

# 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, wildlife photography, environmental education, or interpretation. The National Wildlife Refuge System Improvement Act of 1997 specifies that these are the six priority general public uses of the Refuge System.

**WMD**—*See* wetland management district.

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

**WPA**—Works Progress Administration.

**WUI**—Wildland–urban interface.



# Appendixes



# 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 and photography, and environmental education and interpretation).
- Foster understanding and instill appreciation of the diversity and interconnectedness of fish, wildlife, and plants and their habitats.

#### Guiding Principles

There are four guiding principles for management and general public use of the Refuge System

established by Executive Order 12996 (1996):

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

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

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

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

### LEGAL AND POLICY GUIDANCE

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

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

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

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

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

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

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

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

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

**Executive Order 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*

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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*

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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>      |
|--------------------|--|-------------------------------|
| Dave Azure         | Refuge manager   | Arrowwood NWR; Pingree, ND    |
| Mark Ely           | Geographic information system (GIS) specialist                 | USFWS, region 6; Lakewood, CO |
| Sean Fields        | <i>Former</i> GIS Specialist                                   | USFWS, region 6; MT           |
| Kim Hanson         | Project leader   | Arrowwood NWR; Pingree, ND    |
| Linda Kelly        | <i>Former</i> planning team leader                             | Bureau of Land Management; NV |
| Kathleen Linder    | <i>Former</i> planning team leader                             | USFWS, region 6; CO           |
| Adam Misztal       | <i>Former</i> planning team leader                             | USFWS, region 6; Lakewood, CO |
| Deb Parker         | Writer-editor  | USFWS, region 6; Lakewood, CO |
| Paulette Scherr    | Wildlife biologist   | Arrowwood NWR; Pingree, ND    |
| Mike Spratt        | Planning team leader; chief of the division of refuge planning | USFWS, region 6; Lakewood, CO |
| Mark Vaniman       | <i>Former</i> refuge manager                                   | Arrowwood NWR; Pingree, ND    |
| Stacy Whipp        | WMD manager  | Arrowwood WMD; Pingree, ND    |

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.

- Bob Barrett (deputy refuge supervisor for ND and SD; USFWS, region 6)
- Rick Coleman (assistant regional director for the Refuge System; USFWS, region 6)
- Sheri Fetherman (chief of the division of education and visitor services; USFWS, region 6)
- Galen Green (fire ecologist, *retired*; USFWS, region 6)
- Wayne King (biologist; USFWS, region 6)
- Lynne Koontz (economist; USGS science center, Fort Collins, CO)
- Rod Krey (refuge supervisor for ND and SD; USFWS, region 6)
- Murray Laubhan (special assistant to the director; USGS Northern Prairie Wildlife Research Center, Jamestown, ND)
- Rachel Laubhan (wildlife biologist; USFWS, region 6)
- Rhoda Lewis (regional archaeologist, *retired*; USFWS, region 6)
- Cindy Souders (outdoor recreation planner; USFWS, region 6)
- Cheryl Williss (chief hydrologist, *retired*; USFWS, region 6)
- Harvey Wittmier (chief of the division of realty, *retired*; USFWS, region 6)



# Appendix D

## *Public Involvement*

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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 meetings were held in Kensal, Pingree, and Jamestown, North Dakota. Approximately 40 people attended these meetings. Numerous written comments were received during the open comment period. Comments received identified biological, social, and economic concerns regarding refuge management. The mailing list follows.

### **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**

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

### **Organizations**

American Bird Conservancy, Washington DC

American Rivers, Washington DC

Audubon Dakota, Fargo, ND

Dakota Anglers, Jamestown, ND

Defenders of Wildlife, Washington DC

Ducks Unlimited, Memphis, TN

Izaak Walton League, Gaithersburg, MD

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**

1 individual

# Appendix E

## *Fire Management Program*

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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 would 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 would protect life, property, and other resources by safely suppressing all wildfires. Prescribed fire and manual and mechanical fuel treatments would be used in an ecosystem management context for habitat management, and to protect federal and private property. Fuel reduction activities would be applied where needed, especially in areas with a higher proportion of residences that may be considered “wildland–urban interface” (WUI) areas.

All aspects of the fire management program would be conducted consistent with applicable laws, policies, and regulations. The refuge would maintain a FMP and carry it out to accomplish resource management objectives. Prescribed fire and manual and mechanical fuel treatments would 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 would 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 F

## 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>         | lambquarters            |
| <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>chrysocarpa</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 |

| <b>Genus</b>        | <b>Species</b>         | <b>Common Name</b>     |
|---------------------|------------------------|------------------------|
| <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 G

