

# Glossary

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

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

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

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

**ATV**—All-terrain vehicle.

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

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

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

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

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

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

**CCC**—*See* Civilian Conservation Corps.

**CCP**—*See* comprehensive conservation plan.

**CFR**—*See* Code of Federal Regulations.

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

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

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

**compatible use**—A wildlife-dependent recreational use or any other use of a refuge that, in the sound professional judgment of the director of the U.S. Fish and Wildlife Service, will not materially interfere with or detract from the fulfillment of the mission of the Refuge System or the purposes of the refuge (Draft Service Manual 603 FW 3.6). A compatibility determination supports the selection of compatible uses and identified stipulations or limits necessary to ensure compatibility.

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

**concern**—*See* issue.

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

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

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

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

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

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

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

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

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

**DNC**—*See* dense nesting cover.

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

**EA**—*See* environmental assessment.

**ecological diversity**—The variety of life and its processes including the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur (Service Manual 052 FW 1.12B).

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

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

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

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

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

**EPA**—Environmental Protection Agency.

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

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

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

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

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

**flora**—All the plant species of an area.

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

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

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

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

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

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

**GIS**—*See* geographic information system.

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

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

**GPS**—*See* global positioning system.

**grassland block**—A contiguous area of grassland without fragmentation.

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

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

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

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

**impoundment**—A body of water created by collection and confinement within a series of levees or dikes, creating separate management units although not always independent of one another.

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

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

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

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

**IPM**—*See* integrated pest management.

**issue**—Any unsettled matter that requires a management decision; e.g., a Service initiative, opportunity, resource management problem, a threat to the resources of the unit, conflict in uses, public concern, or the presence of an undesirable resource condition (Draft Service Manual 602 FW 1.5).

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

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

**management alternative**—*See* alternative.

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

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

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

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

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

**MMS**—*See* maintenance management system.

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

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

**national wildlife refuge**—A designated area of land, water, or an interest in land or water within the National Wildlife Refuge System, but does not

include coordination areas; a complete listing of all units of the Refuge System is in the current “Annual Report of Lands Under Control of the U.S. Fish and Wildlife Service.”

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

**National Wildlife Refuge System Improvement Act of 1997**—Sets the mission and the administrative policy for all refuges in the National Wildlife Refuge System; defines a unifying mission for the Refuge System; establishes the legitimacy and appropriateness of the six priority public uses (hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation); establishes a formal process for determining appropriateness and compatibility; establish the responsibilities of the Secretary of the Interior for managing and protecting the Refuge System; requires a comprehensive conservation plan for each refuge by the year 2012. This Act amended portions of the Refuge Recreation Act and National Wildlife Refuge System Administration Act of 1966.

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

**NAWMP**—North American Waterfowl Management Plan.

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

**NEPA**—National Environmental Policy Act.

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

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

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

environment and, therefore, is detrimental to the agriculture and commerce of the U.S. and to public health.

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

**NWR**—national wildlife refuge.

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

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

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

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

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

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

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

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

**PIF**—See Partners in Flight.

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

**prescribed fire**—The skillful application of fire to natural fuels under conditions such as weather, fuel moisture, and soil moisture that allow confinement of the fire to a predetermined area and produces the intensity of heat and rate of spread to accomplish

planned benefits to one or more objectives of habitat management, wildlife management, or hazard reduction.

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

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

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

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

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

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

**refuge operations needs system (RONS)**—A national database that contains the unfunded operational needs of each refuge. Projects included are those required to implement approved plans and meet goals, objectives, and legal mandates.

**refuge purpose**—*See* purpose of the refuge.

**Refuge System**—*See* National Wildlife Refuge System.

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

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

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

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

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

**RONS**—*See* refuge operations needs system.

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

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

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

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

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

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

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

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

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

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

**special-use permit**—A permit for special authorization from the refuge manager required for any refuge service, facility, privilege, or product of the soil provided at refuge expense and not usually

available to the general public through authorizations in Title 50 CFR or other public regulations (Refuge Manual 5 RM 17.6).

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

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

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

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

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

**tame species**—*See* dense nesting cover.

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

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

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

**trust species**—*See* federal trust species.

**U.S. Fish and Wildlife Service (Service, USFWS, FWS)**—The principal federal agency responsible for conserving, protecting, and enhancing fish and wildlife and their habitats for the continuing benefit of the American people. The Service manages the

93-million-acre National Wildlife Refuge System comprised of more than 530 national wildlife refuges and thousands of waterfowl production areas. It also operates 65 national fish hatcheries and 78 ecological service field stations, the agency enforces federal wildlife laws, manages migratory bird populations, restores national significant fisheries, conserves and restores wildlife habitat such as wetlands, administers the Endangered Species Act, and helps foreign governments with their conservation efforts. It also oversees the federal aid program that distributes millions of dollars in excise taxes on fishing and hunting equipment to state wildlife agencies.

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

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

**USGS**—*See* U.S. Geological Survey.

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

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

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

**VOR**—*See* visual obstruction reading.

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

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

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

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

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

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

**WII**—Wetland of International Importance.

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

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

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

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

**WPA**—waterfowl production area.





# Appendices



# Appendix A—Key Legislation and Policies

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

## NATIONAL WILDLIFE REFUGE SYSTEM

The mission of the Refuge System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans (National Wildlife Refuge System Improvement Act of 1997).

### GOALS

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

### GUIDING PRINCIPLES

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

- **Public Use**—The Refuge System provides important opportunities for compatible wildlife-dependent recreational activities involving hunting, fishing, wildlife observation and photography, and environmental education and interpretation.
- **Habitat**—Fish and wildlife will not prosper without high quality habitat, and without fish and wildlife, traditional uses of refuges cannot be

sustained. The Refuge System will continue to conserve and enhance the quality and diversity of fish and wildlife habitat within refuges.

- **Partnerships**—America’s sportsmen and women were the first partners who insisted on protecting valuable wildlife habitat within wildlife refuges. Conservation partnerships with other federal agencies, state agencies, tribes, organizations, industry, and the general public can make significant contributions to the growth and management of the Refuge System.
- **Public Involvement**—The public should be given a full and open opportunity to participate in decisions regarding acquisition and management of our national wildlife refuges.

## LEGAL AND POLICY GUIDANCE

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

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

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

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

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

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

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

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

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

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

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

**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—Draft Compatibility Determinations

## REFUGE NAME

Sand Lake National Wildlife Refuge

## ESTABLISHING AND ACQUISITION AUTHORITY

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

## REFUGE PURPOSES

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

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

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

## NATIONAL WILDLIFE REFUGE SYSTEM MISSION

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

## 1. DESCRIPTION OF PROPOSED USE: FARMING, GRAZING, AND HAYING

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

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

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

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

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

## Availability of Resources

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

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

## Anticipated Impacts of the Use

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

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

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

## Determination

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

***Stipulations Necessary to Ensure Compatibility***

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

***Justification***

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

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

**Mandatory 15-year Reevaluation Date: 2020**

## **2. DESCRIPTION OF PROPOSED USE: ENVIRONMENTAL EDUCATION AND INTERPRETATION**

*Provide opportunities for environmental education and interpretation.*

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

Currently, environmental education and interpretation activities are conducted at the refuge complex office. Programs and activities are also conducted at the headquarters nature trail and the Columbia Day Use Area. Additional

programs are conducted at schools and other locations as personnel are available.

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

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

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

**Availability of Resources**

Currently all environmental education and interpretation are conducted using available resources. Implementing new programs, activities, and facilities outlined in the CCP is tied to funding requests in the form of refuge operations needs system (RONS) and maintenance management system (MMS) projects (appendices H and I).

**Anticipated Impacts of Use**

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

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

**Determination**

Environmental education and interpretation are compatible.

