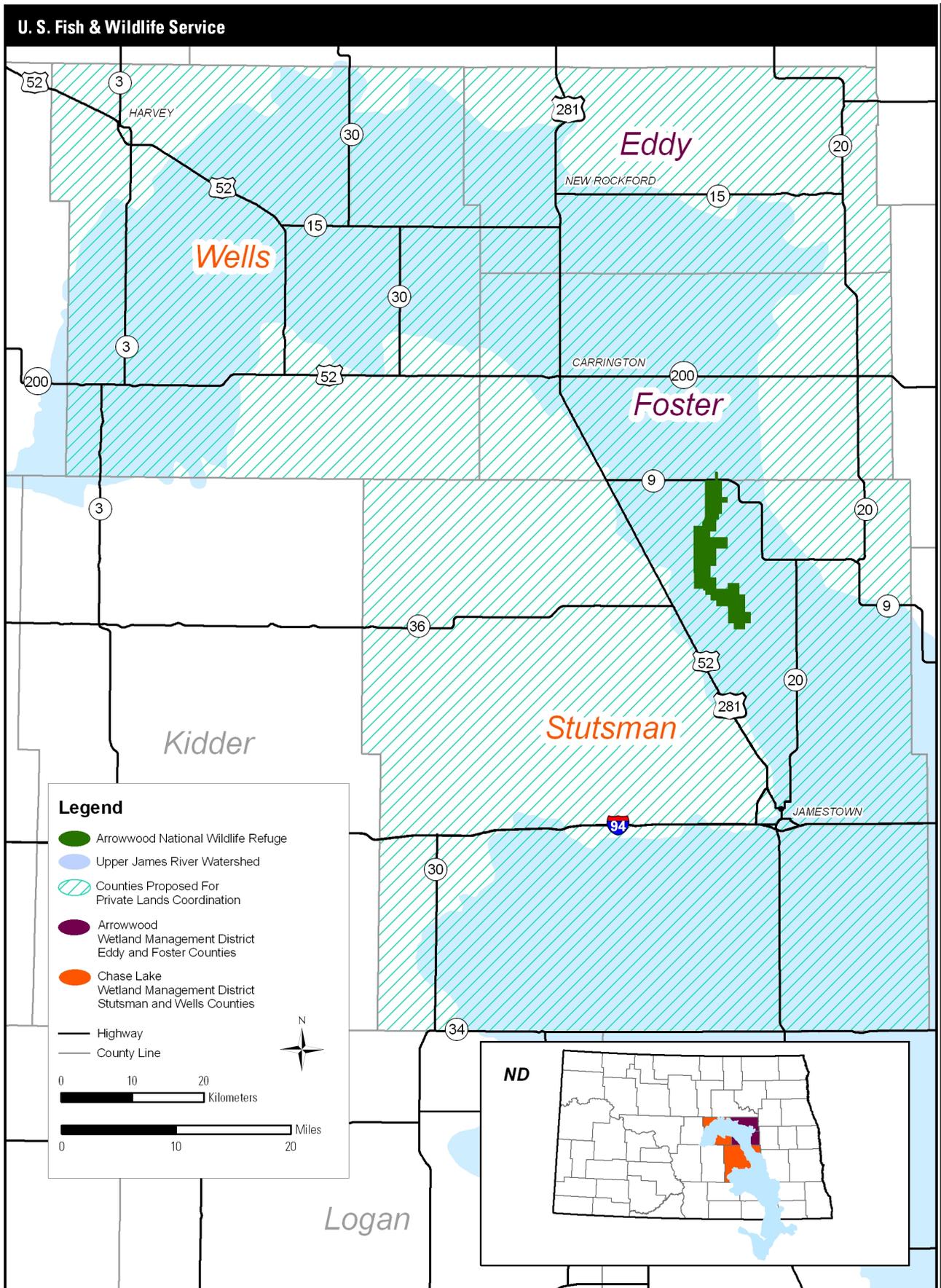


Figure 5. Upper James River watershed.

Water quality upstream of the refuge is determined in large part by land use practices as well as the flushing and hydrology of the watershed. Draining natural wetlands and channeling watercourses increase water quality degradation caused by row cropping and associated use of fertilizers and herbicides. Livestock confinement facilities that drain into the watershed are also responsible for lower water quality. Snowmelt and large rainfall events flush the watershed; however, periods with little or no flow are frequent, and the river may dry up entirely during a drought.

In 1997, Vice President Gore directed federal agencies to develop an action plan for clean water on the 25th anniversary of the 1972 Clean Water Act. The Clean Water Action Plan provided guidelines to restore and protect the water resources of the United States. One of the requirements of the Clean Water Action Plan was the North Dakota Unified Watershed Assessment (UWA). The UWA was issued September 25, 1998, and classified North Dakota's 50 hydrologic unit areas (HUA) into four categories, as follows:

Category I—watersheds in need of restoration

Category II—watersheds meeting goals, but needing action to sustain water quality

Category III—watersheds with pristine or sensitive aquatic systems on lands administered by federal, state, or tribal agencies

Category IV—watersheds with insufficient data to make an assessment

Nineteen data elements were used to categorize and rank each HUA. It was determined early in the evaluation that there were no watersheds in the state that met all of the goals of the Clean Water Act; therefore, all 50 HUAs were either classified as category I or IV. Eight were classified as category IV and the remaining 42 as category I. There were 14 HUAs identified as high-priority watersheds. The James River headwaters HUA was classified as medium priority for restoration and was ranked number 20 in the state.

As authorized under Title III Section 303(d) of the Clean Water Act, the Environmental Protection Agency (EPA) lists impaired waters of each state. These waters do not meet the water quality standards established for their intended purposes, which include public water supply; recreation; and fish, shellfish, and wildlife protection and propagation. Upstream of the refuge, the reach of the James River from the confluence of Big Slough downstream to the confluence with Rocky Run is listed as threatened for recreation because it exceeds standards for total coliform bacteria. At the refuge, the reach between Arrowwood Lake and Mud Lake is listed as threatened for fish, shellfish, and wildlife

protection and propagation because it does not meet EPA standards for dissolved oxygen. Downstream of the refuge, the Jamestown Reservoir is listed as threatened for recreation due to excessive levels of nutrients.

Annual water quality patterns at Arrowwood NWR are typical of shallow lakes in the Prairie Pothole Region of North Dakota. The depth of the refuge pools and the resulting warm temperatures and light availability for photosynthesis are primary factors affecting productivity. Usually, highly productive summer conditions are followed by anoxic (absence of oxygen) winter conditions due to shallow depths and freeze out. During summer, respiration, photosynthesis, and mixing due to wave action can cause dissolved oxygen to fluctuate widely on a daily basis. During winter, limited photosynthesis and decaying organic matter under the snow and ice frequently deplete dissolved oxygen.

Concentrations of nutrients are similar to values reported from other refuges in North Dakota and South Dakota. Major constituents, chlorophyll, pH, conductivity, and dissolved oxygen show seasonal variations consistent with data reported from other prairie wetlands. An examination of trace elements in the water column revealed the presence of elements (arsenic, selenium, mercury, lead) that can, in high concentrations, cause reproductive problems in waterfowl. However, the concentrations of these elements at the refuge are low and should not pose a threat to aquatic biota.

Trace elements present in the sediments at the refuge are considered to be naturally occurring with the exception of arsenic. Elevated arsenic levels may be the result of treatments for grasshopper infestations during the 1930s. Although some persistent organic compounds such as pesticides have been detected in sediment samples from the refuge, the concentrations were within acceptable limits.

Water Rights

Water rights for Arrowwood NWR were filed September 1, 1934. These water rights provide 16,000 acre-feet annually or as much as it takes to fill the impoundments to spillway elevations. An additional water right of 10,000 acre-feet is allowed to maintain these elevations throughout the year.

3.2 BIOLOGICAL RESOURCES

This section describes the existing habitat and wildlife at Arrowwood NWR. Figure 6 shows existing habitat conditions.

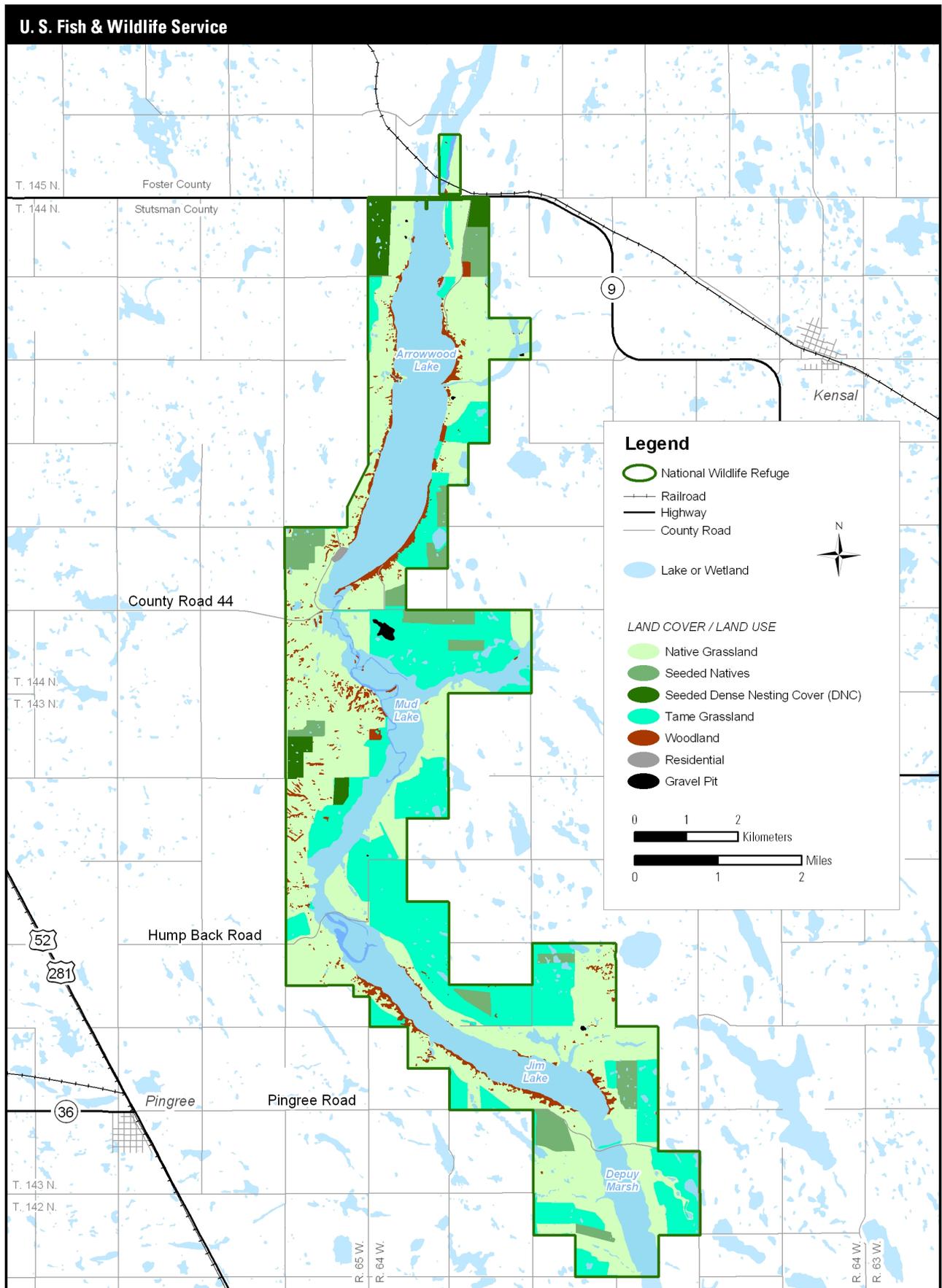


Figure 6. Habitats at Arrowwood NWR, North Dakota.

Habitat

The refuge provides, protects, and manages habitat for resident and migratory species, as well as federal- and state-listed threatened and endangered species. The refuge provides production habitat and resting and feeding areas for thousands of waterfowl and other migratory birds. The refuge historically has been particularly important as a major staging area in North Dakota with specific importance to fall populations of canvasbacks.



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Native forbs and grasses abound in the uplands.

The refuge contains approximately 6,000 acres of native prairie (unbroken sod); 5,340 acres of seeded grasses; 3,430 acres of enhanced wetlands; 420 acres of natural wetlands; 660 acres of wooded ravines and riparian woodlands; and 125 acres of planted trees (figure 6).

Upland vegetation makes up almost 12,000 acres of the 15,973-acre refuge. Deterioration of grassland habitats occurred for many years prior to and, in some cases, after acquisition by the Service. Many tracts have histories of tillage or overgrazing. Farming eliminated many native plant species. Even native grasslands that do not have farming histories face threats from the introduction of exotic plant species. In addition to tillage and overgrazing, many of the native plant communities were altered by other refuge management practices such as fire suppression or excessive rest, which provides exotic species an opportunity to outcompete native grasses. Many of these acres are invaded with nonnative plants such as smooth brome and Kentucky bluegrass, or invasive plants such as leafy spurge and Canada thistle. These nonnative species continue to alter the species composition and structure of grassland ecosystems, reducing their value as wildlife habitat. However, these sites still contain native plant seed sources and dormant native plants with the potential for tremendous biological diversity.

Nearly 90% of wetland habitats are contained within managed impoundments and pools. The remaining wetland acres are natural wetlands or

wetlands created by low-head dikes on tributaries flowing into the refuge. The managed impoundments are natural riverine lakes that have been modified to enhance water management capabilities. The recent construction of the bypass canal and subimpoundments allow for the management of a variety of wetland habitats.

The prairie grassland and wetland complex habitats on and adjacent to the refuge provide nesting and feeding habitat for waterfowl in the spring and summer as well as important breeding habitat for a variety of other ground-nesting birds, especially the declining grassland-dependent songbirds. In addition, hundreds of thousands of birds passing through this area during spring and fall migration rely on these habitats for feeding and resting.

A list of refuge plant species is in appendix G.

Upland Vegetation

Uplands at the refuge are categorized as follows:

- native grass (within unbroken sod areas)
- “go-back” or old cropland from the 1930s allowed to naturally succeed
- seeded natives
- dense nesting cover (DNC), which is usually a mixture of introduced cool-season wheatgrass species, alfalfa, and sweetclover
- old DNC-seeded areas that are now predominately smooth brome and Kentucky bluegrass
- riparian habitat of native prairie interspersed with deciduous tall shrubs and trees, wooded ravines, and shelterbelts

Native Grassland

The refuge is comprised of 7,000 acres of native grasses (1,000 acres of which is “go-back”), 800 acres of seeded native grass species, and 660 acres within riparian corridors and wooded draws. The native prairie habitat is predominantly a cool-season, needlegrass-wheatgrass, mixed-grass prairie that primarily occurs on the steep bluffs on either side of the James River.



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Milkweed is one of the native prairie plant species.

Vegetation of the mixed-grass prairie is characterized by grasses and forbs ranging from 2 to 4 feet tall. Grasses are a mixture of western wheatgrass,

needlegrasses, blue grama, little bluestem, and upland sedges. Interspersed within the grasses are numerous species of forbs such as coneflowers, asters, and goldenrods; and patches of shrubs comprised of western snowberry, Woods' rose, silverberry, or mixtures of these species. The plant community is the transition zone between the wetter tall-grass prairie to the east and the drier short-grass prairie to the west.

The 660 acres of riparian floodplain and wooded draws are primarily associated with the James River valley and with lakeshores within the refuge. Tree species present include green ash, cottonwood, elm, chokecherry, and cedar. Shrubs and small woody species are present in the native and “go-back” areas and wooded ravines. Common species are western snowberry, prairie rose, and silver buffaloberry.

Tame Grassland

Approximately 3,540 acres of the upland habitats are tame grasslands. About 400 acres have been recently seeded with DNC (a mixture of introduced wheatgrass species with alfalfa and sweetclover) and retain the seeded composition. The remaining 3,140 acres are old crop fields that were generally seeded to a mixture of introduced grasses and legumes in the 1970s and 1980s. These old crop fields are predominantly comprised of smooth brome, Kentucky bluegrass and in many cases, invasive plants, with little to no forb component remaining. DNC fields have proven very attractive to nesting waterfowl and have shown increased nest success within their confines.

DNC is very important to upland-nesting birds, especially ducks. DNC makes a major contribution toward achieving the waterfowl production objectives of the Arrowwood NWR Complex (Duebbert 1969, Duebbert and Lokemoen 1976, Higgins and Barker 1982). Some of these stands provide excellent nesting and winter cover. Many have declined in productivity due to the tendency of smooth brome to invade and dominate the stand and then to become sod-bound. DNC fields tend to become heavily infested with leafy spurge, Canada thistle, and other exotic and invasive plant species. An integrated approach to invasive plant control has been carried out to combat this problem.

Grazing, prescribed burning, haying, and cultivation have been the primary management tools used to achieve habitat objectives. Other than prescribed fire treatments, most management actions have been conducted under a special use permit with permittees selected through a bid process.

Woodland and Shelterbelts

Arrowwood NWR contains more than 125 acres in shelterbelts (planted tree rows) and old farmstead



Prescribed fire was used to remove litter, increase native vegetation, and improve habitat for ground-nesting birds in unit G21 at west Jim Lake.

USFWS

tree groves. The CCC and WPA planted most of these from 1937 through 1942 to control wind erosion and provide wildlife habitat. Species planted were chokecherry, caragana, Russian olive, cottonwood, boxelder, ponderosa pine, red cedar, American elm, and plum. Firebreaks have protected the shelterbelts. However, the shelterbelts have deteriorated with no other management such as pruning or replacement of dead trees. More than 30 of these plantings remain scattered throughout the refuge.

Tree plantings have significantly altered grassland habitats. The loss and degradation of native grasslands and habitat fragmentation have been implicated in the consistent decline of grassland bird populations (Samson and Knopf 1994, Herkert 1995, Bakker et al. 2002). In addition, the removal of trees may reduce avian predation on grassland-nesting species (Johnson and Temple 1990). Avian predators such as American crows and black-billed magpies prey on waterfowl eggs and use shelterbelts for nesting and food (Sargeant et al. 1993). Raptor species such as red-tailed hawk, Swainson's hawk, and great horned owl prey on adult ducks and ducklings (Murphy 1997). The removal of woody vegetation within grasslands likely reduces the cover and travel corridors for mammalian predators (Sovada et al. [in press]).

Wetland Vegetation

Wetland or aquatic vegetation consists of plants associated with wetlands or soil saturated for the majority of the growing season. The impoundments and pools contain sedges, smartweed, cordgrass, duckweed, reedgrass, cattails, and submerged plants such as sago pondweed. One of the most important aquatic food resources occurring at the refuge is the extensive beds of sago pondweed. Diving ducks, especially the canvasback, heavily use these beds. Good sago pondweed production occurs approximately 5 out of every 10 years.

Wetland plants affected by upland management are emergent vegetation along the upland-wetland edge. These include cattail, bulrush, and several species of moist soil plants such as smartweed. Substantial natural variation in submergent vegetation quantity and spatial distribution has occurred at the refuge since 1983. Emergent vegetation has remained relatively constant.

Impoundments and pools have been managed using the bypass channel system and water control structures. This manipulation of water levels has encouraged desirable plant growth and discouraged less desirable species.

Threatened and Endangered Plants

The refuge has no documented threatened or endangered plant species; however, no formal surveys have been conducted.

Invasive Plants

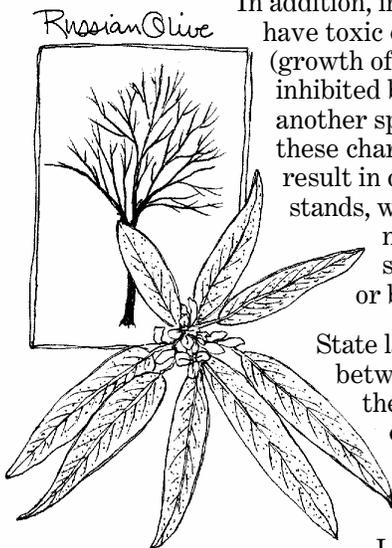
“Noxious weeds” is a legal designation. In the North Dakota Noxious Weed Law and Regulations Guide, the North Dakota Department of Agriculture has identified noxious weeds as plants that are difficult to control, easily spread, and injurious to public health, crops, livestock, land, or other property. Many of the state-listed noxious weeds are also invasive species.

Invasive plants are introduced organisms that colonize and rapidly spread in native systems due to the absence of natural controls. Invasive plants often share characteristics including effective seed dispersal, rapid colonization, and expansion capacities.

In addition, invasive plants can have toxic or allelopathic (growth of one species inhibited by chemicals of another species) effects. All these characteristics can result in dense single-species stands, which rapidly exclude native species or suppress crop yields or both.

State laws, and agreements between the Service and the state, mandate the control of state-listed noxious weeds on Service-owned lands.

Limited resources restrict the ability to control effectively all invasive plants at the refuge; therefore, priorities have been established to determine which species will be controlled first. These priorities are based the weeds’ potential



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adverse effects to refuge grasslands, wildlife, and economic capital. The adverse effects are derived from the life history, species biology, and control techniques of the species. Those species selected as the highest priority for control are those known to be invasive in their characteristics and currently found in refuge habitats. The four priority invasive plant species are Canada thistle, absinth wormwood, leafy spurge, and Russian olive. Infestations of other invasive plant species are targeted for treatment immediately upon identification. Invasive plants are managed as described in the Integrated Pest Management Plan for the Arrowwood NWR Complex (IPM Plan) (USFWS 2005).

Smooth brome, Kentucky bluegrass, crested wheatgrass, and quackgrass are species of tame grasses that have been seeded on or adjacent to refuge lands. These grasses have been seeded by neighboring landowners for forage or in plantings through the Conservation Reserve Program (a U.S. Department of Agriculture [USDA] program that “idles” highly erodible land), or by the USDA for bank stabilization. In some cases, the Service has seeded some of these species on refuge lands for wildlife habitat. Although these grass species are invasive in their characteristics and can damage native prairie grasslands when they invade, they are not considered invasive plants or noxious weeds in the IPM Plan (USFWS 2005).

Significant infestations of invasive plants have resulted in more than a loss of habitat for wildlife and a decline in species diversity in prairie grasslands. For many years, invasive plant issues have been sources of contention between the Service, neighboring landowners, the state of North Dakota, and county officials. Invasive plants have not always been effectively managed at the refuge. Invasive plant control efforts were often cosmetic, shortsighted, and reactive; many times, control efforts used only one technique instead of an integrated approach designed to meet a habitat objective.

The refuge employs an integrated approach to more effectively control noxious weeds and invasive plants, to achieve management goals and refuge purposes. The “Upper James River Weed Management Area” partnership was developed to work cooperatively and apply for grants.

Cropland

Although the refuge has a long history of agricultural crop production, there is currently little cropland at the refuge. The process of reducing cropland acres began in 1995 and most fields were seeded to native grass by 2005. Cropland will only be used to rejuvenate old DNC or to replace DNC with native grasses.



Tundra swan.

John and Karen Hollingsworth/USFWS

Wildlife

An important stopping place for migratory birds, the refuge also hosts threatened and endangered species and other wildlife described in this section. Lists of refuge wildlife species are in appendixes H–K.

Invertebrates

Invertebrate production in refuge waters is excellent especially in low-water years. Production of chironomids (midges), corixids (water boatmen), notonectids, and many other aquatic species normally peak at the same time the majority of the waterfowl broods are hatching. These aquatic insects provide an important source of protein to waterfowl and other wildlife. Terrestrial invertebrates are also an important food source to wildlife at the refuge. There are no known endangered invertebrates at the refuge.

Amphibians and Reptiles

Tiger salamander, Great Plains toad, Dakota toad, leopard frog, snapping turtle, painted turtle, plains garter snake, and prairie skink are some of the common reptiles and amphibians that inhabit the James River watershed.

Several species of reptiles and amphibians have been documented at the refuge, but no formal surveys have been conducted. Tiger salamander, leopard frog, chorus frog, and two species of turtles are known to be present. There are only three species of snakes known to occur at the refuge—garter snake, red-bellied snake, and smooth green snake. Appendix I contains a list of potentially occurring amphibian and reptile species at the refuge.

Fish

The shallow nature of impoundments usually results in a winterkill of fish. However, in high-water years fish can move upstream from the Jamestown Reservoir. This can result in good populations of northern pike, walleye, yellow perch, crappie, smallmouth bass, and black bullhead, but also brings

undesirable species such as bigmouth buffalo and carp. Fathead minnows and sticklebacks are also present. The fish provide a valuable food source for herons, grebes, mergansers, pelicans, and other fish-eating birds. Management efforts directed at sago production normally results in winterkill in all impoundments.

Common carp and bigmouth buffalo are always present in the James River and will enter refuge subimpoundments at every opportunity. Management of water levels on the refuge will minimize these undesirable species. Low water levels in the fall will cause winterkill of fish in most years. In addition, the electric fish barrier constructed as part of the Arrowwood NWR mitigation project (located between the refuge and Jamestown Reservoir) prevents fish from migrating from the reservoir into the refuge. The barrier is effective in normal and low water years but in high-flow years when the reservoir elevation exceeds 1,442 feet, water will overtop the barrier and fish will move into the refuge.

Birds

There are 266 species of birds that have been observed at the refuge (appendix J). Of these, 124 species are known to nest at the refuge. Spring and fall migrations find spectacular numbers of waterfowl passing through the area and the refuge is an important stop for many on the journey north or south. The James River serves as a major migration route and breeding ground for thousands of geese and ducks.



Gadwall.

Dave Menke/USFWS

Canada goose, snow goose, white-fronted goose, mallard, gadwall, blue-winged teal, American wigeon, lesser scaup, hooded merganser, redhead, and canvasback are common in the James River watershed.

Arrowwood NWR provides production habitat as well as resting and feeding areas for thousands of waterfowl and other migratory birds. The refuge is particularly important as a major diving duck staging area in North Dakota, with specific

importance to fall populations of canvasbacks. The refuge is a major waterfowl production area and provides wetland habitat for migratory waterfowl.

In addition to the waterfowl use of the refuge, other migratory and resident species inhabit the wetlands. Game and nongame species observed in the watershed include ring-necked pheasant, sharp-tailed grouse, gray partridge, mourning dove, upland sandpiper, bobolink, western meadowlark, and chestnut-collared longspur. Other bird species associated with riverine and wetland habitat found at the refuge include great blue heron, American bittern, American white pelican, red-winged blackbird, sora rail, American coot, Le Conte's sparrow, and sharp-tailed sparrow. Numbers of upland birds are cyclic, but good populations are normally present.

Mammals

Upland habitats are important to mammals at the refuge in many ways. White-tailed deer is the major big game species found in the James River watershed. Populations have increased statewide over the past 30 years and reached near record levels in the late 1990s.



James R. Williams/USFWS

The eastern cottontail is common where sufficient woody vegetation provides adequate habitat.



Dave Menke/USFWS

Muskrat.

Major furbearers in the James River watershed include mink, muskrat, beaver, raccoon, red fox, and

coyote. In addition, weasels, badgers, striped and spotted skunks, and jackrabbits inhabit the area. Appendix K contains a list of mammal species at the refuge.

Threatened and Endangered Wildlife

There are two federally listed threatened and endangered species known to occur at the refuge. The whooping crane is listed as endangered. The piping plover is a threatened species.

Whooping cranes migrate through the area but there have been only two confirmed sightings in recent years on or near the refuge. A lone whooping crane with a flock of sandhill cranes was recorded during the 2001 fall migration. A single whooping crane was sighted just west of Pingree, North Dakota, during spring 1997.

The piping plover has been recorded nesting at the refuge during years of low water; the bird prefers exposed gravel islands and shoreline habitat for nesting. Piping plovers have not been observed at the refuge since 1991. Because of its history of piping plover use, the refuge has designated critical habitat for piping plovers. The refuge participates in the "International Piping plover Breeding Census" conducted every 5 years.

The following species of special concern may be present at the refuge during certain times of the year:

- black tern
- ferruginous hawk
- Baird's sparrow
- loggerhead shrike
- northern goshawk
- Dakota skipper butterflies (periodic surveys of butterflies have been conducted since 1997; no Dakota skippers have been recorded)
- *Pyrrhopyga sinuate* Green, a rare firefly (documented in 1991 by a professor from the University of Florida, Gainesville)

3.3 CULTURAL RESOURCES

The built environment and archaeological remains on and near refuge lands represent the rich 10,000-year cultural heritage of the Arrowwood NWR. The varied habitats and resources of the refuge have attracted human settlement for more than 10,000 years. Until the last 150 years, the region was occupied by numerous groups of Native Americans who used a wide variety of adaptations to local resources, which included economies based on hunting, gathering, and horticulture (an early form of agriculture). The fur trade initiated contact between native peoples and Anglo visitors in the seventeenth century. By the mid-eighteenth century,

the influx of nonnative peoples significantly altered the traditional culture of the native people and reshaped the landscape of the region. Evidence of both the prehistory (pre-native contact) and the history (postnative contact) is found in the numerous archaeological sites and historic buildings on the refuge.

The refuge lies within the James River study unit of the “Archeological Components of the North Dakota Comprehensive Plan for Historic Preservation.” Based on information provided in that document, the prehistoric occupation of the region began with the Paleo-Indian period (9500–5500 B.C.); and extended through the Archaic (5500–400 B.C.), Woodland (400 B.C.–A.D. 1000), and Plains Village (A.D. 1000–1780) periods. Archaeological evidence suggests that bison were a major component of the economies of the prehistoric residents, with dependence on this resource decreasing through time. The Paleo-Indian period was based on an economy that relied heavily on migratory, large-game animals; this required settlements to be highly mobile. The Archaic and Woodland periods were marked with increased specialization in a broader spectrum of local resources, which resulted in less need for mobile settlements. During the Plains Village period, people became more sedentary because plant husbandry required that crops be tended. The Plains Village lifestyle maintained bison hunting due to the lack of development of crops that would consistently produce in the short growing seasons of the area. A variety of archaeological sites and surface finds provide evidence for prehistoric occupation including stone tool and ceramic scatters, stone circles, burial mounds, villages, and bison kills.

Although there has been very limited cultural resource survey done at the refuge, evidence from the surrounding areas suggests that a common location for prehistoric sites is along the bluff edge overlooking the river valley. Many of these sites probably exist at the refuge; however, future archaeological knowledge should be used to identify and protect these resources. No doubt, prehistoric archaeological sites that were below the bluffs in the river valley were covered with the deposition of sediments when water was dammed for the reservoirs in historic times.

Locations and items of traditional religious and cultural importance to Native Americans deserve special mention. The presence of several historic Native American tribes in the area at various times is well documented, predominantly various bands of the Lakota, Dakota, and Yanktonai Sioux. The name of the refuge, Arrowwood, comes from the fact that the Sioux gathered materials for bow and arrow manufacturing in this area from stands of oak and hackberry, which were not abundant outside the river valley. Sioux speakers named the area “Itazi paha koksaj” meaning “the place for cutting bows”

and they called the James River “san san san,” meaning “white wooded river.” There was a close relationship between native people and refuge lands in the past. Currently, the Spirit Lake Nation Indian Reservation and the Sisseton-Wahpeton Sioux Tribe of the Lake Traverse Reservation are near the refuge. Therefore, refuge lands likely support areas and resources that hold special meaning for these groups to preserve traditional religious or resource procurement activities.

The historical period began with the appearance of the Euro-American explorers and fur traders in the area about A.D. 1750, although extensive settlement did not occur until nearly 100 years later. In 1872, the Fort Totten Trail was constructed as a military route connecting Fort Seward in Jamestown to Fort Totten near Devil’s Lake. The remains of the trail are still visible in the form of wagon ruts east of Jim Lake and in the Grasshopper Hills area. A fortified camp associated with the trail, complete with trenches and sod berms, lies near the north refuge boundary. Once the military was well established, the area became ripe for Anglo homesteading and agriculture. Many of these earlier settlers were of eastern European descent. Common site types associated with the establishment of farming communities are farmsteads, homesteads, dugouts, small rural communities, bridges, schools, and railroads.

The establishment of the refuge is directly tied to the Civilian Conservation Corps (CCC) and Works Progress Administration (WPA) programs of the mid-1930s. President Franklin D. Roosevelt created these programs during the Great Depression as a means to employ young men of ages 18–25 to work providing useful projects for society and income for the workers to send to their families. The men planted thousands of trees and shrubs at the refuge. The CCC and WPA built many low-level dikes and water control structures on the refuge between 1935 and 1942. Arrowwood, Mud, and Jim lakes were natural lakes enhanced by these projects, while Depuy Marsh is a constructed feature. In addition, infrastructure was constructed in the form of a residence, an equipment building, a barn, a root cellar (also referred to as an aquatic cellar), and a bunkhouse.

3.4 SPECIAL MANAGEMENT AREAS

Arrowwood NWR meets the size, scientific, scenic, and ecological value criteria for wilderness. However, the refuge is impacted by roads, fences, and extensive human effects from grazing, agriculture, and wetland modifications that restrict it from being designated a wilderness area.

To be designated a wilderness area, lands must meet certain criteria (below) as outlined in the Wilderness Act of 1964:

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

3.5 VISITOR SERVICES

The refuge offers a wide variety of year-round accessible recreational opportunities that are wildlife dependent. Hunting, fishing, wildlife observation, photography, and environmental education are popular activities.

The report, “Banking on Nature 2004: The Economic Benefits to Local Communities of National Wildlife Refuge Visitation” (Caudill and Henderson 2005), stated that Arrowwood NWR recorded 6,796 visitors in 2004. Residents accounted for 5,526 visits and nonresidents 1,270 visits. Visitors engaged in nonconsumptive activities 76% of the time, with hunting and fishing 19% and 5% of the time. In addition to the wildlife-dependent activities it provides, the refuge offers a scenic contrast to the agriculturally dominated landscape that surrounds it.

Hunting

Unlike most refuges in North Dakota, Arrowwood NWR has never been open to waterfowl hunting. Hunters are able to harvest waterfowl that leave the refuge to feed in surrounding crop fields; resident and nonresident hunters alike take advantage of this fact.

In 2004, there were approximately 1,125 deer-hunting visits. Hunters pursue deer with bows, muzzleloaders, and modern firearms. To maintain a safe, high-quality hunt, access is walk-in only unless a hunter has a documented disability and obtains a refuge permit that allows the use of a vehicle for hunting. Specified times have been established to allow hunters to retrieve harvested deer using vehicles. The entire refuge is open to hunting, except the closed zone around the headquarters and the Warbler Woodland Watchable Wildlife Area (figure 7).

The refuge is open to upland game hunting after the firearm deer season closes. Hunters can take ring-



John Stehn/USFWS

The refuge is well known for white-tailed deer hunting.

necked pheasant, sharp-tailed grouse, gray partridge, cottontail, and red fox.

The hunting program is described in the compatibility determination in appendix L.

Fishing

The Service does not actively manage sport fisheries at refuges, including Arrowwood NWR, in the James River watershed. Managing for sport fisheries would conflict with the wildlife objectives for which the refuge was established. Sport fisheries would also create ideal habitat conditions for the survival of carp, which degrade wetland habitat for migrating and nesting waterfowl.

Fishing opportunities at the refuge are limited to extremely high-water years when the refuge is flooded. When water from the Jamestown Reservoir overtops the levees, fish can move upstream and populate the refuge. Fish species are typical of northern reservoirs with sport fish such as northern pike, walleye, yellow perch, crappie, and smallmouth bass. Abundant nonsport species include black bullhead, white sucker, carp, and bigmouth buffalo.

Public access is allowed to the sport fish resource when it is present. The spring and summer fishing season runs from May 1 through September 30. During that time, the following is allowed:

motorized boats, 25 horsepower and under,
on Arrowwood and Jim lakes

nonmotorized boats on all refuge waters
bank fishing

Primitive boat launch facilities are located in the Warbler Woodland Watchable Wildlife Area and at the southwest corner of Jim Lake (figure 7).

Bow fishing for rough fish is permitted from May 1 through September 30 of each fishing year, in accordance with state regulations. Spear fishing is not permitted.

Arrowwood, Mud, and Jim lakes are open to winter fishing. Fish houses are allowed. Vehicles (no ATVs or snowmobiles) are allowed on the ice, but only on Jim Lake and only via the primitive boat launch. Fish houses must be removed no later than March 15. Portable fish houses can be removed daily and are allowed after March 15.

The fishing program is described in the compatibility determination in appendix M.