## 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                       |
|---|---------------------------------------|
| <b><i>Hesperiidae (Pyrginae)</i></b>    |                                       |
| silver-spotted skipper                  | <i>Epargyreus clarus</i>              |
| common checkered skipper                | <i>Pyrgus communis</i>                |
| common sooty wing*                      | <i>Pholisora catullus</i>             |
| <b><i>Hesperiidae (Hesperiinae)</i></b> |                                       |
| 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>           |
| <b><i>Papilionidae</i></b>              |                                       |
| black swallowtail                       | <i>Papilio polyxenes</i>              |
| Canadian tiger swallowtail              | <i>Papilio (Pterourus) canadensis</i> |
| eastern tiger swallowtail*              | <i>Papilio (Pterourus) glaucus</i>    |
| <b><i>Pieridae</i></b>                  |                                       |
| 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                       |
|---|---------------------------------------|
| <b><i>Lycaenidae (Lycaeninae)</i></b>     |                                       |
| great copper*                             | <i>Lycaena (Gaeides) xanthoides</i>   |
| bronze copper                             | <i>Lycaena (Hyllolycaena) hyllus</i>  |
| purplish copper                           | <i>Lycaena (Epidemia) helloides</i>   |
| <b><i>Lycaenidae (Theclinae)</i></b>      |                                       |
| 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>                |
| <b><i>Lycaenidae (Polyommatainae)</i></b> |                                       |
| 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>              |
| <b><i>Nymphalidae (Heliconiinae)</i></b>  |                                       |
| 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>                |
| <b><i>Nymphalidae (Nymphalinae)</i></b>   |                                       |
| 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>           |
| <b><i>Nymphalidae (Limenitidinae)</i></b> |                                       |
| white admiral                             | <i>Basilarchia a. arthemis</i>        |
| red-spotted purple                        | <i>Basilarchia a. astyanax</i>        |
| viceroys                                  | <i>Basilarchia archippus</i>          |
| <b><i>Nymphalidae (Apaturinae)</i></b>    |                                       |
| 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 H

## *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                                   |
|--------------------------|---|
| <b><i>Amphibians</i></b> |   |
| 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>                         |
| <b><i>Reptiles</i></b>   |   |
| 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 I

## 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 |
|-------------------------------------|--------|--------|------|--------|
| <b>Loons</b>                        |        |        |      |        |
| common loon                         | r      | r      | –    | –      |
| <b>Grebes</b>                       |        |        |      |        |
| 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    | –      |
| <b>Pelicans</b>                     |        |        |      |        |
| American white pelican              | c      | c      | c    | –      |
| <b>Cormorants</b>                   |        |        |      |        |
| double-crested cormorant *          | c      | c      | c    | –      |
| <b>Herons, Egrets, and Bitterns</b> |        |        |      |        |
| 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    | –      |
| <b>Ibises</b>                       |        |        |      |        |
| white-faced ibis                    | r      | –      | –    | –      |
| <b>Vultures</b>                     |        |        |      |        |
| turkey vulture                      | r      | –      | r    | –      |
| <b>Swans, Geese, and Ducks</b>      |        |        |      |        |
| 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    | –      |
| <b><i>Hawks and Eagles</i></b>  |        |        |      |        |
| 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      |
| <b><i>Falcons</i></b>           |        |        |      |        |
| American kestrel *              | c      | u      | c    | r      |
| merlin                          | u      | –      | u    | r      |
| peregrine falcon #              | r      | –      | r    | r      |
| prairie falcon                  | u      | r      | u    | r      |
| <b><i>Upland Game Birds</i></b> |        |        |      |        |
| 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      |
| <b><i>Rails and Coots</i></b>   |        |        |      |        |
| 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 |
|---------------------------------------|--------|--------|------|--------|
| <b><i>Cranes</i></b>                  |        |        |      |        |
| sandhill crane                        | c      | r      | c    | —      |
| whooping crane #                      | r      | —      | r    | —      |
| <b><i>Shorebirds</i></b>              |        |        |      |        |
| 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    | —      |
| <b><i>Gulls and Terns</i></b>         |        |        |      |        |
| 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    | —      |
| <b><i>Doves</i></b>                   |        |        |      |        |
| rock dove *                           | c      | c      | c    | c      |
| mourning dove *                       | c      | c      | c    | r      |
| <b><i>Cuckoos and Roadrunners</i></b> |        |        |      |        |
| black-billed cuckoo *                 | u      | c      | u    | —      |
| yellow-billed cuckoo                  | r      | —      | —    | —      |