***Stipulations Necessary to Ensure Compatibility***

- Allow environmental education and interpretation only in designated areas or under the guidance of refuge complex staff, a volunteer, or a trained teacher to ensure minimal disturbance to wildlife, minimal damage to vegetation, and minimal conflicts between groups.
- Annually review environmental education and interpretation activities to ensure these activities are compatible.

***Justification***

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

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

**Mandatory 15-year Reevaluation Date: 2020**

### **3. DESCRIPTION OF PROPOSED USE: WILDLIFE OBSERVATION AND WILDLIFE PHOTOGRAPHY**

*Provide opportunities that support wildlife-dependent recreation.*

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

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

- Update and improve refuge signs.
- Construct a fully accessible, wildlife photography blind.

- Update existing brochures to the Service's graphic standards.
- Pave the Columbia Day Use Area access road and parking lot with asphalt.
- Hire a full-time law enforcement officer to enforce wildlife laws.

**Availability of Resources**

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

**Anticipated Impacts of Use**

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

**Determination**

Wildlife observation and wildlife photography are compatible.

***Stipulations Necessary to Ensure Compatibility***

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

***Justification***

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

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

Service's actions in achieving the purposes of the refuge and the mission of the National Wildlife Refuge System.

**Mandatory 15-year Reevaluation Date: 2020**

#### 4. DESCRIPTION OF USE: RECREATIONAL FISHING

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

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

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

##### Availability of Resources

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

##### Anticipated Impacts of Use

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

##### Determination

Recreational fishing is compatible.

##### *Stipulations Necessary to Ensure Compatibility*

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

##### *Justification*

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

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

##### **Mandatory 15-year Reevaluation Date: 2020**

#### 5. DESCRIPTION OF USE: RECREATIONAL HUNTING

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

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

##### Availability of Resources

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

##### Anticipated Impacts of Use

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

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

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

**Determination**

Recreational hunting is compatible.

***Stipulations Necessary to Ensure Compatibility***

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

***Justification***

Hunting on national wildlife refuges has been identified as a priority public use in the National Wildlife Refuge System Improvement Act of 1997. Hunting is a legitimate wildlife management tool that can be used to manage populations.

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

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

**Mandatory 15-year Reevaluation Date: 2020**

## **6. DESCRIPTION OF PROPOSED PUBLIC USE: TRAPPING FOR REFUGE MANAGEMENT PURPOSES**

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

**Availability of Resources**

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

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

**Anticipated Impacts of the Use**

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

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

**Determination**

Trapping for management purposes is compatible.

***Stipulations Necessary to Ensure Compatibility***

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

***Justification***

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

**Mandatory 15-year Reevaluation Date: 2020**

**SIGNATURE**

\_\_\_\_\_  
Gene Williams (Date)  
Project Leader  
Sand Lake National Wildlife Refuge

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\_\_\_\_\_  
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# Appendix C—Species List

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

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

## WILDLIFE

### CLASS AMPHIBIA

#### Order Caudata

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

#### Order Anura

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

### CLASS REPTILIA

#### Order Testudines

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

#### Order Squamata

- Northern prairie skink (*Eumeces septentrionalis*)
- Northern red-bellied snake (*Storeria occipitomaculata*)
- Plains garter snake (*Thamnophis radix*)

### CLASS AVES

#### Order Podicipediformes

- Western grebe (*Aechmophorus occidentalis*)
- Clark's grebe (*A. clarkii*)
- Eared grebe (*Podiceps nigricolis*)
- Pied-billed grebe (*Podilymbus podiceps*)

#### Order Pelicaniformes

- American white pelican (*Pelecanus erythrocephalus*)
- Double-crested cormorant (*Phalacrocorax auritus*)

#### Order Ciconiiformes

- Great blue heron (*Ardea herodias*)
- Great egret (*A. alba*)
- American bittern (*Botaurus lentiginosus*)
- Cattle egret (*Bubulcus ibis*)
- Green-backed heron (*Boturides striatus*)
- Little blue heron (*Egretta caerulea*)

- Snowy egret (*E. thula*)
- Least bittern (*Ixobrychus exilis*)
- Black-crowned night-heron (*Nycticorax nycticorax*)
- White-faced ibis (*Plegadis chihi*)

#### Order Anseriformes

- Wood duck (*Aix sponsa*)
- Northern pintail (*Anas acuta*)
- American wigeon (*A. americana*)
- Northern shoveler (*A. clypeata*)
- Green-winged teal (*A. crecca*)
- Blue-winged teal (*A. discors*)
- Mallard (*A. platyrhynchos*)
- American black duck (*A. rubripes*)
- Gadwall (*A. strepera*)
- Lesser scaup (*Aythya affinis*)
- Redhead (*A. americana*)
- Canvasback (*A. vallisneria*)
- Canada goose (*Branta canadensis*)
- Bufflehead (*Bucephala albeola*)
- Hooded merganser (*Lophodytes cucullatus*)
- Ruddy duck (*Oxyura jamaicensis*)

#### Order Falconiformes

- Cooper's hawk (*Accipiter cooperii*)
- Sharp-shinned hawk (*A. striatus*)
- Red-tailed hawk (*Buteo jamaicensis*)
- Swainson's hawk (*B. swainsoni*)
- Northern harrier (*Circus cyaneus*)
- American kestrel (*Falco sparverius*)

#### Order Galliformes

- Ring-necked pheasant (*Phasianus colchicus*)
- Sharp-tailed grouse (*Tympanuchus phasianellus*)
- Gray partridge (*Perdix perdix*)

#### Order Gruiformes

- American coot (*Fulica americana*)
- Common moorhen (*Gallinula chloropus*)
- Sora (*Porzana carolina*)
- Virginia rail (*Rallus limicola*)

**Order Charadriiformes**

Killdeer (*Charadrius vociferus*)  
 Upland sandpiper (*Bartramia longicauda*)  
 Spotted sandpiper (*Actitis macularia*)  
 Willet (*Catoptrophorus semipalmatus*)  
 Marbled godwit (*Limosa fedoa*)  
 American avocet (*Recurvirostra americana*)  
 Wilson's phalarope (*Phalaropus tricolor*)  
 Ring-billed gull (*Larus delawarensis*)  
 Franklin's gull (*L. pipixcan*)  
 Black tern (*Chlidonias niger*)  
 Forster's tern (*Sterna forsteri*)  
 Common tern (*S. hirundo*)

**Order Columbiformes**

Rock dove (*Columba livia*)  
 Mourning dove (*Zenaida macroura*)

**Order Cuculiformes**

Yellow-billed cuckoo (*Coccyzus americanus*)  
 Black-billed cuckoo (*C. erythrophthalmus*)

**Order Strigiformes**

Long-eared owl (*Asio otus*)  
 Short-eared owl (*A. flammeus*)  
 Eastern screech owl (*Otus asio*)  
 Great horned owl (*Bubo virginianus*)

**Order Caprimulgiformes**

Common nighthawk (*Chordeiles minor*)

**Order Apodiformes**

Chimney swift (*Chaetura pelagica*)

**Order Coraciiformes**

Belted kingfisher (*Ceryle alcyon*)

**Order Piciformes**

Northern flicker (*Colaptes auratus*)  
 Red-headed woodpecker (*Melanerpes erythrocephalus*)  
 Downy woodpecker (*Picoides pubescens*)  
 Hairy woodpecker (*P. villosus*)