When needed to address the problem of carp and bigmouth buffalo, the refuge has issued a special use permit for commercial fishing to net these undesirable fish species. More information is in the compatibility determination in appendix N.

Wildlife Observation and Photography

Three county roads and one state highway cross the refuge and offer opportunities for wildlife viewing. The refuge is included in two of the birding routes described in the “Birding Drives Dakota” brochure and the number of nonresident birders has increased in recent years. The first half of the 5.5-mile auto tour route (figure 7) follows the river channel and provides access to a wildlife observation deck on the riverbank overlooking two managed wetlands. The second half of the tour route climbs to the top of the river bluffs and offers panoramic views of the valley and surrounding lands.

The Warbler Woodland Watchable Wildlife Area (figure 7) includes an interpretive nature trail, natural spring drinking water, a vault toilet, tables, and grills. The Centennial Overlook provides a panoramic view of Arrowwood Lake; in the spring and fall months, thousands of migrating waterfowl, shorebirds, and other waterbirds can be seen. The public can reserve two blinds set up each spring on sharp-tailed grouse leks, offering excellent viewing and photo opportunities.

Walk-in access is allowed everywhere except the closed area near the headquarters, which includes the shop, equipment storage areas, and residents’ quarters. Nonmotorized biking is allowed on roads

and service trails, but not allowed off-road. Horseback riding is allowed only by special use permit.

During the boating season, from May 1 through September 20, nonmotorized boats and canoes are allowed on all waters. Boats with less than 25 horsepower motors are allowed on Arrowwood and Jim lakes.

The program for wildlife observation and photography is described in the compatibility determination in appendix O.

Interpretation

There is interpretive information for the auto tour route and nature trail. In addition, there are information kiosks at the entrance to the tour route, in the Warbler Woodland Watchable Wildlife Area, at the entrance to the grouse blind, and at refuge headquarters (figure 7). The refuge headquarters has a very small visitor contact area. The refuge staff is interested in increasing the size of the visitor contact area to provide interpretive information and brochures.

The interpretive program is described in the compatibility determination in appendix P.

Environmental Education

The refuge has both on- and off-site environmental education programs. Special events include participation with other refuges and conservation agencies in several water and river festivals, “JAKES (Juniors Acquiring Knowledge, Ethics & Skills) Day,” “Refuge Night at the Redhawks,” “Go Wild at the Mall,” and “Refuge Day at the Zoo.”



Refuge staff demonstrate the benefits of wetland and riparian habitats.

The refuge hosts numerous elementary, secondary, and college groups; and scout groups for environmental education activities and tours.

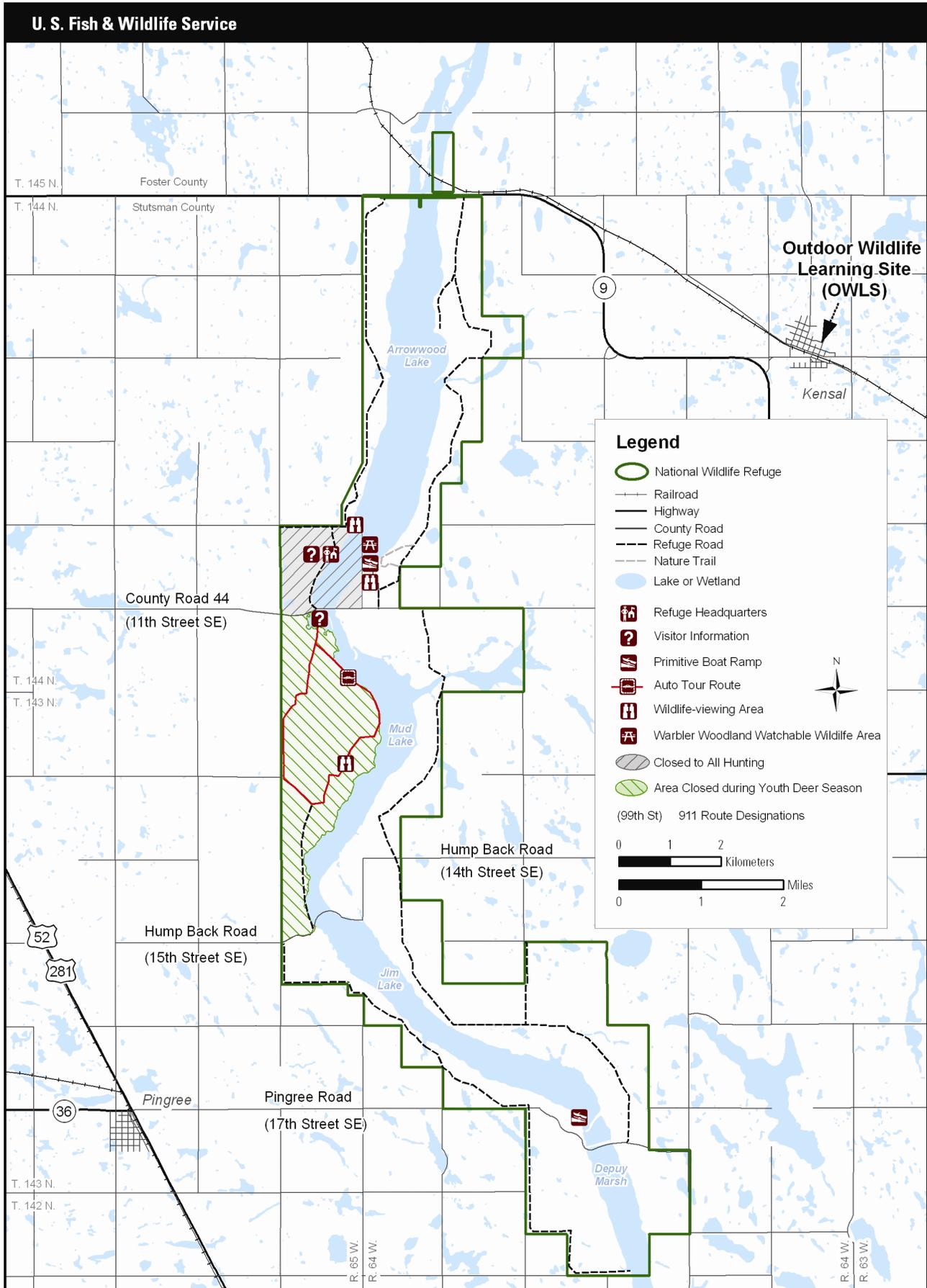


Figure 7. Public use areas at Arrowwood NWR, North Dakota.

Additionally, local third graders join the refuge for educational games and demonstrations during National Wildlife Refuge Week. The refuge is also a partner with the Kensal Public School and supports programs at the 1.5-acre Outdoor Wildlife Learning Site (OWLS).

The environmental education program is described in the compatibility determination in appendix P.

Other Recreational Uses

Refuge users are allowed to collect aboveground portions of commonly used edible plants such as berries, mushrooms, and asparagus for their personal use (see appendix Q). Trapping for recreational purposes is also allowed, under special use permit, on most areas of the refuge (see appendix R). The visiting public, under special use permit, can enjoy horseback riding on designated areas (see appendix S).

Compatibility Determinations

Compatibility determinations were approved for several uses in 1998. New compatibility determinations (listed below) have been prepared to update the 1998 determinations and to address public use at Arrowwood NWR:

- hunting (appendix L)
- fishing (appendix M)
- commercial fishing (appendix N)
- wildlife observation and photography (appendix O)
- interpretation and environmental education (appendix P)
- wild food gathering (appendix Q)
- recreational trapping (appendix R)
- horseback riding (appendix S)

3.6 AESTHETICS

The NEPA requires agencies to consider aesthetic impacts to scenery, noise, and odor from proposed federal actions. The Service preserves and enhances aesthetic resources to the extent that refuge objectives can still be fulfilled. A natural undisturbed appearance is the visual standard that applies to refuge habitat rehabilitation and management projects. If this standard cannot be met, the Service takes actions to mitigate or diminish any negative impacts.

Service policy is to use the most natural means available to meet wildlife objectives. In situations where objectives cannot be met using natural processes, more intensive and artificial methods

such as cropland management may be employed. The acreage cropped will be the minimum required to meet approved objectives. Service policy also states that the long-term productivity of the soil will not be jeopardized to meet wildlife objectives.

The following are examples of how the refuge carries out these policies:

- Borrow sites are reclaimed using pre-existing species.
- Old crop fields are being converted to various mixtures of grasses.
- Firebreaks are kept to the minimum necessary for safety and to meet prescribed fire management objectives; most firebreaks are being eliminated,
- Existing gravel pits are being reclaimed and no new gravel pits are being opened.

3.7 SOCIOECONOMIC ENVIRONMENT

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

Jamestown (Stutsman County) and Carrington (Foster County) are the primary communities near the refuge. According to “Tour North Dakota” (Central Dakota Tourism Partnership 2004), one of the greatest assets of the area is the quality of life enjoyed by its residents. In 2000, the population of North Dakota was 642,200 with an average density of 9.3 persons per square mile (U.S. Census Bureau 2002).

Stutsman County accounted for 3.4% of North Dakota’s total population in the year 2000, with a population of 21,908 residents averaging 9.9 persons per square mile (U.S. Census Bureau 2002). Jamestown, the county seat, is located in the south end of Stutsman County with a population of 15,571 people. Located in the valley where the James and Pipestem rivers meet, Jamestown offers a variety of recreational opportunities from summer activities such as fishing, hunting, and golfing to winter activities such as ice fishing, snowmobiling, and cross-country skiing (Jamestown, ND 2004).

Foster County, located just north of Stutsman County, is one of the smallest of the state’s 53 counties, 18 miles by 36 miles in size. Foster County accounted for 0.5% of North Dakota’s total population in the year 2000, with a population of 3,759 residents averaging 5.9 persons per square mile (U.S. Census Bureau 2002). Carrington, the largest town in Foster County, is commonly referred to as the “Central City” for its location central to the four major North Dakota cities of Bismarck, Fargo, Minot, and Grand Forks. With its outstanding leadership, community commitment, location, and updated infrastructure, Carrington has

been recognized as the most dynamic community in North Dakota with a population under 2,500 (Carrington, ND 2004).

While the state of North Dakota experienced a relatively low 0.5 % population increase from 1990 to 2000, Stutsman County's population increased by 3.0%, while Foster County's population decreased 6.0% over the same time frame. Approximately 78% of the Foster County population and 81% of the Stutsman County population 25 years and older have high school diplomas, while 20% were college graduates (U.S. Census Bureau 2002).

Based on population origin estimates from the 2000 census, 91.7% of the state's population was white persons not of Hispanic/Latino origin, 5.0% were American Indian and Alaska Native, 1.2% were Hispanic or Latino origin, 0.6% were Black or African American persons, and 0.6% of Asian decent. Population origins in Foster and Stutsman counties were similar to the state population (U.S. Census Bureau 2002). The predominant immigrant cultures in the region include Scandinavian, German, Ukrainian, and Icelandic (Central Dakota Tourism Partnership 2004).

The majority of Stutsman and Foster counties are rural with agriculture as the main industry (U.S. Department of Commerce 2002). Like most North Dakota communities, Jamestown and Carrington can trace their development to the arrival of the railroad (Central Dakota Tourism Partnership 2004). Agriculture formed the basis for the region's early economy and still is an important component today. According to the U.S. Department of Commerce (2002), total farm self-employment accounted for 8.3% of total employment in North Dakota (8.3% in Stutsman County and 13.8% in Foster County) in 2000. Besides agriculture, the other major local and state employers are service-related business, government, and retail trade.

Major employers in Jamestown include health providers, education, potato processing, and aerospace products manufacturing (U.S. Census Bureau 2002). Carrington's business community is diversified, including agriculture, manufacturing, financial, retail, and technology-based endeavors (Carrington, ND 2004). Carrington serves as the center of an important corridor of agribusiness (Dietz 2003). Carrington is home to state-of-the-art Dakota Growers Pasta Company, which markets premium quality pasta worldwide (Carrington, ND 2004).

Foster County per capita personal income was \$25,138 in 2000, which very close to the state average of \$25,109. Meanwhile, Stutsman County per capita personal income was \$23,686, which was \$1,423 lower than the state average (U.S. Department of Commerce 2002). Total personal income was \$94 million in Foster County and \$517

million for Stutsman County in 2000 (U.S. Department of Commerce 2002).

The communities and local governments near the refuge benefit economically from the presence of the refuge and the activities that occur there. In September 2005, the Service released the results of a report entitled "Banking on Nature 2004: The Economic Benefits to Local Communities of National Wildlife Refuge Visitation" (Caudill and Henderson 2005). Arrowwood NWR served as a sample refuge for this study, which resulted in the creation of economic models used to estimate the economic impact of refuge visitation nationwide. The report estimates that in fiscal year 2004, Arrowwood NWR recreational visitors spend \$68,300, with the majority of that related to big game hunting (\$46,200). When the total monetary value of this economic activity to the local area economy is considered, recreational visitation to the refuge generates \$87,500 per year, which is enough to create two jobs (both part time and full time) with a combined income of \$30,400.

3.8 STAFFING

Staff located at the refuge headquarters has responsibility for the entire Arrowwood NWR Complex; however, for this document, the payroll expenditures are attributed entirely to Arrowwood NWR. Currently there are nine permanent employees and six temporary employees located at the refuge headquarters. Funding for employee salaries and benefits totaled \$752,993 in fiscal year 2006. Table 1 shows the current refuge staff.

3.9 PARTNERSHIPS AND OTHER PUBLIC OUTREACH

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

The refuge's partners have assisted in wildlife and habitat management, visitor services and recreational opportunities, and community outreach. Many of these relationships have developed into formalized partnerships with written agreements or understandings, while others remain more informal.

Existing Partnerships

The most significant partnership is with the Bureau of Reclamation for construction of the mitigation features authorized under the Garrison Diversion Unit Reformulation Act of 1986. Once completed, this

Table 1. Current staff at Arrowwood NWR, North Dakota.

<i>Staff Group</i>	<i>Position</i>
Management	Project leader, GS ¹ -14* Deputy project leader, GS-13* Refuge operations specialist, GS-7/9/11*
Biology	Wildlife biologist, GS-9/11*
Administration	Administrative officer, GS-11* Clerk (office assistant), GS-6*
Maintenance	Engineering equipment operator, WG ² -10
Fire	Fire management officer, GS-11* Fire technician, GS-6/7*
Term ³ , Temporary	Tractor operator (term), WG-6 Biological technicians (5), GS-3/4/5/6
<i>Total Salaries and Benefits = \$752,993</i>	

¹GS=general pay schedule.

²WG=wage grade pay schedule.

³term=temporary time-limited position.

*Staff with responsibilities for the entire Arrowwood NWR Complex.

project will allow independent management of water levels in each of the refuge impoundments. An agreement that stipulates Reclamation will purchase necessary equipment and supplies and fund a position to operate and maintain the mitigation project features has been in effect for several years.

The refuge has worked closely with the Stutsman County Weed Board to combine resources, apply for grants, and cooperate on control actions. This arrangement has allowed both parties to purchase chemicals and insects for biological control at lower prices. In addition, this partnership has allowed county employees to assist with chemical application and map infestations on refuge lands. This partnership has expanded to three other county weed boards and extension offices, and several other partners. This partnership has received funding from the National Fish and Wildlife Foundation's "Pulling Together Initiative," for additional invasive species work within the Arrowwood NWR Complex.

"Birding Drives Dakota," a coalition of communities and agencies dedicated to the promotion of birding in North Dakota, is a new organization with which the refuge is collaborating. Some of the primary sponsors are Carrington Chamber of Commerce, Carrington Community Development Corporation, Carrington Convention & Visitors Bureau, Garrison Diversion Conservancy District, Jamestown Area Chamber of Commerce, Jamestown Promotion & Tourism, Jamestown Sun, and Northern Plains

Electric Cooperative. Arrowwood NWR was a major contributor to the development of the "Birding Drives Dakota" pamphlet, which details six routes in and around Stutsman County where birders can expect to view North Dakota's abundant bird life. Additionally, the refuge was a major sponsor and organizer of the first "Potholes and Prairie Birding Festival," which has become an annual event to promote birding, other nature-based activities, and preservation of native grassland and wetland habitats.

The Northern Prairie Wildlife Research Center of the USGS is a valuable partner, providing the latest research information on wildlife issues. A current project includes long-term monitoring following completion of the study, "Role of nutrient manipulation and biological control insects on leafy spurge population regulation at Arrowwood and Tewauckon national wildlife refuges," in 2003.

The development of the OWLS at Kensal (figure 7) is the result of another partnership with the Kensal Public School and NDGF.

The refuge actively sought and fostered partnerships with organizations and individuals with whom a common goal is shared. Many individuals, groups, and organizations have contributed in important ways to the refuge, including the following groups:

- U.S. Army Corps of Engineers–Pipestem Dam
- NDGF
- Stutsman County Weed Board
- Foster County Weed Board

- North Dakota State University Extension Service
- Stutsman County Park Board
- Stutsman County Wildlife Club
- United Sportsman–Jamestown Chapter
- Dakota Anglers
- Tri-County Trap Club
- Ducks Unlimited
- Boy Scouts
- Girl Scouts
- 4-H

Potential Partnerships

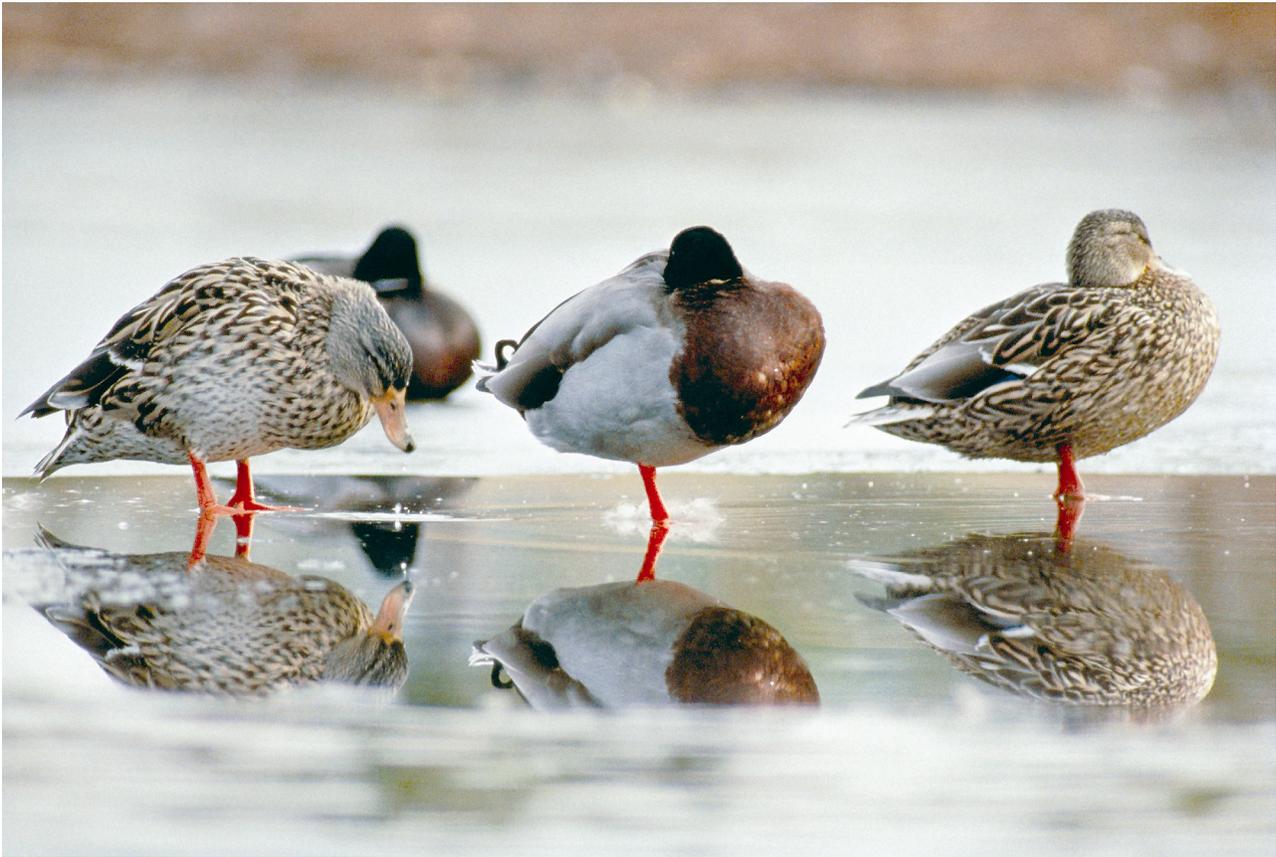
Only with public support can the Service succeed in its mission. That support comes through outreach—fostering education and understanding, and communicating the importance of the Service commitment to protecting habitat on which wildlife

depends. Outreach includes a broad array of activities and services focused on building relationships and communication. The Service is committed to getting its message to both traditional and nontraditional groups.

Existing Service private lands programs and the refuge’s proposed watershed management (alternative 3 in chapter 4) correspond very well with programs offered by the Natural Resources Conservation Service (NRCS), NDGF, EPA, North Dakota State Health, and county water boards. A partnership to improve watershed health in the upper James River could include all these entities as well as others. The refuge is open to any partnership that will further the purposes, goals, and objectives of the Service, the refuge, or the Refuge System.

Additional partnerships can be forged with various universities to assist with research needs. Researchers from University of North Dakota and North Dakota State University have inquired into potential sites to initiate or expand current research.

4 Management Direction



Tim McCabe/USFWS

Mallards at rest.

The management direction in this chapter meets the purposes, vision, and goals of the Arrowwood National Wildlife Refuge. This direction helps fulfill the mission of the Refuge System, maintains and where appropriate restores the ecological integrity of the refuge and the Refuge System, addresses significant issues and mandates, and is consistent with principles of sound fish and wildlife management.

The Section 7 biological evaluation for threatened and endangered species (see appendix U) documents that this CCP will have “no adverse effect for whooping crane, gray wolf, bald eagle, Dakota skipper, piping plover, and piping plover critical habitat.”

This chapter contains the following sections:

- management summary
- goals, objectives, rationales, and strategies
- staffing and funding
- step-down management plans
- monitoring

4.1 MANAGEMENT SUMMARY

The Service will maintain the biological potential of wetland and upland habitats at the refuge to support a well-balanced and diverse flora and fauna representative of the Prairie Pothole Region. A scientific-based monitoring program will be developed and incorporated in the HMP. Monitoring will measure the habitat and wildlife population response to management activities. Public use opportunities will be expanded with the construction of additional facilities and development of educational programs. Public use regulations will be clarified and modified where appropriate to enhance the quality and quantity of wildlife-dependent recreational opportunities.

Water Resources

Wetland habitats will be managed to provide habitat conditions for migrating waterfowl, migrating shorebirds, and nesting waterbirds. Properly timed water level manipulations will result in the development of various wetland habitats:

(1) deepwater, emergent vegetation habitat for black terns, Franklin's gulls, and heron and egret nesting habitat; (2) shallow water with emergent vegetation for pied-billed grebes and rails; (3) open water and submergent vegetation for eared grebes; and (4) annual plants for feeding waterfowl. Acres and location will vary from year to year. A monitoring plan will be developed and carried out to monitor the water manipulations, timing, habitat characteristics and response from the birds. The current long-range water management plan will be rewritten to reflect the habitat benefits to the colonial or overwater-nesting species.

This CCP proposes development of a plan to improve water quality entering the refuge and reduce peak flows in the upper James River watershed during spring runoff and summer rainfall events.

In addition to wildlife benefits, the water quality and flood prevention benefits of protecting small streams and wetlands are well documented. Small streams and wetlands provide natural flood control, maintain surface water and groundwater supplies, trap sediment, filter and process natural nutrients and pollutants, and sustain natural biological diversity. Agricultural and other land use changes near small streams and wetlands can impair the natural functions on headwater systems. Removal of natural vegetation, hardening of soil surfaces, removal or straightening of stream channels, and draining of small wetlands greatly reduces the amount of rainfall and snowmelt the watershed can absorb before it floods. This increase in water volume scours stream channels, which promotes additional flooding. The altered channels and lack of wetlands significantly reduce groundwater recharge, sediment retention, and recycling of nutrients. Downstream lakes and rivers have poorer water quality, greater fluctuations in flow, and less diverse aquatic life. Algal blooms and fish kills become more common and recreational uses are adversely affected.

As stated in the UWA (described in chapter 3 under "Water Quality"), the upper James River watershed (including portions of Stutsman, Foster, and Eddy counties) encompasses 1,773 square miles with 70% in cropland. Targeting cropland in key areas and converting it to permanent cover will reduce sedimentation and improve water quality. Restoring wetlands in these key areas will trap sediment, slow runoff, and reduce peak flows entering the refuge, resulting in increased groundwater recharge. Based on interpretation of the National Wetland Inventory maps, more than 7,000 acres of wetlands have been drained in Eddy and Foster counties.

The water quality and water retention capabilities of the upper James River watershed could be improved and the refuge's wetland objectives could be achieved through cooperative efforts. This will include working through existing programs, as well

as with the Service's Private Lands Program, the NRCS, county soil conservation districts, water boards, the EPA, Reclamation, and private landowners.

Habitat and Wildlife

Upland habitats will be managed to maximize production of waterfowl and other grassland-nesting species. Areas of tame grass or DNC close to water will be managed primarily for tall DNC for waterfowl. Sharp-tailed grouse, other grassland birds, and small mammals will also benefit from this habitat type. Areas of native prairie will primarily be managed for ecological integrity, but will also provide important habitat conditions for upland-nesting birds, especially the grassland-endemic songbirds. The Grasshopper Hills area, which is probably the largest contiguous tract of native prairie, will be a priority tract for management.



© Jennifer Jewett

Early morning fog rolls over Arrowwood's uplands.

Upland habitats will be managed with grazing, prescribed fire, mechanical manipulations, chemical applications, biological control, and rest. The treatment applications will vary from year to year and will be applied as habitat objectives dictate. A monitoring plan will be developed and carried out to monitor the habitat characteristics and wildlife population response to management activities.

To reduce the impacts of woody vegetation on grassland-dependent birds, selected sites will be targeted for tree removal; grasslands invaded by trees in areas with populations of priority species will be targeted. Priority will be given to sites with planted tree rows (shelterbelts) within 164 feet of grassland patches greater than 247 acres, and to plantings of single rows and dilapidated stands of trees.

Cropping will be used to prepare fields for planting of DNC or native grasses.

Invasive plant control will be carried out as outlined in the IPM Plan (USFWS 2005).

Predator management will remain at the current level unless population monitoring results dictate otherwise.



Eastern bluebird.

Visitor Services

Public use will be enhanced with the improvement and expansion of wildlife-dependent recreation. The compatibility determinations in appendixes L–S detail the public use programs.

Opportunities to increase hunting and fishing will be reviewed and facilities constructed as funding became available. Due to recent changes made by the state regarding the early Canada goose season and resident-only waterfowl season, the periods for which the refuge is accessible to boats and canoes will be shortened to minimize disturbance and allow waterfowl to use the refuge as a rest area.

Refuge-specific regulations for access into the refuge for wildlife observation, photography, and other wildlife-dependent recreational uses will be clarified and, where appropriate, modified to eliminate or minimize potential conflicts between refuge user groups. For example, biking on vehicle trails will cease when archery deer season begins and walk-in access for wildlife observation and photography will not be recommended during the deer gun and muzzleloader seasons.

Environmental education programs will be developed for presentation on and off the refuge. Additional staff will seek out opportunities to share the story of the Refuge System and educate the public about the refuge's natural resources.

Additional wildlife-viewing opportunities will be explored with the possible development of additional trails, overlooks, and improved interpretive and directional signs. The office entrance will be remodeled to accommodate a small visitor contact area. Outdated and extraneous signs will be removed to enhance the aesthetic beauty of the refuge. The access road to the Warbler Woodland Watchable Wildlife Area will be upgraded, along with the directional signs to the trailhead and interpretive signs on the trail. A covered pavilion at the Warbler Woodland Watchable Wildlife Area is planned to accommodate workshops, group presentations, and environmental education. The refuge will maintain at least one portable observation blind on an active sharp-tailed grouse lek and seek a suitable site for a permanent blind.

4.2 GOALS, OBJECTIVES, RATIONALES, AND STRATEGIES

Objectives and strategies to carry out the goals will provide for ecosystem and resource needs and public use.

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

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

- review and interpretation of national plans
- biological assessment of the refuge
- review of existing scientific literature
- evaluation of habitat conditions
- personal knowledge of planning team participants

Upland Goal

Provide a diversity of grassland types that emulate the range of natural variation characteristic of the Prairie Pothole Region to benefit trust resources including waterfowl, grassland birds, and songbirds.

NOTE: Arrowwood NWR contains about 11,340 acres of grassland, of which approximately 6,000 acres are native prairie. The potential natural vegetation of the area is cool-season, needlegrass-wheatgrass, mixed-grass prairie. Vegetation of the mixed-grass prairie is predominantly a mixture of western wheatgrass, needlegrasses, blue grama, little bluestem, and upland sedges. Interspersed within the grasses are numerous species of forbs and patches of shrubs comprised of western snowberry, Woods' rose, silverberry, or mixtures of these species (Kuchler 1964). Long-term management will be to provide pre-1870s vegetation composition and habitat characteristics of the grassland-dependent species currently exhibiting significant population declines. The remaining 5,340 acres are comprised of seeded natives, DNC, or other cool-season introduced grasses.



© Rick Bohn

Sharp-tailed grouse.

Upland Objective 1

Provide 4,000 acres of grassland habitats on a 5-year average, in blocks of a minimum of 100 acres in size with less than 30% shrub cover, located within 300 feet of brood water. Structural characteristics of these grasslands include variable visual obstruction readings (VORs) greater than 4 inches and variable vegetation heights greater than 6 inches. This will primarily benefit nesting waterfowl such as mallard, gadwall, and blue-winged teal. In addition, these vegetation characteristics will provide the habitat needs for sharp-tailed grouse, dickcissel, sedge wren, and common yellowthroat.

Rationale

The locations where this objective is met will change over time as burning, grazing, and mowing are used to manipulate the habitat. Structural characteristics such as litter, grass height, and density will be lowest the first one or two growing seasons following treatment and will increase each year after that. Since treatments will not be applied consistently over the entire landscape, this will result in a mosaic of vegetation structures.

Emphasis will be placed on DNC and other tame grass fields located within 300 feet of permanent and semipermanent water for nesting waterfowl. In addition to providing tall dense cover for nesting waterfowl, tame grass fields generally contain less than 10% shrub canopy. Tracts of native prairie located within 300 feet of permanent water will also be managed to provide tall, dense cover. This tall dense cover also provides optimal habitat for nesting sharp-tailed grouse and common yellowthroat, as well as nesting waterfowl.

Strategies

a. DNC and other tame grass fields will periodically be treated using grazing, prescribed fire, haying, and mowing. Approximately 30% of the 4,000 acres will have periods of 3–5 years rest between treatments for undisturbed nesting habitat. Prescribed fire and

grazing will be used to remove excessive litter that is suppressing growth of favorable species such as wheatgrasses and forbs in DNC and native grasses and forbs in native prairie. Burning and grazing will improve nutrient cycling and encourage new vegetation growth and seed production. Haying and mowing will be used primarily for invasive plant control and litter reduction. In native prairie, haying and mowing will be used to reduce or maintain shrub canopy.

b. Croplands have been eliminated except as a means of rejuvenating DNC and for invasive plant control. Other seed mixes may be used once research is available for restoration techniques that are cost-effective and efficient. Fields in areas designated primarily for waterfowl production management will be planted to a DNC mixture. Recently, approximately 130 acres of cropland were seeded to DNC. Reduction of cropland will provide larger contiguous grassland tracts. Some existing grassland tracts may need to be cultivated and reseeded or “interseeded” with various grass and forb species to increase the height and density of the cover and provide the necessary structural characteristics for the species of interest. Approximately 2,200 acres of tame grasses will need to be rejuvenated in the next 15 years.

c. Some fields of native prairie will require an aggressive, systematic use of prescribed fire, grazing, haying, and mowing to reduce the brush canopy cover under 30% for sedge wren, Savannah sparrow, grasshopper sparrow, Baird’s sparrow, bobolink and chestnut-collared longspur (Arnold and Higgins 1986, Bakker 2003). The common yellowthroat prefers tall dense cover, but with a higher brush composition of 30–60%. These thicker patches of brush are scattered throughout the fields and will continue to provide the habitat conditions necessary for breeding common yellowthroats.



USFWS

Unit G21, west Jim Lake, is treated with prescribed fire for brush reduction, litter removal, and grassland rejuvenation for ground-nesting wildlife.

d. Maintain the 38-acre predator enclosure to provide safe nesting habitat for waterfowl and other grassland-nesting species. The habitat within the fence will be maintained as DNC and periodically treated using prescribed fire or haying following the nesting season to maintain tall dense cover. The fence will be electrified from late March through July each year and the area trapped to ensure a predator-free nesting environment. The surrounding vegetation will be managed to minimize competing vegetation outside the fence and encourage nesting within the boundary of the fence. The fenced area

will be monitored annually to determine the nesting success.

e. Invasive plant species such as leafy spurge, wormwood, and especially Canada thistle will continue to be controlled using an integrated approach. Control methods will include mechanical and chemical treatments, but priority will be given to current and emerging biological control methods. Research will be encouraged to investigate improved methods to control invasive plants and analyze the effect of grassland management treatments on invasive plants.

f. Selected planted tree rows (shelterbelts) will no longer be protected from prescribed fire. Decreasing the number of trees will reduce perching sites for predators such as red-tailed hawk and great horned owl. Tree removal will increase field size and eliminate the “hostile” habitat within select grassland tracts. The abandoned firebreaks around the trees will be seeded to a vegetation mixture similar to the surrounding habitat.

g. Purchase of private inholdings to complete the legislated refuge boundary could provide an additional 3,200 acres of upland and wetland habitat that could be managed to provide the habitat required by many of the grassland-dependent species. The additional upland habitat could increase the field sizes and reduce the habitat fragmentation. In turn, this could increase the nesting success. Also, the addition of 260 acres of wetlands could increase the pair habitat to attract additional waterfowl pairs and other waterbirds.

Upland Objective 2

Provide 5,000 acres of grassland habitats on a 5-year average with less than 30% shrub cover and greater than 25% grass cover, in blocks of a minimum of 75 acres but preferably greater than 150 acres. Structural characteristics include a variable VOR greater than 4 inches and a variable vegetation height from less than 6 inches to greater than 20 inches. This will benefit nesting grassland Neotropical migrants including Le Conte’s sparrow, clay-colored sparrow, Savannah sparrow, grasshopper sparrow, western meadowlark, and bobolink, in addition to other nesting species such as common snipe, willet, northern pintail, short-eared owl, and northern harrier. This grassland habitat will also support abundant small mammal populations that provide prey for numerous raptor species.

Rationale

This objective will increase diversity of both flora and fauna and will be mainly applied to the native prairie areas, but also will apply to tame grass fields located away from permanent water. The emphasis will be to return the native prairie areas to



S. Maslowski/USFWS

Bobolink.

conditions that existed prior to European settlement (pre-1870s), which provided the necessary habitat characteristics for many grassland-dependent species that are showing significant breeding population declines today. This will include reducing brush and exotic, cool-season grasses such as smooth brome and Kentucky bluegrass; and increasing the composition of the native grasses and forbs.