| Common Name                     | Spring | Summer | Fall | Winter |
|---------------------------------|--------|--------|------|--------|
| <b>Owls</b>                     |        |        |      |        |
| 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      |
| <b>Nighthawks and Nightjars</b> |        |        |      |        |
| common nighthawk *              | u      | u      | u    | –      |
| whip-poor-will                  | r      | –      | –    | –      |
| <b>Swifts</b>                   |        |        |      |        |
| chimney swift                   | r      | r      | r    | –      |
| <b>Hummingbirds</b>             |        |        |      |        |
| ruby-throated hummingbird       | r      | u      | r    | –      |
| <b>Kingfishers</b>              |        |        |      |        |
| belted kingfisher *             | c      | c      | c    | –      |
| <b>Woodpeckers</b>              |        |        |      |        |
| 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      |
| <b>Flycatchers</b>              |        |        |      |        |
| 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    | –      |
| <b>Shrikes</b>                  |        |        |      |        |
| loggerhead shrike *             | u      | u      | r    | –      |
| northern shrike                 | u      | –      | u    | u      |
| <b>Vireos</b>                   |        |        |      |        |
| 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    | –      |
| <b>Jays, Magpies, and Crows</b> |        |        |      |        |
| 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 |
|--|--------|--------|------|--------|
| <b>Larks</b>                             |        |        |      |        |
| horned lark *                            | c      | c      | c    | c      |
| <b>Swallows</b>                          |        |        |      |        |
| 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    | —      |
| <b>Chickadees and Titmice</b>            |        |        |      |        |
| black-capped chickadee *                 | c      | c      | c    | c      |
| <b>Nuthatches</b>                        |        |        |      |        |
| red-breasted nuthatch                    | u      | —      | u    | c      |
| white-breasted nuthatch *                | u      | u      | c    | c      |
| <b>Creepers</b>                          |        |        |      |        |
| brown creeper                            | u      | —      | u    | u      |
| <b>Wrens</b>                             |        |        |      |        |
| house wren *                             | c      | c      | c    | —      |
| winter wren                              | r      | —      | —    | —      |
| sedge wren *                             | u      | c      | r    | —      |
| marsh wren *                             | u      | c      | u    | —      |
| <b>Kinglets, Bluebirds, and Thrushes</b> |        |        |      |        |
| 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      |
| <b>Mimics</b>                            |        |        |      |        |
| gray catbird *                           | c      | c      | u    | —      |
| brown thrasher *                         | c      | c      | u    | —      |
| <b>Starlings</b>                         |        |        |      |        |
| European starling *                      | u      | u      | u    | u      |
| <b>Pipits</b>                            |        |        |      |        |
| American (water) pipit                   | u      | —      | u    | —      |
| Sprague's pipit *                        | u      | u      | u    | —      |
| <b>Waxwings</b>                          |        |        |      |        |
| Bohemian waxwing                         | u      | —      | u    | u      |
| cedar waxwing *                          | u      | c      | c    | u      |
| <b>Warblers</b>                          |        |        |      |        |
| 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    | –      |
| <b>Tanagers</b>                          |        |        |      |        |
| scarlet tanager                          | r      | –      | r    | –      |
| <b>Sparrows, Buntings, and Grosbeaks</b> |        |        |      |        |
| 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    | –      |
| <b>Blackbirds and Orioles</b>            |        |        |      |        |
| 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    | —      |
| <b><i>Finches</i></b>            |        |        |      |        |
| 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      |
| <b><i>Old World Sparrows</i></b> |        |        |      |        |
| house sparrow *                  | c      | c      | c    | c      |



# Appendix J

## *List of Potentially Occurring Mammal Species*

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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 jack rabbit       | <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>                 |

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

# Appendix K

## *Draft Compatibility Determination for Hunting*

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**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 public use?***

The use would 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 would the use be conducted?***

The use would 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—would be closed to youth deer hunting.

***When would the use be conducted?***

Big game hunting (youth deer, archery deer, deer gun, and muzzleloader) would be allowed during the seasons established by the state. Late-season, upland game bird hunting and small game hunting would open on the day following the deer gun season. The upland game bird hunting season would close when the state season closes. The small game hunting season would close on March 31.

***How would the use be conducted?***

A state-issued unit permit would 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 would be allowed on trails to retrieve deer during designated retrieval times. These times would be conspicuously posted on all refuge gates where access is allowed. Absolutely no ATVs or snowmobiles would 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, priority public 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 would 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 would result if animal populations, especially deer, remain beneath carrying capacity.

*Cumulative impacts:* There would be no direct nor indirect cumulative impacts anticipated with this use.

### Public Review and Comment

This compatibility determination was prepared concurrently with the draft CCP and EA for the refuge. Public review and comment will be 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 would 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, priority public 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.

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### Signature

\_\_\_\_\_  
Kim Hanson Date  
Project Leader, Arrowwood NWR  
USFWS, Region 6

### Concurrence

\_\_\_\_\_  
Richard A. Coleman, Ph.D. Date  
Assistant Regional Director  
National Wildlife Refuge System  
USFWS, Region 6

### Review

\_\_\_\_\_  
Lloyd Jones Date  
Regional Compatibility Coordinator  
USFWS, Region 6

### Mandatory 10- or 15-Year Reevaluation Date: 2022

\_\_\_\_\_  
Rod Krey Date  
Refuge Supervisor (ND, SD)  
USFWS, Region 6

# Appendix L

## *Draft Compatibility Determination for Fishing*

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**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 public use?***

The use would be a continuation of the existing fishing program. 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 public uses specified in the Improvement Act.

***Where would the use be conducted?***

The use would occur over the entire refuge, including all four major impoundments (Arrowwood, Mud, and Jim Lakes; and Depuy Marsh), the subimpoundments, and the bypass channel. Motorized boats would be restricted to Arrowwood and Jim lakes and motor size would be limited to a maximum of 25 horsepower. Nonmotorized boats would be allowed on all impoundments for fishing.