**Order Passeriformes**

Eastern wood-pewee (*Contopus virens*)  
 Least flycatcher (*Empidonax minimus*)  
 Willow flycatcher (*E. traillii*)  
 Eastern phoebe (*Sayornis phoebe*)  
 Eastern kingbird (*Tyrannus tyrannus*)  
 Western kingbird (*T. verticalis*)  
 Horned lark (*Eremophila alpestris*)  
 Cliff swallow (*Hirundo pyrrhonota*)  
 Barn swallow (*H. rustica*)  
 Purple martin (*Progne subis*)  
 Bank swallow (*Riparia riparia*)  
 Northern rough-winged swallow (*Stelgidopteryx serripennis*)  
 Tree swallow (*Tachycineta bicolor*)  
 American crow (*Corvus brachyrhynchos*)  
 Blue jay (*Cyanocitta cristata*)  
 Black-capped chickadee (*Parus atricapillus*)  
 White-breasted nuthatch (*Sitta carolinensis*)

Marsh wren (*Cistothorus palustris*)  
 Sedge wren (*C. platensis*)  
 House wren (*Troglodytes aedon*)  
 American robin (*Turdus migratorius*)  
 Eastern bluebird (*Sialia sialis*)  
 Gray catbird (*Dumetella carolinensis*)  
 Brown thrasher (*Toxostoma rufum*)  
 Cedar waxwing (*Bombycilla cedrorum*)  
 Loggerhead shrike (*Lanius ludovicianus*)  
 European starling (*Sturnus vulgaris*)  
 Warbling vireo (*Vireo gilvus*)  
 Red-eyed vireo (*V. olivaceus*)  
 Yellow warbler (*Dendroica petechia*)  
 Common yellowthroat (*Geothlypis trichas*)  
 Dickcissel (*Spiza americana*)  
 Sharp-tailed sparrow (*Ammodramus caudacutus*)  
 LeConte's sparrow (*A. lecontei*)  
 Grasshopper sparrow (*A. savannarum*)  
 Chestnut-collared longspur (*Calcarius ornatus*)  
 Lark sparrow (*Chondestes grammacus*)  
 Swamp sparrow (*Melospiza georgiana*)  
 Song sparrow (*M. melodia*)  
 Savannah sparrow (*Passerculus sandwichensis*)  
 Vesper sparrow (*Poocetes gramineus*)  
 Clay-colored sparrow (*Spizella pallida*)  
 Field sparrow (*S. pusilla*)  
 Red-winged blackbird (*Agelaius phoeniceus*)  
 Bobolink (*Dolichonyx oryzivorus*)  
 Brewer's blackbird (*Euphagus cyanocephalus*)  
 Northern oriole (*Icterus galbula*)  
 Orchard oriole (*I. spurius*)  
 Brown-headed cowbird (*Molothrus ater*)  
 Common grackle (*Quiscalus quiscula*)  
 Western meadowlark (*Sturnella neglecta*)  
 Yellow-headed blackbird (*Xanthocephalus xanthocephalus*)  
 American goldfinch (*Carduelis tristis*)  
 House finch (*Carpodacus mexicanus*)  
 House sparrow (*Passer domesticus*)

**CLASS MAMMALIA****Order Marsupialia**

Virginia opossum (*Didelphis virginianus*)

**Order Insectivora**

Northern short-tailed shrew (*Blarina brevicauda*)  
 Masked shrew (*Sorex cinereus*)

**Order Chiroptera**

Hoary bat (*Lasiurus cinereus*)

**Order Carnivora**

Coyote (*Canis latrans*)  
 Red fox (*Vulpes vulpes*)  
 Raccoon (*Procyon lotor*)  
 Long-tailed weasel (*Mustela frenata*)  
 Least weasel (*M. nivalis*)  
 Mink (*M. vison*)  
 Badger (*Taxidea taxus*)

Striped skunk (*Mephitis mephitis*)  
Spotted skunk (*Spilogale putorius*)

### Order Artiodactyla

White-tailed deer (*Odocoileus virginianus*)

### Order Rodentia

Woodchuck (*Marmota monax*)  
Fox squirrel (*Sciurus niger*)  
Franklin's ground squirrel (*Spermophilus franklinii*)  
Richardson's ground squirrel (*S. richardsonii*)  
Thirteen-lined ground squirrel (*S. tridecemlineatus*)  
Plains pocket gopher (*Geomys bursarius*)  
Northern pocket gopher (*Thomomys talpoides*)  
Plains pocket mouse (*Perognathus flavescens*)  
Beaver (*Castor canadensis*)  
Northern grasshopper mouse (*Onychomys leucogaster*)  
White-footed mouse (*Peromyscus leucopus*)  
Deer mouse (*P. maniculatus*)  
Western harvest mouse (*Reithrodontomys megalotis*)  
Meadow vole (*Microtus pennsylvanicus*)  
Muskrat (*Ondatra zibethicus*)  
House mouse (*Mus musculus*)  
Norway rat (*Rattus norvegicus*)  
Meadow jumping mouse (*Zapus hudsonius*)  
White-tailed jackrabbit (*Lepus townsendii*)  
Eastern cottontail (*Sylvilagus floridanus*)

## CLASS OSTEICHTHYES

### Order Lepisosteiformes

Shortnose gar (*Lepisosteus platostomus*)

### Order Salmoniformes

Northern pike (*Esox lucius*)

### Order Cypriniformes

Common carp (*Cyprinus carpio*)  
Brassy minnow (*Hybognathus hankinsoni*)  
Golden shiner (*Notemigonus crysoleucas*)  
Common shiner (*Luxilus cornutus*)  
Spottail shiner (*Notropis hudsonius*)  
Red shiner (*Cyprinella lutrensis*)  
Sand shiner (*Notropis stramineus*)  
Fathead minnow (*Pimephales promelas*)  
Creek chub (*Semotilus atromaculatus*)  
River carpsucker (*Carpionodes carpio*)  
White sucker (*Catostomus commersoni*)  
Bigmouth buffalo (*Ictiobus cyprinellus*)

### Order Siluriformes

Black bullhead (*Ameiurus melas*)  
Channel catfish (*Ictalurus punctatus*)  
Tadpole madtom (*Noturus gyrinus*)

### Order Gasterosteiformes

Brook stickleback (*Culaea inconstans*)

### Order Perciformes

Green sunfish (*Lepomis cyanellus*)  
Pumpkinseed (*L. gibbosus*)  
Orangespotted sunfish (*L. humilis*)  
Bluegill (*L. macrochirus*)  
Smallmouth bass (*Micropterus dolomieu*)  
Largemouth bass (*M. salmoides*)  
White crappie (*Pomoxis annularis*)  
Black crappie (*P. nigromaculatus*)  
Iowa darter (*Etheostoma exile*)  
Johnny darter (*E. nigrum*)  
Yellow perch (*Perca flavescens*)  
Walleye (*Stizostedion vitreum*)

## PLANTS

Alfalfa (*Medicago* spp.)  
American elm (*Ulmus americana*)  
Barley (*Hordeum* spp.)  
Big bluestem (*Andropogon gerardii*)  
Boxelder (*Acer negundo*)  
Canada thistle (*Cirsium arvense*)  
Cattail (*Typha* spp.)  
Chinese elm (*Ulmus parvifolia*)  
Common reed (*Phragmites australis*)  
Coon's tail (*Ceratophyllum demersum*)  
Corn (*Zea mays*)  
Green ash (*Fraxinus pennsylvanica*)  
Green needlegrass (*Nassella viridula*)  
Hardstem bulrush (*Schoenoplectus acutus*)  
Indiangrass (*Sorghastrum* spp.)  
Intermediate wheatgrass (*Agropyron intermedium*)  
Kentucky bluegrass (*Poa pratensis*)  
Leafy spurge (*Euphorbia esula*)  
Little bluestem (*Schizachyrium* spp.)  
Needle and thread (*Hesperostipa comata*)  
Prairie cordgrass (*Spartina pectinata*)  
Prairie dropseed (*Sporobolus heterolepis*)  
Purple loosestrife (*Lythrum salicaria*)  
Quackgrass (*Elymus repens*)  
Rush (*Juncus* spp.)  
Russian olive (*Elaeagnus angustifolia*)  
Sago pondweed (*Potamogeton pectinatus*)  
Sedge (*Carex* spp.)  
Sideoats grama (*Bouteloua curtipendula*)  
Smooth brome (*Bromus inermis*)  
Soybean (*Glycine* spp.)  
Spotted knapweed (*Centaurea biebersteinii*)  
Spring wheat (*Triticum* spp.)  
Sweetclover (*Melilotus officinalis*)  
Switchgrass (*Panicum virgatum*)  
Western wheatgrass (*Agropyron smithii*)  
Willow (*Salix* spp.)  
Wormwood sage (*Artemisia absinthium*)



# Appendix D—Landscape-level Goals and Objectives

This appendix summarizes landscape-level plans that are relevant to management of Sand Lake National Wildlife Refuge.