Strategies

a. Brush will be reduced. Currently, approximately 40% of the native prairie acreage has a brush canopy cover greater than 50%. Woody vegetation within or bordering prairie fragments will be reduced because it attracts nest predators and consequently reduces nesting success (Johnson and Winter 1999). These fields will require an aggressive, systematic use of prescribed fire during mid-July to late August to reduce western snowberry stems and increase the composition of native grasses and forbs. Haying and mowing will be used on those areas not conducive to prescribed fire. An integrated approach will be carried out using fire; grazing; and mechanical, chemical, and biological control methods to maintain the brush canopy cover under 30% and encourage native species.

b. Native vegetation composition will be increased. Native prairie areas will be rejuvenated and enhanced using grazing, prescribed fire, haying, and mowing when the native grasses and forbs have less than 50% canopy cover. Prescribed burning and grazing will be carried out during different periods of vegetative growth or, in combination, to attain specific objectives: (1) to remove excessive litter suppressing favorable species such as native grasses and forbs; (2) to reduce the competition between the native and nonnative species; (3) to reduce exotic cool-season grasses when at the 3- to 5-leaf stage; (4) to increase the native forb composition; (5) to provide nutrient cycling; and (6) to encourage new vegetation growth and seed production. The presence of various native grasses and forbs will provide the structural characteristics required by

most grassland-nesting species and foraging habitat and habitat needs for various invertebrates such as butterflies and moths. Native prairie areas will be aggressively treated with multiple treatments to reduce brush and increase the native species composition of grasses and forbs.

c. Decrepit DNC stands will be rejuvenated and enhanced using grazing, prescribed fire, haying and mowing when the VORs and vegetation heights fall below 50% of the maximum values (as identified in the habitat management plan to be completed by 2010). Prescribed fire and grazing will be used to (1) remove excessive litter that is suppressing favorable species growth such as that of wheatgrasses and forbs in DNC, (2) to increase nutrient cycling, and (3) to encourage new vegetation growth and seed production. Haying and mowing will be used primarily in the tame grass fields for invasive plant control and litter reduction and in native prairie fields to reduce or maintain shrub canopy. Tame grass fields with very low habitat value will require cropping for 2 or 3 years and reseeded with native grasses and forbs. As an alternative to farming, fields may be treated with a nonselective herbicide and then “no-till” seeded with native species.

d. The use of croplands will be eliminated except as a means of rejuvenating old DNC fields and for invasive plant control.



Leafy spurge, a noxious weed, infested this area of the refuge prior to release of flea beetles for biological control in 1995.

e. Invasive plant species such as leafy spurge, wormwood, and especially Canada thistle will continue to be controlled using an integrated approach. Control methods will include mechanical and chemical treatments, but priority will be given to current and emerging biological control methods. Research will be encouraged to investigate improved methods to control invasive plants and analyze the effect of grassland management treatments on invasive plants.

f. Selected planted tree rows (shelterbelts) will no longer be protected from prescribed fire. Decreasing

the number of trees will reduce perching sights for predators such as red-tailed hawk and great horned owl. Tree removal will reduce habitat fragmentation and eliminate the “hostile” habitat within select grassland tracts. The abandoned firebreaks will be seeded to a vegetation mixture similar to the surrounding habitat.

g. Purchase of private inholdings to complete the legislated refuge boundary will increase the size of several fields to meet the minimum required habitat size of 25–100 acres for most species.

Upland Objective 3

Provide a minimum of 1,600 acres of grassland habitats in blocks of at least 75 acres with less than 30% shrub cover and 15–70% grass cover. Structural characteristics include less than 4 inches VOR and variable vegetation heights ranging from 6 to 20 inches to benefit Vesper sparrow, chestnut-collared longspur, horned lark, upland sandpiper, and marbled godwit (Kantrud and Higgins 1992).

Rationale

This set of grassland habitat characteristics exists off the refuge and in abundance on private lands. Smaller areas are available on refuge hilltops and within the thin upland soil types. In addition, this habitat will be provided at the refuge for one or two growing seasons following management treatments applied to achieve upland objectives 1 and 2.

Strategies

- a. The development of mini-joint-venture grazing systems that encourage rest on adjacent private lands will continue.
- b. The potential for reintroduction of prairie dogs will be evaluated.
- c. Purchase of private inholdings to complete the legislated refuge boundary will increase the size of several fields to meet the minimum required habitat size of 25–100 acres for most species.

Upland Objective 4

Maintain existing wooded ravines and trees in riparian zones that historically supported woody vegetation.

Rationale

The 660 acres of riparian floodplain and wooded ravines are primarily associated with the James River valley and lakeshores within the refuge. These native woodlands provide habitat for many woodland-dependent species. Although these habitats cover less than 1% of the northern Great Plains, wooded ravines can attract a disproportionately rich number of bird species

compared to other plains habitats (Dobkin 1992.) These woody habitats increase species diversity by providing the migration and breeding habitats for many migratory land birds. Some of the bird species that use these habitats include Cooper's hawk, black-billed cuckoo, least flycatcher, willow flycatcher, great-crested flycatcher, red-eyed vireo, yellow warbler, and northern oriole.

Strategies

- a. The woody ravines will not be intentionally burned; however, they will not be protected from prescribed fire treatments. Fires historically kept the ravines in early successional plant species, which benefited many birds.
- b. Management treatments to increase bur oak germination in the riparian zones will be investigated.

Wetland Goal

Provide a diversity of wetland types that emulate the range of natural variation characteristic of the Prairie Pothole Region to benefit threatened and endangered species, waterfowl, shorebirds, wading birds, and other wetland birds.

Wetland Objective 1

Provide 1,250 acres (50%) consisting of 30–60% emergent vegetation, primarily bulrushes and cattail, interspersed with 40–70% open water that supports beds of aquatic vegetation, preferably sago pondweed, with water depths of 8–20 inches (stable or slightly declining) between May 1 and August 1.

Rationale

This vegetation will provide brood habitat for dabbling ducks such as mallard, gadwall, and blue-wing teal and foraging habitat for migrating diving ducks and tundra swan.

Beds of aquatic vegetation provide foraging habitat for breeding dabbling ducks, herons, egrets, grebes, canvasback, and tundra swan (Earnst 1994, Kantrud 1990) in the fall. This objective will be applied to Arrowwood and Jim lakes.

A minimum of 25% wetland habitat will support dense emergent vegetation with a VOR greater than 12 inches and vegetation height greater than 20 inches to provide nesting habitat for American bittern (Laubhan and Roelle 2001), black-crowned night-heron, canvasback, redhead, common yellowthroat, and sedge wren.

A minimum of 25% wetland habitat will support sparse emergent vegetation with a VOR ranging from 4 to 12 inches and vegetation height ranging from 6 to 20 inches to provide nesting habitat for black tern (Bergman 1970, Naugle et al. 2000),

Franklin's gull (Du Mont 1940), and pied-billed grebe (Naugle et al. 1999).

Strategies

- a. After ice out, maintain or raise water depths to 3–5 feet, with clear water for adequate light penetration during the critical sago pondweed-germination period, March through April.

Slowly raise the water level from mid-June through September, and then slowly draw down the water level through October, to develop 3- to 5-foot bands of seasonally flooded emergent vegetation. Emergent vegetation establishment may take several years of low water levels. A fringe of emergent vegetation around the shoreline will reduce wind erosion and re-suspension of sediments. Reflood the emergent vegetation the following spring to provide nesting and brood cover.

- b. Reduce sedimentation rates by working with other federal and state programs to improve the upper James River watershed. Conserve, restore, enhance, and create habitat resources in watersheds to influence the quality and quantity of water flowing into rivers and streams.

- c. Control rough fish by reducing water levels enough to result in fish kills during winter months, as conditions dictate.

- d. Use Arrowwood Lake to store water for management of other pools as long as sago production is unimpeded.

Wetland Objective 2

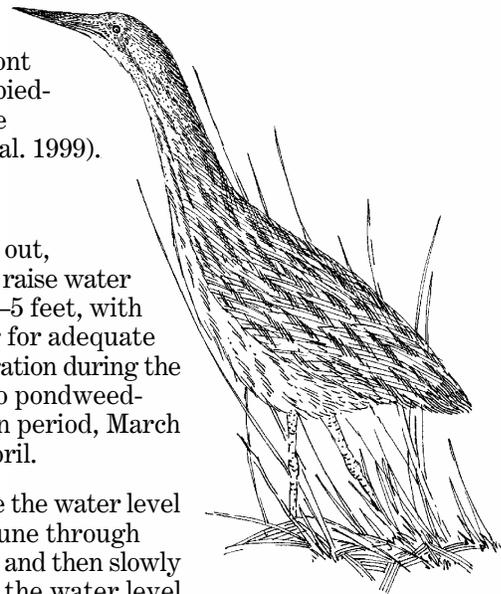
Provide 300 acres consisting of greater than 80% emergent vegetation (such as bulrushes and cattail) and 0–20% open water with depths ranging from moist to 8 inches, between May 1 and August 1, in patches greater than 25 acres.

Rationale

Thick stands of bulrushes and cattails provide nesting habitat for black tern, eared grebe, western grebe, Franklin's gull, sora, and Virginia rail. This objective will target Arrowwood and Jim lakes.

Strategies

- a. Control rough fish by reducing the water level enough to result in fish kills during winter months.



American Bittern
© Cindie Brunner

b. Raise water levels slowly until May 1, to depths of 1–4 feet, then maintain at stable or slightly declining levels between May 1 and August 1 to favor emergent vegetation growth along edges.

Emergent vegetation establishment may take several years of low water levels. A fringe of emergent vegetation around the shoreline will reduce wind fetch and re-suspension of sediments. Reflood the emergent vegetation the following spring to provide nesting and brood cover.

c. Reduce sedimentation rates by working with other federal and state programs to improve the upper James River watershed. Conserve, restore, enhance, and create habitat resources in watersheds to influence the quality and quantity of water flowing into rivers and streams.

d. Use Arrowwood Lake to store water for management of other pools as long as sago production is unimpeded.

e. When expanses of emergent vegetation exceed 150 acres, draw down the lake and disturb with prescribed fire or disking to set back plant succession.

Wetland Objective 3

Provide 500 acres of open-water habitats consisting of 20–100% submergent aquatic vegetation (such as pondweed, bladderwort, and coon's tail) in patches greater than 8 acres, with depths ranging from moist to 8 inches, between May 1 and August 1.

Rationale

Patches of submergent aquatic vegetation provide habitat for nesting black tern, eared grebe, western grebe, Franklin's gull, sora, and Virginia rail. In addition, this vegetation provides foraging habitat for breeding dabbling ducks, herons, egrets, grebes, canvasback, and tundra swan in the fall. This objective will target Arrowwood and Jim lakes.

Strategies

a. After ice out, maintain or raise water depths to 3–5 feet, with clear water for adequate light penetration during the critical submergent vegetation germination period, March through April.

b. Beginning in July, slowly draw down water levels in selected pools to 8 inches, through July.

Wetland Objective 4

Provide 300–600 acres of less than 12 inches tall emergent vegetation (such as rushes, sedges, and spikerush) that is flooded with less than 8 inches between April 1 through June 1, and between July 15 through November 30 with a VOR of less than 4 inches (or approximately less than 1.4 stems per square foot).



Tim McCabe/USFWS

Western grebe.

Rationale

This objective will provide nesting habitat to benefit foraging waterfowl and migrating shorebirds. This objective will target the Mud Lake and Depuy Marsh subimpoundments and Stony Brook. Approximately one-third of the units will be managed to achieve this objective on an annual basis.

Strategies

a. In the early spring, draw down selected ponds to initiate new growth of spikerushes and expose old clumps of rushes, bulrushes, grasses, and sedges for rail habitat (Fredrickson and Taylor 1982).

b. In the fall, slowly draw down selected ponds to concentrate foods for migrating waterfowl and other waterbirds.

Wetland Objective 5

Provide annually approximately 300–600 acres of greater than 80% cover of seed-producing vegetation (such as smartweeds, millet, beggarticks, and sedges) flooded to depths less than 8 inches, between April 1 and November 30.

Rationale

Annual seed-producing vegetation will provide habitat for foraging waterfowl and shorebirds. This objective will target the subimpoundments;

approximately one-third of the units will be managed to achieve this objective on an annual basis.

Strategies

a. Periodically flood nine moist soil units to depths less than 12 inches. Every third year or as conditions dictate, completely draw down the units in the spring and early summer, then dry, and disturb and reflood the soil surface to increase the sprouting of seeds within the soil.

Use early drawdowns to stimulate germination of smartweeds. Mid-season drawdowns will result in millets and late-season drawdowns will produce beggarticks. Once plants reach 6–8 inches in height, shallowly (1–2 inches) flood them. As the perennials increase, so do the invertebrates that provide foraging habitat for waterfowl, rails, and herons. The uneven topography of pools will provide foraging habitat for the various wildlife groups migrating through the area. Shorebirds will use the mud flats and shallow water areas with 2 inches or less of water, wading birds will use those areas with water depths from 3 to 5 inches deep, and waterfowl will have areas available with water depths ranging from 5 to 10 inches deep.

Time to shorebird migration the early spring drawdowns with shallow water zones interspersed with mud flats. The new growth of spikerushes and old clumps of rushes, bulrushes, grasses, and sedges provide concealment for rails (Fredrickson and Taylor 1982).

Wetland Objective 6

During years of severe drought in the region, maintain low water levels in Jim Lake to provide exposed gravel islands and shoreline habitat during piping plover nesting season.

Rationale

The piping plover has been recorded nesting at the refuge during years of low water that exposed the gravel islands and shoreline habitat the bird prefers for nesting. Because the refuge has a history of piping plover use, it has designated critical habitat for piping plovers. Piping plovers are not expected to nest regularly at the refuge. However, in years of severe drought when habitat is limited across the state, Jim Lake will be managed to provide access to the gravel islands and gravel side slopes of the dike along the eastern edge of the lake.

Strategies

a. Draw down Jim Lake to maintain exposed gravel islands and shorelines from mid-May through mid-July.

b. Participate in the International Piping Plover Breeding Census at the refuge every 5 years.

Wetland Objective 7

Improve water quality in the watershed upstream of the refuge and also water leaving the refuge. Reduce peak flows entering the refuge during spring snowmelt and summer rainfall events to reduce flooding and improve water management capability.

Rationale

During high-water events, most water entering the refuge will be diverted into the bypass channel at the southern end of Arrowwood Lake. This practice will limit opportunities to improve the quality of water leaving the refuge. However, managing water levels in Arrowwood Lake to promote emergent vegetation growth along the shoreline and other shallow areas will improve water quality by increasing plant uptake of nitrogen and phosphorous.

Another water quality problem that has existed for many years is lack of dissolved oxygen during periods of low flow and under ice (Reclamation 1992). To help alleviate this problem, water released from Arrowwood Lake into other impoundments and the bypass channel will be from the top of the water column, which usually has higher dissolved oxygen levels. Furthermore, as water drops over the water control structure and mixes with air, dissolved oxygen levels will be increased.

When water is diverted from Arrowwood Lake or the bypass channel into other wetland units, there will be additional opportunities for improving water quality. Sedimentation rates will increase as water levels are maintained to provide migratory bird habitat. Water levels will be managed to promote growth of desirable aquatic vegetation, which will greatly increase plant uptake of organic nutrients. Wetland units will be periodically drawn down and burned or disked to recycle nutrients and set back succession. As part of the Arrowwood NWR mitigation project, fish barriers were installed to prevent carp from entering the bypass channel and the wetland units. Excluding carp will also benefit water quality by reducing turbidity. As with Arrowwood Lake, water released from these units will be from the top of the water column and dissolved oxygen levels will be increased when the water drops over the structure.

Strategies

a. Use stream-gauging data in conjunction with water quality models to calculate a mass nutrient balance for the refuge. The Water Resources Division of the USGS maintains stream gauging stations on the James River, both upstream and

downstream of the refuge. Data collected at these gauging stations include streamflow and water chemistry. This data, when combined with water quality models, can be used to calculate a mass nutrient balance for the refuge. A mass nutrient balance assesses nutrient load entering and leaving the refuge, providing insight into the refuge's role as a nutrient source or nutrient "sink" for downstream water users.

b. Work with the watershed managers from county soil conservation districts to use the agricultural nonpoint source (AGNPS) model. The AGNPS model predicts soil erosion and nutrient transport and loadings from agricultural watersheds for real or hypothetical storms. It can be used in evaluating the effect of management decisions impacting a watershed. It can also be used to target areas in the upper watershed for "best management practices" such as minimum tillage, grass waterways, filter strips, green belts, and grazing systems that will provide the greatest water quality benefit to the refuge.

c. Achieve the goals of the Federal Water Pollution Control Act by developing partnerships with county, state, and federal agencies. In cooperation with the state health department and the EPA, identify potential projects in the upper watershed that qualify for Clean Water Act funding.

d. Use available resources to determine priority wetlands and grasslands in the upper James River watershed for protection and restoration. In these same priority areas, the proportion of perennial cover will be increased; where permanent cover restoration was not possible, annual cover such as winter cereals for nesting waterfowl will be increased.

Visitor Services Goal

Visitors of all abilities will enjoy a refuge visit and increase their knowledge and appreciation of the prairie ecosystem and the refuge's history by participating in compatible wildlife-dependent recreation.

NOTE: Appendixes L–S contain compatibility determinations for the public uses at Arrowwood NWR.

Visitor Services Objective 1—Hunting

Continue to provide and increase opportunities as compatible and appropriate for accessible hunting of big game, upland birds, small game, and fox.

Rationale

Current refuge-specific regulations are designed to provide opportunities for a quality hunt within the laws imposed by the state. The definition of a

quality hunt is completely determined by the individual participating in the activity. In a survey of 10,000 hunters conducted by the Wisconsin Department of Natural Resources in 2000, hunters were asked to rate the factors having the most influence on their perception of a quality hunt. The most important factor indicated by the respondents was seeing game. The second most frequent answer was spending time with friends and family, and the least important factor in determining a quality hunt was the weather. Successful hunters (harvest of game pursued) rated their hunt quality as very high or fairly high 22% of the time, while unsuccessful hunters (no game harvested) rated their hunt quality as very high or fairly high only 7% of the time. Other factors determined to be integral to a quality hunt include seeing few other hunters, ethical behavior by all participants, safety, and the opportunity to harvest trophy animals (Dhuey 2004). The compatibility determination for hunting is in appendix L.

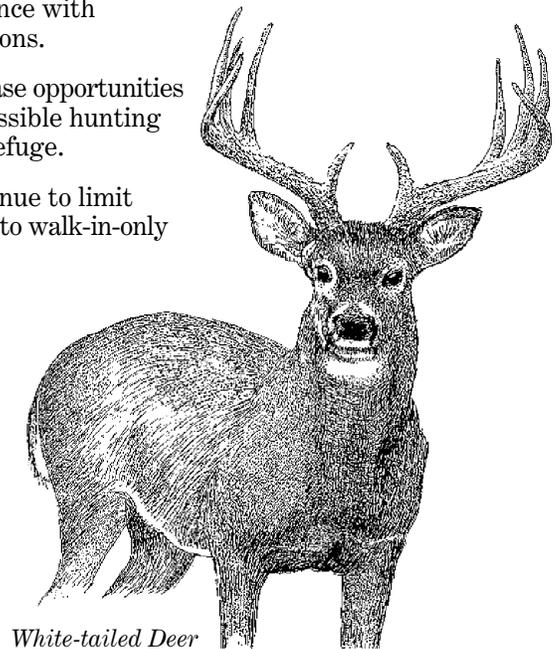
Strategies

a. Revise the current hunting brochures and "tear sheets" that provide information on refuge hunting regulations, and access.

b. Continue to work cooperatively with the NDGF to conduct law enforcement patrols to ensure compliance with regulations.

c. Increase opportunities for accessible hunting at the refuge.

d. Continue to limit hunting to walk-in-only access.



White-tailed Deer

Visitor Services Objective 2—Fishing

Continue to provide public opportunity for accessible fishing, including bow fishing for rough fish during high-water years and ice fishing when conditions permit.

Rationale

Fishing is a compatible priority public use and will continue to be supported. See the compatibility determination in appendix M.

Strategies

- a. Update and revise brochures that provide information on refuge fishing opportunities, regulations, and access.
- b. Use local media to promote fishing opportunities during high-water years when the fishery is active.
- c. Permit fishing, in accordance with state regulations, year-round except during the deer gun and muzzleloader seasons.
- d. Allow boats from May 1 through August 31.
- e. Allow, on Arrowwood and Jim lakes, boats with less than 25 horsepower motors.

Visitor Services Objective 3—Wildlife Observation and Photography

Provide the public opportunities for accessible wildlife/wildland observation and photography for at least 10,000 visitors per year.

Rationale

The refuge's auto tour route and locations around Jim Lake and the Depuy pools provide excellent opportunities for viewing and photographing wildlife. These are compatible priority public uses (see the compatibility determination in appendix O).

Strategies

- a. Continue to maintain the refuge's 5.5-mile auto tour route to provide a safe and enjoyable experience for visitors.
- b. Update and revise the interpretive brochure. Clarify and revise regulations regarding access into the refuge for walk-in access, biking on refuge trails, and horseback riding (special use permit).
- c. Upgrade the access road to the Warbler Woodland Watchable Wildlife Area.
- d. Improve and maintain the nature trail in the Warbler Woodland Watchable Wildlife Area by adding directional signs to the trailhead and replacing the interpretive signs.
- e. Maintain at least one observation blind located near an active sharp-tailed grouse lek. Locate a suitable site for installation of a permanent, accessible blind.
- f. Investigate new opportunities for compatible wildlife viewing, with the possible development of additional trails and overlooks.

g. Develop and upgrade wildlife and bird lists as new information becomes available.

h. Allow boats from May 1 through August 31.

i. Allow, on Arrowwood and Jim lakes, boats with less than 25 horsepower motors.

Visitor Services Objective 4—Interpretation

Increase public awareness and advocacy by reaching 10,000 people annually using accessible programs, exhibits, signs, and pamphlets that interpret refuge management activities, and the natural, cultural, and historic resources.

Rationale

By expanding the interpretive and public outreach activities at the refuge, the public will be made aware of the Refuge System and Arrowwood NWR and the benefits it provides to wildlife and the local community. This is a compatible priority public use (see the compatibility determination in appendix P).

Strategies

- a. Remodel the office entrance to include a visitor contact station containing interpretive exhibits and a cooperative association store.
- b. Develop permanent exhibits at local community locations to increase awareness of national wildlife refuges in North Dakota.
- c. Widely disseminate informational leaflets to libraries, local businesses, chambers of commerce, recreational groups, local lodging, and designated rest areas along interstates.
- d. Develop a portable travel exhibit interpreting the refuge and its key resources.
- e. Develop a professional-quality presentation on Arrowwood NWR and the Refuge System.
- f. Create a native grass and forb demonstration plot, complete with interpretive signs and identification markers for each species.
- g. Work with tourism division of the North Dakota Commerce Department, and North Dakota Department of Transportation to install directional signs off Interstate 94 and state highways.
- h. Maintain existing interpretive panels.
- i. Develop and place new entrance signs at each main refuge access road.
- j. Interpret the cultural history including the Fort Totten Trail, the story of Limpy Jack, and the legend of Grasshopper Hills.
- k. Interpret the geology of the refuge and surrounding area.

Visitor Services Objective 5—Partnerships and Other Public Outreach

Foster advocacy and develop public awareness of refuge resource issues and management practices through accessible public outreach.

Rationale

Fostering relationships within the community will help the refuge open the lines of communication, build support for the refuge, and provide an avenue for discussion. The Service recognizes that communication is vital to the Service mission. Refuge staff will continue to seek out new opportunities and foster existing relationships to help with achieving mutually beneficial goals and objectives.

Strategies

- a. Pursue development of a “friends group.”
- b. Develop partnerships to increase volunteer opportunities at the refuge.
- c. Annually update the refuge website.
- d. Send out monthly news releases to communities regarding refuge events and management activities. Conduct radio and television spots on request.
- e. Attend local wildlife and community group meetings on a regular basis to provide information on refuge activities, management, and other issues.
- f. Continue to work with the nonprofit organization, Birding Drives Dakota, on the annual “Potholes & Prairie Birding Festival” and visits to the refuge.
- g. Annually participate in at least five outreach programs such as holding events for National Wildlife Refuge Week and International Migratory Bird Day, or staffing a booth at a local event.
- h. Work with congressional offices and external affairs to keep them informed of refuge activities and management issues. Build and maintain relationships with county officials.

Visitor Services Objective 6—Environmental Education

Promote the Refuge System and Arrowwood NWR by conducting or hosting at least 10 environmental education programs per year to local schools and groups on the wetlands and grasslands within the Prairie Pothole Region.

Rationale

By expanding the environmental education activities at the refuge, the public will be made aware of the Refuge System and Arrowwood NWR and the



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Prairie lily.

benefits it provides to wildlife and the local community. This is a compatible priority public use (see the compatibility determination in appendix P).

Strategies

- a. Enhance the OWLS, located at the Kensal Public School, with interpretive signs or a brochure describing the native vegetation.
- b. Develop environmental education trunks complete with hands-on items such as mammal skins and skulls, to be used during presentations and tours with various school groups and organizations.
- c. Develop field study equipment kits to be checked out by visitors or organized groups. Include a backpack with binoculars, field guides, hand lenses, dip nets, tweezers, ruler, pen, vials, and other supplies.
- d. Replace the bathhouse at the Warbler Woodland Watchable Area with a “learning pavilion” that will facilitate hosting outdoor classrooms. There is potential for an addition to the headquarters to add space for exhibits and visitors.
- e. Involve local schools to develop an education program that can be used to explain the refuge management practices, and the wildlife and habitats found at the refuge.

4.3 STAFFING AND FUNDING

Current staffing consists of 10 permanent, full-time employees (table 2). This current staff, plus additional staff, as shown in table 2 will be required to carry out all aspects of the CCP.

Table 2. Current and additional staff required to carry out the management direction for Arrowwood NWR, North Dakota.

<i>Staff Group</i>	<i>Current Management</i>	<i>CCP Management Direction</i>
Management	Project leader, GS ¹ -14* Deputy project leader, GS-13* Refuge operations specialist, GS-7/9/11*	Project leader, GS-14* Deputy project leader, GS-13* Refuge operations specialist, GS-7/9/11* Refuge operations specialist, GS-9
Biology	Wildlife biologist, GS-9/11*	Wildlife biologist, GS-9/11* Biological technician, GS-7 Fish and wildlife biologist, GS-5/7/9/11 Biological technician, GS-5/6/7
Visitor Services	Outdoor recreation planner (assigned to Long Lake NWR), GS-9	Outdoor recreation planner, GS-9 Park ranger, GS-7/9
Administration	Administrative officer, GS-11* Clerk (office assistant), GS-6*	Administrative officer, GS-11* Clerk (office assistant), GS-6*
Maintenance	Engineering equipment operator, WG ² -10 Tractor operator (term ³), WG-6	Engineering equipment operator, WG-10 Tractor operator (term), WG-6 Maintenance worker, WG-7/8 Maintenance worker, WG-6
Fire	Fire management officer, GS-11* Fire technician, GS-6/7*	Fire management officer, GS-11* Fire technician, GS-6/7* Range technician (career-seasonal), GS-5/6
<i>Total Cost of Staff Salaries and Benefits</i>		
\$754,746		\$1,214,662

¹GS=general pay schedule.

²WG=wage grade pay schedule.

³term=temporary time-limited position.

⁴career-seasonal=permanent seasonal position.

*Staff with responsibilities for the entire Arrowwood NWR Complex.

Base operational funding for fiscal year 2007 is \$1,327,000. With additional funds for annual maintenance, deferred maintenance, small equipment, and the fire program, the total is \$1,759,500. This base budget represents the minimum required to maintain existing programs. However, this budget level will not adequately support the CCP's management direction for habitat management, biological monitoring, public use and education programs, and maintenance of all facilities and structures.

Additional funding to carry out the CCP may be made available through Refuge System funding and the Service Asset Maintenance Management System (SAMMS). The SAMMS is a database that records maintenance and replacement needs for real

property. Cost estimates will be developed for projects needed to carry out the final CCP, and then entered into the SAMMS.

4.4 STEP-DOWN MANAGEMENT PLANS

A CCP is intended as a broad umbrella plan that provides general concepts and specific wildlife, habitat, endangered species, visitor services, and partnership objectives. Step-down management plans provide detail to managers and staff who carry out specific actions authorized in a CCP. Based on this CCP, table 3 displays plans needed for Arrowwood NWR.

Table 3. Step-down management plans for Arrowwood NWR, North Dakota.

<i>Plan</i>	<i>Status</i>
Disease Contingency Plan	To be completed in 2006
Environmental Management Plan	Completed in 2003; revised annually
Fire Management Plan	Completed in 2001; revised annually
Habitat Management Plan (HMP)	To be completed in 2010
Integrated Pest Management Plan (IPM Plan)	Completed in 2005
Law Enforcement Plan	To be completed in 2008
Visitor Services Plan	To be completed after the CCP is final
Predator Management Plan	Completed in 2006
Safety Plan	Completed in 1991; revised annually
Water Use Plan	Completed in 2006; revised annually

4.5 MONITORING

Monitoring is essential not only to ensure that approved CCP goals and objectives have been met, but also to assess whether those goals and objectives have achieved the desired effects.

Plan Monitoring

Implementation of the CCP will be monitored throughout its 15-year effective period (2007 through 2022). The supervisor of the project leader for Arrowwood NWR will annually monitor accomplishment of objectives in the CCP. Monitoring of accomplishments will be critical to carrying out the CCP.

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

Habitat and Wildlife Monitoring

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

Monitoring is essential to successful implementation of the CCP. Periodic review of the CCP is required to ensure that established goals and objectives are being met and strategies are being carried out. Many of the objectives have associated monitoring strategies; others remain to be developed. A HMP and wildlife-monitoring plan will be developed with



Big bluestem.

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the specific details on monitoring techniques, frequency, and locations.

An adaptive resource management approach to monitoring will be used. Adaptive resource management is a flexible management framework in

which the success of management strategies can be evaluated. Management techniques for habitat, wildlife, and public use will be periodically evaluated; results will be used to modify or adapt the techniques or objectives to better achieve refuge goals.

Effects of management strategies on habitats and wildlife populations will be evaluated to assess whether the desired effects have been achieved. Baseline surveys will be conducted for wildlife species for which existing data is lacking or not well documented. Monitoring protocols will be developed—cooperatively with the wildlife researchers within the USGS and universities, and with other professionals—to ensure proper data collections and analysis. A habitat-monitoring plan

will be written; a wildlife inventory plan will be updated following completion of the CCP.

Habitat and wildlife-related research will be encouraged. Refuge staff will pursue research opportunities related to the refuge's habitat management goals, species of concern, monitoring techniques, and data analysis. All studies will be applicable and compatible with refuge objectives.

Monitoring for wildlife diseases will be limited primarily to the detection of avian botulism outbreaks in waterfowl in the wetlands. New diseases that are causing some concern and that may affect refuge wildlife include the West Nile virus, avian chlamydiosis, avian influenza, and chronic wasting disease.

Glossary

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

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

Administration Act—National Wildlife Refuge System Administration Act of 1966.

AGNPS—Agricultural nonpoint source (model).

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

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

annual—A plant that flowers and dies within 1 year of germination.

ATV—All-terrain vehicle.

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

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

biological diversity, also biodiversity—The variety of life and its processes, including the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur (“The Fish and Wildlife Service Manual,” 052 FW 1.12B). The National Wildlife Refuge System’s focus is on indigenous species, biotic communities, and ecological processes.

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

canopy—A layer of foliage, generally the uppermost layer, in a vegetative stand; midlevel or understory vegetation in multilayered stands. Canopy closure (*also canopy cover*) is an estimate of the amount of overhead vegetative cover.

CCC—*See* Civilian Conservation Corps.

CCP—*See* comprehensive conservation plan.

CFR—*See* Code of Federal Regulations.

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.

Code of Federal Regulations (CFR)—The codification of the general and permanent rules published in the *Federal Register* by the executive departments and agencies of the federal government. Each volume of the CFR is updated once each calendar year.

compatibility determination—*See* compatible use.

compatible use—A wildlife-dependent recreational use or any other use of a refuge that, in the sound professional judgment of the director of the U.S. Fish and Wildlife Service, will not materially interfere with or detract from the fulfillment of the mission of the Refuge System or the purposes of the refuge (“The 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.

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 (“The Fish and Wildlife Service Manual,” 602 FW 1.5).

concern—*See* issue.

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

cool-season grasses—Grasses that begin growth earlier in the season and often become dormant in

the summer. These grasses will germinate at lower temperatures. Examples of cool-season grasses at the refuge are western wheatgrass, needle and thread, and green needlegrass.

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

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

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

dense nesting cover (DNC)—A composition of grasses and forbs that allows for a dense stand of vegetation that protects nesting birds from the view of predators, usually consisting of one to two species of wheatgrass, alfalfa, and sweetclover.

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

DNC—*See* dense nesting cover.

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

EA—*See* environmental assessment.

ecosystem—A dynamic and interrelating complex of plant and animal communities and their associated nonliving environment; a biological community, together with its environment, functioning as a unit. For administrative purposes, the Service has designated 53 ecosystems covering the United States and its possessions. These ecosystems generally correspond with watershed boundaries and their sizes and ecological complexity vary.

EIS—Environmental impact statement.

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

endangered species, federal—A plant or animal species listed under the Endangered Species Act of 1973, as amended, that is in danger of extinction throughout all or a significant portion of its range.

endangered species, state—A plant or animal species in danger of becoming extinct or extirpated in a particular state within the near future if factors contributing to its decline continue. Populations of these species are at critically low levels or their habitats have been degraded or depleted to a significant degree.

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)—A concise public document, prepared in compliance with the National Environmental Policy Act, that briefly discusses the purpose and need for an action and alternatives to such action, and provides sufficient evidence and analysis of impacts to determine whether to prepare an environmental impact statement or finding of no significant impact (40 CFR 1508.9).

EPA—Environmental Protection Agency.

extinction—The complete disappearance of a species from the earth; no longer existing.

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

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

federal trust resource—A trust is something managed by one entity for another who holds the ownership. The Service holds in trust many natural resources for the people of the United States as a result of federal acts and treaties. Examples are species listed under the Endangered Species Act, migratory birds protected by international treaties, and native plant or wildlife species found on a national wildlife refuge.

federal trust species—All species where the federal government has primary jurisdiction including federally endangered or threatened species, migratory birds, anadromous fish, and certain marine mammals.

flora—All the plant species of an area.

FMP—Fire management plan.

forb—A broad-leaved, herbaceous plant; a seed-producing annual, biennial, or perennial plant that does not develop persistent woody tissue but dies down at the end of the growing season.

fragmentation—The alteration of a large block of habitat that creates isolated patches of the original habitat that are interspersed with a variety of other habitat types; the process of reducing the size and connectivity of habitat patches, making movement of individuals or genetic information between parcels difficult or impossible.

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

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

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

GIS—*See* geographic information system.

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

grassland tract—A contiguous area of grassland without fragmentation.

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

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

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

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

hemi-marsh—A wetland with a 50–50 interspersion of open-water and emergent vegetation.

HMP—Habitat management plan.

HUA—Hydrologic unit area.

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.

indigenous—Originating or occurring naturally in a particular place.

integrated pest management (IPM)—Methods of managing undesirable species such as invasive plants; education, prevention, physical or mechanical methods of control, biological control, responsible chemical use, and cultural methods.

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

invasive plant, also noxious weed—A species that is nonnative to the ecosystem under consideration and whose introduction causes, or is likely to cause, economic or environmental harm or harm to human health.

inviolate sanctuary—A place of refuge or protection where animals and birds may not be hunted.

IPM—*See* integrated pest management.

issue—Any unsettled matter that requires a management decision; 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 (“The Fish and Wildlife Service Manual,” 602 FW 1.5).

JAKES—“Juniors Acquiring Knowledge, Ethics & Skills.”

management alternative—*See* alternative.

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

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

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

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

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

national wildlife refuge—A designated area of land, water, or an interest in land or water within the National Wildlife Refuge System, but does not include coordination areas; a complete listing of all units of the Refuge System is in the current “Annual Report of Lands Under Control of the U.S. Fish and Wildlife Service.”

National Wildlife Refuge System (Refuge System)—Various categories of areas administered by the Secretary of the Interior for the conservation of fish and wildlife including species threatened with extinction, all lands, waters, and interests therein administered by the Secretary as wildlife refuges, areas for the protection and conservation of fish and wildlife that are threatened with extinction, wildlife ranges, game ranges, wildlife management areas, and waterfowl production areas.

National Wildlife Refuge System Improvement Act of 1997 (Improvement Act)—Sets the mission and the administrative policy for all refuges in the National Wildlife Refuge System; defines a unifying mission for the Refuge System; establishes the

legitimacy and appropriateness of the six priority public uses (hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation); establishes a formal process for determining appropriateness and compatibility; establish the responsibilities of the Secretary of the Interior for managing and protecting the Refuge System; requires a comprehensive conservation plan for each refuge by the year 2012. This Act amended portions of the Refuge Recreation Act and National Wildlife Refuge System Administration Act of 1966.

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

Neotropical migrant—A bird species that breeds north of the United States and Mexican border and winters primarily south of this border.

NEPA—National Environmental Policy Act.

NDGF—North Dakota Department of Game and Fish.

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

NOA—Notice of availability.

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

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 United States) 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 (such as 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.