All areas would be open to ice fishing; however, vehicle access onto the ice would be restricted to Jim Lake as this is the only impoundment with vehicle access (a primitive boat ramp). This access is not maintained in winter months, so access would not be guaranteed.

***When would the use be conducted?***

Fishing would be permitted year-round in accordance with state regulations, with the exception of the deer gun and muzzleloader seasons. For safety reasons, fishing would not be allowed during these hunting seasons. This would be a change from the current regulations that allow (1) bank fishing and bow fishing only from May 1 to September 30, and (2) fishing the bypass channel only from June 1 to September 30.

Motorized boats would be allowed from May 1 through August 31 of each year. This would 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 would the use be conducted?***

Most of the access to fishing opportunities would 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, priority public 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 would be no direct or indirect cumulative impacts anticipated with this use.

### Public Review and Comment

This compatibility determination was prepared concurrently with the draft CCP and EA for the refuge. Public review and comment will be 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 would be made available in the refuge’s fishing “tear sheet.” These stipulations specify when the activities would be allowed, describe access restrictions, and outline special regulations.

### Justification

Fishing is a legislated, wildlife-dependent, priority public use. No significant adverse impacts to the wildlife resource is expected from the primary or supporting uses.

Access into the refuge would 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 would not be allowed after August 31.

### Signature

\_\_\_\_\_  
Kim Hanson Date  
Project Leader, Arrowwood NWR  
USFWS, Region 6

### Concurrence

\_\_\_\_\_  
Richard A. Coleman, Ph.D. Date  
Assistant Regional Director  
National Wildlife Refuge System  
USFWS, Region 6

### Review

\_\_\_\_\_  
Lloyd Jones Date  
Regional Compatibility Coordinator  
USFWS, Region 6

### Mandatory 10- or 15-Year Reevaluation

**Date:** 2022

\_\_\_\_\_  
Rod Krey Date  
Refuge Supervisor (ND, SD)  
USFWS, Region 6

# Appendix M

## *Draft Compatibility Determination for Commercial Fishing*

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**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 public use?***

The use would 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 would be required.

Commercial fishing is not a wildlife-dependent public use.

***Where would the use be conducted?***

This activity would 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 would the use be conducted?***

Removal of rough fish by commercial-fishing contractors would occur in the spring, usually from April to June.

***How would the use be conducted?***

Seines would be used to corral rough fish into holding pens. Fish would then be scooped into large containers, which would be emptied into holding crates. The fish would be loaded either onto a refrigerated trailer or into holding tanks on trailers for transport. A backhoe would 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 would be no direct nor indirect cumulative impacts anticipated with this use.

## Public Review and Comment

This compatibility determination was prepared concurrently with the draft CCP and EA for the refuge. Public review and comment will be 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 would adhere to the provisions of the state-issued harvest permit. Vehicles and equipment would be restricted to existing refuge roads, trails, and other facilities.

## Justification

The exclusion of rough fish from refuge impoundments would 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 would it contribute to the purposes of the refuge or the mission of the Refuge System?*

As described above, commercial fishing would 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

\_\_\_\_\_  
Kim Hanson Date  
Project Leader, Arrowwood NWR  
USFWS, Region 6

## Concurrence

\_\_\_\_\_  
Richard A. Coleman, Ph.D. Date  
Assistant Regional Director  
National Wildlife Refuge System  
USFWS, Region 6

## Review

\_\_\_\_\_  
Lloyd Jones Date  
Regional Compatibility Coordinator  
USFWS, Region 6

## Mandatory 10- or 15-Year Reevaluation Date: 2022

\_\_\_\_\_  
Rod Krey Date  
Refuge Supervisor (ND, SD)  
USFWS, Region 6

# Appendix N

## *Draft Compatibility Determination for Wildlife Observation and Wildlife Photography*

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**Uses:** Wildlife Observation and Wildlife 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 public uses?***

The uses would be the continuation and enhancement of existing public use programs and activities of and related to wildlife observation and wildlife photography. Wildlife observation and wildlife photography would be the primary uses. Vehicle access, walk-in access (including the hiking trail), nonmotorized bicycle access, and canoe access would be supporting uses.

Wildlife observation and wildlife photography are two of the six wildlife-dependent public uses specified in the Improvement Act.

***Where would the uses be conducted?***

The uses would occur over the entire refuge, with the exception of the area surrounding the residences, shop, and equipment yard. Vehicle access would be restricted to the headquarters road, the auto tour route, and the Warbler Woodlands Road. Nonmotorized bicycle access would be restricted to existing refuge vehicle trails and not allowed on river dikes. Canoe access would be restricted to river impoundments.

***When would the uses be conducted?***

Wildlife observation and wildlife photography would be allowed year-round. However, access into the refuge would be limited during the deer gun and muzzleloader seasons; only hunters or those accompanying hunters (details are in the “tear sheet”) would be allowed at the refuge during these seasons.