## NORTH AMERICAN WATERFOWL MANAGEMENT PLAN

Signed in 1986, the North American Waterfowl Management Plan (NAWMP) is broad policy framework that describes the overall scope of requirements for management of waterfowl in the United States, Canada, and Mexico.

The NAWMP also serves as a guide for the participation of various private organizations and the public in the conservation and management of waterfowl. The goal of the NAWMP is to restore waterfowl populations to the levels recorded during the 1970s, a benchmark decade for waterfowl. The NAWMP is designed to reach its objectives through key joint venture areas, species joint ventures, and state implementation plans within these joint ventures.

The “North American Waterfowl Management Plan, 1998 Update, Expanding the Vision” reflects on the legacy established by the NAWMP and presents three visions to advance waterfowl conservation in the future:

- Plan partners enhance the capability of landscapes to support waterfowl and other wetland-associated species by ensuring that plan implementation is guided by biologically based planning, which in turn is refined through ongoing evaluation.
- Plan partners define the landscape conditions needed to sustain waterfowl, benefit other wetland-associated species, and participate in the development of conservation, economic, management, and social policies and programs that most affect the ecological health of these landscapes.
- Plan partners collaborate with other conservation efforts, particularly migratory bird initiatives, and reach out to other sectors and communities to forge broader alliances in a collective search for sustainable uses of landscapes.

## PARTNERS IN FLIGHT

Nationally and internationally, several nongame bird initiatives are in the planning stage and implementation is expected to begin in the near

future. Partners in Flight (PIF) is developing bird conservation plans, primarily for land birds, in numerous physiographic areas. The plans include priority species lists, associated habitats, and management strategies.

The primary goal of PIF is to provide for the long-term health of the avifauna of this continent.

- The first priority is to prevent the rarest species from going extinct.
- The second priority is to prevent uncommon species from descending into threatened status.
- The third goal is to keep common birds common.

PIF’s general recommendations for the mixed-grass prairie are:

“Although agriculture has taken over much of the mixed-grass, significant areas of native prairie remain, most notably in the glacial coteau of the Dakotas and the sandhills of Nebraska.

These great reservoirs for grassland birds must be retained through easements, protection, and strengthening of ranching economies.

The interests of land birds extensively overlap with those of waterfowl and shorebirds in the wetter portions of this ecosystem.”

## UNITED STATES SHOREBIRD CONSERVATION PLAN

The shorebird plan is designed to complement the existing landscape-scale conservation efforts of the North American Waterfowl Management Plan, Partners in Flight, and the North American Colonial Waterbird Conservation Plan. The plan has three major goals at different scales.

At a regional scale, the goal of the plan is to ensure that adequate quantity and quality of habitat is identified and maintained to support the different shorebirds that breed in, winter in, and migrate through each region (Brown et al. 2001).

There are eleven regional working groups formed in this planning process. The Sand Lake National Wildlife Refuge is in the northern plains/prairie–potholes region. Three major shorebird issues have been identified for this region:

- endangered and threatened species, declining species, and species of special concern
- habitat loss, including fragmentation and degradation
- the need for additional information to evaluate potential threats, such as contaminants, depredation, and invasion of exotic plants, to migrating and breeding shorebirds

The regional goals are:

- maintain biotic integrity and persistence of breeding shorebird populations in the northern plains/prairie-potholes region
- ensure that adequate stopover resources exist to support populations of migrating shorebirds
- identify and fill information gaps, including the development of tools to use within the context of dynamic ecosystem processes
- coordinate with other conservation efforts in a cross-border landscape

## NORTH AMERICAN WATERBIRD CONSERVATION PLAN

VOLUME 1: SEABIRDS AND COLONIAL WATERBIRDS, REVIEW DRAFT II

The goal of this plan is ensure that the distribution, diversity, and abundance of water bird populations and habitats (breeding, nonbreeding, and migratory) is sustained or restored throughout North America (Kushlan et al. 2002).

**Species and population goal**—Have sustainable distributions, diversity and abundance of priority species for conservation and those in decline.

**Habitat goal**—Secure, maintain, and enhance sufficient high quality habitat throughout the year to achieve and maintain sustainable populations of water birds throughout North America.

**Area goal**—Identify, protect, maintain, and enhance important areas needed to maintain sustainable populations and habitats of water birds throughout their ranges in North America.

**Education goal**—Ensure that information for the conservation of water birds is widely available to decision makers, the public, and all those whose actions affect seabird and colonial water bird populations.

## NONGAME MIGRATORY BIRDS CONSERVATION PLAN, REGION 6

This plan outlines the conservation of nongame bird species in Region 6 (Mountain–Prairie Region) of the U.S. Fish and Wildlife Service. Information concerning nongame species in the region is scarce and research is ongoing.

The goal of the nongame migratory bird program is to protect and maintain all native, nongame species at viable population levels and protect their habitats. An important part of this goal is to prevent any avian species from becoming listed as threatened or endangered, or from becoming extirpated from Region 6.

# Appendix E—Ecosystem Goals and Objectives

This appendix summarizes information and includes excerpts from the “Ecosystem Plan, Mainstem Missouri River; North Dakota, South Dakota and East Montana” (USFWS 2001).

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

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

The Service has adopted watersheds as the basic building blocks for implementing ecosystem conservation. The Sand Lake National Wildlife Refuge is located in the Mainstem Missouri River ecosystem, which includes the Dakotas and northeastern Montana. The refuge contains three of the four focus areas for the ecosystem: wetlands, riparian areas, and prairie grasslands.

## WETLANDS

The glaciated prairies of North and South Dakota and northeastern Montana cover approximately 60 million acres. Once a myriad of prairie–pothole wetlands in a sea of native prairie, the area is now intensively farmed and is the bread basket of the country.

Drainage, largely for agricultural purposes, has reduced 7.2 million acres of wetlands by more than 40 percent, to 3.9 million acres. Native prairie, consisting mostly of mid-grass prairie, has been reduced by 75 percent to 14.9 million acres. Much of the remainder is overgrazed by livestock.

The area is rich in wildlife. Prairie potholes are the lifeblood for waterfowl and other migratory water birds. As an example of the importance of the prairie, ducks banded in North Dakota have been recovered in 46 states and 23 other countries. Grassland-nesting, Neotropical migrants have been declining faster than woodland Neotropical migrants or prairie-nesting ducks. Several endangered, threatened, and candidate species, including the ferruginous hawk, black tern, and Baird’s sparrow, breed in the prairie and wetland habitats of this focus area.

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

The Service has been involved in prairie and wetland resources since the early 1900s. The Service has 69 national wildlife refuges (380,000 acres) and 19 wetland management districts in the focus area. Since 1961, the Service’s small wetland acquisition program has acquired 448,000 acres in fee title and 1.9 million acres in perpetual easement.