NWR—National wildlife refuge.

objective—An objective is a concise target statement of what will be achieved, how much will be achieved, when and where it will be achieved, and who is responsible for the work; derived from goals and provide the basis for determining management strategies. Objectives should be attainable and time-specific and should be stated quantitatively to the extent possible. If objectives cannot be stated quantitatively, they may be stated qualitatively (“The Fish and Wildlife Service Manual,” 602 FW 1.5).

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

OWLS—Outdoor wildlife learning site.

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

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

plant community—An assemblage of plant species unique in its composition; occurs in particular locations under particular influences; a reflection or integration of the environmental influences on the site such as soil, temperature, elevation, solar radiation, slope, aspect, and rainfall; denotes a general kind of climax plant community, such as ponderosa pine or bunchgrass.

prescribed fire—The skillful application of fire to natural fuels under conditions such as weather, fuel moisture, and soil moisture that allow confinement of the fire to a predetermined area and produces the intensity of heat and rate of spread to accomplish planned benefits to one or more objectives of habitat management, wildlife management, or hazard reduction.

priority public use—One of six uses authorized by the National Wildlife Refuge System Improvement Act of 1997 to have priority if found to be compatible with a refuge’s purposes. This includes hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation.

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

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

public involvement—A process that offers affected and interested individuals and organizations an opportunity to become informed about, and to express their opinions on, Service actions and policies. In the process, these views are studied thoroughly and thoughtful consideration of public views is given in shaping decisions for refuge management.

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

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

Reclamation—Bureau of Reclamation of the U.S. Department of the Interior.

refuge purpose—*See* purpose of the refuge.

Refuge System—*See* National Wildlife Refuge System.

refuge use—Any activity on a refuge, except administrative or law enforcement activity, carried out by or under the direction of an authorized Service employee.

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

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

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

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

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

SAMMS—*See* Service Asset Maintenance Management System.

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

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

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

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

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

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.

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

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

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

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

step-down management plan—A plan that provides the details necessary to implement management strategies identified in the comprehensive conservation plan (“The Fish and Wildlife Service Manual,” 602 FW 1.5).

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

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

tame grass—*See* dense nesting cover.

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

threatened species, state—A plant or animal species likely to become endangered in a particular state within the near future if factors contributing to population decline or habitat degradation or loss continue.

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

trust resource—*See* federal trust resource.

trust species—*See* federal trust species.

USDA—U.S. Department of Agriculture.

U.S. Fish and Wildlife Service (Service, USFWS, FWS)—The principal federal agency responsible for conserving, protecting, and enhancing fish and wildlife and their habitats for the continuing benefit of the American people. The Service manages the 93-million-acre National Wildlife Refuge System comprised of more than 530 national wildlife refuges and thousands of waterfowl production areas. It also operates 65 national fish hatcheries and 78 ecological service field stations, the agency enforces federal wildlife laws, manages migratory bird populations, restores national significant fisheries, conserves and restores wildlife habitat such as wetlands, administers the Endangered Species Act, and helps foreign governments with their conservation efforts. It also oversees the federal aid program that distributes millions of dollars in excise taxes on fishing and hunting equipment to state wildlife agencies.

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

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

USGS—*See* U.S. Geological Survey.

UWA—Unified watershed assessment.

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

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

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

VOR—*See* visual obstruction reading.

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

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

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

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

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

wildland fire—A free-burning fire requiring a suppression response; all fire other than prescribed fire that occurs on wildlands (draft, “The Fish and Wildlife Service Manual,” 621 FW 1.7).

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

WMD—*See* wetland management district.

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

WPA—Works Progress Administration.

WUI—Wildland–urban interface.

Appendix A

Key Legislation and Policies

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

NATIONAL WILDLIFE REFUGE SYSTEM

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

—National Wildlife Refuge System Improvement Act of 1997

Goals

- Conserve a diversity of fish, wildlife, and plants and their habitats, including species that are endangered or threatened with becoming endangered.
- Develop and maintain a network of habitats for migratory birds, anadromous and interjurisdictional fish, and marine mammal populations that is strategically distributed and carefully managed to meet important life history needs of these species across their ranges.
- Conserve those ecosystems, plant communities, wetlands of national or international significance, and landscapes and seascapes that are unique, rare, declining, or underrepresented in existing protection efforts.
- Provide and enhance opportunities to participate in compatible wildlife-dependent recreation (hunting, fishing, wildlife observation, photography, environmental education, and interpretation).
- Foster understanding and instill appreciation of the diversity and interconnectedness of fish, wildlife, and plants and their habitats.

Guiding Principles

There are four guiding principles for management and general public use of the Refuge System established by Executive Order 12996 (1996):

Public Use—The Refuge System provides important opportunities for compatible wildlife-dependent recreational uses involving hunting, fishing, wildlife observation and photography, and environmental education and interpretation.

Habitat—Fish and wildlife will not prosper without high quality habitat, and without fish and wildlife, traditional uses of refuges cannot be sustained. The Refuge System will continue to conserve and enhance the quality and diversity of fish and wildlife habitat within refuges.

Partnerships—America’s sportsmen and women were the first partners who insisted on protecting valuable wildlife habitat within wildlife refuges. Conservation partnerships with other federal agencies, state agencies, tribes, organizations, industry, and the general public can make significant contributions to the growth and management of the Refuge System.

Public Involvement—The public should be given a full and open opportunity to participate in decisions regarding acquisition and management of our national wildlife refuges.

LEGAL AND POLICY GUIDANCE

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

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

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

Antiquities Act (1906)—Authorizes the scientific investigation of antiquities on federal land and provides penalties for unauthorized removal of objects taken or collected without a permit.

Archaeological and Historic Preservation Act (1974)—Directs the preservation of historic and archaeological data in federal construction projects.

Archaeological Resources Protection Act (1979), as amended—Protects materials of archaeological interest from unauthorized removal or destruction and requires federal managers to develop plans and schedules to locate archaeological resources.

Architectural Barriers Act (1968)—Requires federally owned, leased, or funded buildings and facilities to be accessible to persons with disabilities.

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

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

Executive Order No. 7168 (1935)—Establishes Arrowwood Migratory Waterfowl Refuge “as a refuge and breeding ground for migratory birds and other wild life...to effectuate further the purposes of the Migratory Bird Conservation Act.”

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

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

Executive Order 13007, Indian Sacred Sites (1996)—Directs federal land management agencies to accommodate access to and ceremonial uses of Indian sacred sites by Indian religious practitioners, avoid adversely affecting the physical integrity of such sacred sites, and where appropriate, maintain the confidentiality of sacred sites.

Federal Noxious Weed Act (1990)—Requires the use of integrated management systems to control or contain undesirable plant species and an interdisciplinary approach with the cooperation of other federal and state agencies.

Federal Records Act (1950)—Requires the preservation of evidence of the government’s organization, functions, policies, decisions, operations, and activities, as well as basic historical and other information.

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

Migratory Bird Conservation Act (1929)—Establishes procedures for acquisition by purchase, rental, or gifts of areas approved by the Migratory Bird Conservation Commission.

Migratory Bird Hunting and Conservation Stamp Act (1934)—Authorizes the opening of part of a refuge to waterfowl hunting.

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

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

National Historic Preservation Act (1966), as amended—Establishes as policy that the federal government is to provide leadership in the preservation of the nation’s prehistoric and historical resources.

National Wildlife Refuge System Administration Act (1966)—Defines the National Wildlife Refuge System and authorizes the Secretary of the Interior to permit any use of a refuge, provided such use is compatible with the major purposes for which the refuge was established.

National Wildlife Refuge System Improvement Act of 1997—Sets the mission and administrative policy for all refuges in the National Wildlife Refuge System; mandates comprehensive conservation planning for all units of the Refuge System.

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

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

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

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

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

Appendix B

Ecosystem Goals and Objectives

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

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

The Service has adopted watersheds as the basic building blocks for carrying out ecosystem conservation. Arrowwood NWR is located in the “main stem Missouri River ecosystem,” which includes North Dakota, South Dakota, and northeastern Montana. This ecosystem has been categorized into nine, prioritized focus areas. The refuge contains three of these focus areas: wetland habitat (priority 1), riparian habitat (priority 3), and grassland habitat (priority 5).

WETLAND HABITAT—PRIORITY 1

The glaciated prairies of North Dakota, South Dakota, and northeastern Montana cover approximately 60 million acres. Once a myriad of prairie pothole wetlands in a sea of native prairie, the area is now intensively farmed and is considered the breadbasket of the country. Drainage, largely for agricultural purposes, has reduced 7.2 million acres of wetlands by more than 54%, to 3.9 million acres. Native prairie, mostly mid-grass, has been reduced by 75% to 14.9 million acres. Livestock overgraze much of the remainder.

The area is rich in wildlife. Prairie potholes are essential for waterfowl and other migratory waterbirds. As an example of the importance of the prairie, ducks banded in North Dakota have been recovered in 46 states and 23 other countries. Grassland-nesting, Neotropical birds have been declining faster than woodland Neotropical birds or prairie-nesting ducks. Several endangered, threatened, and candidate species including the

ferruginous hawk, black tern, and Baird’s sparrow breed in the prairie and wetland habitats of this focus area.

Agriculture is the dominant economic activity and force on prairie wetlands and grasslands. No other activity in the focus area affects habitats and wildlife populations to the extent that agriculture does. The USDA and various federal farm programs have more influence on natural resources and wildlife than the Service, all the state wildlife agencies, and all the conservation organizations combined.

The Service has been involved in prairie and wetland resources since the early 1900s. The Service has 68 national wildlife refuges (340,000 acres) and 16 wetland management districts in the focus area. Since 1961, the Service’s Small Wetland Acquisition Program has acquired 380,000 acres in fee title and 1.3 million acres in perpetual easement.

Vision, Goals, and Objectives— Wetlands and Watersheds Focus Area

Vision—Diverse wetland habitats and watersheds that provide an abundance and diversity of native flora and fauna in the ecosystem for the benefit of the American public.

Goal 1: Increase recognition of wetland values by the various publics (community, conservation, communication, congressional, and corporate entities) and develop a wetland advocacy.

Objective A: Over the next 3 years, develop and implement an information and outreach plan in North and South Dakota and northeastern Montana. (Work with the division of education and visitor services).

Goal 2: Conserve, restore, and enhance wetland habitats’ qualities and functions for trust species and species of concern.

Objective A: At a minimum, annually protect 10,000 acres of wetlands through fee and easement over the next 10 years in the ecosystem.

Objective B: Assist partners and other agencies in protecting, creating, restoring, managing, and enhancing 5,000 acres of wetlands and associated uplands annually.

Goal 3: Protect the water supply and property interests of wetlands on Service lands and easements. (This goal would be further defined with the water rights division.)

Objective A: File for water rights on eligible Service properties and easements over the next 10 years.

Goal 4: Maintain and restore values and functions of watersheds in the ecosystem.

RIPARIAN HABITAT—PRIORITY 3

Riparian areas make up a very small portion of the habitat in the ecosystem. However, riparian and riverine wetland habitats are very important to fish and wildlife resources including migratory birds, threatened and endangered species, native fish, rare and declining fish, amphibians, and many mammals. Many vertebrates, including species of nongame and Neotropical migratory birds, are dependent on riparian and adjacent aquatic zones for reproduction or for foraging during reproduction. Riparian habitats provide for much of the biodiversity in the ecosystem. Many of the species occurring in the ecosystem would be eliminated without healthy riparian habitats.

Riparian habitats are important even to the species that mainly occur in the adjacent upland areas. Many of the rare and declining Neotropical prairie grassland species need to nest a short distance from water and use riparian areas during juvenile dispersal and as critical sites during migratory stopovers. Many wildlife species use these zones as migratory corridors. Riparian habitats are also important for stabilizing riverbanks, reducing sedimentation, and providing woody debris and organic material for invertebrates, therefore, enhancing fish habitat. Many resident wildlife species use riparian areas for winter survival. These species leave the upland areas to use the riparian areas for food and cover during the winter.

National wildlife refuges have been established along the Souris, James, and Des Lacs rivers and tributaries of the Red River. These refuges include sites of internationally significant Prairie Pothole Joint Venture projects that are critical to success of the North American Waterfowl Management Plan.

Vision, Goals, and Objectives—Riparian Habitat Focus Area

Vision—Healthy riparian floodplain and watershed ecosystems that provide an abundance and diversity of indigenous flora and fauna.

Goal 1: Reduce the conversion of riparian habitats and maintain, restore, or enhance riparian habitat quality and function.

Objective A: Inventory and determine the quality of riparian habitats within the ecosystem by 2004 to provide baseline information.

Objective B: Implement an informational program in the ecosystem by 2004 to promote a public appreciation and understanding of the benefits and the threats to riparian habitats.

Objective C: Use existing programs and opportunities in the ecosystem by 2009 to improve critical riparian habitats.

Objective D: Facilitate the location and control of invasive species in the ecosystem by 2007 to maintain or improve the quality of the riparian habitat.

Goal 2: Conserve and recover threatened and endangered species of special concern.

Objective A: Inventory threatened and endangered species of special concern along riparian corridors in the ecosystem by 2004 to provide baseline information.

Objective B: Develop and implement strategies for conserving and recovering threatened and endangered species of special concern along riparian habitat in the ecosystem by 2004, and prevent any species from becoming listed.

Goal 3: Conserve, restore, enhance, and create habitat resources in watersheds to influence the quality and quantity of water flowing into rivers and streams.

Objective A: Use existing oversight, coordination, and technical assistance by 2007 to promote sound management on critical watersheds in the ecosystem.

Objective B: Use existing programs and opportunities in the ecosystem by 2007 to conserve, enhance, or restore grasslands and to provide quality water runoff.

GRASSLAND HABITAT—PRIORITY 4

Prairie habitats in the MMRE consist of tall-grass, mid-grass, and short-grass prairies from eastern North Dakota and South Dakota to the west. Although the plant and wildlife species differ across the gradation from tall to short grass, the threats and issues remain the same—conversion of prairie to other uses. Habitat losses have been the most severe in the tall grass, and least in the western reaches of the Dakotas and northeastern Montana.

The tall-grass prairie once spanned millions of acres along the eastern borders of North Dakota and South Dakota. Vegetation representative of tall-grass prairie including big bluestem, switchgrass, Indiangrass, and prairie dropseed characterizes the focus area. In North Dakota, this is found mainly in the Agassiz Lake plain, but transitionally can be found along the state's eastern border in a strip two to three counties wide. Similarly, in South Dakota, the zone follows the eastern border in a comparable width broadening to the Missouri River at the southern end of the state and extending into northeastern Nebraska. Vast acreages of the habitat have been converted to agriculture. The remaining prairie sites are found in small fragmented parcels scattered throughout and are crucial to maintaining and restoring the ecosystem. These sites are threatened by conversion to cropland; invasion of exotics, invasive plants, and woody plants; pesticides; and heavy grazing pressure.

The remaining prairie sites support a wide diversity of plant and animal species including many federally and state-listed rare species. Sites in North Dakota have the largest population of the western prairie fringed orchid, a federally listed threatened plant found in wet meadows and low prairie within the tall-grass community. Other species of concern include (1) the regal fritillary and Dakota skipper butterflies, which are federally classified as candidates for endangered or threatened status, and (2) the powesheik skipper, a species of high concern. Eighteen state-classified rare plants occur in the tall-grass prairies of North Dakota. These prairies also provides primary and secondary breeding habitat for Neotropical migrants in decline such as the upland plover, bobolink, common yellowthroat, grasshopper sparrow, and clay-colored sparrow. Candidate bird species include the Baird's sparrow and loggerhead shrike. Long-term survival of these small, isolated prairies depends on establishing prairie networks and connecting these prairies and nearby habitats to ward off extinctions, and integrating prairies with their surroundings to reduce harm from improper management on surrounding lands.

Vision, Goals, and Objectives— Grassland Habitat Focus Area

Vision—Protect, restore, and maintain native prairie and other grasslands to ensure diversity and abundance of indigenous flora and fauna.

Goal 1: Prevent degradation and conversion of native prairie grassland.

Objective A: Locate, categorize, evaluate, and map native prairie within the ecosystem for baseline information by 2003.

Objective B: Protect native prairie by FWS easement on a minimum of 50,000 acres per year for the next 10 years.

Objective C: By the year 2003, develop and implement informational programs to promote awareness and advocacy for native prairie.

Objective D: Develop partnerships to protect 500,000 acres of native prairie by 2010.

Objective E: Develop partnerships to minimize the extent and reduce impacts of invasive species in native prairie by 2010.

Objective F: Strive to work with partners to reduce fragmentation effects to flora and fauna in native prairie communities.

Objective G: Identify contaminants entering native prairie and what adverse impact each contaminant may have on native prairie.

Objective H: Develop a plan, including informational programs, on how to prevent and/or reduce further contaminants from entering native prairie.

Goal 2: Maintain and establish networks of native prairie and planted grasslands on public and private lands.

Objective A: Promote and implement prescribed burning and rotational grazing on a minimum of 20% of private lands per year to enhance and maintain healthy native prairie.

Objective B: By the year 2003, develop informational programs on types and importance of proper defoliation of native prairie.

Objective C: By the year 2002, identify the key areas in the ecosystem to restore perennial grasslands, or maintain and/or increase planted grassland, with an emphasis on native species restoration.

Objective D: Strive to treat a minimum of 20% of agency-administered grasslands annually.

Goal 3: Protect and enhance habitat for trust species and species of special concern.

Objective A: Identify grassland species that are in decline, by the year 2003.

Objective B: Develop informational programs on why grassland species in decline are important, approaches to be taken to reverse decline, and the public role in remedies.

Objective C: Develop statewide partnerships to get private landowners and the public involved in species management.

Objective D: Develop criteria and use to identify the most biologically significant landscapes by 2003.

Objective E: Over the next 10 years, develop partnerships to enhance and manage native prairie including invasion by nonnative species.

Appendix C

List of Preparers, Consultation, and Coordination

This document is the result of the extensive, collaborative, and enthusiastic efforts by the members of the planning team shown below.

<i>Team Member</i>	<i>Position</i>	<i>Current Work Unit</i>
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Many organizations, agencies, and individuals provided invaluable assistance with the preparation of this draft CCP and EA. The Service acknowledges the efforts of the following individuals. The diversity, talent, and knowledge contributed dramatically improved the vision and completeness of this document.

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- Rhoda Lewis (*former* regional archaeologist; USFWS, region 6)
- Cindy Souders (outdoor recreation planner; USFWS, region 6)
- Cheryl Williss (*former* chief hydrologist; USFWS, region 6)
- Harvey Wittmier (*former* chief of the division of realty; USFWS, region 6)

Appendix D

Public Involvement

Public scoping was initiated for Arrowwood NWR in a NOI dated August 1, 2001. The NOI announced the availability of an issues workbook and dates for open houses to be held for public input on management of the refuge and development of the CCP.

PUBLIC INVOLVEMENT

An issues workbook was made available to the public, beginning in August 2001, through mailings to interested parties and public open houses. On August 14 and 15, 2001, the Service held open house, scoping sessions in the communities of Kensal, Pingree, Carrington, and Jamestown, North Dakota. Approximately 40 people attended these meetings. Numerous written comments were received during the comment period. Comments received identified biological, social, and economic concerns regarding refuge management. Many of these comments were incorporated into the draft CCP and EA.

A “Notice of Availability” (NOA) was published in the *Federal Register* on March 22, 2007. The NOA announced the availability of the draft CCP and EA for Arrowwood NWR for public review and comment. An open house was held on April 13, 2007 at the Pingree Community Center, Pingree, North Dakota. Six people attended the open house. They provided a wide range of comments, concerns, and ideas. Many of these comments and ideas were incorporated and addressed in this final CCP.

PUBLIC COMMENTS

The following issues, concerns, and comments are a compilation and summary of those expressed during the comment period for the draft CCP and EA in March–April 2007. Comments were provided by public, federal, and state agencies, local and county governments, private organizations, and individuals concerned about the natural resources and public use of Arrowwood NWR. Comments were received orally at meetings, via email, and in writing.

The refuge staff recognizes and appreciates all input received from the public. To address this input, several clarifications and some changes are reflected in this final CCP.

This section is organized by three general topics: habitat and wildlife, visitor services, and administration. The issues, comments, and concerns are summarized, followed by responses from the Service. Where there were similar statements from more than one commenter, the statements were grouped into one summarized comment.

Comments about editorial and presentation corrections were addressed in the production of this final CCP and are not detailed here.

Habitat and Wildlife

Comment 1: Shelterbelts should not be removed because they are good habitat for wildlife.

Response 1: Shelterbelts provide habitat for some species of wildlife; however, shelterbelts and other trees and shrubs decrease the size of grassland blocks and result in fragmented habitats. Recent studies have shown that many grassland-nesting birds and upland-nesting waterfowl either avoid areas adjacent to trees or have lower nest success due to predation. The historical natural vegetation of the area was primarily grass. Only a few trees were located in riparian areas. Shelterbelts are unnatural in grasslands and provide habitat for both avian and mammalian predators. Tree removal will be carried out in a few select areas.

Comment 2: Habitats should not be manipulated, particularly with prescribed fire.

Response 2: The native grasses and forbs on the refuge evolved over thousands of years with frequent fire and grazing by immense herds of large ungulates. Without these disturbances, nutrients are not recycled, grasslands are not as healthy and diverse, and invasive species such as smooth brome and Kentucky bluegrass and noxious weeds become dominant. The most efficient and effective way to maintain healthy grasslands is to attempt to mimic the natural processes through prescribed fire, grazing, and haying.

Comment 3: There needs to be something done about spurge and Canada thistle.

Response 3: “Upland Goal 1, strategies a. and e.” and “Upland Goal 2, strategy e.” address control of invasive plant species through use of an integrated approach of mechanical and chemical treatment.

Comment 4: The draft CCP claims that the plan is an attempt to return the refuge's prairie areas to a pre-European settlement "natural" state but the proposed actions do not reflect this.

Response 4: "Upland Objective 2, Strategies a. and b." propose management actions that will be targeted to native prairie areas (unbroken native sod). The proposed management actions, grazing and prescribed fire, will be implemented to mimic the natural processes that helped develop these grasslands prior to the 1870s. Since these areas have attained their current vegetation composition and structure over many years, it will take many years with aggressive management to achieve the desired condition. However, most most tracts are not likely to achieve the desired condition during the life of this plan (15 years).

Comment 5: The use of predator-free exclosures does not resemble a "natural" condition at the refuge.

Response 5: The Service agrees—the predator exclosure is not a natural condition. The exclosure is a very small portion of the refuge and serves as a demonstration and study area to compare nesting densities and success with and without predator control.

Comment 6: Botulism and other diseases are of concern when refuge staff keeps water levels low and stagnant.

Response 6: The mitigation project completed on the refuge by the Bureau of Reclamation will allow refuge staff to manage water levels in wetland impoundments independent from each other and at depths optimal for waterfowl and other waterbirds. If an impoundment does develop botulism or other disease problems, managers could add water to raise water levels or create a flow-through system, alternatively, the impoundment could be drawn down completely to discourage waterbird use.

Comment 7: How far will the new Stony Brook Dike back up water?

Response 7: Water levels in Stony Brook will be maintained at the same level as in the past. The new dike is higher than the old one; however, the new water control structure is set at the same elevation as before and it has the capacity to pass greater volumes of water.

Visitor Services

Comment 8: Wildlife watching outspends all other uses and is the prime reason for refuges and needs first priority.

Response 8: Wildlife observation is one of six priority wildlife-dependent recreational uses, along

with hunting, fishing, photography, environmental education, and interpretation.

Comment 9: Hunting is not compatible with the purposes for which many refuges were created. Hunting needs to be banned because it has negative effects on the purpose of the Arrowwood NWR.

Response 9: The Service understands some citizens' concern with hunting at national wildlife refuges. Arrowwood NWR, as well as the entire Refuge System, is guided by laws enacted by Congress and the President as well as policy derived from those laws. The 1997 National Wildlife Refuge System Improvement Act identifies hunting as one of six priority wildlife-dependent recreational uses to be facilitated when compatible with the purposes of a refuge and the mission of the Refuge System.

Hunting is consistent with the purposes of the Refuge. Those purposes derive from the Migratory Bird Conservation Act, which does not preclude hunting. In 1949, Congress amended the Migratory Bird Conservation Act to allow waterfowl hunting at 25% of the areas acquired under its authority. Congress increased the figure to the present level of 40% in 1958. In 1978, Congress added a provision granting the Secretary of the Interior discretion to exceed the 40% standard by an unlimited extent when it is beneficial to the species.

While national wildlife refuges are managed first and foremost for wildlife, the focus is on perpetuating populations not individuals. Hunting does adversely affect individual animals, but is allowed when it will not threaten the perpetuation of the population being hunted.

Comment 10: Provisions to expand hunting of deer and upland game at the refuge and refuge management of these species to provide hunting opportunities is of concern.

Response 10: The refuge is not managed to increase populations of deer, pheasant, or partridge to provide hunting opportunities. As stated in response 9 above, hunting is allowed because it is one of the priority wildlife-dependent recreational uses of the Refuge System. In addition, deer numbers are high as a result of habitat alterations and the abundance of agricultural crops surrounding the refuge. Hunting helps keep populations from increasing further. As the commenter stated, pheasant and partridge are present due to introductions and habitat modifications. Hunting provides some opportunity and helps keep populations low.

Presently there are no red fox at the refuge. Protecting coyotes at the refuge has helped prevent the establishment of foxes. The coyote is a more general predator and also helps keep rodent and rabbit populations in balance.

There is very little hunting of cottontail rabbit at the refuge. The promotion of more opportunities for rabbit hunting would have very little effect on rabbit numbers, other wildlife, or other public uses.

Comment 11: Even though hunting and hunters are declining, the Service has continued to focus on hunters and not on nonconsumptive users.

Response 11: The Refuge System has greatly expanded opportunities for nonconsumptive uses at many refuges. Even though hunter numbers are declining, deer hunting exceeds all other uses at Arrowwood NWR. To promote nonconsumptive uses, the refuge constructed a wildlife observation deck on the auto tour route and is working with local groups to promote birding and expand trails at the refuge.

Comment 12: Recreational trapping is not one of the six wildlife-dependent recreational uses and should not be permitted.

Response 12: Recreational trapping is not allowed at the refuge. Trapping is only allowed under a special use permit for management purposes. Snowmobiles are prohibited and ATVs are strictly controlled.

The benefit of trapping to all species of ground-nesting birds is well documented. Habitat loss and predators are the greatest threats to ground-nesting birds. Populations of raccoon, skunk, and fox have responded favorably to the fragmented habitats created by development and agriculture. These predators are effective hunters of ground-nesting birds, in particular waterfowl eggs and young. Their overabundant and unnatural populations are devastating to populations of ground-nesting birds.

Comment 13: The installation of a fish barrier to keep fish out of the refuge is disappointing because the refuge provides a close place to fish, without driving 25 miles.

Response 13: The primary purposes of the refuge are for migratory birds with emphasis on waterfowl and other waterbirds. During normal and low-water years, the fish barrier is intended to prevent carp from migrating into the refuge from Jamestown Reservoir. Carp compete with waterfowl for the same foods. Because carp are bottom feeders, they stir up sediment, which reduces plant growth and reproduction. In high-water years, when water levels overtop the dikes and water control structures at the refuge, carp and game fish will become established at the refuge and provide fishing opportunities for the public.

Comment 14: The addition of one optional (longer) tour trail is suggested.

Response 14: The Service has considered additional hiking, bike riding, and horseback riding trails. No additional or expanded auto routes are planned.

Comment 15: Will the public be allowed to drive or bike ride on the dike?

Response 15: No, the dike will be open to the public for foot travel only. The dike meanders through prime waterfowl and shorebird habitat and public access with autos and bikes would greatly increase disturbance. The auto tour route and the county roads crossing the refuge provide abundant wildlife observation opportunities.

Comment 16: A monorail should be built to give people a good look at the refuge.

Response 16: A monorail would be very expensive and could not be justified at the current levels of public use.

Administration

Comment 17: An environmental impact statement should be prepared because of sport hunting and overall refuge recreation programs.

Response 17: The preferred alternative (CCP) was not a major federal action that would significantly affect the quality of the human environment within the meaning of Section 102(2)(C) of the National Environmental Policy Act of 1969. Accordingly, the preparation of an environmental impact statement was not required. While enhancement of the hunting experience is part of the CCP, no new hunting is proposed. If additional hunting opportunities were proposed, full public disclosure through preparation of a step-down hunt plan and a compatibility determination would be undertaken.

Comment 18: A full range of alternatives has not been considered, particularly for nonconsumptive uses.

Response 18: Based on the purposes of the refuge, the requirements of the National Wildlife Refuge System Improvement Act of 1997, and other applicable laws, regulations, and policies, a full range of reasonable alternatives was considered. The planning team—using public and government comments, conducting numerous workshops, and analyzing biological, visitor use, and socioeconomic data—considered those uses appropriate and compatible with the purposes of the refuge. In the draft CCP and EA, two alternatives were considered but eliminated from further study because they did not meet the refuge's purposes and goals for management.

Comment 19: The Service must prepare a Section 7 evaluation.

Response 19: The Service has completed the Section 7 biological evaluation for this final CCP and it is included in appendix U.

Comment 20: How was the approved acquisition boundary determined?

Response 20: The approved acquisition boundary was established by Executive Order 7168, which was signed by President Franklin D. Roosevelt on September 4, 1935.

Comment 21: Refuge Revenue Sharing payments need to be increased and grazing at the refuge would help. Who determines how much the Refuge Revenue Sharing payments will be?

Response 21: Under provisions of the Refuge Revenue Sharing Act (Public Law 95-469), the Service annually reimburses counties to offset revenue lost as a result of acquisition of private property. This law states that the Secretary of the Interior (Secretary) shall pay to each county in which any area acquired in fee title is situated, the greater of the following amounts:

1. An amount equal to the product of 75 cents multiplied by the total acreage of that portion of the fee area which is located within such county.
2. An amount equal to $\frac{3}{4}$ of 1% of the fair market value, as determined by the Secretary, for that portion of the fee area located within such county.
3. An amount equal to 25% of the net receipts collected by the Secretary in connection with the operation and management of such fee area during such fiscal year. However, if a fee area is located in two or more counties, the amount for each county shall be apportioned in relationship to the acreage in that county.

In addition, the Refuge Revenue Sharing Act requires that Service lands be reappraised every 5 years to ensure that payments to local governments remain equitable. Payments under this act would be made only on lands that the Service acquires in fee title. On lands where the Service acquires only partial interest through easement, all taxes would remain the responsibility of the individual landowner.

MAILING LIST

The following mailing list was developed for this 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, Bismarck, ND

U.S. Senator Byron Dorgan, Washington DC
Sen. Dorgan's Area Director, Bismarck, ND

Federal Agencies

Bureau of Reclamation, Bismarck, ND

U.S. Army Corps of Engineers, Omaha District
Office, NE

USFWS Ecological Services, Bismarck, ND
USFWS Habitat and Population Evaluation Team,
Bismarck, ND

USGS-Northern Prairie Wildlife Research Center,
Jamestown, ND

Tribal Officials

Spirit Lake Tribal Council, Fort Totten, ND

Three Affiliated Tribes, New Town, ND

Turtle Mountain Band of Chippewa, Belcourt, ND

State Officials

Governor John Hoeven, Bismarck, ND

Representative William Devlin, Finley, ND

Representative Lyle Hanson, Jamestown, ND

Representative Craig Headland, Montpelier, ND

Representative Joe Kroeber, Jamestown, ND

Representative Chet Pollert, Carrington, ND

Representative Don Vigesaa, Cooperstown, ND

Senator Michael Every, Minnewaukan, ND

Senator April Fairfield, Eldridge, ND

State Agencies

NDGF, Bismarck, ND

North Dakota State Water Commission, Bismarck, ND

Southeast Fisheries District, Jamestown, ND

Local Government

Eddy County Weed Board, Tim Becker, New
Rockford, ND

Foster County Weed Board, Nate Monson,
Carrington, ND

James River Water Development District, Huron, ND

Jamestown Promotion & Tourism, Jamestown, ND

Kensal Fire Protection District, Kensal, ND

Mayor, Carrington, ND

Mayor, Jamestown, ND

Pingree Fire Protection District Chief Bill Riebe,
Pingree, ND

Stutsman County Commission Chair Steve Cichos,
Jamestown, ND

Stutsman County Extension, Tom Olson,
Jamestown, ND
Stutsman County Weed Board, Kathy Kraft,
Jamestown, ND
Wells County Weed Board, Richard Maine,
Fessenden, ND

Organizations

American Bird Conservancy, Washington DC
American Rivers, Washington DC
Audubon Dakota, Fargo, ND
Birding Drives Dakota, Jamestown, ND
Dakota Anglers, Jamestown, ND
Defenders of Wildlife, Washington DC
Ducks Unlimited, Memphis, TN
Izaak Walton League, Gaithersburg, MD
Landowners Association of North Dakota,
Bismarck, ND
National Audubon Society; Washington DC; New
York, NY
National Wildlife Federation, Reston, VA
National Wildlife Refuge Association, Washington DC
The Nature Conservancy, Boulder, CO
North Dakota Chapter of The Wildlife Society,
Bismarck, ND

North Dakota Wildlife Federation, Bismarck, ND
Sierra Club, San Francisco, CA
Stutsman County Wildlife Federation, Jamestown, ND
United Sportsmen—Jamestown Chapter,
Jamestown, ND
The Wilderness Society, Washington DC
Wildlife Management Institute; Fort Collins, CO;
Bend, OR; Washington DC

Universities, Colleges, and Schools

Jamestown College, Jamestown, ND
Kensal Public School, Kensal, ND
North Dakota State University, Fargo, ND
Pingree-Buchanan School District, Buchanan, ND
The University of North Dakota, Grand Forks, ND

Media

Foster County Independent, Carrington, ND
The Jamestown Sun, Jamestown, ND

Individuals

182 individuals

Finding of No Significant Impact

U.S. Fish and Wildlife Service, Region 6
Lakewood, Colorado

Fulfill the Comprehensive Conservation Plan for Arrowwood National Wildlife Refuge

Three management alternatives for Arrowwood National Wildlife Refuge were assessed as to their effectiveness in achieving the refuge's purposes and their impact on the human environment. Alternative 1, "No Action" would continue current management. Alternative 2, "Enhanced Management" maximizes the biological potential of the refuge for both wetland and upland habitats, and supports a well-balanced and diverse flora and fauna representative of the Prairie Pothole Region. The Arrowwood National Wildlife Refuge mitigation project would be used to achieve wetland habitat objectives. Public use opportunities would be expanded with the construction of additional facilities and development of educational programs. Alternative 3, "Enhanced Refuge and Watershed Management," in addition to the features described in alternative 2, would include a plan to improve water quality entering the refuge and reduce peak flows in the upper James River watershed during spring runoff and summer rainfall events. The watershed management component would include working with private landowners through the U.S. Fish and Wildlife Service's Partners for Fish and Wildlife Program and other federal, state, and private conservation programs. The focus would be to protect and restore wetlands and grasslands, and reduce the impacts on water quality from cropland and livestock operations. Improving the health of the upper James River watershed would not only benefit wildlife habitat in the watershed and at the refuge, it would also benefit Jamestown Reservoir and all downstream users.

Based on this assessment and comments received, I have selected alternative 3 as the preferred alternative for implementation.

The preferred alternative was selected because it best meets the purposes for which the Arrowwood National Wildlife Refuge was established and is preferable to the "no-action" alternative in light of physical, biological, economic, and social factors. The preferred alternative will continue to provide public access for wildlife-dependent recreation (hunting, fishing, wildlife observation, photography, environmental education, and interpretation).

I find that the preferred alternative is not a major federal action that would significantly affect the quality of the human environment within the meaning of Section 102(2)(C) of the National Environmental Policy Act of 1969. Accordingly, the preparation of an environmental impact statement on the proposed action is not required.

The following is a summary of anticipated environmental effects from implementation of the preferred alternative:

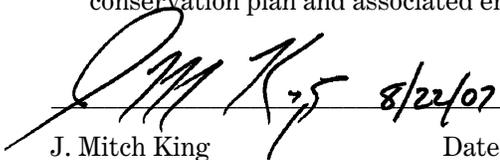
The preferred alternative will not adversely impact endangered or threatened species or their habitat.

The preferred alternative will not adversely impact archaeological or historical resources.

The preferred alternative will not adversely impact wetlands nor does the plan call for structures that could be damaged by or that would significantly influence the movement of floodwater.