The refuge manager would open and close the auto tour route and the Warbler Woodlands Road as road conditions allow. However, they would remain closed during the deer gun and muzzleloader seasons (including bicycle access). Nonmotorized bicycle access would be allowed on vehicle trails (with the exception of river dikes) as soon as conditions allow in the spring. This access would close at the beginning of deer archery season (September 1).

Canoe access to river impoundments would be allowed as soon as conditions allow in the spring; canoe access would close at the beginning of deer archery season (September 1).

***How would the uses be conducted?***

The refuge would be open for wildlife observation and wildlife photography. Their supporting use (access) would 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 would be maintained, and maybe enhanced, by refuge staff.

***Why are these uses being proposed?***

Wildlife observation and wildlife photography are two of the six wildlife-dependent, priority public 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 would be added to the trailhead. New opportunities for wildlife viewing would 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 would be minor and nonpermanent.

***Long-term impacts:*** None.

***Cumulative impacts:*** There would be no direct nor indirect cumulative impacts anticipated with these uses.

**Public Review and Comment**

This compatibility determination was prepared concurrently with the draft CCP and EA for the refuge. Public review and comment will be achieved concurrently with the public review and comment period for the draft CCP and EA.

**Determination**

Wildlife observation and wildlife photography, along with their supporting uses, are compatible uses at Arrowwood NWR.

**Stipulations Necessary to Ensure Compatibility**

Stipulations regarding the public use program would be made available in published refuge brochures. Dates, closed areas, and other information would be specified.

Access into the refuge would be restricted during the deer gun and muzzleloader seasons for safety reasons. Access to vehicle trails would not be allowed once archery deer season begins to conflict with other refuge users. Canoe access to river impoundments would be allowed beginning May 1 each year, and would cease to be allowed on September 1.

**Justification**

Wildlife observation and wildlife photography are legislated, wildlife-dependent public uses. No significant adverse impacts to the wildlife resource are expected from the primary or supporting uses.

Access into the refuge would 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 would 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.

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**Signature**

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Kim Hanson  
Project Leader, Arrowwood NWR  
USFWS, Region 6

Date

**Concurrence**

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Richard A. Coleman, Ph.D.  
Assistant Regional Director  
National Wildlife Refuge System  
USFWS, Region 6

Date

**Review**

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Lloyd Jones  
Regional Compatibility Coordinator  
USFWS, Region 6

Date

**Mandatory 10- or 15-Year Reevaluation****Date:** 2022

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Rod Krey  
Refuge Supervisor (ND, SD)  
USFWS, Region 6

Date



# Appendix O

## *Draft Compatibility Determination for Interpretation and Environmental Education*

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**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 public uses?***

The uses would continue and enhance the interpretation and environmental education programs. The refuge would 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 public uses specified in the Improvement Act.

***Where would the uses be conducted?***

Environmental education and interpretation would take place over the entire refuge. However, most activities would 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 would be constructed at the Warbler Woodland Watchable Wildlife Area for environmental education. Occasionally, small groups would be led to interior portions of the refuge such as the river dikes and impoundments.

***When would the uses be conducted?***

These activities would be held during the daytime, most frequently while school is in session (September–May). Less frequently, nonprofit groups would be hosted during the summer months.

***How would the uses be conducted?***

Refuge staff would 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, priority public 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 would be replaced with a learning pavilion that would facilitate hosting outdoor classrooms.

***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 would also occur during the remodeling of the bathhouse into the learning pavilion.

However, nearby suitable habitats exist for all wildlife species and the impacts would not be permanent.

**Long-term impacts:** These activities would increase local support of the refuge and increase knowledge of stewardship of natural resources to students young and old.

**Cumulative impacts:** There would be no direct nor indirect cumulative impacts anticipated with the continuation of these uses.

## Public Review and Comment

This compatibility determination was prepared concurrently with the draft CCP and EA for the refuge. Public review and comment will be 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 would be approved by the refuge manager. The refuge manager would ensure that the timing and location of activities would 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 priority public uses. Other than minor disturbance, they would have no impact to the resource. These uses would 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

\_\_\_\_\_  
Kim Hanson Date  
Project Leader, Arrowwood NWR  
USFWS, Region 6

## Concurrence

\_\_\_\_\_  
Richard A. Coleman, Ph.D. Date  
Assistant Regional Director  
National Wildlife Refuge System  
USFWS, Region 6

## Review

\_\_\_\_\_  
Lloyd Jones Date  
Regional Compatibility Coordinator  
USFWS, Region 6

## Mandatory 10- or 15-Year Reevaluation Date: 2022

\_\_\_\_\_  
Rod Krey Date  
Refuge Supervisor (ND, SD)  
USFWS, Region 6

# Appendix P

## *Draft Compatibility Determination for Wild Food Gathering*

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**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 public use?***

The use would be the continued gathering of certain wild foods for personal use. This would include wild foods such as Juneberries, chokecherries, raspberries, asparagus, and aboveground fruits and vegetables.

Wild food gathering is not a wildlife-dependent public use.