The following vision, goals, and objectives are shown as described in the ecosystem plan.

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

**Goal 1:** Increase recognition of wetland values by the various publics (communities, conservation organizations, communication people, congressional delegations and staff, and corporate entities) to develop a wetland advocacy.

**Objective A:** Over the next 3 years, develop and implement an information and outreach plan in North and South Dakota and northeastern Montana.

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

**Objective A:** As a minimum, annually protect 15,000 acres of wetlands through fee and easement over the next 10 years in the ecosystem.

**Objective B:** Assist partners and other agencies in protecting, creating, restoring, managing, and enhancing 10,000 acres of wetlands and associated uplands annually.

**Goal 3:** Protect the water supply and property interests of wetlands on Service lands and easements.

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

## RIPARIAN AREAS

Riparian areas make up a very small portion of the habitat in the ecosystem. However, riparian and riverine wetland habitats are very important to fish and wildlife resources including migratory birds, threatened and endangered species, native fish, rare and declining fisheries, amphibians, and many mammals.

Many vertebrates, including species of nongame wildlife and Neotropical migrants, are dependent on riparian and adjacent aquatic zones for reproduction or foraging. Riparian habitats provide for much of the biodiversity in the ecosystem. Many of the species currently occurring in the ecosystem would be eliminated without healthy riparian habitats.

Riparian habitats are important even to the species that mainly occur in the adjacent upland areas. Many rare and declining Neotropical grassland species need to nest within a short distance from water and will use riparian areas during juvenile dispersal and as critical sites of migratory stopovers.

Many additional wildlife species use these zones as migratory corridors. Riparian habitats are important for stabilizing river banks, reducing sedimentation, and providing woody debris and organic material for invertebrates, thus enhancing fishery habitat.

Many resident wildlife species also use riparian areas for winter survival. These species leave the upland areas, using the riparian areas for food and cover during the winter.

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

The following vision, goals, and objectives are shown as described in the ecosystem plan.

**VISION:** Healthy riparian and flood plain ecosystems that provide an abundance and diversity of indigenous flora and fauna.

**Goal 1:** Reduce the conversion of riparian habitats and maintain, restore, or enhance riparian habitats, quality and functions on priority rivers and tributaries.

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

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

**Objective C:** Support and assist in locating and control of invasive species in the ecosystem by 2006 to maintain or improve the quality of the riparian habitat and protect national wildlife refuges and other important habitats.

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

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

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

**Objective B:** Develop and implement strategies for conserving and recovering threatened and endangered species and species of concern along riparian habitat in the ecosystem by 2004 and preclude the need to list any further species.

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

**Objective A:** Use existing oversight, coordination, and technical assistance by 2006 to promote sound management on critical watersheds in the ecosystem.

**Objective B:** Use existing programs and opportunities in the ecosystem by 2006 to conserve, enhance, or restore grasslands and wetlands to provide quality water runoff.

## PRAIRIE GRASSLANDS

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

The tall-grass prairie once spanned millions of acres along the eastern border of North and South Dakota. The focus area is characterized by the dominant vegetation of the tall-grass prairie, including big bluestem, switchgrass, Indiangrass, and prairie dropseed. In North Dakota, this is found mainly in the Agassiz Lake plain, but transitionally can be found along the state's eastern border in a strip 2–3 counties wide. Similarly, in South Dakota, the zone follows the eastern border at a similar width, broadening to the Missouri River at the southern end of the state and extending into northeastern Nebraska. Vast acreage of the habitat has been converted to agriculture. The remaining

prairie sites are found in small, fragmented parcels scattered throughout and are crucial to maintaining and restoring the ecosystem. These sites are threatened by conversion to cropland, invasion of exotics, invasive plants, woody plants, pesticides, and heavy grazing pressure.

The remaining prairie sites support a wide assemblage of plant and animal species including many federal and state rare species. Sites in North Dakota have the largest population of the western prairie fringed orchid, a federally listed threatened plant found in lowland swales within the tall-grass community. The regal fritillary and Dakota skipper are butterflies that are federally classified as candidates for endangered or threatened status. The powesheik skipper is a butterfly of high concern.

Eighteen state-classified rare plants occur in the tall-grass prairie of North Dakota. This prairie also provides primary and secondary breeding habitat for declining Neotropical migrants such as upland sandpiper, bobolink, common yellowthroat, grasshopper sparrow, and clay-colored sparrow. Candidate bird species include Baird's sparrow and loggerhead shrike.

Long-term survival of these small, isolated prairies depends on establishing prairie networks and connecting these prairies and nearby habitats to ward off extinctions and integrating prairies with

their surroundings to reduce harm from improper management on surrounding lands. The following vision, goals, and objectives are shown as described in the ecosystem plan.

**VISION:** Protect, restore, and maintain ecosystem native prairie and other grasslands to ensure its diversity and abundance of indigenous flora and fauna.

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

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

**Objective B:** Protect native prairie by U.S. Fish and Wildlife Service (FWS) easement on a minimum of 100,000 acres per year for the next 10 years.

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

**Objective D:** Develop partnerships to protect 1,000,000 acres of native prairie by 2010.

**Objective E:** Develop partnerships to reduce the extent and curtail the impact of invasive species in native prairie by 2010.

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

**Objective G:** Identify contaminant issues affecting native prairie and the adverse impact each may be on native prairie and associated wildlife species.

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

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

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

**Objective B:** By the year 2003, develop informational materials on the importance of proper grazing management of native prairie.

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

**Objective D:** Strive to treat a minimum of 20 percent of FWS-administered grasslands annually using prescribed fire, prescribed grazing, invasive species control, or other recognized management practice.

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

**Objective A:** Identify grassland species that are in decline by the year 2006.

**Objective B:** Develop information programs on why grassland species in decline are important, approaches to be taken to reverse decline, and the public's role in prairie conservation.

**Objective C:** Develop statewide partnerships to get people involved in species management.

**Objective D:** Develop criteria and identify the most biologically significant grasslands by 2003.

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

**Objective F:** Develop management strategies to enhance species of concern on priority grasslands.

# Appendix F—List of Preparers, Consultation, and Coordination

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

<i>Team Member</i>	<i>Position</i>	<i>Work Unit</i>
Sean Fields	Biologist, geographic information system (GIS) specialist	U.S. Fish and Wildlife Service (USFWS), Region 6, Lakewood, CO
Bridgette Flanders-Wanner	Wildlife biologist	Sand Lake National Wildlife Refuge, Columbia, SD
John Jave	Refuge manager	Sand Lake National Wildlife Refuge, Columbia, SD
Linda Kelly	Chief of comprehensive conservation planning branch, planning team leader	USFWS, Region 6, Lakewood, CO
John Koerner	<i>Former</i> project leader	Sand Lake National Wildlife Refuge, Columbia, SD
Rachel Laubhan	Wildlife biologist	USFWS, Region 6
Rhoda Lewis	<i>Former</i> regional archaeologist	USFWS, Region 6, Lakewood, CO
Kathleen Linder	Fish and wildlife biologist, <i>former</i> planning team leader	USFWS, Region 6, Lakewood, CO
Adam Misztal	Fish and wildlife biologist, <i>former</i> planning team leader	USFWS, Region 6, Lakewood, CO
Deb Parker	Writer-editor	USFWS, Region 6, Lakewood, CO
William Schultze	Wildlife biologist	Sand Lake National Wildlife Refuge, Columbia, SD
Cindy Souders	Outdoor recreation planner	USFWS, Region 6, Lakewood, CO
Beth Ullenberg	Outdoor recreation planner	Sand Lake National Wildlife Refuge, Columbia, SD
Gene Williams	Project leader	Sand Lake National Wildlife Refuge, Columbia, SD
Cheryl Williss	Chief of division of water resources	USFWS, Region 6, Lakewood, CO

Valuable support to the planning team was provided by the individuals listed on the next page.