The preferred alternative will not have a disproportionately high or adverse human health or environmental effect on minority or low-income populations.

The state of North Dakota has been notified and given the opportunity to review the comprehensive conservation plan and associated environmental assessment.

 8/22/07

J. Mitch King Date
Regional Director
U.S. Fish and Wildlife Service
Region 6
Lakewood, CO

Appendix F

Fire Management Program

The Service has management and administrative responsibility, including fire management, on approximately 21,684 acres of national wildlife refuge lands and approximately 62,671 acres of lands in wetland management districts in eastern North Dakota.

FIRE: A CRITICAL NATURAL PROCESS

In prairie ecosystems of the Great Plains, vegetation has evolved under periodic disturbance and defoliation from grazing animals and fire, with minor weather events. This periodic disturbance is what kept the ecosystem diverse and healthy while maintaining significant biodiversity for thousands of years. Historically, natural fire including Native American ignitions has played an important disturbance role in many ecosystems: 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 (such as 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, and have created a potential in many areas across the country for uncharacteristically severe wildland fires. These catastrophic wildland fires often pose risks to public and firefighter safety. In addition, they threaten property and resource values such as wildlife habitat, grazing opportunities, timber, soils, water quality, and cultural resources.

Return of fire is essential for healthy vegetation and wildlife habitat in most ecosystems including grasslands, wetlands, woodlands, and forests. 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 or modifying the species in the vegetation;

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 woodlands and shrublands;

can improve soil fertility;

can improve the quality and amount of livestock forage;

can improve growth in immature woodlands by reducing density;

can 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, the Secretaries of the Interior and Agriculture approved an update of the 1995 Federal Fire Policy. 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 fire as an essential ecological process and natural change agent will be incorporated into the planning process.
- Fire management plans (FMPs), programs, and activities support land and resource management plans and their implementation.
- Sound risk management is a foundation for all fire management activities.

- Fire management programs and activities are economically viable based 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 resources 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 Arrowwood NWR will protect life, property, and other resources by safely suppressing all wildfires. Prescribed fire and manual and mechanical fuel treatments will be used in an ecosystem management context for habitat management, and to protect 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 will be conducted consistent with applicable laws, policies, and regulations. The refuge will maintain an FMP and carry it out to accomplish resource management objectives. Prescribed fire and manual and mechanical fuel treatments will be applied in a scientific way under selected weather and environmental conditions to accomplish habitat management objectives.

Fire Management Goals

1. Protect life, property, and other resources from wildland fire.
2. Use prescribed fire as a tool to accomplish habitat management objectives.
3. Maintain a wildland-fire management program that is professional in nature and uses available resources both economically and efficiently.

Fire Management Objectives

1. Safely suppress all wildland fires using appropriate management responses based on safety

considerations, refuge complex objectives, and values at risk.

2. Minimize the impact and cost of fire suppression activities through the professional use of preparedness processes.
3. Use prescribed fire for hazardous fuel reduction to the fullest extent possible within or near the refuge complex’s development zones, wildfire sensitive resources, and boundary areas to reduce the risk from wildland fire damage. Treat 3,000 acres yearly.
4. Restore fire to the refuge complex on a landscape scale with prudent use of prescribed fire to restore and perpetuate native species and communities.
5. Maintain a diversity of healthy plant communities at various successional stages to provide suitable habitat for all grassland species with prescribed fire.
6. Use prescribed fire to suppress and control exotic invader species such as leafy spurge, smooth brome, and Kentucky bluegrass. Treat 2,000 acres yearly.
7. Use prescribed fire to control woody plant invasion within the refuge complex. Treat 1,000 acres yearly.
8. Educate the public regarding the role of prescribed fire within the refuge complex.
9. Work with adjacent landowners and cooperators to increase the use of prescribed fire in the public and private sectors within the refuge complex’s sphere of influence and to foster increased understanding and cooperation between all entities involved in wildland fire activities.
10. Provide wildland-fire management support to other agencies to the extent possible within the interagency fire management support network.

Strategies

Strategies and tactics that consider public and firefighter safety as well as resource values at risk have been used. Wildland fire suppression, wildland fire use and prescribed fire methods, manual and mechanical means, timing, and monitoring are found in a more detailed list in the step-down FMP for Arrowwood NWR.

All management actions will use prescribed fire and manual and/or mechanical means to (1) restore and maintain desired habitat conditions, and (2) control nonnative vegetation and the spread of woody vegetation within the diverse ecosystem habitats. The prescribed fire program is outlined in the FMP for the refuge.

Additionally, detailed prescribed burn plans have been developed that describe the following:

- burn units and their predominant vegetation
- primary objectives for the 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 procedure
- postburn monitoring

FIRE MANAGEMENT ORGANIZATION, CONTACTS, AND COOPERATION

The region has established qualified fire management, technical oversight, and support for the Arrowwood NWR Complex using the fire management district approach. Using this approach, an appropriate fire management staffing organization has been determined and is listed in more detail in the Arrowwood NWR Complex FMP.

Appendix G

List of Plant Species

The following plant species that occur at Arrowwood NWR are listed in alphabetic order of their scientific names (The Great Plains Flora Association 1991, NRCS 2006).

Genus	Species	Common Name
<i>Acer</i>	<i>negundo</i>	boxelder
<i>Acer</i>	<i>negundo</i>	boxelder shrub
<i>Achillea</i>	<i>lanulosa</i>	yarrow
<i>Achnatherum</i>	<i>hymenoides</i>	Indian ricegrass
<i>Acroptilon</i>	<i>repens</i>	Russian knapweed
<i>Actaea</i>	<i>rubra</i>	baneberry
<i>Agalinis</i>	<i>aspera</i>	rough gerardia
<i>Agalinis</i>	<i>tenuifolia</i>	slender gerardia
<i>Agastache</i>	<i>foeniculum</i>	lavender hyssop
<i>Agoseris</i>	<i>glauca</i>	false dandelion
<i>Agrimonia</i>	<i>striata</i>	agrimony
<i>Agropyron</i>	<i>desertorum</i>	crested wheatgrass
<i>Agrostis</i>	<i>hyemalis</i>	ticklegrass
<i>Agrostis</i>	<i>perennans</i>	autumn bent
<i>Agrostis</i>	<i>stolonifera</i>	redtop
<i>Allium</i>	<i>cernuum</i>	nodding onion
<i>Allium</i>	<i>stellatum</i>	pink wild onion
<i>Allium</i>	<i>textile</i>	white wild onion
<i>Almutaster</i>	<i>pauciflorus</i>	few-flowered aster
<i>Alopecurus</i>	<i>aequalis</i>	shortawn foxtail
<i>Alopecurus</i>	<i>carolinianus</i>	Carolina foxtail
<i>Alopecurus</i>	<i>geniculatus</i>	marsh foxtail
<i>Amaranthus</i>	<i>albus</i>	tumbleweed
<i>Amaranthus</i>	<i>graecizans</i>	tumbleweed
<i>Amaranthus</i>	<i>retroflexus</i>	rough pigweed
<i>Ambrosia</i>	<i>artemisiifolia</i>	common ragweed
<i>Ambrosia</i>	<i>psilostachya</i>	western ragweed
<i>Ambrosia</i>	<i>trifida</i>	giant ragweed
<i>Amelanchier</i>	<i>alnifolia</i>	Juneberry
<i>Amorpha</i>	<i>canescens</i>	leadplant
<i>Amorpha</i>	<i>nana</i>	dwarf wild indigo
<i>Andropogon</i>	<i>gerardi</i>	big bluestem
<i>Androsace</i>	<i>occidentalis</i>	western rock jasmine
<i>Androsace</i>	<i>septentrionalis</i>	pygmy flower
<i>Anemone</i>	<i>canadensis</i>	meadow anemone
<i>Anemone</i>	<i>cylindrica</i>	candle anemone
<i>Anemone</i>	<i>multifida</i>	anemone multi
<i>Anemone</i>	<i>patens</i>	pasqueflower
<i>Anemone</i>	<i>quinquefolia</i>	wood anemone
<i>Anemone</i>	<i>virginiana</i>	tall anemone
<i>Anethum</i>	<i>graveolens</i>	dill

Genus	Species	Common Name
<i>Antennaria</i>	<i>neglecta</i>	field pussytoes
<i>Antennaria</i>	<i>parvifolia</i>	pussytoes
<i>Antennaria</i>	<i>plantaginifolia</i>	plainleaf pussytoes
<i>Antennaria</i>	<i>rosea</i>	rose pussytoes
<i>Apocynum</i>	<i>androsaemifolium</i>	spreading dogbane
<i>Apocynum</i>	<i>cannabinum</i>	hemp dogbane
<i>Apocynum</i>	<i>sibiricum</i>	prairie dogbane
<i>Arabis</i>	<i>divaricarpa</i>	rockcress
<i>Arabis</i>	<i>glabra</i>	tower mustard
<i>Arabis</i>	<i>hirsuta</i>	rockcress
<i>Arabis</i>	<i>holboellii</i>	rockcress
<i>Aralia</i>	<i>nudicaulis</i>	wild sarsaparilla
<i>Arctium</i>	<i>minus</i>	common burdock
<i>Arctostaphylos</i>	<i>uva-ursi</i>	bearberry
<i>Argentina</i>	<i>anserina</i>	silverweed
<i>Aristida</i>	<i>purpurea</i>	red threeawn
<i>Arnica</i>	<i>fulgens</i>	arnica
<i>Artemisia</i>	<i>absinthium</i>	wormwood
<i>Artemisia</i>	<i>biennis</i>	biennial wormwood
<i>Artemisia</i>	<i>cana</i>	dwarf sagebrush
<i>Artemisia</i>	<i>caudata</i>	western sagebrush
<i>Artemisia</i>	<i>dracunculus</i>	silky wormwood
<i>Artemisia</i>	<i>filifolia</i>	silver wormwood
<i>Artemisia</i>	<i>frigida</i>	fringed sagewort
<i>Artemisia</i>	<i>longifolia</i>	longleaf wormwood
<i>Artemisia</i>	<i>ludoviciana</i>	white sage
<i>Asclepias</i>	<i>hirtella</i>	green milkweed
<i>Asclepias</i>	<i>ovalifolia</i>	oval-leaf milkweed
<i>Asclepias</i>	<i>speciosa</i>	showy milkweed
<i>Asclepias</i>	<i>syriaca</i>	common milkweed
<i>Asclepias</i>	<i>verticillata</i>	whorled milkweed
<i>Asparagus</i>	<i>officinalis</i>	asparagus
<i>Aster</i>	<i>ericoides</i>	white aster
<i>Aster</i>	<i>falcatus</i>	smallflower aster
<i>Aster</i>	<i>laevis</i>	smooth blue aster
<i>Aster</i>	<i>oblongifolius</i>	aromatic aster
<i>Aster</i>	<i>simplex</i>	simple aster
<i>Astragalus</i>	<i>agrestis</i>	purple milkvetch
<i>Astragalus</i>	<i>bisulcatus</i>	two-grooved milkvetch
<i>Astragalus</i>	<i>canadensis</i>	Canada milkvetch
<i>Astragalus</i>	<i>crassicaarpus</i>	ground plum milkvetch
<i>Astragalus</i>	<i>flexuosus</i>	slender milkvetch
<i>Astragalus</i>	<i>gilviflorus</i>	tufted milkvetch
<i>Astragalus</i>	<i>laxmannii</i>	vetch adsug
<i>Astragalus</i>	<i>missouriensis</i>	Missouri milkvetch
<i>Astragalus</i>	<i>pectinatus</i>	narrowleaf poisonvetch
<i>Astragalus</i>	<i>racemosus</i>	creamy poisonvetch
<i>Astragalus</i>	<i>tenellus</i>	looseflower milkvetch
<i>Atriplex</i>	<i>argentea</i>	silverscale saltbush
<i>Atriplex</i>	<i>dioica</i>	rillscale

Genus	Species	Common Name
<i>Atriplex</i>	<i>hortensis</i>	garden orach
<i>Atriplex</i>	<i>nuttallii</i>	salt sage
<i>Atriplex</i>	<i>patula</i>	spearscale
<i>Atriplex</i>	<i>rosea</i>	redscale
<i>Axyris</i>	<i>amaranthoides</i>	Russian pigweed
<i>Bassia</i>	<i>scoparia</i>	kochia
<i>Beckmannia</i>	<i>syzigachne</i>	American sloughgrass
<i>Berteroa</i>	<i>incana</i>	hoary false alyssum
<i>Betula</i>	<i>papyrifera</i>	paper birch
<i>Bidens</i>	<i>cernua</i>	nodding beggarticks
<i>Bidens</i>	<i>frondosa</i>	beggarticks
<i>Bidens</i>	<i>vulgata</i>	beggarticks
<i>Boltonia</i>	<i>asteroides</i>	violet boltonia
<i>Bouteloua</i>	<i>curtipendula</i>	sideoats grama
<i>Bouteloua</i>	<i>gracilis</i>	blue grama
<i>Brickellia</i>	<i>eupatorioides</i>	false boneset
<i>Bromus</i>	<i>ciliatus</i>	fringed brome
<i>Bromus</i>	<i>inermis</i>	smooth brome
<i>Bromus</i>	<i>japonicus</i>	Japanese brome
<i>Bromus</i>	<i>latiglumis</i>	brome lati
<i>Bromus</i>	<i>porteri</i>	nodding brome
<i>Bromus</i>	<i>tectorum</i>	downy brome
<i>Buchloe</i>	<i>dactyloides</i>	buffalograss
<i>Calamagrostis</i>	<i>canadensis</i>	blue joint
<i>Calamagrostis</i>	<i>montanensis</i>	plains reedgrass
<i>Calamagrostis</i>	<i>stricta</i>	slimstem reedgrass
<i>Calamovilfa</i>	<i>longifolia</i>	prairie sandreed
<i>Calylophus</i>	<i>serrulatus</i>	yellow evening primrose
<i>Calystegia</i>	<i>sepium</i>	hedge bindweed
<i>Camelina</i>	<i>microcarpa</i>	littlepod false flax
<i>Camelina</i>	<i>sativa</i>	gold-of-pleasure
<i>Campanula</i>	<i>rapunculoides</i>	creeping bellflower
<i>Campanula</i>	<i>rotundifolia</i>	harebell
<i>Capsella</i>	<i>bursa-pastoris</i>	shepherd's purse
<i>Cardaria</i>	<i>draba</i>	hoary cress
<i>Carduus</i>	<i>nutans</i>	musk thistle
<i>Carex</i>	<i>aenea</i>	sedge
<i>Carex</i>	<i>assiniboinensis</i>	Assiniboia sedge
<i>Carex</i>	<i>atherodes</i>	wheat sedge
<i>Carex</i>	<i>aurea</i>	golden sedge
<i>Carex</i>	<i>bebbii</i>	Bebb's sedge
<i>Carex</i>	<i>bicknellii</i>	Bicknell's sedge
<i>Carex</i>	<i>brevior</i>	shortbeak sedge
<i>Carex</i>	<i>douglasii</i>	Douglas' sedge
<i>Carex</i>	<i>duriuscula</i>	needleleaf sedge
<i>Carex</i>	<i>filifolia</i>	threadleaf sedge
<i>Carex</i>	<i>gravida</i>	heavy sedge
<i>Carex</i>	<i>hallii</i>	deer sedge
<i>Carex</i>	<i>inops</i>	sun sedge
<i>Carex</i>	<i>interior</i>	inland sedge

Genus	Species	Common Name
<i>Carex</i>	<i>laeviconica</i>	smoothcone sedge
<i>Carex</i>	<i>lanuginosa</i>	woolly sedge
<i>Carex</i>	<i>meadii</i>	Mead's sedge
<i>Carex</i>	<i>molesta</i>	troublesome sedge
<i>Carex</i>	<i>peckii</i>	Peck's sedge
<i>Carex</i>	<i>pensylvanica</i>	Pennsylvania sedge
<i>Carex</i>	<i>praegracilis</i>	clustered field sedge
<i>Carex</i>	<i>retrorsa</i>	knotsheath
<i>Carex</i>	<i>rostrata</i>	beaked sedge
<i>Carex</i>	<i>saximontana</i>	Rocky Mountain sedge
<i>Carex</i>	<i>sprengelii</i>	Sprengel's sedge
<i>Carex</i>	<i>sychnocephala</i>	manyhead sedge
<i>Carex</i>	<i>tetanica</i>	rigid sedge
<i>Carex</i>	<i>vulpinoidea</i>	fox sedge
<i>Carum</i>	<i>carvi</i>	caraway
<i>Castilleja</i>	<i>sessiliflora</i>	downy paintbrush
<i>Catabrosa</i>	<i>aquatica</i>	brookgrass
<i>Celastrus</i>	<i>scandens</i>	climbing bittersweet
<i>Celtis</i>	<i>occidentalis</i>	hackberry
<i>Centunculus</i>	<i>minimus</i>	common pimpernel
<i>Cerastium</i>	<i>arvense</i>	prairie chickweed
<i>Cerastium</i>	<i>brachypodium</i>	nodding chickweed
<i>Cerastium</i>	<i>nutans</i>	powderhorn cerastium
<i>Ceratoides</i>	<i>lanata</i>	winterfat
<i>Ceratophyllum</i>	<i>demersum</i>	hornwort
<i>Chamaerhodos</i>	<i>erecta</i>	little rose
<i>Chamaesyce</i>	<i>glyptosperma</i>	ridge-seeded spurge
<i>Chamaesyce</i>	<i>serpyllifolia</i>	thyme-leaved spurge
<i>Chenopodium</i>	<i>album</i>	lambsquarters
<i>Chenopodium</i>	<i>berlandieri</i>	pitseed goosefoot
<i>Chenopodium</i>	<i>disiccatum</i>	aridland goosefoot
<i>Chenopodium</i>	<i>fremontii</i>	Fremont's goosefoot
<i>Chenopodium</i>	<i>glaucum</i>	oakleaf goosefoot
<i>Chenopodium</i>	<i>rubrum</i>	akali blite
<i>Chenopodium</i>	<i>simplex</i>	maple-leaved goosefoot
<i>Chenopodium</i>	<i>strictum</i>	chenopodium
<i>Cinna</i>	<i>arundinacea</i>	woodreed
<i>Cinna</i>	<i>latifolia</i>	drooping woodreed
<i>Cirsium</i>	<i>arvense</i>	Canada thistle
<i>Cirsium</i>	<i>canescens</i>	prairie thistle
<i>Cirsium</i>	<i>undulatum</i>	wavyleaf thistle
<i>Cirsium</i>	<i>vulgare</i>	bull thistle
<i>Cleome</i>	<i>serrulata</i>	Rocky Mountain beeplant
<i>Collomia</i>	<i>linearis</i>	collomia
<i>Comandra</i>	<i>umbellata</i>	bastard toadflax
<i>Commelina</i>	<i>communis</i>	dayflower
<i>Conringia</i>	<i>orientalis</i>	hare's ear mustard
<i>Convolvulus</i>	<i>arvensis</i>	field bindweed
<i>Conyza</i>	<i>canadensis</i>	horseweed
<i>Cornus</i>	<i>sericea</i>	redosier dogwood

Genus	Species	Common Name
<i>Corydalis</i>	<i>aurea</i>	golden corydalis
<i>Corylus</i>	<i>americana</i>	American hazelnut
<i>Crataegus</i>	<i>chrysoarpa</i>	roundleaf hawthorn
<i>Crataegus</i>	<i>rotundifolia</i>	northern hawthorn
<i>Crataegus</i>	<i>succulenta</i>	fleshy hawthorn
<i>Crepis</i>	<i>occidentalis</i>	hawksbeard
<i>Crepis</i>	<i>runcinata</i>	hawksbeard
<i>Cryptantha</i>	<i>celosioides</i>	buttecandle
<i>Cuscuta</i>	<i>cephalanthi</i>	buttonbush dodder
<i>Cuscuta</i>	<i>gronovii</i>	scaldweed
<i>Cuscuta</i>	<i>indecora</i>	bigseed alfalfa dodder
<i>Cymopterus</i>	<i>acaulis</i>	wild parsley
<i>Cyperus</i>	<i>bipartitus</i>	brook flatsedge
<i>Cyperus</i>	<i>erythrorhizos</i>	redroot cyperus
<i>Cyperus</i>	<i>odoratus</i>	slender flatsedge
<i>Cyperus</i>	<i>squarrosus</i>	bearded flatsedge
<i>Cystopteris</i>	<i>fragilis</i>	common bladder fern
<i>Dactylorhiza</i>	<i>viridis</i>	longbract frog orchid
<i>Dalea</i>	<i>candida</i>	western prairie clover
<i>Dalea</i>	<i>purpurea</i>	purple prairie clover
<i>Danthonia</i>	<i>spicata</i>	poverty oatgrass
<i>Delphinium</i>	<i>bicolor</i>	little larkspur
<i>Deschampsia</i>	<i>caespitosa</i>	tufted hairgrass
<i>Descurainia</i>	<i>pinnata</i>	tansy mustard
<i>Descurainia</i>	<i>sophia</i>	flixweed
<i>Desmodium</i>	<i>canadense</i>	Canada tickclover
<i>Dichanthelium</i>	<i>leibergii</i>	Leiberg's panicum
<i>Dichanthelium</i>	<i>wilcoxianum</i>	Wilcox's panicum
<i>Distichlis</i>	<i>stricta</i>	saltgrass
<i>Dodecatheon</i>	<i>pulchellum</i>	shooting star
<i>Draba</i>	<i>nemorosa</i>	woodland draba
<i>Dracocephalum</i>	<i>parviflorum</i>	dragonhead
<i>Echinacea</i>	<i>angustifolia</i>	purple coneflower
<i>Echinochloa</i>	<i>crusgalli</i>	barnyard grass
<i>Echinocystis</i>	<i>lobata</i>	wild cucumber
<i>Elaeagnus</i>	<i>angustifolia</i>	Russian olive
<i>Elaeagnus</i>	<i>commutata</i>	silverberry
<i>Eleocharis</i>	<i>acicularis</i>	needle spikesedge
<i>Eleocharis</i>	<i>compressa</i>	flatstem spikesedge
<i>Eleocharis</i>	<i>erythropoda</i>	spikerush
<i>Eleocharis</i>	<i>macrostachya</i>	spikerush
<i>Eleocharis</i>	<i>obtusa</i>	blunt spikesedge
<i>Ellisia</i>	<i>nyctelea</i>	waterpod
<i>Elymus</i>	<i>canadensis</i>	Canada wildrye
<i>Elymus</i>	<i>lanceolatus</i>	thickspike wheatgrass
<i>Elymus</i>	<i>repens</i>	quackgrass
<i>Elymus</i>	<i>trachycaulus</i>	slender wheatgrass
<i>Elymus</i>	<i>virginicus</i>	Virginia wildrye
<i>Epilobium</i>	<i>angustifolium</i>	fireweed
<i>Epilobium</i>	<i>brachycarpum</i>	tall annual willowherb

Genus	Species	Common Name
<i>Epilobium</i>	<i>ciliatum</i>	willowherb
<i>Epilobium</i>	<i>leptophyllum</i>	bog willowherb
<i>Equisetum</i>	<i>arvense</i>	field horsetail
<i>Equisetum</i>	<i>fluviatile</i>	water horsetail
<i>Equisetum</i>	<i>laevigatum</i>	smooth horsetail
<i>Eragrostis</i>	<i>hypnoides</i>	teal lovegrass
<i>Ericameria</i>	<i>nauseosa</i>	rubber rabbitbrush
<i>Erigeron</i>	<i>caespitosus</i>	tufted fleabane
<i>Erigeron</i>	<i>compositus</i>	fernleaf fleabane
<i>Erigeron</i>	<i>glabellus</i>	smooth fleabane
<i>Erigeron</i>	<i>lonchophyllus</i>	spearleaf fleabane
<i>Erigeron</i>	<i>philadelphicus</i>	Philadelphia fleabane
<i>Erigeron</i>	<i>pumilus</i>	low fleabane
<i>Erigeron</i>	<i>strigosus</i>	daisy fleabane
<i>Eriogonum</i>	<i>flavum</i>	yellow buckwheat
<i>Eriogonum</i>	<i>pauciflorum</i>	erigonum
<i>Eriophorum</i>	<i>viridicarinatum</i>	cottongrass
<i>Erucastrum</i>	<i>gallicum</i>	dog mustard
<i>Erysimum</i>	<i>asperum</i>	western wallflower
<i>Erysimum</i>	<i>cheiranthoides</i>	wormseed wallflower
<i>Erysimum</i>	<i>inconspicuum</i>	smallflower wallflower
<i>Escobaria</i>	<i>vivipara</i>	pincushion cactus
<i>Eupatorium</i>	<i>maculatum</i>	spotted joeypyeweed
<i>Euphorbia</i>	<i>esula</i>	leafy spurge
<i>Euthamia</i>	<i>graminifolia</i>	narrowleaf goldenrod
<i>Festuca</i>	<i>campestris</i>	rough fescue
<i>Festuca</i>	<i>idahoensis</i>	bluebunch fescue
<i>Festuca</i>	<i>ovina</i>	sheep's fescue
<i>Fragaria</i>	<i>virginiana</i>	wild strawberry
<i>Fraxinus</i>	<i>pennsylvanica</i>	green ash
<i>Fritillaria</i>	<i>atropurpurea</i>	spotted fritillary
<i>Gaillardia</i>	<i>aristata</i>	blanketflower
<i>Galium</i>	<i>aparine</i>	catchweed bedstraw
<i>Galium</i>	<i>boreale</i>	northern bedstraw
<i>Galium</i>	<i>trifidum</i>	small bedstraw
<i>Galium</i>	<i>triflorum</i>	sweet-scented bedstraw
<i>Gaura</i>	<i>coccinea</i>	scarlet gaura
<i>Gentiana</i>	<i>affinis</i>	northern gentian
<i>Gentianella</i>	<i>amarella</i>	annual gentian
<i>Gentianopsis</i>	<i>crinita</i>	gentian
<i>Geum</i>	<i>aleppicum</i>	yellow avens
<i>Geum</i>	<i>triflorum</i>	purple avens
<i>Glaux</i>	<i>maritima</i>	sea milkwort
<i>Glyceria</i>	<i>borealis</i>	northern mannagrass
<i>Glyceria</i>	<i>grandis</i>	tall mannagrass
<i>Glyceria</i>	<i>striata</i>	fowl mannagrass
<i>Glycyrrhiza</i>	<i>lepidota</i>	wild licorice
<i>Gnaphalium</i>	<i>palustre</i>	everlasting
<i>Gratiola</i>	<i>neglecta</i>	hedge hyssop
<i>Grindelia</i>	<i>squarrosa</i>	curlycup gumweed

Genus	Species	Common Name
<i>Gutierrezia</i>	<i>sarathrae</i>	broom snakeweed
<i>Gypsophila</i>	<i>paniculata</i>	perennial baby's breath
<i>Hackelia</i>	<i>deflexa</i>	wood stickseed
<i>Hackelia</i>	<i>floribunda</i>	stickseed
<i>Haplopappus</i>	<i>lanceolatus</i>	lanceleaf goldenweed
<i>Haplopappus</i>	<i>spinulosus</i>	spring ironplant
<i>Hedeoma</i>	<i>hispida</i>	rough pennyroyal
<i>Hedysarum</i>	<i>boreale</i>	sweet vetch
<i>Helenium</i>	<i>autumnale</i>	sneezeweed
<i>Helianthus</i>	<i>annuus</i>	common sunflower
<i>Helianthus</i>	<i>maximiliani</i>	Maximilian sunflower
<i>Helianthus</i>	<i>nuttallii</i>	Nuttall's sunflower
<i>Helianthus</i>	<i>petiolaris</i>	plains sunflower
<i>Helianthus</i>	<i>rigidus</i>	stiff sunflower
<i>Helianthus</i>	<i>tuberosus</i>	Jerusalem artichoke
<i>Helictotrichon</i>	<i>hookeri</i>	spikeoat
<i>Heliotropium</i>	<i>curassavicum</i>	seaside heliotrope
<i>Heracleum</i>	<i>sphondylium</i>	cowparsnip
<i>Hesperis</i>	<i>matronalis</i>	dames rocket
<i>Hesperostipa</i>	<i>comata</i>	intermediate needle and thread
<i>Hesperostipa</i>	<i>spartea</i>	shortbristle needle and thread
<i>Heterotheca</i>	<i>villosa</i>	golden aster
<i>Heuchera</i>	<i>richardsonii</i>	alum root
<i>Hibiscus</i>	<i>trionum</i>	flower of an hour
<i>Hieracium</i>	<i>umbellatum</i>	hawkweed
<i>Hierochloa</i>	<i>odorata</i>	sweetgrass
<i>Hippuris</i>	<i>vulgaris</i>	mare's-tail
<i>Hordeum</i>	<i>jubatum</i>	foxtail barley
<i>Humulus</i>	<i>lupulus</i>	common hop
<i>Hymenopappus</i>	<i>filifolius</i>	fineleaf hymenopappus
<i>Hymenopappus</i>	<i>tenuifolius</i>	slimleaf hymenopappus
<i>Hyoscyamus</i>	<i>niger</i>	henbane
<i>Hypoxis</i>	<i>hirsuta</i>	yellow stargrass
<i>Iva</i>	<i>axillaris</i>	povertyweed
<i>Iva</i>	<i>xanthifolia</i>	marsh elder
<i>Juncus</i>	<i>alpinoarticulatus</i>	alpine rush
<i>Juncus</i>	<i>arcticus</i>	Baltic rush
<i>Juncus</i>	<i>bufonius</i>	toad rush
<i>Juncus</i>	<i>dudleyi</i>	Dudley's rush
<i>Juncus</i>	<i>interior</i>	inland rush
<i>Juncus</i>	<i>longistylis</i>	longstyle rush
<i>Juncus</i>	<i>nodosus</i>	knotted rush
<i>Juncus</i>	<i>torreyi</i>	Torrey's rush
<i>Juniperus</i>	<i>communis</i>	dwarf juniper
<i>Juniperus</i>	<i>horizontalis</i>	creeping juniper
<i>Juniperus</i>	<i>scopulorum</i>	Rocky Mountain red cedar
<i>Koeleria</i>	<i>macrantha</i>	Junegrass
<i>Lactuca</i>	<i>ludoviciana</i>	western wild lettuce
<i>Lactuca</i>	<i>tatarica</i>	blue lettuce
<i>Lactuca</i>	<i>serriola</i>	prickly lettuce

Genus	Species	Common Name
<i>Lappula</i>	<i>squarrosa</i>	blue stickseed
<i>Lappula</i>	<i>occidentalis</i>	low stickseed
<i>Lathyrus</i>	<i>ochroleucus</i>	yellow vetchling
<i>Lathyrus</i>	<i>palustris</i>	marsh vetchling
<i>Leonurus</i>	<i>cardiaca</i>	common motherwort
<i>Lepidium</i>	<i>densiflorum</i>	peppergrass
<i>Lepidium</i>	<i>ramosissimum</i>	bushy peppergrass
<i>Leptochloa</i>	<i>fusca</i>	bearded sprangletop
<i>Lesquerella</i>	<i>alpina</i>	alpine bladderpod
<i>Lesquerella</i>	<i>ludoviciana</i>	silver bladderpod
<i>Liatris</i>	<i>ligulistylis</i>	Rocky Mountain blazing star
<i>Liatris</i>	<i>punctata</i>	dotted blazing star
<i>Lilium</i>	<i>philadelphicum</i>	wood lily
<i>Limosella</i>	<i>aquatica</i>	mudwort
<i>Linaria</i>	<i>vulgaris</i>	butter and eggs
<i>Linum</i>	<i>perenne</i>	blue flax
<i>Linum</i>	<i>rigidum</i>	stiffstem flax
<i>Linum</i>	<i>sulcatum</i>	grooved flax
<i>Linum</i>	<i>usitatissimum</i>	common flax
<i>Lipocarpa</i>	<i>drummondii</i>	Drummond's halfchaff sedge
<i>Lithospermum</i>	<i>canescens</i>	hoary puccoon
<i>Lithospermum</i>	<i>incisum</i>	narrowleaf stoneseed
<i>Lobelia</i>	<i>kalmii</i>	Kalm's lobelia
<i>Lobelia</i>	<i>spicata</i>	palespike lobelia
<i>Lolium</i>	<i>perenne</i>	perennial ryegrass
<i>Lolium</i>	<i>persicum</i>	Persian ryegrass
<i>Lomatium</i>	<i>foeniculaceum</i>	desert biscuitroot
<i>Lomatium</i>	<i>macrocarpum</i>	bigseed biscuitroot
<i>Lomatium</i>	<i>orientale</i>	northern Idaho biscuitroot
<i>Lonicera</i>	<i>dioica</i>	wild honeysuckle
<i>Lonicera</i>	<i>tatarica</i>	Tatarian honeysuckle
<i>Lotus</i>	<i>unifoliolatus</i>	prairie bird's-foot trefoil
<i>Lycium</i>	<i>barbarum</i>	matrimony vine
<i>Lycopus</i>	<i>americanus</i>	American bugleweed
<i>Lycopus</i>	<i>asper</i>	rough bugleweed
<i>Lygodesmia</i>	<i>juncea</i>	rush skeletonplant
<i>Lysimachia</i>	<i>ciliata</i>	fringed loosestrife
<i>Lysimachia</i>	<i>hybrida</i>	loosestrife
<i>Lysimachia</i>	<i>thrysiflora</i>	tufted loosestrife
<i>Machaeranthera</i>	<i>canescens</i>	canescent aster
<i>Machaeranthera</i>	<i>grindeliode</i>	goldenweed
<i>Maianthemum</i>	<i>stellatum</i>	starry false lily of the valley
<i>Malva</i>	<i>neglecta</i>	common mallow
<i>Marsilea</i>	<i>vestita</i>	pepperwort
<i>Matricaria</i>	<i>maritima</i>	wild chamomile
<i>Matricaria</i>	<i>discoides</i>	mayweed
<i>Medicago</i>	<i>lupulina</i>	black medick
<i>Medicago</i>	<i>sativa</i>	alfalfa
<i>Melilotus</i>	<i>alba</i>	white sweetclover
<i>Melilotus</i>	<i>albus</i>	white sweetclover

Genus	Species	Common Name
<i>Melilotus</i>	<i>officinalis</i>	yellow sweetclover
<i>Mentha</i>	<i>arvensis</i>	field mint
<i>Mentzelia</i>	<i>decapetala</i>	tenpetal blazingstar
<i>Mertensia</i>	<i>lanceolata</i>	prairie bluebells
<i>Mertensia</i>	<i>oblongifolia</i>	oblongleaf bluebells
<i>Mirabilis</i>	<i>hirsuta</i>	hairy four o'clock
<i>Mirabilis</i>	<i>linearis</i>	narrowleaf four o'clock
<i>Mirabilis</i>	<i>nyctaginea</i>	heartleaf four o'clock
<i>Monarda</i>	<i>fistulosa</i>	wild bergamot
<i>Monolepis</i>	<i>nuttalliana</i>	povertyweed
<i>Muhlenbergia</i>	<i>asperifolia</i>	scratchgrass
<i>Muhlenbergia</i>	<i>cuspidata</i>	plains muhly
<i>Muhlenbergia</i>	<i>racemosa</i>	marsh muhly
<i>Muhlenbergia</i>	<i>richardsonis</i>	mat muhly
<i>Musineon</i>	<i>divaricatum</i>	leafy musineon
<i>Myosurus</i>	<i>minimus</i>	mousetail
<i>Nassella</i>	<i>viridula</i>	green needlegrass
<i>Navarretia</i>	<i>intertexta</i>	woolly gilia
<i>Nepeta</i>	<i>cataria</i>	catnip
<i>Nothocalais</i>	<i>cuspidata</i>	false dandelion
<i>Oenothera</i>	<i>caespitosa</i>	gumbo lily
<i>Oenothera</i>	<i>flava</i>	yellow lavauxia
<i>Oenothera</i>	<i>nuttallii</i>	Nuttall's evening-primrose
<i>Oenothera</i>	<i>villosa</i>	common evening-primrose
<i>Oligoneuron</i>	<i>album</i>	sneezewort aster
<i>Oligoneuron</i>	<i>rigidum</i>	stiff goldenrod
<i>Onosmodium</i>	<i>molle</i>	false gromwell
<i>Opuntia</i>	<i>fragilis</i>	brittle pricklypear
<i>Opuntia</i>	<i>polyacantha</i>	plains pricklypear
<i>Orobanche</i>	<i>fasciculata</i>	clustered broomrape
<i>Orobanche</i>	<i>ludoviciana</i>	broomrape
<i>Orthocarpus</i>	<i>luteus</i>	yellow owl's-clover
<i>Osmorhiza</i>	<i>longistylis</i>	longstyle sweetroot
<i>Oxalis</i>	<i>stricta</i>	common yellow oxalis
<i>Oxytropis</i>	<i>campestris</i>	late yellow locoweed
<i>Oxytropis</i>	<i>lambertii</i>	purple locoweed
<i>Oxytropis</i>	<i>splendens</i>	showy locoweed
<i>Packera</i>	<i>cana</i>	gray ragwort
<i>Panicum</i>	<i>capillare</i>	witchgrass
<i>Panicum</i>	<i>virgatum</i>	witchgrass
<i>Parietaria</i>	<i>pennsylvanica</i>	Pennsylvania pellitory
<i>Parnassia</i>	<i>palustris</i>	northern grass-of-parnassus
<i>Paronychia</i>	<i>sessiliflora</i>	whitlowwort
<i>Pascopyrum</i>	<i>smithii</i>	western wheatgrass
<i>Pastinaca</i>	<i>sativa</i>	wild parsnip
<i>Pedimelum</i>	<i>argophyllum</i>	silver-leaf scurfpea
<i>Pedimelum</i>	<i>esculentum</i>	breadroot
<i>Penstemon</i>	<i>albidus</i>	white beardtongue
<i>Penstemon</i>	<i>angustifolius</i>	narrow beardtongue
<i>Penstemon</i>	<i>eriantherus</i>	crested beardtongue