***Where would the use be conducted?***

The entire refuge, with the exception of the area closed to all access surrounding the residences and shop, would be open to wild food gathering.

***When would the use be conducted?***

Wild food gathering would typically occur in the spring and summer. Due to safety reasons, this activity would 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 would occur at the same time are extremely unlikely.

***How would the use be conducted?***

Those interested in gathering wild food would be allowed to access the refuge by walking. Vehicles would be allowed on the auto tour route and the road leading to the Warbler Woodlands Watchable Wildlife Area. Nonmotorized bicycles would 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 would be no direct nor indirect cumulative impacts anticipated with this use.

### Public Review and Comment

This compatibility determination was prepared concurrently with the draft CCP and EA for the refuge. Public review and comment will be 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 would be strictly prohibited.

### Justification

Wild food gathering is a traditional use of the native vegetation in the area. Allowing this activity would increase the public's appreciation for the natural resources. It would also provide them an opportunity to enjoy other, wildlife-dependent, priority uses such as wildlife observation.

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### Signature

\_\_\_\_\_  
Kim Hanson Date  
Project Leader, Arrowwood NWR  
USFWS, Region 6

### Concurrence

\_\_\_\_\_  
Richard A. Coleman, Ph.D. Date  
Assistant Regional Director  
National Wildlife Refuge System  
USFWS, Region 6

### Review

\_\_\_\_\_  
Lloyd Jones Date  
Regional Compatibility Coordinator  
USFWS, Region 6

### Mandatory 10- or 15-Year Reevaluation Date: 2022

\_\_\_\_\_  
Rod Krey Date  
Refuge Supervisor (ND, SD)  
USFWS, Region 6

# Appendix Q

## Draft Compatibility Determination for Recreational Trapping

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**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 public use?***

The use would be continuation of recreational trapping under special use permit. Recreational trappers would 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 would the use be conducted?***

The entire refuge would be open to recreational trapping under special use permit only.

***When would the use be conducted?***

Recreational trapping would be allowed under the seasons and restrictions established by the state.

***How would the use be conducted?***

Recreational trapping would 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 would be no direct nor indirect cumulative impacts anticipated with this use.

## Public Review and Comment

This compatibility determination was prepared concurrently with the draft CCP and EA for the refuge. Public review and comment will be 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 would be allowed under special use permit only. Trapping would be conducted in accordance with state laws and regulations, in addition to refuge regulations. Only species specified on the special use permit would be permitted to be taken.

## Justification

Recreational trapping in specific areas would 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 would 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 would 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 would it contribute to the purposes of the refuge or the mission of the Refuge System?*

As described above, recreational trapping would 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

\_\_\_\_\_  
Kim Hanson Date  
Project Leader, Arrowwood NWR  
USFWS, Region 6

## Concurrence

\_\_\_\_\_  
Richard A. Coleman, Ph.D. Date  
Assistant Regional Director  
National Wildlife Refuge System  
USFWS, Region 6

## Review

\_\_\_\_\_  
Lloyd Jones Date  
Regional Compatibility Coordinator  
USFWS, Region 6

## Mandatory 10- or 15-Year Reevaluation Date: 2022

\_\_\_\_\_  
Rod Krey Date  
Refuge Supervisor (ND, SD)  
USFWS, Region 6

# Appendix R

## *Draft Compatibility Determination for Horseback Riding*

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**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 public use?***

The use would 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 would be minimal (May through August).

This use would support two of the six wildlife-dependent public uses—wildlife observation and wildlife photography—specified in the Improvement Act.

***Where would the use be conducted?***

Horseback riding under special use permit would be restricted to existing vehicle trails, with the exception of the auto tour route, where horseback riding would not be allowed. Trails where horseback

riding would be allowed would be highlighted on a map attached to the special use permit.

***When would the use be conducted?***

Horseback riding on trails would be allowed during daylight hours only, from May through August. This period would result in the least amount of interference with other public use such as hunting in the fall. This period would also prevent wildlife disturbance during winter months when wildlife may become stressed and vulnerable to harsh weather conditions.

***How would the use be conducted?***

Horseback riding would be allowed under a special use permit only. One of the following staff would sign a special use permit: office automation clerk, project leader, deputy project leader, or assistant refuge manager. No additional facilities would be needed to support this use.

***Why is this use being proposed?***

Horseback riding on selected trails would 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 would 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 would be minor and easily controlled.

**Cumulative impacts:** There would be no direct or indirect cumulative impacts anticipated with this use.

## Public Review and Comment

This compatibility determination was prepared concurrently with the draft CCP and EA for the refuge. Public review and comment will be 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 would 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 would support two of the legislated, wildlife-dependent priority public 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 would be enhanced.