<i>Name</i>	<i>Position</i>	<i>Work Unit</i>
Ned (Chip) H. Euliss, Jr.	Research wildlife biologist	U.S. Geological Survey (USGS) Northern Prairie Wildlife Research Center, Jamestown, ND
Doug Johnson	Supervisory statistician	USGS Northern Prairie Wildlife Research Center, Jamestown, ND
Marcia Haaland	Administrative officer	USGS Northern Prairie Wildlife Research Center, Jamestown, ND
Lynne Koontz	Economist	USGS, science center, Fort Collins, CO
Murray Laubhan	Special assistant to the director	USGS Northern Prairie Wildlife Research Center, Jamestown, ND
Jay Lincoln	Engineer	U.S. Army Corps of Engineers, Jamestown and Pipestem project, Jamestown, ND
Will Morlock	Regional wildlife manager	South Dakota Department of Game, Fish and Parks (SDGFP), Watertown, SD
Dave Mushet	Wildlife biologist	USGS Northern Prairie Wildlife Research Center, Jamestown, ND
Tim Temeyer	Chief of water quality and water control section	U.S. Army Corps of Engineers, hydrology branch, NE
Spencer Vaa	State waterfowl biologist	SDGFP, Brookings, SD

Additionally, the following staffs of region 6 of the Service were of enormous help through their review and input on the drafts of this document:

- Bob Barrett, deputy refuge supervisor, ND, SD
- Rick Coleman, assistant regional director
- Shane Delgrosso, fire management officer
- John Esperance, chief of land protection planning branch
- Sheri Fetherman, chief of education and visitor services
- Bernardo Garza, refuge planner
- Galen Green, fire ecologist
- Toni Griffin, refuge planner
- Laura King, refuge planner
- Wayne King, biologist
- Rod Krey, refuge supervisor, ND, SD
- Ralph D. Morgenweck, regional director
- Michael Spratt, chief of division of refuge planning
- Harvey Wittmier, chief of division of realty

# Appendix G—Public Involvement

Public scoping was initiated for the Sand Lake National Wildlife Refuge in a Notice of Intent (NOI) dated August 1, 2001, announcing the availability of an issue workbook and dates for open houses to be held for public input on refuge management and the development of a CCP for the refuge.

An issues booklet was made available to the public, beginning in August 2001, through mailings to interested parties and public meetings.

The first public involvement meeting was scheduled for Hecla, South Dakota on September 11, 2001, with two more to follow that week. The refuge had sent out news releases and flyers during the last two weeks of August advertising the meetings and a “reminder” news release during the first week of September. Given the circumstances surrounding the events of September 11, 2001, the refuge sent out a news release canceling these meetings.

News releases and flyers were distributed the last week of September 2001 and first week of October 2001. A media contact list was compiled and invitations sent. The refuge had a link on their website for information and the issues workbook. Three scoping meetings were held in October 2001 to gather input from the public.

- October 9, 2001 in Hecla, SD
- October 10, 2001 in Columbia, SD
- October 11, 2001 in Aberdeen, SD

Sixty-two people attended these meetings and approximately 35 written comments were received during the open comment period. Comments received identified biological, social, and economic concerns regarding management.

Many of the public comments were general comments for all units of the refuge complex—Sand Lake National Wildlife Refuge, Sand Lake Wetland Management District, and associated waterfowl production areas). They are included here for the refuge as well.

## MAILING LIST

The following mailing list was developed for this CCP.

### Federal Officials

U.S. Representative Stephanie Herseth, Washington, DC; Scott Herreid, area director, Aberdeen, SD

U.S. Senator Tim Johnson, Washington, DC; Sharon Stroschein, Aberdeen, SD

U.S. Senator John Thune, Washington, DC; Judy Vrchota, area directory, Aberdeen, SD

### Federal Agencies

Bureau of Reclamation, Dakotas Area Office, Bismarck, ND

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

U.S. Department of Agriculture (USDA), Farm Service Agency, Brown County, SD

USDA, Natural Resources Conservation Service, Aberdeen and Burke, SD

U.S. Fish and Wildlife Service, ND—Arrowwood National Wildlife Refuge (NWR) Complex, Kulm Wetland Management District (WMD), Valley City WMD

U.S. Fish and Wildlife Service, SD—Brookings Wildlife Habitat Office, Ecological Services, Huron WMD, Lacreek NWR, Lake Andes NWR Complex, Madison WMD, Waubay NWR

U.S. Geological Survey, Huron, SD

U.S. National Ramsar Committee, Arlington, VA

### South Dakota State Officials

Representative Paul Dennert, Columbia

Representative Burt Elliott, Aberdeen

Representative Larry Frost, Aberdeen

Representative Jim Hundstad, Bath

Representative Al Novstrup, Aberdeen

Governor Mike Rounds, Pierre

Senator Duane Sutton, Aberdeen

### South Dakota State Agencies

Department of Agriculture, Pierre

Department of Emergency Management, Pierre

Department of Environment and Natural Resources, Pierre

Department of Game, Fish and Parks; Aberdeen, Brookings, Pierre, and Watertown

Division of Forestry, Aberdeen

Division of Water Rights, Pierre

Farm Bureau Federation, Huron

State Conservationist, Huron

State Historic Preservation Officer, Pierre

**Local Agencies and Officials**

Aberdeen Parks, Recreation and Forestry  
 Aberdeen School District  
 Beadle County Commission, Huron  
 Britton School District  
 Brown County Auditor  
 Brown County Commission, Aberdeen  
 Brown County Emergency Manager, Aberdeen  
 Brown County Extension Service, Aberdeen  
 Brown County Highway Department, Aberdeen  
 Brown County Sheriff, Aberdeen  
 Brown/Day Conservation District, Webster  
 Brown/Marshall Conservation District, Hecla  
 Columbia Fire Department  
 Conde Public School  
 Davison County Commission, Mitchell  
 Elm Valley School District, Barnard  
 Groton School District  
 Hanson County Commission, Alexandria  
 Hecla Volunteer Firefighters  
 Hecla-Houghton School District, Hecla  
 Hutchinson County Commission, Olivet  
 James River Water Development District, Huron  
 Lower Crow Creek Watershed District, Claremont  
 Mayor, Aberdeen  
 Mayor, Claremont  
 Mayor, Columbia  
 Mayor, Frederick  
 Mayor, Groton  
 Mayor, Hecla  
 Mayor, Westport  
 Northeast Council of Governments, Aberdeen  
 Redfield School District  
 Richmond Lake/Mina Recreation Area, Aberdeen  
 Roncalli School District, Aberdeen  
 Sanborn County Commission, Woonsocket  
 Spink County Commission, Redfield  
 Yankton County Commission

**State Colleges and Universities**

Northern State University, Aberdeen  
 Presentation College, Aberdeen

South Dakota Fish and Wildlife Cooperative  
 Research Unit, Brookings  
 South Dakota State University, Brookings

**North Dakota Agencies and Officials**

Dickey-Sargent Irrigation District, Oakes  
 Garrison Diversion Conservancy District, Oakes  
 Mayor, Ellendale  
 Mayor, Oakes