Genus	Species	Common Name
<i>Penstemon</i>	<i>gracilis</i>	slender beardtongue
<i>Penstemon</i>	<i>nitidus</i>	smooth blue beardtongue
<i>Phalaris</i>	<i>arundinacea</i>	reed canarygrass
<i>Phleum</i>	<i>pratense</i>	timothy
<i>Phlox</i>	<i>hoodii</i>	Hood's phlox
<i>Physalis</i>	<i>heterophylla</i>	clammy groundcherry
<i>Physalis</i>	<i>virginiana</i>	Virginia groundcherry
<i>Physostegia</i>	<i>parviflora</i>	obedient plant
<i>Piptatherum</i>	<i>micranthum</i>	littleseed ricegrass
<i>Plagiobothrys</i>	<i>scouleri</i>	Scouler's popcornflower
<i>Plantago</i>	<i>elongata</i>	prairie plantain
<i>Plantago</i>	<i>eriopoda</i>	alkali plantain
<i>Plantago</i>	<i>major</i>	common plantain
<i>Plantago</i>	<i>patagonica</i>	buckhorn
<i>Plantanthera</i>	<i>aquilonis</i>	northern green orchid
<i>Poa</i>	<i>arida</i>	plains bluegrass
<i>Poa</i>	<i>compressa</i>	Canada bluegrass
<i>Poa</i>	<i>cusickii</i>	early bluegrass
<i>Poa</i>	<i>nemoralis</i>	inland bluegrass
<i>Poa</i>	<i>palustris</i>	foul bluegrass
<i>Poa</i>	<i>pratensis</i>	Kentucky bluegrass
<i>Poa</i>	<i>secunda</i>	Canby's bluegrass
<i>Polanisia</i>	<i>dodecandra</i>	clammyweed
<i>Polygala</i>	<i>alba</i>	white milkwort
<i>Polygala</i>	<i>senega</i>	Seneca snakeroot
<i>Polygala</i>	<i>verticillata</i>	whorled milkwort
<i>Polygonatum</i>	<i>biflorum</i>	smooth Solomon's seal
<i>Polygonum</i>	<i>achoreum</i>	erect knotweed
<i>Polygonum</i>	<i>amphibium</i>	swamp smartweed
<i>Polygonum</i>	<i>arenastrum</i>	common knotweed
<i>Polygonum</i>	<i>convolvulus</i>	wild buckwheat
<i>Polygonum</i>	<i>lapathifolium</i>	pale smartweed
<i>Polygonum</i>	<i>pensylvanicum</i>	Pennsylvania smartweed
<i>Polygonum</i>	<i>persicaria</i>	lady's-thumb
<i>Polygonum</i>	<i>ramosissimum</i>	bushy knotweed
<i>Populus</i>	<i>balsamifera</i>	balsam poplar
<i>Populus</i>	<i>deltoides</i>	cottonwood
<i>Populus</i>	<i>tremuloides</i>	quaking aspen
<i>Portulaca</i>	<i>oleracea</i>	common purslane
<i>Potentilla</i>	<i>arguta</i>	tall cinquefoil
<i>Potentilla</i>	<i>concinna</i>	early cinquefoil
<i>Potentilla</i>	<i>gracilis</i>	graceful cinquefoil
<i>Potentilla</i>	<i>hippiana</i>	woolly cinquefoil
<i>Potentilla</i>	<i>norvegica</i>	Norwegian cinquefoil
<i>Potentilla</i>	<i>paradoxa</i>	bushy cinquefoil
<i>Potentilla</i>	<i>pensylvanica</i>	prairie cinquefoil
<i>Potentilla</i>	<i>rivalis</i>	brook cinquefoil
<i>Prenanthes</i>	<i>racemosa</i>	prairie rattlesnakeroot
<i>Prosartes</i>	<i>trachycarpa</i>	fairybells
<i>Prunella</i>	<i>vulgaris</i>	selfheal

Genus	Species	Common Name
<i>Prunus</i>	<i>americana</i>	American plum
<i>Prunus</i>	<i>pensylvanica</i>	pin cherry
<i>Prunus</i>	<i>pumila</i>	sandcherry
<i>Prunus</i>	<i>virginiana</i>	chokecherry
<i>Pseudoroegneria</i>	<i>spicatum</i>	bluebunch wheatgrass
<i>Psoraleidium</i>	<i>lanceolatum</i>	lemon scurfpea
<i>Puccinellia</i>	<i>nuttalliana</i>	alkaligrass
<i>Quercus</i>	<i>macrocarpa</i>	bur oak
<i>Ranunculus</i>	<i>abortivus</i>	early wood buttercup
<i>Ranunculus</i>	<i>glaberrimus</i>	shiny-leaved buttercup
<i>Ranunculus</i>	<i>macounii</i>	Macoun's buttercup
<i>Ranunculus</i>	<i>rhomboideus</i>	Labrador buttercup
<i>Ratibida</i>	<i>columnifera</i>	prairie coneflower
<i>Rhamnus</i>	<i>cathartica</i>	common buckthorn
<i>Rhus</i>	<i>aromatica</i>	aromatic sumac
<i>Ribes</i>	<i>americanum</i>	wild black currant
<i>Ribes</i>	<i>aureum</i>	buffalo currant
<i>Ribes</i>	<i>hirtellum</i>	low wild gooseberry
<i>Ribes</i>	<i>oxyacanthoides</i>	bristly gooseberry
<i>Rorippa</i>	<i>palustris</i>	bog yellow cress
<i>Rosa</i>	<i>arkansana</i>	prairie rose
<i>Rosa</i>	<i>blanda</i>	smooth rose
<i>Rosa</i>	<i>woodsii</i>	Woods' rose
<i>Rubus</i>	<i>idaeus</i>	red raspberry
<i>Rudbeckia</i>	<i>hirta</i>	black-eyed susan
<i>Rumex</i>	<i>aquaticus</i>	western dock
<i>Rumex</i>	<i>crispus</i>	curly dock
<i>Rumex</i>	<i>longifolius</i>	field dock
<i>Rumex</i>	<i>maritimus</i>	golden dock
<i>Rumex</i>	<i>salicifolius</i>	Mexican dock
<i>Rumex</i>	<i>stenophyllus</i>	narrowleaf dock
<i>Ruppia</i>	<i>maritima</i>	ditchgrass
<i>Salicornia</i>	<i>rubra</i>	saltwort
<i>Salix</i>	<i>amygdaloides</i>	peachleaf willow
<i>Salix</i>	<i>bebbiana</i>	Bebb willow
<i>Salix</i>	<i>candida</i>	sageleaf willow
<i>Salix</i>	<i>discolor</i>	pussy willow
<i>Salix</i>	<i>eriocephala</i>	diamond willow
<i>Salix</i>	<i>exigua</i>	narrowleaf willow
<i>Salix</i>	<i>lucida</i>	shining willow
<i>Salix</i>	<i>pentandra</i>	laurel willow
<i>Salix</i>	<i>petiolaris</i>	meadow willow
<i>Salsola</i>	<i>tragus</i>	Russian thistle
<i>Sanicula</i>	<i>marilandica</i>	black snakeroot
<i>Saponaria</i>	<i>officinalis</i>	bouncing bet
<i>Schedonnardus</i>	<i>paniculatus</i>	tumblegrass
<i>Schizachne</i>	<i>purpurascens</i>	false melic
<i>Scolochloa</i>	<i>festucea</i>	sprangletop
<i>Scrophularia</i>	<i>lanceolata</i>	figwort
<i>Scutellaria</i>	<i>lateriflora</i>	blue skullcap

Genus	Species	Common Name
<i>Selaginella</i>	<i>densa</i>	small clubmoss
<i>Senecio</i>	<i>congestus</i>	swamp ragwort
<i>Senecio</i>	<i>integerrimus</i>	lambstongue ragwort
<i>Senecio</i>	<i>plattensis</i>	prairie ragwort
<i>Setaria</i>	<i>glauca</i>	yellow foxtail
<i>Setaria</i>	<i>viridus</i>	green foxtail
<i>Shepherdia</i>	<i>argentea</i>	buffaloberry
<i>Shizachyrium</i>	<i>scoparius</i>	little bluestem
<i>Silene</i>	<i>cserei</i>	smooth catchfly
<i>Silene</i>	<i>drummondii</i>	Drummond's cockle
<i>Silene</i>	<i>antirrhina</i>	sleepy catchfly
<i>Silene</i>	<i>latifolia</i>	white cockle
<i>Silene</i>	<i>vulgaris</i>	bladder campion
<i>Sinapis</i>	<i>arvensis</i>	charlock
<i>Sisymbrium</i>	<i>altissimum</i>	tumbling mustard
<i>Sisyrinchium</i>	<i>angustifolium</i>	narrowleaf blue-eyed grass
<i>Smilax</i>	<i>herbacea</i>	smooth carrionflower
<i>Solanum</i>	<i>dulcamara</i>	bittersweet
<i>Solanum</i>	<i>triflorum</i>	cutleaf nightshade
<i>Solidago</i>	<i>canadensis</i>	Canada goldenrod
<i>Solidago</i>	<i>gigantea</i>	late goldenrod
<i>Solidago</i>	<i>missouriensis</i>	prairie goldenrod
<i>Solidago</i>	<i>mollis</i>	soft goldenrod
<i>Solidago</i>	<i>nemoralis</i>	gray goldenrod
<i>Solidago</i>	<i>speciosa</i>	showy goldenrod
<i>Sonchus</i>	<i>arvensis</i>	field sowthistle
<i>Sonchus</i>	<i>asper</i>	spiny sowthistle
<i>Sonchus</i>	<i>oleraceus</i>	common sowthistle
<i>Sorghastrum</i>	<i>nutans</i>	Indiangrass
<i>Spartina</i>	<i>gracilis</i>	alkali cordgrass
<i>Spartina</i>	<i>pectinata</i>	prairie cordgrass
<i>Sphaeralcea</i>	<i>coccinea</i>	scarlet globemallow
<i>Sphenopholis</i>	<i>obtusata</i>	prairie wedgegrass
<i>Spiraea</i>	<i>alba</i>	meadowsweet
<i>Spiranthes</i>	<i>cernua</i>	nodding lady's tresses
<i>Spiranthes</i>	<i>romanzoffiana</i>	hooded lady's tresses
<i>Sporobolus</i>	<i>compositus</i>	rough dropseed
<i>Sporobolus</i>	<i>cryptandrus</i>	sand dropseed
<i>Sporobolus</i>	<i>heterolepis</i>	prairie dropseed
<i>Stachys</i>	<i>palustris</i>	hedge nettle
<i>Stellaria</i>	<i>longifolia</i>	longleaf starwort
<i>Stellaria</i>	<i>longipes</i>	longstalk starwort
<i>Stellaria</i>	<i>scarassifolia</i>	fleshy stitchwort
<i>Suaeda</i>	<i>calceoliformis</i>	sea blite
<i>Symphoricarpos</i>	<i>albus</i>	snowberry
<i>Symphoricarpos</i>	<i>occidentalis</i>	western snowberry
<i>Symphyotrichum</i>	<i>boreale</i>	rush aster
<i>Symphyotrichum</i>	<i>ciliatum</i>	rayless aster
<i>Symphyotrichum</i>	<i>ericoides</i>	white aster
<i>Symphyotrichum</i>	<i>falcatum</i>	smallflower aster

Genus	Species	Common Name
<i>Symphyotrichum</i>	<i>laeve</i>	smooth blue aster
<i>Symphyotrichum</i>	<i>lanceolatum</i>	panicked aster
<i>Symphyotrichum</i>	<i>oblongifolium</i>	aromatic aster
<i>Tanacetum</i>	<i>vulgare</i>	common tansy
<i>Taraxacum</i>	<i>laevigatum</i>	rock dandelion
<i>Taraxacum</i>	<i>officinale</i>	dandelion
<i>Teucrium</i>	<i>canadense</i>	American germander
<i>Thalictrum</i>	<i>dasycarpum</i>	purple meadowrue
<i>Thalictrum</i>	<i>venulosum</i>	early meadowrue
<i>Thermopsis</i>	<i>rhombifolia</i>	golden pea
<i>Thinopyrum</i>	<i>intermedium</i>	intermediate wheatgrass
<i>Thlaspi</i>	<i>arvense</i>	penny cress
<i>Townsendia</i>	<i>exscapa</i>	stemless Townsend daisy
<i>Toxicodendron</i>	<i>radicans</i>	poinson ivy
<i>Tradescantia</i>	<i>bracteata</i>	spiderwort
<i>Tragopogon</i>	<i>dubius</i>	goatsbeard
<i>Trifolium</i>	<i>hybridum</i>	alsike clover
<i>Trifolium</i>	<i>pratense</i>	red clover
<i>Trifolium</i>	<i>repens</i>	white clover
<i>Ulmus</i>	<i>americana</i>	American elm
<i>Ulmus</i>	<i>pumila</i>	Siberian elm
<i>Urtica</i>	<i>dioica</i>	stinging nettle
<i>Vaccaria</i>	<i>hispanica</i>	cowherb
<i>Verbena</i>	<i>bracteata</i>	bracted vervain
<i>Verbena</i>	<i>hastata</i>	blue vervain
<i>Verbena</i>	<i>stricta</i>	hoary vervain
<i>Verbena</i>	<i>urticifolia</i>	white vervain
<i>Veronica</i>	<i>anagallis-aquatic</i>	water speedwell
<i>Veronica</i>	<i>fasciculata</i>	ironweed
<i>Veronica</i>	<i>peregrina</i>	purslane speedwell
<i>Veronica</i>	<i>scutellata</i>	marsh speedwell
<i>Viburnum</i>	<i>lentago</i>	nannyberry
<i>Vicia</i>	<i>americana</i>	American vetch
<i>Vicia</i>	<i>villosa</i>	hairy vetch
<i>Viola</i>	<i>adunca</i>	small blue violet
<i>Viola</i>	<i>canadensis</i>	Canada violet
<i>Viola</i>	<i>nephrophylla</i>	meadow violet
<i>Viola</i>	<i>nuttallii</i>	Nuttall's violet
<i>Viola</i>	<i>pedatifida</i>	prairie violet
<i>Vitis</i>	<i>vulpina</i>	wild grape
<i>Vulpia</i>	<i>octoflora</i>	sixweeks fescue
<i>Xanthium</i>	<i>strumarium</i>	cocklebur
<i>Zigadenus</i>	<i>elegans</i>	white camas
<i>Zigadenus</i>	<i>venenosus</i>	death camas
<i>Zizia</i>	<i>aptera</i>	meadow parsnip

Appendix H

List of Insect Species

The following list of insect species at Arrowwood NWR was developed by Dr. Ronald A. Royer, professor at Minot State University, Minot, North Dakota. A star (*) indicates a species that has not yet been recorded at the refuge.

Common Name	Scientific Name
<i>Hesperiidae (Pyrginae)</i>	
silver-spotted skipper	<i>Epargyreus clarus</i>
common checkered skipper	<i>Pyrgus communis</i>
common sooty wing*	<i>Pholisora catullus</i>
<i>Hesperiidae (Hesperiinae)</i>	
roadside skipper	<i>Amblyscirtes vialis</i>
Delaware skipper*	<i>Anatrytone logan</i>
least skipper*	<i>Ancyloxypha numitor</i>
Arogos skipper*	<i>Atrytone arogos</i>
dusted skipper*	<i>Atrytonopsis hianna</i>
Dunn skipper	<i>Euphyes vestris</i>
common branded skipper	<i>Hesperia comma</i>
Dakota skipper*	<i>Hesperia dacotae</i>
Pawnee skipper	<i>Hesperia leonardus pawnee</i>
Ottoo skipper*	<i>Hesperia ottoe</i>
Uncas skipper*	<i>Hesperia uncas</i>
Garita skipperling	<i>Oarisma garita</i>
Hobomok skipper	<i>Poanes hobomok</i>
long dash	<i>Polites mystic</i>
Peck's skipper	<i>Polites peckius</i>
tawny-edge skipper	<i>Polites themistocles</i>
<i>Papilionidae</i>	
black swallowtail	<i>Papilio polyxenes</i>
Canadian tiger swallowtail	<i>Papilio (Pterourus) canadensis</i>
eastern tiger swallowtail*	<i>Papilio (Pterourus) glaucus</i>
<i>Pieridae</i>	
European cabbage butterfly	<i>Artogeia rapae</i>
alfalfa butterfly	<i>Colias eurytheme</i>
clouded sulphur	<i>Colias philodice</i>
Olympia marble*	<i>Euchloe olympia</i>
checkered white	<i>Pontia protodice</i>

Common Name	Scientific Name
<i>Lycaenidae (Lycaeninae)</i>	
great copper*	<i>Lycaena (Gaeides) xanthoides</i>
bronze copper	<i>Lycaena (Hyllolycaena) hyllus</i>
purplish copper	<i>Lycaena (Epidemia) helloides</i>
<i>Lycaenidae (Theclinae)</i>	
coral hairstreak	<i>Satyrrium (Harkenclenus) titus</i>
Acadian hairstreak*	<i>Satyrrium acadicum</i>
striped hairstreak	<i>Satyrrium liparops</i>
gray hairstreak	<i>Strymon melinus</i>
<i>Lycaenidae (Polyommatainae)</i>	
spring azure	<i>Celastrina ladon</i>
summer azure*	<i>Celastrina neglecta</i>
eastern tailed blue*	<i>Everes comyntas</i>
silvery blue	<i>Glaucopsyche lygdamus</i>
Melissa blue	<i>Lycaeides melissa</i>
<i>Nymphalidae (Heliconiinae)</i>	
meadow fritillary	<i>Clossiana bellona</i>
silver-bordered fritillary	<i>Clossiana selene</i>
variegated fritillary	<i>Euptoieta claudia</i>
Aphrodite fritillary	<i>Speyeria aphrodite</i>
Callippe fritillary	<i>Speyeria callippe</i>
great spangled fritillary	<i>Speyeria cybele</i>
regal fritillary*	<i>Speyeria idalia</i>
<i>Nymphalidae (Nymphalinae)</i>	
Milbert's tortoise shell	<i>Aglais milberti</i>
Gorgone checkerspot	<i>Charidryas gorgone</i>
silvery checkerspot*	<i>Charidryas nycteis</i>
mourning cloak	<i>Nymphalis antiopa</i>
northern pearl crescent	<i>Phyciodes cocyta</i>
pearl crescent	<i>Phyciodes tharos</i>
hop merchant	<i>Polygonia comma</i>
question mark	<i>Polygonia interrogationis</i>
gray comma	<i>Polygonia progne</i>
red admiral	<i>Vanessa atalanta</i>
painted lady	<i>Vanessa cardui</i>
American painted lady*	<i>Vanessa virginiensis</i>
<i>Nymphalidae (Limenitidinae)</i>	
white admiral	<i>Basilarchia a. arthemis</i>
red-spotted purple	<i>Basilarchia a. astyanax</i>
viceroys	<i>Basilarchia archippus</i>
<i>Nymphalidae (Apaturinae)</i>	
hackberry butterfly	<i>Asterocampa celtis</i>

Common Name	Scientific Name
<i>Nymphalidae (Satyrinae)</i>	
common wood nymph	<i>Cercyonis pegala</i>
inornate ringlet	<i>Coenonympha inornata</i>
northern pearly eye	<i>Enodia anthedon</i>
little wood satyr*	<i>Megisto cymela</i>
Varuna Arctic*	<i>Oeneis uhleri varuna</i>
eyed brown	<i>Satyroides eurydice</i>
<i>Danaidae</i>	
monarch	<i>Danaus plexippus</i>

Appendix I

List of Potentially Occurring Amphibian and Reptile Species

The following amphibian and reptile species potentially occur at the Arrowwood NWR, as determined by information in the USGS's GAP (geographic analysis program) database for North Dakota.

Common Name	Scientific Name
<i>Amphibians</i>	
plains spadefoot toad	<i>Scaphiopus bombifrons</i>
Woodhouse's toad	<i>Bufo woodhousei woodhousei</i>
Great Plains toad	<i>Bufo cognatus</i>
American toad	<i>Bufo americanus</i>
Canadian toad	<i>Bufo hemiophrys</i>
gray tree frog	<i>Hyla versicolor</i>
northern leopard frog	<i>Rana pipiens</i>
wood frog	<i>Rana sylvatica</i>
boreal chorus frog	<i>Pseudacris triseriata maculata</i>
tiger salamander	<i>Ambystoma tigrinum</i>
mudpuppy	<i>Necturus maculosus</i>
<i>Reptiles</i>	
northern prairie skink	<i>Eumeces septentrionalis</i>
western painted turtle	<i>Chrysemys picata bellii (gray)</i>
common snapping turtle	<i>Chelydra serpentina serpentina</i>
red-sided garter snake	<i>Thamnophis sirtalis parietalis</i>
plains garter snake	<i>Thamnophis radix</i>
northern redbelly snake	<i>Storeria occipitomaculata occipitomaculata</i>
smooth green snake	<i>Opheodrys vernalis</i>
western hognose snake	<i>Heterodon nasicus</i>

Appendix J

List of Bird Species

This list of resident and breeding bird species at Arrowwood NWR is based on “Birds of Arrowwood National Wildlife Refuge” (USFWS 1999).

Legend

- c = common (certain to be seen or heard in suitable habitat)
- u = uncommon (present, but not certain to be seen)
- r = rare (may be present, but not in most years)
- = no occurrence (during specified season)
- * = nests (species that nests at the refuge)
- # = threatened or endangered species in the United States

Common Name	Spring	Summer	Fall	Winter
<i>Loons</i>				
common loon	r	r	–	–
<i>Grebes</i>				
pied-billed grebe *	c	c	c	–
horned grebe *	u	u	u	–
red-necked grebe *	r	r	r	–
eared grebe *	c	c	c	–
western grebe *	c	c	c	–
Clark's grebe	r	r	r	–
<i>Pelicans</i>				
American white pelican	c	c	c	–
<i>Cormorants</i>				
double-crested cormorant *	c	c	c	–
<i>Hérons, Egrets, and Bitterns</i>				
American bittern *	c	c	c	–
least bittern	r	r	r	–
great blue heron	c	c	c	–
great egret	u	c	c	–
snowy egret	r	r	r	–
little blue heron	r	r	r	–
cattle egret	r	r	u	–
green heron *	r	r	r	–
black-crowned night-heron *	c	c	c	–
<i>Ibises</i>				
white-faced ibis	r	–	–	–
<i>Vultures</i>				
turkey vulture	r	–	r	–
<i>Swans, Geese, and Ducks</i>				
tundra swan	c	–	c	–
greater white-fronted goose	u	r	u	–
snow goose *	c	r	c	–
Ross's goose	r	–	r	–
brant	–	–	r	–
Canada goose *	c	c	c	u
wood duck *	c	c	c	–
gadwall *	c	c	c	–

Common Name	Spring	Summer	Fall	Winter
American wigeon *	c	u	c	–
American black duck *	r	r	r	–
mallard *	c	c	r	–
blue-winged teal *	c	c	c	–
cinnamon teal *	r	r	r	–
northern shoveler *	c	c	c	–
northern pintail *	c	c	c	–
green-winged teal *	c	u	c	–
canvasback *	c	u	c	–
redhead *	c	c	c	–
ring-necked duck *	c	r	c	–
greater scaup	r	–	r	–
lesser scaup *	c	u	c	–
white-winged scoter	–	–	r	–
bufflehead	c	r	c	–
common goldeneye	c	–	u	r
hooded merganser *	c	c	c	–
common merganser	c	–	c	r
red-breasted merganser	u	–	–	–
ruddy duck *	c	u	c	–
<i>Hawks and Eagles</i>				
osprey	r	–	r	–
bald eagle #	c	–	c	r
northern harrier *	c	c	c	r
sharp-shinned hawk	u	–	u	r
Cooper's hawk *	u	r	u	r
northern goshawk	r	–	r	r
broad-winged hawk	r	–	r	–
Swainson's hawk *	c	c	c	–
red-tailed hawk *	c	c	c	r
ferruginous hawk *	u	r	u	r
rough-legged hawk	c	–	c	r
golden eagle	u	r	u	u
<i>Falcons</i>				
American kestrel *	c	u	c	r
merlin	u	–	u	r
peregrine falcon #	r	–	r	r
prairie falcon	u	r	u	r
<i>Upland Game Birds</i>				
gray partridge *	c	c	c	c
ring-necked pheasant *	c	c	c	c
sharp-tailed grouse *	c	c	c	c
greater prairie chicken *	r	r	r	r
wild turkey *	u	u	u	u
<i>Rails and Coots</i>				
king rail	r	r	r	–
Virginia rail *	u	u	u	–
sora *	c	c	c	–
American coot *	c	c	c	r
common moorhen	r	–	–	–

Common Name	Spring	Summer	Fall	Winter
<i>Cranes</i>				
sandhill crane	c	r	c	—
whooping crane #	r	—	r	—
<i>Shorebirds</i>				
black-bellied plover	r	—	r	—
American golden plover	u	—	u	—
semipalmated plover	u	—	u	—
piping plover *#	r	r	r	—
killdeer *	c	c	c	—
American avocet *	c	c	c	—
greater yellowlegs	u	u	u	—
lesser yellowlegs	c	u	c	—
solitary sandpiper	u	u	u	—
willet *	c	c	c	—
spotted sandpiper *	u	u	c	—
upland sandpiper *	c	c	—	—
Hudsonian godwit	r	—	—	—
marbled godwit *	c	c	r	—
sanderling	r	—	r	—
semipalmated sandpiper	c	—	u	—
western sandpiper	c	r	c	—
least sandpiper	c	r	c	—
white-rumped sandpiper	c	—	r	—
Baird's sandpiper	c	—	u	—
pectoral sandpiper	c	—	u	—
dunlin	r	—	r	—
stilt sandpiper	u	—	u	—
buff-breasted sandpiper	r	—	—	—
short-billed dowitcher	u	u	u	—
long-billed dowitcher	c	u	c	—
common snipe *	c	u	c	—
American woodcock	r	r	r	—
Wilson's phalarope *	u	u	u	—
red-necked phalarope	u	—	u	—
<i>Gulls and Terns</i>				
Franklin's gull	c	c	c	—
Bonaparte's gull	u	—	u	—
ring-billed gull	c	c	c	—
California gull	c	c	c	—
herring gull	r	—	—	—
Caspian tern	r	—	r	—
common tern	c	c	c	—
Forster's tern *	u	u	—	—
black tern *	c	c	c	—
<i>Doves</i>				
rock dove *	c	c	c	c
mourning dove *	c	c	c	r
<i>Cuckoos and Roadrunners</i>				
black-billed cuckoo *	u	c	u	—
yellow-billed cuckoo	r	—	—	—

Common Name	Spring	Summer	Fall	Winter
<i>Owls</i>				
barn owl *	r	r	r	r
eastern screech owl *	r	c	r	u
great horned owl *	c	c	c	c
snowy owl	r	–	u	u
burrowing owl	–	r	–	–
barred owl	–	–	–	r
long-eared owl *	r	r	r	–
short-eared owl *	c	c	c	u
northern saw-whet owl	–	–	–	r
<i>Nighthawks and Nightjars</i>				
common nighthawk *	u	u	u	–
whip-poor-will	r	–	–	–
<i>Swifts</i>				
chimney swift	r	r	r	–
<i>Hummingbirds</i>				
ruby-throated hummingbird	r	u	r	–
<i>Kingfishers</i>				
belted kingfisher *	c	c	c	–
<i>Woodpeckers</i>				
red-headed woodpecker *	r	r	r	–
yellow-bellied sapsucker	u	–	u	–
downy woodpecker *	c	c	c	c
hairy woodpecker *	c	c	c	c
northern flicker *	c	c	c	r
<i>Flycatchers</i>				
olive-sided flycatcher	r	–	r	–
eastern wood pewee *	u	u	u	–
yellow-bellied flycatcher	r	–	–	–
alder flycatcher	r	–	–	–
willow flycatcher *	u	c	r	–
least flycatcher *	u	c	r	–
eastern phoebe	u	r	u	–
Say's phoebe *	u	u	u	–
great crested flycatcher	r	r	r	–
western kingbird *	c	c	c	–
eastern kingbird *	c	c	c	–
<i>Shrikes</i>				
loggerhead shrike *	u	u	r	–
northern shrike	u	–	u	u
<i>Vireos</i>				
blue-headed vireo	r	–	r	–
yellow-throated vireo	r	–	r	–
warbling vireo *	u	c	u	–
Philadelphia vireo	r	–	r	–
red-eyed vireo	u	u	u	–
<i>Jays, Magpies, and Crows</i>				
gray jay	–	–	–	r
blue jay *	c	c	c	c
black-billed magpie *	c	c	c	c
American crow *	c	u	c	u

Common Name	Spring	Summer	Fall	Winter
Larks				
horned lark *	c	c	c	c
Swallows				
purple martin *	u	c	u	—
tree swallow *	c	c	c	—
northern rough-winged swallow *	u	u	—	—
bank swallow *	c	c	u	—
cliff swallow *	c	c	c	—
barn swallow *	c	c	c	—
Chickadees and Titmice				
black-capped chickadee *	c	c	c	c
Nuthatches				
red-breasted nuthatch	u	—	u	c
white-breasted nuthatch *	u	u	c	c
Creepers				
brown creeper	u	—	u	u
Wrens				
house wren *	c	c	c	—
winter wren	r	—	—	—
sedge wren *	u	c	r	—
marsh wren *	u	c	u	—
Kinglets, Bluebirds, and Thrushes				
golden-crowned kinglet	r	—	r	r
ruby-crowned kinglet	u	—	u	—
eastern bluebird *	c	u	u	—
mountain bluebird	u	—	u	—
veery	u	—	u	—
gray-cheeked thrush	u	—	u	—
Swainson's thrush	c	—	u	—
hermit thrush	r	—	r	—
American robin *	c	c	c	r
Mimics				
gray catbird *	c	c	u	—
brown thrasher *	c	c	u	—
Starlings				
European starling *	u	u	u	u
Pipits				
American (water) pipit	u	—	u	—
Sprague's pipit *	u	u	u	—
Waxwings				
Bohemian waxwing	u	—	u	u
cedar waxwing *	u	c	c	u
Warblers				
golden-winged warbler	r	—	—	—
Tennessee warbler	c	—	u	—
orange-crowned warbler	c	—	u	—
Nashville warbler	u	—	r	—
yellow warbler *	c	c	u	—
chestnut-sided warbler	u	—	u	—
magnolia warbler	u	—	u	—
Cape May warbler	r	—	r	—
yellow-rumped warbler	c	c	r	—

Common Name	Spring	Summer	Fall	Winter
black-throated green warbler	r	–	r	–
Blackburnian warbler	r	–	r	–
pine warbler	–	r	–	–
palm warbler	c	–	u	–
bay-breasted warbler	r	–	r	–
blackpoll warbler	c	–	u	–
black-and-white warbler	c	–	u	–
American redstart	u	r	u	–
ovenbird	c	–	u	–
northern waterthrush	c	–	u	–
Connecticut warbler	r	–	–	–
mourning warbler	r	–	r	–
common yellowthroat *	c	c	c	–
Wilson's warbler	u	–	u	–
Canada warbler	r	–	r	–
yellow-breasted chat	r	–	r	–
<i>Tanagers</i>				
scarlet tanager	r	–	r	–
<i>Sparrows, Buntings, and Grosbeaks</i>				
eastern towhee	r	–	r	–
American tree sparrow	c	–	c	r
chipping sparrow *	c	c	u	–
clay-colored sparrow *	c	c	u	–
field sparrow	u	r	u	–
vesper sparrow	u	c	u	–
lark sparrow *	u	r	u	–
lark bunting *	u	u	–	–
Savannah sparrow *	c	c	u	–
grasshopper sparrow *	u	c	r	–
Baird's sparrow *	r	r	r	–
Le Conte's sparrow *	u	c	u	–
Nelson's sharp-tailed sparrow *	u	u	u	–
fox sparrow	r	–	r	–
song sparrow *	c	c	c	r
swamp sparrow	u	r	u	–
Lincoln's sparrow	c	–	u	–
white-throated sparrow	c	–	c	r
Harris' sparrow	c	–	c	r
white-crowned sparrow	c	–	c	–
dark-eyed junco	c	–	c	r
Lapland longspur	c	r	c	c
Smith's longspur	r	–	r	–
chestnut-collared longspur *	u	u	u	–
snow bunting	u	–	u	c
rose-breasted grosbeak *	u	r	u	–
indigo bunting	r	–	r	–
dickcissel *	u	u	u	–
<i>Blackbirds and Orioles</i>				
bobolink *	c	c	u	–
red-winged blackbird *	c	c	c	u
western meadowlark *	c	c	c	r
yellow-headed blackbird *	c	c	u	–

Common Name	Spring	Summer	Fall	Winter
rusty blackbird	u	–	u	r
Brewer's blackbird *	u	u	u	r
common grackle *	c	c	c	r
brown-headed cowbird *	c	c	c	–
orchard oriole *	c	u	r	–
Baltimore oriole *	c	c	u	–
<i>Finches</i>				
pine grosbeak	r	–	r	r
purple finch	u	–	u	u
house finch	r	r	r	c
red crossbill	r	–	r	u
common redpoll	u	–	u	c
hoary redpoll	–	–	–	r
pine siskin *	u	r	c	c
American goldfinch *	u	c	c	r
evening grosbeak	–	–	r	r
<i>Old World Sparrows</i>				
house sparrow *	c	c	c	c

Appendix K

List of Potentially Occurring Mammal Species

The following mammals potentially occur at Arrowwood NWR.

Common Name	Scientific Name
masked shrew	<i>Sorex cinereus</i>
Arctic shrew	<i>Sorex arcticus</i>
pigmy shrew	<i>Microsorex hoyi</i>
northern short-tailed shrew	<i>Blarina brevicauda</i>
little brown bat	<i>Myotis lucifugus</i>
big brown bat	<i>Eptesicus fuscus</i>
eastern cottontail	<i>Sylvilagus floridanus</i>
snowshoe hare	<i>Lepus americanus</i>
white-tailed jackrabbit	<i>Lepus townsendii</i>
woodchuck	<i>Marmota monax</i>
Richardson's ground squirrel	<i>Spermophilus richardsonii</i>
thirteen-lined ground squirrel	<i>Spermophilus tridecemlineatus</i>
Franklin's ground squirrel	<i>Spermophilus franklinii</i>
eastern fox squirrel	<i>Sciurus niger</i>
northern pocket gopher	<i>Thomomys talpoides</i>
olived-backed pocket mouse	<i>Perognathus fasciatus</i>
plains pocket mouse	<i>Perognathus flavescens</i>
western harvest mouse	<i>Reithrodontomys megalotis</i>
deer mouse	<i>Peromyscus maniculatus</i>
northern grasshopper mouse	<i>Onychomys leucogaster</i>
southern red-backed vole	<i>Clethrionomys gapperi</i>
meadow vole	<i>Microtus pennsylvanicus</i>
muskrat	<i>Ondatra zibethicus</i>
meadow jumping mouse	<i>Zapus hudsonius</i>
American beaver	<i>Castor canadensis</i>
common porcupine	<i>Erethizon dorsatum</i>
coyote	<i>Canis latrans</i>
red fox	<i>Vulpes vulpes</i>
common gray fox	<i>Urocyon cinereoargenteus</i>
common raccoon	<i>Procyon lotor</i>
ermine	<i>Mustela erminea</i>
least weasel	<i>Mustela nivalis</i>
long-tailed weasel	<i>Mustela frenata</i>
mink	<i>Mustela vison</i>
American badger	<i>Taxidea taxus</i>

Common Name	Scientific Name
striped skunk	<i>Mephitis mephitis</i>
bobcat	<i>Felis rufus</i>
white-tailed deer	<i>Odocoileus virginianus</i>
moose	<i>Alces alces</i>

Appendix L

Compatibility Determination for Hunting

Use: Hunting

Refuge Name: Arrowwood NWR

County: Stutsman and Foster counties, North Dakota

Establishing and Acquisition Authorities

Migratory Bird Conservation Act, Executive Order 7168

Refuge Purposes

“As a refuge and breeding ground for migratory birds and other wild life.”
(Executive Order 7168, dated September 4, 1935)

“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 Use

What is the use? Is the use a wildlife-dependent recreational use?