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## Signature

\_\_\_\_\_  
 Kim Hanson Date  
 Project Leader, Arrowwood NWR  
 USFWS, Region 6

## Concurrence

\_\_\_\_\_  
 Richard A. Coleman, Ph.D. Date  
 Assistant Regional Director  
 National Wildlife Refuge System  
 USFWS, Region 6

## Review

\_\_\_\_\_  
 Lloyd Jones Date  
 Regional Compatibility Coordinator  
 USFWS, Region 6

## Mandatory 10- or 15-Year Reevaluation

**Date:** 2022

\_\_\_\_\_  
 Rod Krey Date  
 Refuge Supervisor (ND, SD)  
 USFWS, Region 6

# Appendix S

## *Economic Analysis*

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### **Regional Economic Effects of Current and Proposed Management —Alternatives for Arrowwood National Wildlife Refuge**

Lynne Koontz and Heather Lambert  
U.S. Geological Survey  
Biological Resources Division  
Fort Collins, CO 80526

#### **Introduction**

The National Wildlife Refuge System Improvement Act of 1997 requires all units of the National Wildlife Refuge System to be managed under a Comprehensive Conservation Plan (CCP). The CCP must describe the desired future conditions of a Refuge and provide long range guidance and management direction to achieve Refuge purposes. 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<br>(% of County total) | Stutsman County<br>(% of County total) | State of North Dakota<br>(% 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

|                         | <b>Alternative I - Current Management</b>                      | <b>Alternative II - Enhanced Refuge Management</b>                                    | <b>Alternative III - Enhanced Refuge and Watershed Management</b>                     |
|-------------------------|--|---|---|
| Management Staff        | Project Leader*<br>Deputy Proj. Leader*<br>Refuge Oper. Spec.* | Project Leader*<br>Deputy Proj. Leader*<br>Refuge Oper. Spec. *<br>Refuge Oper. Spec. | Project Leader*<br>Deputy Proj. Leader*<br>Refuge Oper. Spec. *<br>Refuge Oper. Spec. |
| Biological Staff        | Wildlife Biologist*  | Wildlife Biologist*<br>Biological Tech<br>Biological Tech                             | Wildlife Biologist*<br>Biological Tech<br>F/W Biologist<br>Biological Tech            |
| Public Use Staff        | Outdoor Rec. Planner<br>(½ time, shared<br>w/Long Lake)        | Outdoor Rec. Planner<br>Park Ranger   | Outdoor Rec. Planner<br>Park Ranger   |
| Admin Staff             | Admin. Officer*<br>Clerk*                                      | Admin. Officer*<br>Clerk*   | Admin. Officer*<br>Clerk*   |
| Maintenance Staff       | Engineer. Equip. Op.<br>Tractor Operator                       | Engineer. Equip. Op.<br>Tractor Operator<br>Maintenance Worker<br>Maintenance Worker  | Engineer. Equip. Op.<br>Tractor Operator<br>Maintenance Worker<br>Maintenance Worker  |
| Fire Staff              | Fire Manage. Officer*<br>Fire Tech*                            | Fire Manage. Officer*<br>Fire Tech*<br>Seasonal Range Tech                            | Fire Manage. Officer*<br>Fire Tech*<br>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             |               |                |                 |
| <b>Direct Effects</b>               |               |                |                 |
| Income (\$/year)                    | \$107,600     | \$156,900      | \$167,600       |
| Jobs                                | 5.7           | 8.4            | 8.9             |
| <b>Indirect and Induced Effects</b> |               |                |                 |
| Income (\$/year)                    | \$37,400      | \$54,600       | \$58,300        |
| Jobs                                | 1.8           | 2.6            | 2.8             |
| <b>Total Effects</b>                |               |                |                 |
| 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<br><i>(60% of total non salary expenditures spent locally)</i> |               |                |                 |
| <b>Direct Effects</b>   |               |                |                 |
| Income (\$/year)  | \$70,500      | \$97,600       | \$104,200       |
| Jobs  | 5.9           | 8.2            | 8.8             |
| <b>Indirect and Induced Effects</b>   |               |                |                 |
| Income (\$/year)  | \$35,700      | \$49,400       | \$52,800        |
| Jobs  | 1.6           | 2.2            | 2.3             |
| <b>Total Effects</b>  |               |                |                 |
| 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. Alternatives 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 |               |                |                 |
| <b>Direct Effects</b>                       |               |                |                 |
| Income (\$/year)                            | \$178,100     | \$254,500      | \$271,800       |
| Jobs  | 11.6          | 16.6           | 17.7            |
| <b>Indirect and Induced Effects</b>         |               |                |                 |
| Income (\$/year)                            | \$73,100      | \$104,000      | \$111,100       |
| Jobs  | 3.4           | 4.8            | 5.1             |
| <b>Total Effects</b>                        |               |                |                 |
| 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.

|   | <b>Total # of Visitors</b> | <b>Percentage (%) of Local Stutsman and Foster County Visitors</b> | <b>Percentage (%) of Non Local North Dakota Visitors</b> | <b>Percentage (%) of Nonresident Visitors (live outside of North Dakota)</b> |
|---|----------------------------|--|--|--|
| 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 <sup>1</sup> | Number of nonresident visitor days <sup>1</sup> |
|----------------------------|---|--------------------------------|--------------------------------|---|---|
| <b>Non-Consumptive</b>     |   |                                |                                |   |   |
| 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   |
| <b>Hunting</b>             |   |                                |                                |   |   |
| Upland Game                | 10  | 10                             | 4 hours                        | 5   | 5   |
| Big Game                   | 125                                       | 125                            | 6 hours                        | 94  | 94  |
| <b>Fishing</b>             | 4   | 4                              | 4 hours                        | 2   | 2   |
| Total                      |   |                                |                                | 222   | 221   |