**Media**

Krause Publications, Iola, WI

**Organizations, Business, and Civic Groups**

Aberdeen Bird Club, SD  
 American Bird Conservancy, Washington, DC  
 Aberdeen Chamber of Commerce, SD  
 Aberdeen Convention and Visitors Bureau, SD  
 American Fisheries Society–Dakota Chapter,  
 Brookings, SD  
 American Rivers, Lincoln, NE  
 Boy Scouts–Sioux Council, Sioux Falls, SD  
 Dacotah Prairie Museum, Aberdeen, SD  
 Defenders of Wildlife, Washington, DC  
 Ducks Unlimited; Aberdeen, SD and Memphis, TN  
 Farmers Union State Office, Huron, SD  
 Girl Scouts–Nyoda Council, Huron, SD  
 Glacial Lakes and Prairies Tourism, Watertown, SD  
 Izaak Walton League, Gaithersburg, MD  
 Manomet Center for Conservation Sciences,  
 Manomet, MA  
 National Audubon Society, NY  
 National Wildlife Federation, Reston, VA  
 National Wildlife Refuge Association, Washington, DC  
 Northeast South Dakota Walleye Club, Aberdeen, SD  
 Pheasants Forever, Aberdeen, SD  
 Rocky Mountain Elk Foundation, Warner, SD  
 Sierra Club, San Francisco, CA  
 South Dakota Bowhunters Association, Hot Springs, SD  
 South Dakota Ornithological Union, Sioux Falls, SD  
 South Dakota Resources Coalition, Brookings, SD  
 South Dakota Wildlife Federation, Pierre, SD  
 Sportsmen’s Club of Brown County, Aberdeen, SD  
 The Nature Conservancy–Northern Tall-Grass  
 Prairie Ecoregion, Clear Lake, SD

The Nature Conservancy—Samuel H. Ordway  
Prairie, Leola, SD

The Nature Conservancy—South Dakota Chapter,  
Sioux Falls

The Wildlife Society—South Dakota Chapter,  
Brookings

Whitetail Bowmen, Aberdeen, SD

Whitetails Unlimited, Groton, SD

Wild Turkey Federation, Aberdeen, SD

Wildlife Management Institute, Washington, DC

**Individuals**

128 persons



# Appendix H—Economic Analysis

## **Regional Economic Effects of Current and Proposed Management Alternatives for Sand Lake National Wildlife Refuge**

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

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

### **Introduction**

The National Wildlife Refuge System Improvement Act of 1997 requires all units of the National Wildlife Refuge System to be managed under a Comprehensive Conservation Plan (CCP). The CCP must describe the desired future conditions of a Refuge and provide long range guidance and management direction to achieve Refuge purposes. Sand Lake National Wildlife Refuge (NWR), located 27 miles northeast of Aberdeen, South Dakota, is in the process of developing a range of management goals, objectives, and strategies for the CCP. The CCP for Sand Lake NWR must contain an analysis of expected effects associated with current and proposed Refuge management strategies.

Special interest groups and local residents often criticize a change in Refuge management, especially if there is a perceived negative impact to the local economy. Having objective data on income and employment impacts may show that these economic fears are drastically overstated. Quite often, residents do not realize the extent of economic benefits a Refuge provides to a local community; yet at the same time overestimate the impact of negative changes. Spending associated with Refuge recreational activities such as wildlife viewing and hunting can generate considerable tourism activity for the regional economy. Refuge personnel typically spend considerable amounts of money purchasing supplies in the local lumber and hardware stores, repairing equipment and purchasing fuel at the local service stations, as well as reside and spend their salaries in the community.

The purpose of this study was to provide the economic analysis needed for the Sand Lake NWR CCP by evaluating the regional economic impacts associated with the Sand Lake NWR Draft CCP management strategies. For Refuge CCP planning, an economic impact analysis describes how current (No Action Alternative) and proposed management activities (alternatives) affect the local economy. This type of analysis provides two critical pieces of information: 1) it illustrates a refuge's contribution to the local community; and 2) it can help in determining whether local economic effects are or are not a real concern in choosing among management alternatives.

Sand Lake NWR is currently managed to improve and maintain habitat for nesting and resting waterfowl and other migratory birds, such as diving and puddle ducks, geese, grebes, herons, egrets, gulls, and terns. There are three alternatives evaluated in the draft CCP. Alternative 1, the No Action alternative, would continue Refuge management at current levels and would not involve extensive restoration of cropland, grassland, and wetland habitat or improvements to roads, interpretive, and administrative facilities. No new funding or staff levels would occur and programs would follow the same direction, emphasis, and intensity as they do at present. Alternative 2 would maximize the biological potential of

the refuge for species of grassland-nesting birds. This would be accomplished through intense management of upland habitat for nesting migratory birds, minimal management for resident species, and minimization of public use that may interfere with migratory bird production. The third alternative takes an integrated approach, with management practices that would serve to maximize the biological potential of Sand Lake for migratory birds.

This report first provides a description of the local community and economy near the Refuge. An analysis of current and proposed management strategies that could affect the local economy is then presented. The Refuge management activities of economic concern in this analysis are Refuge personnel staffing and Refuge spending within the local community, and spending in the local community by Refuge visitors.

### **Regional Economic Setting**

Sand Lake NWR is located in Brown County, northeast of Aberdeen, South Dakota. Brown County is part of the Glacial Lakes and Prairies Region of South Dakota and is sometimes called the heart of the Prairie-Pothole Region of North America. The County offers such attractions as the Dacotah Prairie Museum, Centennial Village, Pari-Mutual Horse Racing, Brown County Fair, and the Richmond Lake Youth Camp (Brown County, SD 2004). Brown County has a total area of 1,713 square miles (1,096,320 acres). Aberdeen, the third largest city in South Dakota, is the county seat and the center of commerce for the region.

Aberdeen was nicknamed the "Hub City" because it served as an important intersection for many busy railroad lines. Today's "Hub City" has grown into a diverse, regional trade center with service and manufacturing industries, attractive retail shopping opportunities, convention facilities, a private college, a state university and two large medical centers (Aberdeen Area Chamber of Commerce 2004). For the purposes of an economic impact analysis, a region (and its economy) is typically defined as all counties within a 30-60 mile radius of the impact area. Only spending that takes place within this local area is included as stimulating the changes in economic activity. The size of the region influences both the amount of spending captured and the multiplier effects. Based on the relative self-containment in terms of retail trade and distance to other communities, Brown County was assumed to comprise the economic region for this analysis.

### **Population, Employment, and Income**

The 2000 Census estimated Brown County's population at 35,460 persons (US Census Bureau). Approximately 70% of the County's residents reside in Aberdeen (Discover Aberdeen, SD 2004). While the state of South Dakota experienced a 7.8% population increase from 1990 to 2000, Brown County's population decreased 0.4% over the same time frame (U.S. Census Bureau). In 2000, Brown County averaged 21 persons per square mile, the state average was 10 persons per square mile.

The 2000 Census reported 0.7% of the county population consisting of persons of Hispanic or Latino origin, 95.1% of white persons not of Hispanic/Latino origin, 0.3% of Black or African American persons, 2.7% of American Indian and Alaska Native Persons, and 0.4% of Asian persons. Approximately, 86% of the county population 25 years and older were high school graduates, and 24% were college graduates (US Census Bureau). There are two colleges in Aberdeen, Northern State University and Presentation College.

According to the Discover Aberdeen website, the major employers in Aberdeen are hospital/health service, education, manufacturing, hotel reservations, agriculture, higher education, call center, and support services. South Dakota's major exports include computers & electronic production, machinery manufactures, processed foods, and crop production (U.S. Department of Commerce 2002). Local and state employment is shown in Table 1. In 2000, 83.5% of County jobs were in private wage and salary employment (people who work for someone else) as compared to 79.2% for the State of South Dakota.

Table 1. Industry Breakdown of Full Time and Part Time Employment for 2000.