The use will be continuation of the existing hunting program, which includes youth deer hunting, archery deer hunting, deer gun hunting, deer muzzleloader hunting, late-season upland game bird hunting (pheasant, sharp-tailed grouse, and gray partridge), late-season small game hunting (cottontail rabbit and red fox) in accordance with state and federal regulations.

Where will the use be conducted?

The use will be conducted over the entire refuge, with the exception of the “Closed Area,” described as section 25 and a small portion of section 36, T. 144 N., R. 65 W., Stutsman County, North Dakota. The portion of the refuge encompassing the auto tour route—the west side of Mud Lake from County

Road 44 to Humpback Road—will be closed to youth deer hunting.

When will the use be conducted?

Big game hunting (youth deer, archery deer, deer gun, and muzzleloader) will be allowed during the seasons established by the state. Late-season, upland game bird hunting and small game hunting will open on the day following the deer gun season. The upland game bird hunting season will close when the state season closes. The small game hunting season will close on March 31.

How will the use be conducted?

A state-issued unit permit will be required to hunt deer. Current refuge regulations specify that on opening day of deer gun season, hunters may not enter the refuge before legal shooting hours. Thereafter, hunters may enter the refuge, but not shoot, prior to legal shooting hours. Hunters may not reenter the refuge after harvesting their deer, unless unarmed and wearing blaze orange.

Vehicles will be allowed on trails to retrieve deer during designated retrieval times. These times will be conspicuously posted on all refuge gates where access is allowed. Absolutely no ATVs or snowmobiles will be allowed.

There are an estimated 1,200 deer hunter visits at the refuge per year and an estimated 200 upland and small game hunter visits per year.

Why is this use being proposed?

Hunting is one of the six wildlife-dependent, recreational uses specified in the Improvement Act. It can be allowed at the refuge without interfering with the migratory bird resource.

Availability of Resources

Resources involved in the administration and management of the use: None.

Special equipment, facilities, or improvements necessary to support the use: None.

Maintenance costs: None.

Monitoring costs: None.

Offsetting revenues: None.

Anticipated Impacts of the Use

Short-term impacts: There may be temporary disturbance to nontarget wildlife near the activity. Animals surplus to populations will be removed by hunting, which may help ensure populations remain beneath the carrying capacity of available habitats.

Long-term impacts: Higher quality habitats capable of supporting healthy populations of wildlife will result if animal populations, especially deer, remain beneath carrying capacity.

Cumulative impacts: There are no direct or indirect cumulative impacts anticipated with this use.

Public Review and Comment

This compatibility determination was prepared concurrently with the CCP for the refuge. Public review and comment was achieved concurrently with the public review and comment period for the draft CCP and EA.

Determination

Hunting is a compatible use at Arrowwood NWR.

Stipulations Necessary to Ensure Compatibility

Stipulations for the hunting program will be made available in the refuge’s hunting “tear sheet.” These stipulations specify the “Closed Area,” times for which vehicle access is permitted for deer retrieval, specific season dates, and other information.

Justification

Hunting is a traditional and legislated, wildlife-dependent, recreational use. The current staff levels are adequate to ensure the activity takes place with minimum negative impacts to the refuge and its associated wildlife. Hunting at the refuge is a legitimate and necessary wildlife management tool that can be used to keep wild animal populations at healthy levels.

Signature

 8/10/07
 Kim Hanson Date
 Project Leader, Arrowwood NWR
 USFWS, Region 6

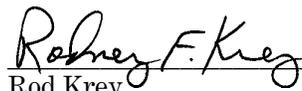
Concurrence

 8/20/07
 Richard A. Coleman, PhD Date
 Assistant Regional Director
 National Wildlife Refuge System
 USFWS, Region 6

Review

 8/14/07
 Lloyd Jones Date
 Regional Compatibility Coordinator
 USFWS, Region 6

Mandatory 10- or 15-Year Reevaluation Date: 2022

 8/20/07
 Rod Krey Date
 Refuge Supervisor
 USFWS, Region 6

Appendix M

Compatibility Determination for Fishing

Use: Fishing

Refuge Name: Arrowwood NWR

County: Stutsman and Foster counties, North Dakota

Establishing and Acquisition Authorities

Migratory Bird Conservation Act, Executive Order 7168

Refuge Purposes

“As a refuge and breeding ground for migratory birds and other wild life.”
(Executive Order 7168, dated September 4, 1935)

“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 Use

What is the use? Is the use a wildlife-dependent recreational use?

The use will be continuation of the fishing program at the refuge. Current fishing opportunities are temporary and sporadic in nature due to the predominately low water levels in managed impoundments. However, good fishing opportunities sometimes exist. Fishing techniques include hook and line, as well as bow fishing for rough fish (carp and bigmouth buffalo). Regulations are set by the NDGF and must be observed while fishing at the refuge.

Fishing is one of the six wildlife-dependent, recreational uses specified in the Improvement Act.

Where will the use be conducted?

The entire refuge will be open to fishing activities; this includes all four major impoundments (Arrowwood, Mud, and Jim Lakes; and Depuy Marsh), the subimpoundments, and the bypass channel.

Motorized boats will be restricted to Arrowwood and Jim lakes and motor size will be limited to a maximum of 25 horsepower. Nonmotorized boats will be allowed on all impoundments for fishing.

All areas will be open to ice fishing; however, vehicle access onto the ice will be restricted to Jim Lake via the primitive boat ramps at the southwest side. This access is not maintained in winter months, so access will not be guaranteed.

When will the use be conducted?

Fishing will be permitted year-round in accordance with state regulations, with the exception of the deer gun and muzzleloader seasons. For safety reasons, fishing will not be allowed at the refuge during these times. This will be a change from the current regulations.

Motorized boats will be allowed from May 1 through the summer until the start of the waterfowl-hunting season. This will be a change from current regulations that allow the use of boats through September 30. This change is necessary because the state has, in recent years, opened an early Canada goose season and a resident-only waterfowl season in September.

How will the use be conducted?

Most of the access to fishing opportunities will be walk-in only.

Primitive boat ramps are available on the southeast side of Arrowwood Lake in the Warbler Woodlands Watchable Wildlife Area, and on the southwest side of Jim Lake.

Why is this use being proposed?

Fishing is one of the six wildlife-dependent, recreational uses specified in the Improvement Act. It can be allowed at the refuge without interfering with the migratory bird resource.

Availability of Resources

Resources involved in the administration and management of the use: None.

Special equipment, facilities, or improvements necessary to support the use: None.

Maintenance costs: None.

Monitoring costs: None.

Offsetting revenues: None.

Anticipated Impacts of the Use

Short-term impacts: Temporary disturbance may exist to wildlife near the activity.

Long-term impacts: None.

Cumulative impacts: There are no direct or indirect cumulative impacts anticipated with this use.

Public Review and Comment

This compatibility determination was prepared concurrently with the CCP for the refuge. Public review and comment was achieved concurrently with the public review and comment period for the draft CCP and EA.

Determination

Fishing is a compatible use at Arrowwood NWR.

Stipulations Necessary to Ensure Compatibility

Stipulations for the fishing program will be made available in the refuge’s fishing “tear sheet.” These stipulations specify when the activities are allowed, describe access restrictions, and outline special regulations.

Justification

Fishing is a legislated, wildlife-dependent, recreational use. No significant adverse impacts to the wildlife resource is expected from the primary or supporting uses.

Access into the refuge will be restricted during the deer gun and muzzleloader seasons due to safety reasons.

In recent years, the state has held an early Canada goose hunting season beginning on September 1 and an early resident-only waterfowl season during the last week of September. Because of this, and the potential for disturbance of hunted species during these times, boat access will not be allowed after August 31.

Signature

 8/10/07 Date
Kim Hanson
Project Leader, Arrowwood NWR
USFWS, Region 6

Concurrence

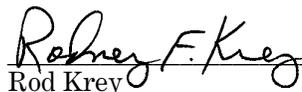
 8/20/07 Date
Richard A. Coleman, PhD
Assistant Regional Director
National Wildlife Refuge System
USFWS, Region 6

Review

 8/14/07 Date
Lloyd Jones
Regional Compatibility Coordinator
USFWS, Region 6

Mandatory 10- or 15-Year Reevaluation

Date: 2022

 8/20/07 Date
Rod Krey
Refuge Supervisor
USFWS, Region 6

Appendix N

Compatibility Determination for Commercial Fishing

Use: Commercial Fishing

Refuge Name: Arrowwood NWR

County: Stutsman and Foster counties, North Dakota

Establishing and Acquisition Authorities

Migratory Bird Conservation Act, Executive Order 7168

Refuge Purposes

“As a refuge and breeding ground for migratory birds and other wild life.”
(Executive Order 7168, dated September 4, 1935)

“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 Use

What is the use? Is the use a wildlife-dependent recreational use?

The use will be continuation of removal of rough fish (carp and bigmouth buffalo) from the areas below the Depuy Marsh spillway and downstream of the Depuy structure on the bypass channel by commercial fishermen and fisherwomen contracted and licensed by the state of North Dakota. (Reference 50 CFR 31.13.) A special use permit issued by the refuge manager will be required.

Commercial fishing is not a wildlife-dependent recreational use.

Where will the use be conducted?

This activity will be allowed where rough fish congregate and make it possible for removal.

Specifically, these areas are below the Depuy Marsh spillway and downstream of the Depuy structure on the bypass channel.

When will the use be conducted?

Removal of rough fish by commercial-fishing contractors will occur in the spring, usually from April to June.

How will the use be conducted?

Seines will be used to corral rough fish into holding pens. Fish will then be scooped into large containers, which will be emptied into holding crates. The fish will be loaded either onto a refrigerated trailer or into holding tanks on trailers for transport. A backhoe will sometimes be used to move fish containers from the boats to shore, and from shore to the trailers.

Why is this use being proposed?

Because the Depuy spillway and structure on the bypass channel create barriers that prevent rough fish from moving farther upstream in the spring, rough fish congregate in these areas, making them available for harvest. This situation does not presently exist anywhere else downstream of the refuge, so it is presently not feasible for this activity to occur anywhere else.

Availability of Resources

Resources involved in the administration and management of the use: None.

Special equipment, facilities, or improvements necessary to support the use: None.

Maintenance costs: None.

Monitoring costs: None.

Offsetting revenues: None.

Anticipated Impacts of the Use

Short-term impacts: There may be temporary disturbance to nontarget wildlife near the activity.

Long-term impacts: None.

Cumulative impacts: There are no direct or indirect cumulative impacts anticipated with this use.

Public Review and Comment

This compatibility determination was prepared concurrently with the CCP for the refuge. Public review and comment was achieved concurrently with the public review and comment period for the draft CCP and EA.

Determination

Commercial fishing is a compatible use at Arrowwood NWR.

Stipulations Necessary to Ensure Compatibility

All laws, policies, and regulations in effect must be followed. Contractors will adhere to the provisions of the state-issued harvest permit. Vehicles and equipment will be restricted to existing refuge roads, trails, and other facilities.

Justification

The exclusion of rough fish from refuge impoundments will result in higher water clarity, which allows for better light penetration, increased aquatic plant production, improved habitat for invertebrates, and higher quality habitat for migratory birds. With proper water level management, lakes at the refuge have historically provided quality staging areas for thousands of waterfowl, especially canvasback and tundra swan.

If the proposed use is an economic use of refuge natural resources, how will it contribute to the purposes of the refuge or the mission of the Refuge System?

As described above, commercial fishing will contribute to the achievement of the refuge’s purposes by excluding rough fish from impoundments to result in higher quality habitat for migratory birds.

Signature

 8/10/07 Date
 Kim Hanson
 Project Leader, Arrowwood NWR
 USFWS, Region 6

Concurrence

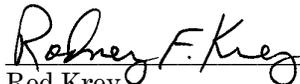
 8/20/07 Date
 Richard A. Coleman, PhD
 Assistant Regional Director
 National Wildlife Refuge System
 USFWS, Region 6

Review

 8/14/07 Date
 Lloyd Jones
 Regional Compatibility Coordinator
 USFWS, Region 6

Mandatory 10- or 15-Year Reevaluation

Date: 2022

 8/20/07 Date
 Rod Krey
 Refuge Supervisor
 USFWS, Region 6

Appendix O

Compatibility Determination for Wildlife Observation and Photography

Uses: Wildlife Observation and Photography

Refuge Name: Arrowwood NWR

County: Stutsman and Foster counties, North Dakota

Establishing and Acquisition Authorities

Migratory Bird Conservation Act, Executive Order 7168

Refuge Purposes

“As a refuge and breeding ground for migratory birds and other wild life.”
(Executive Order 7168, dated September 4, 1935)

“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 Uses

What are the uses? Are the uses wildlife-dependent recreational uses?

The uses will be the continuation and enhancement of existing public use programs and activities of and related to wildlife observation and photography. Wildlife observation and photography will be the primary uses. Supporting uses are vehicle access, walk-in access (including the hiking trail), nonmotorized bicycle access, canoe access, and motorized boats. Horseback riding will be allowed under a special use permit.

Wildlife observation and photography are two of the six wildlife-dependent, recreational uses specified in the Improvement Act.

Where will the uses be conducted?

The uses will occur over the entire refuge, with the exception of the area surrounding the residences, shop, and equipment yard.

Vehicle access will be restricted to the headquarters road, the auto tour route, and the Warbler Woodlands Road.

Nonmotorized bicycle access will be restricted to existing refuge vehicle trails and not allowed on river dikes.

Canoe access will be restricted to river impoundments.

Motorized boats will be restricted to Arrowwood and Jim lakes and motor size will be limited to a maximum of 25 horsepower.

When will the uses be conducted?

Wildlife observation and photography will be allowed year-round. However, access into the refuge will be limited during the deer gun and muzzleloader seasons; only hunters or those accompanying hunters (details are in the “tear sheet”) will be allowed at the refuge during these seasons.

The refuge manager will open and close the auto tour route and the Warbler Woodlands Road as road conditions allow. However, they will remain closed during the deer gun and muzzleloader seasons (including bicycle access).

Nonmotorized bicycle access will be allowed on vehicle trails (with the exception of river dikes) as soon as conditions allow in the spring. This access will close at the beginning of deer archery season (September 1).

Canoe access to river impoundments will be allowed as soon as conditions allow in the spring; canoe access will close at the beginning of deer archery season (September 1).

Motorized boats will be allowed from May 1 through the summer until the start of the waterfowl-hunting season.

Horseback riding will be allowed during daylight hours from May to August under a special use permit.

How will the uses be conducted?

The refuge will be open for wildlife observation and photography. Their supporting use (access) will be controlled and regulated through the publication of refuge "tear sheets" and brochures, and through information posted at the kiosks. The auto tour route, the Warbler Woodlands Road, and the hiking trail will be maintained, and maybe enhanced, by refuge staff.

Why are these uses being proposed?

Wildlife observation and photography are two of the six wildlife-dependent, recreational uses specified in the Improvement Act. These uses and their supporting access-related uses can be allowed at the refuge without interfering with the migratory bird resource.

Availability of Resources

Resources involved in the administration and management of the uses: None.

Special equipment, facilities, or improvements necessary to support the uses: Pending funding, directional signs will be added to the trailhead. New opportunities for wildlife viewing will be investigated, with the possible development of additional trails and overlooks.

Maintenance costs: None.

Monitoring costs: None.

Offsetting revenues: None.

Anticipated Impacts of the Uses

Short-term impacts: Temporary disturbance may exist to wildlife near the activity. Direct, short-term impacts may include minor damage from traffic to refuge roads and trails when wet and muddy. Temporary disturbance may occur due to facility improvements. However, suitable habitats exist nearby and effects to wildlife will be minor and nonpermanent.

Long-term impacts: None.

Cumulative impacts: There are no direct or indirect cumulative impacts anticipated with these uses.

Public Review and Comment

This compatibility determination was prepared concurrently with the CCP for the refuge. Public review and comment was achieved concurrently with the public review and comment period for the draft CCP and EA.

Determination

Wildlife observation and photography, along with their supporting uses, are compatible uses at Arrowwood NWR.

Stipulations Necessary to Ensure Compatibility

Stipulations regarding the public use program will be made available in published refuge brochures. Dates, closed areas, and other information will be specified.

Access into the refuge will be restricted during the deer gun and muzzleloader seasons for safety reasons. Access to vehicle trails will not be allowed once archery deer season begins to conflict with other refuge users. Canoe access to river impoundments will be allowed beginning May 1 each year, and will cease to be allowed on September 1.

Justification

Wildlife observation and photography are legislated, wildlife-dependent, recreational uses. No significant adverse impacts to the wildlife resource are expected from the primary or supporting uses.

Access into the refuge will be restricted during the deer gun and muzzleloader seasons for safety reasons. In recent years, the state has held an early Canada goose season beginning on September 1 and an early resident-only waterfowl season during the last week of September. Because of this, and the potential for disturbance of hunted species during these times, canoe access on river impoundments will not be allowed after August 31.

The refuge contains unique habitats and supports wildlife populations—particularly migratory birds, upland game birds, and big game animals—in excess of what can be observed on neighboring private lands. These uses promote an appreciation for the natural resources at the refuge. In addition, these uses support conservation programs at the refuge.

Signature



Kim Hanson
Project Leader, Arrowwood NWR
USFWS, Region 6

8/10/07
Date

Concurrence



Richard A. Coleman, Ph.D.
Assistant Regional Director
National Wildlife Refuge System
USFWS, Region 6

8/20/07
Date

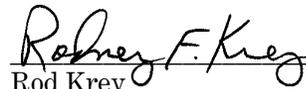
Review



Lloyd Jones
Regional Compatibility Coordinator
USFWS, Region 6

8/14/07
Date

Mandatory 10- or 15-Year Reevaluation**Date:** 2022



Rod Krey
Refuge Supervisor (ND, SD)
USFWS, Region 6

8/20/07
Date

Appendix P

Compatibility Determination for Interpretation and Environmental Education

Uses: Interpretation and Environmental Education

Refuge Name: Arrowwood NWR

County: Stutsman and Foster counties, North Dakota

Establishing and Acquisition Authorities

Migratory Bird Conservation Act, Executive Order 7168

Refuge Purposes

“As a refuge and breeding ground for migratory birds and other wild life.”
(Executive Order 7168, dated September 4, 1935)

“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 Uses

What are the uses? Are the uses the wildlife-dependent recreational uses?

The uses will continue and enhance the interpretation and environmental education programs. The refuge will be used as an outdoor classroom and tour site for visiting school and nonprofit groups.

Interpretation and environmental education are two of the six wildlife-dependent, recreational uses specified in the Improvement Act.

Where will the uses be conducted?

Environmental education and interpretation will take place over the entire refuge. However, most

activities will be on the auto tour route and at the Warbler Woodlands Watchable Wildlife Area, the Centennial Observation Overlook, and the refuge headquarters. In addition, a learning pavilion will be constructed at the Warbler Woodland Watchable Wildlife Area for environmental education. Occasionally, small groups will be led to interior portions of the refuge such as the river dikes and impoundments.

When will the uses be conducted?

These activities will be held during the daytime, most frequently while school is in session (September–May). Less frequently, nonprofit groups will be hosted during the summer months.

How will the uses be conducted?

Refuge staff will provide the instruction and host classroom tours in most cases. When someone other than refuge personnel leads activities, a special use permit may be issued.

Why are these uses being proposed?

Interpretation and environmental education are two of the six wildlife-dependent, recreational uses specified in the Improvement Act. These uses can be allowed at the refuge without interfering with the migratory bird resource.

Availability of Resources

Resources involved in the administration and management of the uses: None.

Special equipment, facilities, or improvements necessary to support the uses: Pending funding, the bathhouse located at the Warbler Woodlands Watchable Wildlife Area will be replaced with a learning pavilion that will facilitate hosting outdoor classrooms. There is potential for an addition to the headquarters to add space for exhibits and visitors.

Maintenance costs: None.

Monitoring costs: None.

Offsetting revenues: None.

Anticipated Impacts of the Uses

Short-term impacts: Temporary disturbance may exist to wildlife near the activities. Temporary disturbance will also occur during the remodeling of the bathhouse into the learning pavilion. However, nearby suitable habitats exist for all wildlife species and the impacts will not be permanent.

Long-term impacts: These activities will increase local support of the refuge and increase knowledge of stewardship of natural resources to students young and old.

Cumulative impacts: There are no direct or indirect cumulative impacts anticipated with the continuation of these uses.

Public Review and Comment

This compatibility determination was prepared concurrently with the CCP for the refuge. Public review and comment was achieved concurrently with the public review and comment period for the draft CCP and EA.

Determination

Interpretation and environmental education are compatible uses at Arrowwood NWR.

Stipulations Necessary to Ensure Compatibility

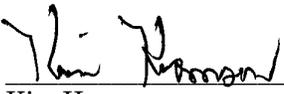
Interpretation and environmental education programs for visiting school and nonprofit groups will be approved by the refuge manager. The refuge manager will ensure that the timing and location of activities will not excessively disturb wildlife, particularly migratory birds that may be using the refuge at the time.

Justification

Interpretation and environmental education are legislated, wildlife-dependent recreational uses. Other than minor disturbance, they will have no impact to the resource. These uses will contribute to the mission of the Refuge System by increasing knowledge and support of the stewardship of natural resources.

The refuge contains unique habitats and supports wildlife populations—particularly migratory birds, upland game birds, and big game animals—in excess of what can be observed on neighboring private lands. These uses promote an appreciation for natural resources and support for conservation programs at the refuge.

Signature


 _____ 8/10/07
 Kim Hanson Date
 Project Leader, Arrowwood NWR
 USFWS, Region 6

Concurrence

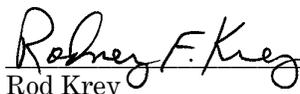

 _____ 8/20/07
 Richard A. Coleman, PhD Date
 Assistant Regional Director
 National Wildlife Refuge System
 USFWS, Region 6

Review


 _____ 8/14/07
 Lloyd Jones Date
 Regional Compatibility Coordinator
 USFWS, Region 6

Mandatory 10- or 15-Year Reevaluation

Date: 2022


 _____ 8/20/07
 Rod Krey Date
 Refuge Supervisor
 USFWS, Region 6

Appendix Q

Compatibility Determination for Wild Food Gathering

Use: Wild Food Gathering

Refuge Name: Arrowwood NWR

County: Stutsman and Foster counties, North Dakota

Establishing and Acquisition Authorities

Migratory Bird Conservation Act, Executive Order 7168

Refuge Purposes

“As a refuge and breeding ground for migratory birds and other wild life.”
(Executive Order 7168, dated September 4, 1935)

“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 Use

What is the use? Is the use a wildlife-dependent recreational use?

The use will be the continued gathering of certain wild foods for personal use. This will include wild foods such as Juneberries, chokecherries, raspberries, asparagus, and aboveground fruits and vegetables.

Wild food gathering is not a wildlife-dependent recreational use.

Where will the use be conducted?

The entire refuge, with the exception of the area closed to all access surrounding the residences and shop, will be open to wild food gathering.

When will the use be conducted?

Wild food gathering will typically occur in the spring and summer. Due to safety reasons, this activity will not be allowed during the deer gun and muzzleloader seasons. However, because these seasons occur late in the year (November–December) at a time when wild foods are typically not gathered, the chances that the two uses will occur at the same time are extremely unlikely.

How will the use be conducted?

Those interested in gathering wild food will be allowed to access the refuge by walking. Vehicles will be allowed on the auto tour route and the road leading to the Warbler Woodlands Watchable Wildlife Area. Nonmotorized bicycles will be allowed on established vehicle trails (not including river dikes) until September 1.

Why is this use being proposed?

This is an existing use that could be allowed without damage to the migratory bird resource.

Availability of Resources

Resources involved in the administration and management of the use: None.

Special equipment, facilities, or improvements necessary to support the use: None.

Maintenance costs: None.

Monitoring costs: None.

Offsetting revenues: None.

Anticipated Impacts of the Use

Short-term impacts: Temporary disturbance may exist to wildlife near the activity.

Long-term impacts: None.

Cumulative impacts: There are no direct or indirect cumulative impacts anticipated with this use.

Public Review and Comment

This compatibility determination was prepared concurrently with the CCP for the refuge. Public review and comment was achieved concurrently with the public review and comment period for the draft CCP and EA.

Determination

Wild food gathering is a compatible use at Arrowwood NWR.

Stipulations Necessary to Ensure Compatibility

Picking, digging, or destroying flowers, shrubs, or other vegetation will be strictly prohibited.

Justification

Wild food gathering is a traditional use of the native vegetation in the area. Allowing this activity will increase the public's appreciation for the natural resources. It will also provide them an opportunity to enjoy other, wildlife-dependent, recreational uses such as wildlife observation.

Signature



Kim Hanson
Project Leader, Arrowwood NWR
USFWS, Region 6

8/10/07
Date

Concurrence



Richard A. Coleman, PhD
Assistant Regional Director
National Wildlife Refuge System
USFWS, Region 6

8/20/07
Date

Review

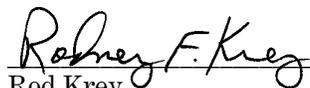


Lloyd Jones
Regional Compatibility Coordinator
USFWS, Region 6

8/14/07
Date

Mandatory 10- or 15-Year Reevaluation

Date: 2022



Rod Krey
Refuge Supervisor
USFWS, Region 6

8/20/07
Date

Appendix R

Compatibility Determination for Recreational Trapping

Use: Recreational Trapping

Refuge Name: Arrowwood NWR

County: Stutsman and Foster counties, North Dakota

Establishing and Acquisition Authorities

Migratory Bird Conservation Act, Executive Order 7168

Refuge Purposes

“As a refuge and breeding ground for migratory birds and other wild life.”
(Executive Order 7168, dated September 4, 1935)

“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 Use

What is the use? Is the use a wildlife-dependent recreational use?

The use will be continuation of recreational trapping under special use permit. Recreational trappers will be allowed to remove red fox, mink, beaver, muskrat, striped skunk, and other furbearers—considered pests that could potentially cause severe depredation of migratory birds.

Where will the use be conducted?

The entire refuge will be open to recreational trapping under special use permit only.

When will the use be conducted?

Recreational trapping will be allowed under the seasons and restrictions established by the state.

How will the use be conducted?

Recreational trapping will be allowed under special use permit only. Walk-in access and vehicle access (no snowmobiles or ATVs) may be allowed on established trails and dikes.

Why is this use being proposed?

Recreational trapping can be an effective method of controlling pest species. In addition, trapping can be used to control local populations of small mammalian predators that have a detrimental effect on ground-nesting migratory birds, which are trust species.

Trapping is one method to achieve management goals at the refuge while offering outdoor recreational opportunities.

Availability of Resources

Resources involved in the administration and management of the use: None.

Special equipment, facilities, or improvements necessary to support the use: None.

Maintenance costs: None.

Monitoring costs: None.

Offsetting revenues: None.

Anticipated Impacts of the Use

Short-term impacts: Temporary disturbance may exist to nontarget wildlife near the activity. Short-term benefits may be increased nest success of ground-nesting migratory birds due to decreased local populations of small mammalian predators. In addition, there may be increased muskrat populations due to decreased mink populations. Muskrat can be a “keystone” species, creating open-water areas within cattail-choked impoundments—or “hemi-marsh” habitat—proven to be beneficial to some migratory bird species.

Long-term impacts: None

Cumulative impacts: There are no direct or indirect cumulative impacts anticipated with this use.

Public Review and Comment

This compatibility determination was prepared concurrently with the CCP for the refuge. Public review and comment was achieved concurrently with the public review and comment period for the draft CCP and EA.

Determination

Recreational trapping is a compatible use at Arrowwood NWR.

Stipulations Necessary to Ensure Compatibility

Recreational trapping will be allowed under special use permit only. Trapping will be conducted in accordance with state laws and regulations, in addition to refuge regulations. Only species specified on the special use permit will be permitted to be taken.

Justification

Recreational trapping in specific areas will benefit the refuge by removing pest species such as beaver

and muskrat that can cause considerable damage to facilities such as water control structures, dikes, and dams. Such damage will hamper efforts to manage water levels in impoundments to provide maximum benefits to migratory bird species, which are trust resources.

Trapping can have short-term benefits by removing certain mammalian predators (red fox, skunk, and raccoon) that can cause severe depredation of ground-nesting birds and their nests and young.

Trapping will only be allowed under a special use permit, so that refuge personnel can closely control the timing, number of animals removed, manner in which animals are removed, and species of animals removed.

If the proposed use is an economic use of refuge natural resources, how will it contribute to the purposes of the refuge or the mission of the Refuge System?

As described above, recreational trapping will contribute to the achievement of the refuge's purposes by removing pest species that hamper efforts to manage for maximum benefits to migratory bird species.

Signature

 8/10/07
 _____ Date
 Kim Hanson
 Project Leader, Arrowwood NWR
 USFWS, Region 6

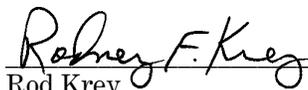
Concurrence

 8/20/07
 _____ Date
 Richard A. Coleman, PhD
 Assistant Regional Director
 National Wildlife Refuge System
 USFWS, Region 6

Review

 8/14/07
 _____ Date
 Lloyd Jones
 Regional Compatibility Coordinator
 USFWS, Region 6

Mandatory 10- or 15-Year Reevaluation Date: 2022

 8/20/07
 _____ Date
 Rod Krey
 Refuge Supervisor
 USFWS, Region 6

Appendix S

Compatibility Determination for Horseback Riding

Use: Horseback Riding

Refuge Name: Arrowwood NWR

County: Stutsman and Foster counties, North Dakota

Establishing and Acquisition Authorities

Migratory Bird Conservation Act, Executive Order 7168

Refuge Purposes

“As a refuge and breeding ground for migratory birds and other wild life.”
(Executive Order 7168, dated September 4, 1935)

“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 Use

What is the use? Is the use a wildlife-dependent recreational use?

The use will be continuation of horseback riding on selected vehicle trails under a special use permit, during daylight hours only, and during a time of year when wildlife disturbance and interference with other public use will be minimal (May through August).

This use will support two of the six wildlife-dependent, recreational uses—wildlife observation and photography—specified in the Improvement Act.

Where will the use be conducted?

Horseback riding under special use permit will be restricted to existing vehicle trails, with the exception of the auto tour route, where horseback

riding will not be allowed. Trails where horseback riding are allowed will be highlighted on a map attached to the special use permit.

When will the use be conducted?

Horseback riding on trails will be allowed during daylight hours only, from May through August. This period will result in the least amount of interference with other public use such as hunting in the fall. This period will also prevent wildlife disturbance during winter months when wildlife may become stressed and vulnerable to harsh weather conditions.

How will the use be conducted?

Horseback riding will be allowed under a special use permit only. One of the following staff will sign a special use permit: office automation clerk, project leader, deputy project leader, or assistant refuge manager. No additional facilities will be needed to support this use.

Why is this use being proposed?

Horseback riding on selected trails will support at least two of the wildlife-dependent priority public uses: wildlife observation and photography. The refuge contains unique habitats and supports wildlife populations—particularly migratory birds, upland game birds, and big game animals—in excess of what can be observed on neighboring private lands.

Availability of Resources

Resources involved in the administration and management of the use: None.

Special equipment, facilities, or improvements necessary to support the use: None.

Maintenance costs: None.

Monitoring costs: None.

Offsetting revenues: None.

Anticipated Impacts of the Use

Short-term impacts: Direct, short-term impacts to the resource may include minor disturbance to some wildlife species during their reproductive life cycle (territory establishment, pairing and breeding,

nesting and birth, young rearing and dispersal).
 Minor damage to trails may result from hoof action.

Long-term impacts: The introduction and spread of invasive plants from horse manure may result. Invasive plant infestations will require the refuge to conduct invasive plant control and expend resources for labor, machinery, and chemicals. However, in relation to the 1,000–3,000 acres of invasive plants annually treated, any additional infestations will be minor and easily controlled.

Cumulative impacts: There are no direct or indirect cumulative impacts anticipated with this use.

Public Review and Comment

This compatibility determination was prepared concurrently with the CCP for the refuge. Public review and comment was achieved concurrently with the public review and comment period for the draft CCP and EA.

Determination

Horseback riding on trails, with stipulations, is a compatible use at Arrowwood NWR.

Stipulations Necessary to Ensure Compatibility

Horseback riding will continue to be allowed only from May-August; during daylight hours only; on specific Refuge vehicle trails only; via special use permit only.

Justification

Horseback riding will support two of the legislated, wildlife-dependent recreational uses: wildlife observation and photography. No significant adverse impacts to the wildlife resource are expected, while the public's appreciation for and support of natural resource conservation will be enhanced.

Signature

 8/10/07
 Kim Hanson Date
 Project Leader, Arrowwood NWR
 USFWS, Region 6

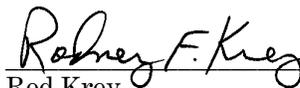
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 USFWS, Region 6

**Mandatory 10- or 15-Year Reevaluation
 Date: 2022**

 8/20/07
 Rod Krey Date
 Refuge Supervisor
 USFWS, Region 6

Appendix T

Economic Analysis

Regional Economic Effects of Current and Proposed Management —Alternatives for Arrowwood National Wildlife Refuge

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Introduction

The National Wildlife Refuge System Improvement Act of 1997 requires all units of the National Wildlife Refuge System to be managed under a Comprehensive Conservation Plan (CCP). The CCP must describe the desired future conditions of a Refuge and provide long range guidance and management direction to achieve Refuge purposes. Arrowwood National Wildlife Refuge (NWR), located along the James River in east central North Dakota, is in the process of developing a range of management goals, objectives, and strategies for the CCP. The CCP for Arrowwood NWR must contain an analysis of expected effects associated with current and proposed Refuge management strategies.

Special interest groups and local residents often criticize a change in Refuge management, especially if there is a perceived negative impact to the local economy. Having objective data on income and employment impacts may show that these economic fears are overstated. Quite often, residents do not realize the extent of economic benefits a Refuge provides to a local community, yet at the same time overestimate the impact of negative changes. Spending associated with Refuge recreational activities such as wildlife viewing and hunting can generate considerable tourism activity for the regional economy. Additionally, Refuge personnel typically spend considerable amounts of money purchasing supplies in the local lumber and hardware stores, repairing equipment and purchasing fuel at the local service stations, as well as reside and spend their salaries in the local community.

The purpose of this study was to provide the economic analysis needed for the Arrowwood NWR CCP by evaluating the regional economic impacts associated with the Arrowwood NWR Draft CCP management strategies. For Refuge CCP planning, an economic impact analysis describes how current (No Action Alternative) and proposed management activities (alternatives) affect the local economy. This type of analysis provides two critical pieces of information: 1) it illustrates a refuge's contribution to the local community; and 2) it can help in determining whether local economic effects are or are not a real concern in choosing among management alternatives. Refuge personnel provided the information needed to analyze the economic impacts of the three alternatives evaluated in the draft CCP.

This report first provides a description of the local community and economy near the Refuge. An analysis of current and proposed management strategies that could affect the local economy is then presented. The Refuge management activities of economic concern in this analysis are Refuge personnel staffing and Refuge spending within the local community, and spending in the local community by Refuge visitors.