<sup>1</sup>One 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.

|                            | <b>Total # of Visitors</b> | <b>Percentage (%) of Local Stutsman and Foster County Visitors</b> | <b>Percentage (%) of Non Local North Dakota Visitors</b> | <b>Percentage (%) of Nonresident Visitors (live outside of North Dakota)</b> |
|----------------------------|----------------------------|--|--|--|
| Total Estimated Visitors   | 17,690                     |  |  |  |
| <b>Non-Consumptive</b>     |                            |  |  |  |
| 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  |
| <b>Hunting</b>             |                            |  |  |  |
| Upland Game                | 250                        | 90   | 5  | 5  |
| Big Game                   | 1,300                      | 80   | 10   | 10   |
| <b>Fishing</b>             | 85                         | 90   | 5  | 5  |

**Table 11.** Annual non local visitor days for Alternatives II and III.

|                            | <b>Number of non local North Dakota visitors</b> | <b>Number of nonresident visitors</b> | <b>Estimated time spent at Refuge</b> | <b>Number of non local North Dakota resident visitor days</b> | <b>Number of nonresident visitor days</b> |
|----------------------------|--|---------------------------------------|---------------------------------------|---|---|
| <b>Non-Consumptive</b>     |  |                                       |                                       |   |   |
| 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  |
| <b>Hunting</b>             |  |                                       |                                       |   |   |
| Upland Game                | 13   | 13                                    | 4                                     | 6   | 6   |
| Big Game                   | 130  | 130                                   | 6                                     | 98  | 98  |
| <b>Fishing</b>             | 4  | 4                                     | 4                                     | 2   | 2   |
| Total                      |  |                                       |                                       | 754   | 752                                       |

<sup>1</sup>One 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            |               |                         |
| <b>Direct effects</b>               |               |                         |
| Income (\$/year)                    | \$6,400       | \$24,500                |
| Jobs                                | 0.4           | 1.6                     |
| <b>Indirect and induced effects</b> |               |                         |
| Income (\$/year)                    | \$3,600       | \$13,900                |
| Jobs                                | 0.1           | 0.4                     |
| <b>Total Effects</b>                |               |                         |
| 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 |               |                |                 |
| <b>Direct Effects</b>                       |               |                |                 |
| Income (\$/year)                            | \$178,100     | \$254,500      | \$271,800       |
| Jobs  | 11.6          | 16.6           | 17.7            |
| <b>Total Effects</b>                        |               |                |                 |
| Income (\$/year)                            | \$251,200     | \$358,500      | \$382,900       |
| Jobs  | 15.0          | 21.4           | 22.8            |
| Recreation Activities                       |               |                |                 |
| <b>Direct Effects</b>                       |               |                |                 |
| Income (\$/year)                            | \$6,400       | \$24,500       | \$24,500        |
| Jobs  | 0.4           | 1.6            | 1.6             |
| <b>Total Effects</b>                        |               |                |                 |
| Income (\$/year)                            | \$10,000      | \$38,400       | \$38,400        |
| Jobs  | 0.5           | 2.0            | 2.0             |
| Aggregate Impacts                           |               |                |                 |
| <b>Direct Effects</b>                       |               |                |                 |
| Income (\$/year)                            | \$184,500     | \$279,000      | \$296,300       |
| Jobs  | 12.0          | 18.2           | 19.3            |
| <b>Total Effects</b>                        |               |                |                 |
| 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 |                |                 |
| <b>Direct effects</b>                       |                |                 |
| Income (\$/year)                            | +\$76,400      | +\$93,700       |
| Jobs  | +5.0           | +6.1            |
| <b>Total effects</b>                        |                |                 |
| Income (\$/year)                            | +\$107,300     | +\$131,700      |
| Jobs  | +6.4           | +7.8            |
| Recreation activities                       |                |                 |
| <b>Direct effects</b>                       |                |                 |
| Income (\$/year)                            | +\$18,100      | +\$18,100       |
| Jobs  | +1.2           | +1.2            |
| <b>Total effects</b>                        |                |                 |
| Income (\$/year)                            | +\$28,400      | +\$28,400       |
| Jobs  | +1.5           | +1.5            |
| Aggregate impacts                           |                |                 |
| <b>Direct Effects</b>                       |                |                 |
| Income (\$/year)                            | +\$94,500      | +\$111,800      |
| Jobs  | +6.2           | +7.3            |
| <b>Total effects</b>                        |                |                 |
| Income (\$/year)                            | +\$135,700     | +\$160,100      |
| Jobs  | +7.9           | +9.3            |

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