Regional Economic Setting

Arrowwood NWR occupies 14 miles of the James River Valley in Foster and Stutsman Counties approximately 30 miles north of Jamestown, North Dakota. Jamestown (Stutsman County) and Carrington (Foster County) are the primary communities near the Refuge. According to Tour North Dakota (2004), one of the greatest assets of the area is the quality of life enjoyed by its residents.

Population, Employment, and Income

In 2000, the population of North Dakota was 642,200 with an average density of 9.3 persons/square mile (U.S. Census 2002). Stutsman County accounted for 3.4% of North Dakota's total population in the year 2000, with a population of 21,908 residents averaging 9.9 persons per square mile (U.S. Census 2002). Jamestown, the county seat, is located in the south end of Stutsman County with a population of 15,571 people. Located in the valley where the James and Pipestem Rivers meet, Jamestown offers a variety of recreational opportunities: from summer activities such as fishing, hunting, and golfing to winter activities such as ice fishing, snowmobiling, and cross-country skiing (Jamestown, ND 2004).

Foster County located just north of Stutsman County, is one of the smallest of the state's 53 counties, 18 miles by 36 miles in dimension. Foster County accounted for less than one percent (0.5%) of North Dakota's total population in the year 2000, with a population of 3,759 residents averaging 5.9 persons per square mile (U.S. Census 2002). Carrington, the main town in Foster County, is commonly referred to as the 'Central City' for its location central to the four major North Dakota cities of Bismarck, Fargo, Minot and Grand Forks. With its outstanding leadership, community commitment, location and updated infrastructure, Carrington has been recognized as the most dynamic community in North Dakota with a population under 2500 (Carrington North Dakota, 2004).

While the state of North Dakota experienced a relatively low 0.5 % population increase from 1990 to 2000, Stutsman County's population increased by 3.0% while Foster County's population decreased 6.0% over the same time frame. Approximately 78% of Foster County and 81% of Stutsman County population 25 years and older have high school diplomas, while 20% were college graduates (US Census Bureau, 2002).

Based on population origin estimates from the 2000 Census, 1.2% of the state population consists of persons of Hispanic or Latino origin, 91.7% of white persons not of Hispanic/Latino origin, 5.0% of American Indian and Alaska Native Persons, 0.6% of Black or African American persons, and 0.6% of Asian persons. Population origin in Foster and Stutsman Counties were similar to the state population (US Census Bureau, 2002). The predominant immigrant cultures in the region include Scandinavian, German, Ukrainian and Icelandic (Tour North Dakota, 2004).

The majority of Stutsman and Foster counties are rural with agriculture as the main industry (U.S. Department of Commerce, 2002). Like most North Dakota communities, Jamestown and Carrington can trace their development to the arrival of the railroad (Tour North Dakota, 2004). Agriculture formed the basis for the region's early economy and still is an important component today. According to the U.S. Department of Commerce (2002), total farm self employment accounted for 8.3% of total employment in North Dakota (8.3% of Stutsman County and 13.8% in Foster County) in 2000. Besides agriculture, the other major local and state employers are service related businesses, government, and retail trade (Table 1).

Table 1. Industry breakdown of full time and part time employment for 2000.

Industry	Foster County (% of County total)	Stutsman County (% of County total)	State of North Dakota (% of State total)
Ag. Services, forestry, & fishing	(D)*	(D)	1.5
Mining	(D)	(D)	1.0
Construction	4.2	3.7	5.2
Manufacturing	(D)	9.6	5.9
Transport/utilities	5.1	5.9	5.3
Wholesale trade	5.1	3.9	5.1
Retail trade	14.7	17.8	16.5
Insurance/real estate	4.4	5.6	6.2
Services	24.2	29.1	28.0
Government	11.4	14.0	17.2

Source: U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Information System, 2002. *(L) less than 10 jobs, but the estimates for this item are included in the totals.

Major employers in Jamestown include health providers, education, and aerospace products manufacturing (U.S. Census, 2002). Carrington's business community is diversified, including agriculture, manufacturing, financial, retail, and technology-based endeavors (Carrington North Dakota, 2004). Carrington serves as the center of an important corridor of agribusiness (Dietz, 2003). Carrington is home to state-of-the-art Dakota Growers Pasta Company, which markets premium quality pasta worldwide (Carrington North Dakota, 2004).

Foster County per capita personal income was \$25,138 in 2000, which very close to the state average of \$25,109. Meanwhile, Stutsman County per capita personal income was \$23,686, which was \$1,423 lower than the state average (U.S. Dept. of Commerce, 2002). Total personal income was \$94 million in Foster County and \$517 million for Stutsman County in 2000 (U.S. Dept. of Commerce, 2002).

Economic Impacts of Current and Proposed Management Activities

For the purposes of an economic impact analysis, a region (and its economy) is typically defined as all counties within a 30-60 mile radius of the impact area. Only spending that takes place within this local area is included as stimulating the changes in economic activity. The size of the region influences both the amount of spending captured and the multiplier effects. Based on the relative self-containment in terms of retail trade, Stutsman and Foster Counties were assumed to comprise the economic region for this analysis.

Economic impacts are typically measured in terms of number of jobs lost or gained, and the associated result on income. Economic input-output models are commonly used to determine how economic sectors would and would not be affected by demographic, economic, and policy changes. The economic impacts of the management alternatives for Arrowwood NWR were estimated using IMPLAN, a regional input-output modeling system developed by the USDA Forest Service (Olson and Lindall, 1996). IMPLAN is a computerized database and modeling system that provides a regional input-output analysis of economic activity in terms of 10 industrial groups involving as many as 528 sectors (Olson and Lindall, 1996). The year 2000

Stustman and Foster County IMPLAN data profiles were used in this study. IMPLAN estimates for employment include both full time and part time workers, which are measured in total jobs.

The IMPLAN model draws upon data collected by the Minnesota IMPLAN Group from multiple federal and state sources including the Bureau of Economic Analysis, Bureau of Labor Statistics, and the U.S. Census Bureau (Olson and Lindall 1999).

Because of the way industries interact in an economy, a change in the activity of one industry affects activity levels in several other industries. For example, if more visitors come to an area, local businesses would purchase extra labor and supplies to meet the increase in demand for additional services. The income and employment resulting from visitor purchases from local businesses represent the *direct* effects of visitor spending within the economy. In order to increase supplies to local businesses, input suppliers must also increase their purchases of inputs from other industries. The income and employment resulting from these secondary purchases by input suppliers are the *indirect* effects of visitor spending within the county. The input supplier's new employees use their incomes to purchase goods and services. The resulting increased economic activity from new employee income is the *induced* effect of visitor spending. The indirect and induced effects are known as the secondary effects of visitor spending. Multipliers capture the size of the secondary effects, usually as a ratio of total effects to direct effects (Stynes 1998). The sums of the direct and secondary effects describe the total economic impact of visitor spending in the local economy.

Regional economic effects from the IMPLAN model are reported in the following categories:

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

Refuge Staffing and Budgeting

Refuge employees reside and spend their salaries on daily living expenses in communities near the 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. Table 2 presents the current and proposed staffing needs for each management alternative. As shown in Table 2, current staffing (Alternative I) at the Refuge consists of ten permanent full time employees and one half time employee. The current staff accounted for an annual payroll (including salaries and benefits) of \$706,000 in 2004. Additional annual funding needed for the proposed personnel/staffing is anticipated to cost \$1,029,800 for Alternative II and \$1,099,400 for Alternative III (Table 2).

Table 2. Current and Proposed Staff by Management Alternative

	Alternative I - Current Management	Alternative II - Enhanced Refuge Management	Alternative III - Enhanced Refuge and Watershed Management
Management Staff	Project Leader* Deputy. Proj. Leader* Refuge Oper. Spec.*	Project Leader* Deputy Proj. Leader* Refuge Oper. Spec. * Refuge Oper. Spec.	Project Leader* Deputy Proj. Leader* Refuge Oper. Spec. * Refuge Oper. Spec.
Biological Staff	Wildlife Biologist*	Wildlife Biologist* Biological Tech Biological Tech	Wildlife Biologist* Biological Tech F/W Biologist Biological Tech
Public Use Staff	Outdoor Rec. Planner (½ time, shared w/Long Lake)	Outdoor Rec. Planner Park Ranger	Outdoor Rec. Planner Park Ranger
Admin Staff	Admin. Officer* Clerk*	Admin. Officer* Clerk*	Admin. Officer* Clerk*
Maintenance Staff	Engineer. Equip. Op. Tractor Operator	Engineer. Equip. Op. Tractor Operator Maintenance Worker Maintenance Worker	Engineer. Equip. Op. Tractor Operator Maintenance Worker Maintenance Worker
Fire Staff	Fire Manage. Officer* Fire Tech*	Fire Manage. Officer* Fire Tech* Seasonal Range Tech	Fire Manage. Officer* Fire Tech* Seasonal Range Tech
Staff Salary & Benefits	\$706,000	\$1,029,800	\$1,099,400

*Shared with other stations in Arrowwood Complex Management

Table 3 shows the economic impacts associated with current and proposed management with local staff salary. The current level (Alternative I) spending of salaries by Refuge personnel directly accounts for 5.7 jobs and \$107,600 in personal income. The associated indirect and induced effects generate an additional 1.8 jobs and \$37,400 in personal income throughout the local economy for a total economic impact of 7.5 jobs and \$145,000 associated with the current level of spending of salaries by Refuge personnel (Table 3). Due to the increased staffing levels for Alternatives II and III (Table 2), the associated economic effects generate more jobs and income than Alternative I.

Table 3. Local economic impacts of salary spending by refuge personnel (2004\$).

Stutsman and Foster Counties	Alternative I	Alternative II	Alternative III
Salary Spending Impacts			
Direct Effects			
Income (\$/year)	\$107,600	\$156,900	\$167,600
Jobs	5.7	8.4	8.9
Indirect and Induced Effects			
Income (\$/year)	\$37,400	\$54,600	\$58,300
Jobs	1.8	2.6	2.8
Total Effects			
Income (\$/year)	\$145,000	\$211,500	\$225,900
Jobs	7.5	11.0	11.7

In addition to providing salaries and benefits, the Refuge purchased goods and services (non salary expenditures) totaling \$248,100 in 2004, approximately 60% of which was spent locally in Stutsman and Foster Counties. Base operational funding for FY 2004 totaled \$1,079,900 with additional funds for annual maintenance, deferred maintenance, small equipment, and fire program, the total was \$1,527,200. This current budget represents the minimum required to maintain existing programs but does not adequately support planned habitat management, biological monitoring, public use and education programs, and maintenance of all Refuge facilities and structures. Annual non salary expenditures are anticipated to cost \$343,200 for Alternative II and \$366,500 for Alternative III. For Alternatives II and III, it is assumed that approximately 60% of non salary expenditures would still be spent locally in Stutsman and Foster Counties. Table 4 summarizes the anticipated annual expenditures by management alternative.

Table 4. Refuge staffing and budgeting expenditures by management alternative (2004\$).

	Annual Expenditures by Alternative		
	I	II	III
Salary	\$706,000	\$1,029,800	\$1,099,400
Non salary	\$248,100	\$343,200	\$366,500
Total	\$954,100	\$1,373,000	\$1,465,900

Table 5 shows the economic impacts associated with current and proposed management non salary spending in Stutsman and Foster Counties. For each alternative, it is assumed that 60% of the non salary expenditures reported in Table 4 are spent locally in Stutsman and Foster Counties. The current level (Alternative I) of Refuge non salary expenditures directly accounts for 5.9 jobs and \$70,500 in personal income. The associated indirect and induced effects generate an additional 1.6 jobs and \$35,700 in personal income throughout the economy of Stutsman and Foster Counties for a total local economic impact of 7.5 jobs and \$106,200 in personal income associated with the current level of Refuge non salary spending in the local economy. Due to the increased non-salary spending levels for Alternatives II and III (Table 4), the associated economic effects generate more jobs and income than Alternative I.

Table 5. Local economic impacts of Refuge non salary expenditures (2004\$).

Stutsman and Foster Counties	Alternative I	Alternative II	Alternative III
Non Salary Impacts <i>(60% of total non salary expenditures spent locally)</i>			
Direct Effects			
Income (\$/year)	\$70,500	\$97,600	\$104,200
Jobs	5.9	8.2	8.8
Indirect and Induced Effects			
Income (\$/year)	\$35,700	\$49,400	\$52,800
Jobs	1.6	2.2	2.3
Total Effects			
Income (\$/year)	\$106,200	\$147,000	\$157,000
Jobs	7.5	10.4	11.1

Table 6 presents the combined economic impacts associated with Refuge non salary purchases and spending of salaries by Refuge staff members within the community. Refuge management activities currently generate 15 jobs and \$251,300 in personal income in the local economy. Alternative II would generate an additional 6.4 jobs and \$107,300 in personal income as compared to Alternative I. Alternative III would generate an additional 7.8 jobs and \$131,700 more in personal income than Alternative I.

Table 6. Combined impacts from Refuge management activities (2004\$).

Stutsman and Foster Counties	Alternative I	Alternative II	Alternative III
Total salary spending and budgeting impacts			
Direct Effects			
Income (\$/year)	\$178,100	\$254,500	\$271,800
Jobs	11.6	16.6	17.7
Indirect and Induced Effects			
Income (\$/year)	\$73,100	\$104,000	\$111,100
Jobs	3.4	4.8	5.1
Total Effects			
Income (\$/year)	\$251,200	\$358,500	\$382,900
Jobs	15.0	21.4	22.8

Recreation Activities

North Dakota is widely considered a top bird-watching destination, with more National Wildlife Refuges than any other state (North Dakota Legendary 2002). Arrowwood NWR offers visitors a variety of recreation opportunities including an auto tour route, nature trails, wildlife observation and photography, upland and big game hunting, fishing, environmental education, and interpretation. A tourist usually buys a wide range of goods and services while visiting an area. Major visitor expenditure categories include lodging, food, and supplies.

To determine the local economic impacts of visitor spending, only spending by persons living outside the local area is included in the analysis. The rationale for excluding local visitor spending is two fold. First, money flowing into Stutsman and Foster Counties from visitors living outside is considered new money injected into the local economy. Second, if residents of Stutsman and Foster Counties visit Arrowwood NWR more or less due to the management changes, they would correspondingly change their spending of money elsewhere in the local area, resulting in no net change to the economy of Stutsman and Foster Counties. These are standard assumptions made in most regional economic analyses at the local level.

Refuge visitors were divided by type of visitor activity and place of residence (local Stutsman and Foster County residents, non local North Dakota residents, and nonresidents). Arrowwood NWR annual visitation was estimated based on the 2003 Refuge annual visitation estimates. The Refuge bases visitation estimates on visitors entering the Visitor Center/Office and general observation. Estimates on the percentage of visitors by place of residence were provided by Refuge personnel. Table 7 summarizes estimated Refuge visitation by type of visitor activity and percentage of visitors by place of residence.

Table 7. Estimated annual refuge visitation by visitor activity and place of residence.

	Total # of Visitors	Percentage (%) of Local Stutsman and Foster County Visitors	Percentage (%) of Non Local North Dakota Visitors	Percentage (%) of Nonresident Visitors (live outside of North Dakota)
Total Estimated Visitors	5,157			
Non-Consumptive Users				
Nature Trails	3,087	70	15	15
Observation Platforms	75	70	15	15
Other Wildlife Observation (grouse blind & roadside)	125	75	13	12
Water Use	60	95	3	2
Other (wild food gathering, horseback riding, bicycling, etc)	275	98	1	1
Hunting				
Upland Game	200	90	5	5
Big Game	1,250	80	10	10
Fishing	85	90	5	5

The next step in estimating total visitor spending is the development of visitor spending profiles. Average daily travel related expenditure profiles for various recreation activities derived from the 1996 National Survey of Hunting, Fishing and Wildlife Related Recreation (U.S. Dept. of Interior 1996) by the U.S. Forest Service (Niccolucci and Winter 2002) were used in this analysis. For each type of visitor activity, the Survey reports trip related spending of state residents and non residents for several different recreational activities. State resident and nonresident spending profiles for non-consumptive wildlife recreation (observing, feeding, or photographing fish and wildlife) were used for non consumptive use visitors at Arrowwood NWR. State resident and nonresident spending profiles for big game hunting, upland game hunting, and fresh water fishing were used for Arrowwood NWR hunting and fishing related visitor activities. Because the non resident big game

hunting spending profile was not available for North Dakota, the non resident big game hunting profile for the neighboring state of Minnesota was used instead. For each visitor activity, spending is reported in the categories of lodging, food & drink, transportation, and other expenses. Total spending per day for state residents and nonresidents by visitor activity is reported in Table 8.

Table 8. Time spent on the refuge and spending per day for each visitor activity.

	Average state resident spending per day	Average nonresident spending per day
Non Consumptive Users	\$11	\$149
Upland game hunting	\$20	\$129
Big game hunting	\$23	\$112
Fishing	\$22	\$63

Source: Niccolucci and Winter (2002).

Visitor spending is typically estimated on an average per day (eight hours) or average per trip basis. In order to properly account for the amount of spending associated with each type of refuge visitor, it is important to determine the average length of trip. Refuge personnel provided estimates for the number of hours spent at Arrowwood NWR for each visitor activity (shown in Table 9). Because the visitor spending profiles are for an 8 hour visitor day, the number of 8 hour state resident and nonresident visitor days for each visitor activity had to be calculated. The current number of visitor days per activity is shown in Table 9.

Table 9. Annual number of non local visitor days per activity for Alternative I.

	Number of non local North Dakota visitors	Number of nonresident visitors	Estimated time spent at Refuge	Number of non local North Dakota resident visitor days ¹	Number of nonresident visitor days ¹
Non-Consumptive					
Nature Trails	463	463	2 hours	116	116
Observation Platforms	11	11	1 hours	1	1
Other Wildlife Observation	16	15	1 hours	2	2
Water Use	2	1	2 hours	0	0
Other	3	3	3 hours	1	1
Hunting					
Upland Game	10	10	4 hours	5	5
Big Game	125	125	6 hours	94	94
Fishing	4	4	4 hours	2	2
Total				222	221

¹One visitor day = 8 hours.

Table 10 shows the anticipated increase in visitation levels for Alternatives II and III. For Alternatives II and III, non consumptive use visitation is expected to increase substantially. The percentage of non local resident and non resident visitation is also anticipated to increase for Alternatives II and III (Table 10). The expected number of non local resident and nonresident visitor days per activity is shown in Table 11.

Table 10. Anticipated annual Refuge visitation for Alternatives II and III.

	Total # of Visitors	Percentage (%) of Local Stutsman and Foster County Visitors	Percentage (%) of Non Local North Dakota Visitors	Percentage (%) of Nonresident Visitors (live outside of North Dakota)
Total Estimated Visitors	17,690			
Non-Consumptive				
Nature Trails	9,500	60	20	20
Observation Platforms	6,000	60	20	20
Other Wildlife Observation	250	65	18	17
Water Use	75	75	13	12
Other	500	85	8	7
Hunting				
Upland Game	250	90	5	5
Big Game	1,300	80	10	10
Fishing	85	90	5	5

Table 11. Annual non local visitor days for Alternatives II and III.

	Number of non local North Dakota visitors	Number of nonresident visitors	Estimated time spent at Refuge	Number of non local North Dakota resident visitor days	Number of nonresident visitor days
Non-Consumptive					
Nature Trails	1,900	1,900	2	475	475
Observation Platforms	1,200	1,200	1	150	150
Other Wildlife Observation	45	43	1	6	5
Water Use	10	9	2	2	2
Other	40	35	3	15	13
Hunting					
Upland Game	13	13	4	6	6
Big Game	130	130	6	98	98
Fishing	4	4	4	2	2
Total				754	752

¹One visitor day = 8 hours.

Total visitor spending is determined by multiplying the total spending per day (Table 8) by the number of non local and non resident visitor days for each visitor activity (Tables 10 and 12). Current Refuge visitors spend about \$32,850 annually in the local economy (Stutsman and Foster Counties). Table 12 shows the economic impacts associated with current visitation and anticipated changes in visitation by management alternative. The current level (Alternative I) of visitor spending directly generates over \$6,400 in personal income and 0.4 of a job for local businesses accommodating visitors (hotels, restaurants, supply stores, and gas stations). The associated indirect and induced effects generate an additional 0.1 of a job and \$3,600 in personal income throughout the

local economy for a total local economic impact of one half of a job and \$10,000 in personal income associated with the current level of Refuge visitation. For Alternatives II and III, the total local economic impact would be 2 jobs and \$38,400 in personal income associated the expected increased level in Refuge visitation (Table 12).

Table 12. Economic impacts of Arrowwood NWR visitor spending by alternative (2004\$).

Stutsman and Foster Counties	Alternative I	Alternatives II and III
Visitor spending impacts		
Direct effects		
Income (\$/year)	\$6,400	\$24,500
Jobs	0.4	1.6
Indirect and induced effects		
Income (\$/year)	\$3,600	\$13,900
Jobs	0.1	0.4
Total Effects		
Income (\$/year)	\$10,000	\$38,400
Jobs	0.5	2.0

As shown in Table 12, the economic impacts associated with current Refuge visitation and anticipated changes in visitation for Alternatives II and III are limited in terms of contributing to the overall local income and employment. Any decrease in visitation associated with a change in Refuge management would not have a significant economic effect. An increase in the amount of time current visitors spend on the Refuge would increase the amount of daily spending that can be attributed to visiting the Refuge. An increase in both the length of stay on the Refuge (and in the local economy) and the number of non local residents and nonresidents visiting the Refuge could have a considerable impact on increasing the role Refuge visitors play in the local economy.

Economic Significance of Local Visitation

Local visitation accounts for over 75% of the total annual number of refuge visits at Arrowwood NWR. The recent FWS Banking on Nature report (Caudill and Henderson, 2005) estimated the *economic impact* and the *economic significance* associated with Arrowwood NWR. As previously discussed, an economic impact analysis only includes spending by persons living outside the local area because only money flowing into the local economic impact area from outside is considered having an economic impact on the region. An economic significance analysis evaluates the spending of local and non-local visitors to show how large a part of the local economy is connected to refuge activities. The economic significance analysis conducted by Caudill and Henderson (2005) estimated that local visitors generated a total (including direct and secondary effects) of \$14,000 in personal income and 1 job. While this can not be interpreted as income and jobs that would be lost if the refuge were not there since local residents would probably have spent their recreation money in the local economy with or without the refuge, it does show that there is a connection between the local economy and local visitation activities at Arrowwood NWR (Caudill and Henderson, 2005).

Summary and Conclusions

Table 13 summarizes the direct and total economic impacts for all Refuge management activities by management alternative. Under current Refuge management (Alternative I), economic activity directly related to all Refuge operations generates an estimated 12 jobs and \$184,600 in personal income in Stutsman and Foster Counties. Including direct, indirect, and induced effects, all Refuge activities account for 15.5 jobs and \$261,200 in personal income in Stutsman and Foster Counties. Current Refuge management activities account for less than 1% of total income and employment in Stutsman and Foster Counties. The associated economic effects of Alternatives II and III generate more jobs and income than Alternative I because of the increased levels Refuge staffing, non salary expenditures, and higher visitation levels.

Table 13. Summary of all refuge management activities by alternative (2004\$).

Stutsman and Foster Counties	Alternative I	Alternative II	Alternative III
Total Refuge Staffing and Budgeting Impacts			
Direct Effects			
Income (\$/year)	\$178,100	\$254,500	\$271,800
Jobs	11.6	16.6	17.7
Total Effects			
Income (\$/year)	\$251,200	\$358,500	\$382,900
Jobs	15.0	21.4	22.8
Recreation Activities			
Direct Effects			
Income (\$/year)	\$6,400	\$24,500	\$24,500
Jobs	0.4	1.6	1.6
Total Effects			
Income (\$/year)	\$10,000	\$38,400	\$38,400
Jobs	0.5	2.0	2.0
Aggregate Impacts			
Direct Effects			
Income (\$/year)	\$184,500	\$279,000	\$296,300
Jobs	12.0	18.2	19.3
Total Effects			
Income (\$/year)	\$261,200	\$396,900	\$421,300
Jobs	15.5	23.4	24.8
<i>% of Total Local Employment</i>	<i>0.12%</i>	<i>0.18%</i>	<i>0.19%</i>

Table 14 summarizes the economic effects associated with management changes from Alternative I. Both proposed alternatives will increase employment and personal income in Stutsman and Foster Counties primarily because of proposed increases in staffing and non salary expenditures.

Table 14. Economic effects associated with changing from Alternative I (2004\$).

Stutsman and Foster Counties	Alternative II	Alternative III
Total salary spending and budgeting impacts		
Direct effects		
Income (\$/year)	+\$76,400	+\$93,700
Jobs	+5.0	+6.1
Total effects		
Income (\$/year)	+\$107,300	+\$131,700
Jobs	+6.4	+7.8
Recreation activities		
Direct effects		
Income (\$/year)	+\$18,100	+\$18,100
Jobs	+1.2	+1.2
Total effects		
Income (\$/year)	+\$28,400	+\$28,400
Jobs	+1.5	+1.5
Aggregate impacts		
Direct Effects		
Income (\$/year)	+\$94,500	+\$111,800
Jobs	+6.2	+7.3
Total effects		
Income (\$/year)	+\$135,700	+\$160,100
Jobs	+7.9	+9.3

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Appendix U

Section 7 Biological Evaluation

INTRA-SERVICE SECTION 7 BIOLOGICAL EVALUATION FORM

Originating Person: Paulette Scherr

Telephone Number: 701-285-3341

Date: 06 June 2006

I. Region: 6

II. Service Activity (Program): U. S. Fish and Wildlife Service, Arrowwood NWR Complex

III. Pertinent Species and Habitat:

A. Listed species and/or their critical habitat within the action area:

Piping Plover (*Charadrius melodus*): The piping plover is a small shorebird listed as "threatened" in 1985. Most piping plovers in North Dakota nest on prairie alkali lakes, while the remaining use the Missouri River. Nearly all natural lakes used by plovers in North Dakota are alkaline in nature and have salt-encrusted, white beaches. Arrowwood NWR is one of the exceptions with freshwater and gravel islands and shorelines. The Arrowwood and Jim Lakes on the refuge have been listed as critical habitat for the piping plover.

Whooping Cranes (*Grus Americana*): The whooping crane is making a slow, but steady comeback. From a low of 21 birds in the 1940s, the current whooper population is believed to be about 189. Its decline is blamed on loss of habitat and excessive hunting. It was declared "endangered" in 1970. Most whoopers migrate through North Dakota each spring and fall, frequently with sandhill cranes. No critical habitat.

Bald Eagle (*Haliaeetus leucocephalus*): The decline of the bird known as "America's symbol" was largely blamed on the pesticide DDT, which caused a thinning of the eggshells. The bird was placed on the Endangered Species List in 1978, DDT was subsequently banned, and the bald eagle recovered enough to be down listed from "Endangered" to "Threatened" in 1995. In 1988, the first bald eagle nest in North Dakota since 1975 was documented along the Missouri River. No known nesting has been reported on or within the Arrowwood NWR Complex, although there have been two known bald eagle nests in Ramsey County, located along the north boundary of the Complex. No critical habitat.

Gray Wolf (*Canis lupus*): The gray wolf is an infrequent visitor to North Dakota. Once abundant in the state, the gray wolf was hunted to near extinction by 1940 at the urging of western settlers, who believed wolves caused widespread livestock losses. No sightings of wolves have been reported in or near the refuge. No critical habitat.

B. Proposed species and/or proposed critical habitat within the action area:
N/A

C. Candidate species within the action area:

Dakota Skipper (*Hesperia dacotae*): The Dakota skipper is a small butterfly with a 1-inch wingspan. Dakota skippers are found in native prairie containing a high diversity of wildflowers and grasses.

D. Include species/habitat occurrence on a map.

Attachment #1 - species range in ND for Piping Plover.

Attachment #2 - species range for Whooping Crane.

Attachment #3 - species range in ND for Bald Eagle.

Attachment #4 - species range for Gray Wolf.

Attachment #5 – Known Dakota Skipper Locations in North Dakota.

IV. Geographic area or station name and action:

The proposed action is the 15 year Comprehensive Conservation Plan (CCP) on the Arrowwood NWR. Attachment #6 – location map of Arrowwood NWR.

V. Location (attach map):

A. Ecoregion Number and Name: Level III Ecoregions of ND.

46. Northern Glaciated Plains

Attachment #7 – Level III Ecoregions of ND

B. County and State:

Arrowwood NWR (Stutsman and Foster Counties)

Attachments #6 – location map of Arrowwood NWR.

C. Section, township, and range (or latitude and longitude):

The Proposed action includes all fee title land within the Arrowwood NWR boundary and potentially land in the upper James River Watershed.

Attachments #6 – location map of Arrowwood NWR.

D. Distance (miles) and direction to nearest town:

1. Pingree is located 9 miles south and west of the refuge headquarters on Hiway 281 or 4 miles west of the refuge boundary.

2. Kensal is located 10 miles north and east of the refuge headquarters on Hiway 9 or 3 miles east of the refuge boundary.

Attachments #6 – location map of Arrowwood NWR.

E. Species/habitat occurrence:

Piping Plover critical habitat maps; Arrowwood and Jim Lake on Arrowwood NWR.
Attachment #8 – Piping Plover Critical Habitat – Stutsman County

VI. Description of proposed action:

The proposed action is the 15 year plan, Comprehensive Conservation Plan (CCP), of the Arrowwood NWR. See the attached draft Arrowwood NWR CCP.

VII. Determination of effects:

A. Explanation of effects of the action on species and critical habitats in items III. A, B, and C:

Listed species and/or their critical habitat within the action area:

Piping plover (*Charadrius melodus*): The piping plover is a small shorebird listed as "threatened" in 1985. Habitat loss and poor breeding success are major reasons for the population decline. North Dakota is the most important state in the Great Plains for nesting piping plovers. More than three-fourths of piping plovers in North Dakota nest on prairie alkali lakes, while the remaining use the Missouri River. Piping plovers inhabit barren sand and gravel shores of rivers and lakes and feed on exposed open beaches eating insects and crustaceans. Piping plovers were first identified on the refuge in 1991 at the peak of a prolonged drought. The usual nesting sites had dried up and the plovers were pioneering new territory. The drought broke in 1993, filling previously drawn down wetlands and the plovers return to their usual nesting sites. Summer and fall rains in 1993, combined with heavy spring runoff, produced flood conditions across the refuge and all islands and shoreline habitats were inundated. Jim Lake within Arrowwood NWR has only one record of use by piping plovers, 12 adults in 1991. No nesting was observed.

Although piping plovers aren't expected to nest regularly on the refuge, in years of severe drought when habitat is limited across the state, Jim Lake would be managed to provide access to the gravel islands, shoreline and gravel side-slopes of the dike along the eastern edge of the lake. Also, the refuge would continue to participate in the International Piping Plover Breeding Census conducted every 5 years. The proposed action to implement the CCP on the Arrowwood NWR should have no adverse affect on the Piping Plover population.

Whooping Cranes (*Grus Americana*): The whooping crane is making a slow, but steady comeback. From a low of 21 birds in the 1940s, the current whooper population is believed to be near 200. Its decline is blamed on loss of habitat and excessive hunting. It was declared "endangered" in 1967. Most whoopers migrate through North Dakota each spring and fall, frequently with sandhill cranes. There have been occasional sightings of whooping cranes within the Arrowwood NWR Complex, usually only one bird, during migration through the area. The most recent confirmed sightings are a single immature bird observed just west of Pingree in Stutsman County in April 1997 and a single adult recorded on Arrowwood NWR in October of 2001. Since Whooping Crane only migrate through the area, the proposed action to implement the CCP on the Arrowwood NWR should have no adverse affect on the Whooping Crane population.

Bald Eagle (*Haliaeetus leucocephalus*): The decline of the bird known as "America's symbol" was largely blamed on the pesticide DDT, which caused a thinning of the eggshells. The bird was placed on the Endangered Species List in 1978, DDT was subsequently banned, and the bald eagle recovered enough to be down listed from "Endangered" to "Threatened" in 1995. In 1988, the first bald eagle nest in North Dakota since 1975 was documented along the Missouri River. The possibility of Bald Eagles nesting on Arrowwood NWR is limited because of the lack of larger trees for adequate nesting habitat. Refuge impoundments will be managed more as moist soil units which should increase the use by waterfowl and other waterbirds during breeding seasons and during migration periods. The lower water levels will result in less fish resources which may result in less use during spring migration. Large numbers of eagles are recorded during spring migration in years following inundation from high water in the Jamestown Reservoir. Receding flood water trap fish species and concentrate them in refuge impoundments. The proposed action to implement the CCP on the Arrowwood NWR should have no adverse affect on the Bald Eagle population.

Gray Wolf (*Canis lupus*): Historically the Gray Wolf ranged within the continental United States, from coast to coast and from Canada to Mexico. Today, the Gray Wolf is only a very infrequent visitor to the state and the Arrowwood NWR Complex, occasionally crossing the borders from neighboring Minnesota, and the province of Manitoba, Canada. The habitat that exists in the state is no longer suitable for the wolf to exist for any length of time in the area. Wolf habitat is extremely fragmented by agriculture and would not be suitable to support wolf packs. Because of the unlikelihood of the wolf species spending much time within the state the proposed action to implement the CCP on the Arrowwood NWR should have no adverse affect on Gray Wolf population.

Candidate Species

Dakota Skipper (*Hesperia dacotae*): Currently, there are no known Dakota skipper sites on or near the Arrowwood NWR. The Dakota Skipper requires high quality native prairie with a high diversity of wildflowers and native grasses to survive, but it should not be discounted that the skipper could, at least in the short term, survive on poorer quality habitat, as it exists on the Arrowwood NWR Complex. Habitat includes two prairie types: 1) low (wet) prairie dominated by bluestem grasses, wood lily, harebell, and smooth camas; and 2) upland (dry) prairie on ridges and hillsides dominated by bluestem grasses, needlegrass, pale purple coneflower and upright coneflowers and blanketflower. Dakota skipper populations have declined historically due to widespread conversion of native prairie. Remnant native prairie sites occupied by Dakota skippers are subject to a variety of threats. For long term persistence/survival the Dakota Skipper needs large expanses (1000 acres) of continuous high quality native prairie (personal communications with Karen Kreil, Ecological Services, Bismarck).

Although the chances of the Dakota skipper existing on native grassland stands on Arrowwood NWR are limited, potential Dakota skipper habitat will not be ignored since they may be able to survive, at least for the short term, on the limited habitat that exists. The primary management objective on native grass fields in the complex is species diversity. A variety of treatment methods will be implemented to increase the native species diversity and reduce the noxious

weeds and other exotic plant species, which will provide the habitat needs of the skippers. The largest noxious weed infestations within fields with the highest potential for Dakota skippers will be treated with biological control methods to ensure no reduction in native forb composition. Those fields with smaller infestations will be spot treated with herbicides to control and eventually eliminate the targeted noxious weeds.

Due to the fact that there are currently no known Dakota skipper populations on Arrowwood NWR and the quality of existing native prairie tracts are generally poor, and that the highest quality tracts will be managed to improve the habitat for Dakota skippers and other native prairie obligates, the proposed action to implement the CCP on the Arrowwood NWR should have no adverse affect on the Dakota skipper population.

B. Explanation of actions to be implemented to reduce adverse effects:

Implementation of the CCP on the Arrowwood NWR should have no adverse affect on any of the listed or proposed species.

VIII. Effect determination and response requested:

[* = optional]

A. Listed species/designated critical habitat:

Determination

Response requested

no effect/no adverse modification

(species: Piping plover (*Charadrius melodus*))

X *Concurrence

no effect/no adverse modification

(species: Whooping Cranes (*Grus Americana*))

X *Concurrence

no effect/no adverse modification

(species: Bald Eagle (*Haliaeetus leucocephalus*))

X *Concurrence

no effect/no adverse modification

(species: Gray Wolf (*Canis lupus*))

X *Concurrence

C. Candidate species:

Determination

Response requested

no effect

(species: Dakota Skipper (*Hesperia dacotae*))

X *Concurrence



Kim Hanson, Project Leader

signature/title

[Title/office of supervisor at originating station]

06-07-06

date

IX. Reviewing ESO Evaluation:

A. Concurrence X Nonconcurrence _____

B. Formal consultation required _____

C. Conference required _____

D. Informal conference required _____

E. Remarks (attach additional pages as needed):



signature/title

[Title/office of reviewing official]

6/27/06
date

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