Industry	Brown County		State of South Dakota	
	# Jobs	% of County Total	# Jobs	% of State Total
Total farm	1,205	4.5%	37,659	7.2%
Total nonfarm	25,650	95.5%	483,677	92.8%
<b>Private</b>	22,431	83.5%	412,957	79.2%
Ag. Services, forestry, & fishing	282	1.1%	7,705	1.5%
Mining	(L)	---	1,552	0.3%
Construction	1,416	5.3%	27,956	5.4%
Manufacturing	2,483	9.2%	52,030	10.0%
Transport/utilities	939	3.5%	22,727	4.4%
Wholesale trade	1,393	5.2%	21,652	4.2%
Retail trade	5,148	19.2%	89,412	17.2%
Insurance/real estate	1,897	7.1%	42,523	8.2%
Services	8,868	33.0%	147,400	28.3%
Government	3,219	12.0%	70,720	13.6%
<b>Total full-time and part time employment</b>	<b>26,855</b>		<b>521,336</b>	

Source: U.S. Dept. of commerce, Bureau of Economic Analysis, Regional Economic Information System, 2002. \*(L) less than 10 jobs, but the estimates for this item are included in the totals.

Hunting, fishing, camping, boating, cross-country skiing, bird watching, biking, and snowmobiling are important tourism activities in Brown County. Most jobs pertaining to the recreation and tourism industry are found in the retail trade (spending on supplies, souvenirs, restaurants, and grocery stores) and service (spending on hotels, gas stations, amusement, and recreation activities) sectors in an economy. As shown in Table 1, service and retail trade industries account for 33% and 19% of total County employment respectively.

As shown in Table 2, County per capita personal income was \$28,421 in 2000, which was \$2,606 higher than the state average (U.S. Dept. of Commerce 2002). Total personal income was just over 1.0 billion for Brown County in 2000 (Table 2). In 2000, non farm personal income for Brown County totaled almost \$960 million which accounted for 5.2% of total statewide non farm personal income, while Brown County farm related income accounted for 4.5% of total statewide farm income.

Table 2. Personal Income for Brown County and South Dakota, 2000.

	Brown County	State of South Dakota
Personal Income	\$1,005,276,000	\$19,510,589,000
Nonfarm personal income	\$958,962,000	\$18,475,437,000
Farm Income	\$46,314,000	\$1,035,152,000
Per capita personal income	\$28,421	\$25,815

Source: U.S. Dept. of Commerce, Bureau of Economic Analysis, Regional Economic Information System, 2002.

## Economic Impacts of Current and Proposed Management Activities

Economic impacts are typically measured in terms of number of jobs lost or gained, and the associated result on income. Economic input-output models are commonly used to determine how economic sectors will and will not be affected by demographic, economic, and policy changes. The economic impacts of the management alternatives for Sand Lake NWR were estimated using IMPLAN, a regional input-output modeling system developed by the USDA Forest Service (Minnesota IMPLAN Group 2002).

IMPLAN is a computerized database and modeling system that provides a regional input-output analysis of economic activity in terms of 10 industrial groups involving as many as 528 sectors (Olson and Lindall, 1996). The year 2000 Brown County IMPLAN data profile was used in this study. IMPLAN estimates for employment include both full time and part time workers which are measured in total jobs. The IMPLAN county level employment data estimates were comparable to the US Department of Commerce, Bureau of Economic Analysis, Regional Economic Information System data at the 1 digit Standard Industrial Code level for the year 2000.

### Refuge Staffing and Budgeting

For the current conditions, (Alternative 1) staffing at the Refuge consists of thirteen permanent and four temporary/seasonal employees. The current staff accounted for an annual payroll (including salaries and benefits) of \$910,600 in 2003. In addition to providing salaries and benefits, the Refuge purchased goods and services totaling \$165,200 in 2003, approximately 65% of which was spent locally in the Brown County economy.

For Alternative 2, the anticipated staffing and non salary expenditures are the same as current conditions. Under Alternative 3 staffing needs are expected to increase by six permanent employees and one permanent half time employee. Including salaries and benefits, annual funding needed for the proposed personnel/staffing for Alternative 3 is anticipated to cost \$1,171,250 (which is \$260,650 more than Alternative 1). Annual non salary expenditures for Alternative 3 are anticipated to cost \$398,600 annually (which is \$233,400 more than Alternative 1). For each alternative, it is assumed that approximately 65% of non salary expenditures will still be spent locally in the Brown County economy. Table 3 summarizes the anticipated annual expenditures by management alternative.

Table 3. Refuge Staffing and Budgeting Expenditures by Management Alternative

	Annual Expenditures by Alternative		
	Alt 1	Alt 2	Alt 3
<b>Salary</b>	\$910,600	\$910,600	\$1,171,250
<b>Non-salary</b>	\$165,200	\$165,200	\$398,600
<b>Total</b>	\$1,075,800	\$1,075,800	\$1,569,850

Because of the way industries interact in an economy, a change in the activity of one industry affects activity levels in several other industries. For example, an increase in funding could allow the Refuge to start new projects or hire additional staff members. This added revenue will directly flow to the businesses from which the Refuge purchases goods and services and to the new Refuge employees. As additional supplies are purchased or as new staff members spend their salaries within the community, local businesses will purchase extra labor and supplies to meet the increase in demand for additional services. The income and employment resulting from Refuge purchases and Refuge employees' spending of salaries locally represents the *direct* effects of Refuge management activities within Brown County. In order to increase supplies to local businesses, input suppliers must also increase their purchases of inputs from other industries. The income and employment resulting from these secondary purchases by input suppliers are the *indirect* effects of Refuge management activities within the county (Stynes 1998). The input supplier's new employees use their incomes to purchase goods and services. The resulting increased economic activity from new employee income is the *induced* effect of visitor spending. The sums of the direct, indirect and induced effects describe the total economic effect of Refuge management activities in Brown County.

Table 4 shows the economic impacts associated with current and proposed management staffing. IMPLAN estimates for employment include both full time and part time workers which are measured in total jobs. The current level (Alternative 1) of Refuge personnel directly accounts for 14.6 jobs and almost \$584,000 in personal income. The associated indirect and induced effects generate an additional 7.6 jobs and \$174,000 in personal income throughout the Brown County economy for a total economic impact of 22.2 jobs and almost \$758,000 associated with the current level of Refuge personnel. For Alternative 2, the staffing levels and economic impacts are the same as for Alternative 1. Due to the increased staffing levels for Alternative 3 (Table 3), the associated economic effects generate more jobs and income than Alternative 1 and 2.

Table 5 shows the economic impacts associated with current and proposed management non salary spending in Brown County. For each alternative, it is assumed that 65% of the non salary expenditures reported in Table 3 are spent locally in the Brown County economy. The current level (Alternative 1) of Refuge non salary expenditures directly accounts for 4.1 jobs and almost \$51,000 in personal income. The associated indirect and induced effects generate an additional 1.3 jobs and almost \$32,000 in personal income throughout the Brown County economy for a total economic impact of 5.4 jobs and almost \$83,000 in personal income associated with the current level of Refuge non salary spending in the local economy. For Alternative 2, the non salary spending levels and economic impacts are the same as for Alternative 1. Due to the increased non salary spending levels for Alternative 3 (Table 3), the associated economic effects generate more jobs and income than Alternative 1 and 2.

Table 4. Local Economic Impacts of Refuge Staffing Expenditures

<b>Brown County</b>	Alternative 1	Alternative 2	Alternative 3
<b>Salary Impacts</b> <i>(excludes benefits)</i>			
Direct Effects ( <i>Federal Government Sector</i> )			
Income (\$/year)	\$583,596	\$583,596	\$770,398
Jobs	14.6	14.6	19.3
Indirect and Induced Effects ( <i>in Brown County Economy</i> )			
Income (\$/year)	\$174,181	\$174,181	\$229,935
Jobs	7.6	7.6	10.0
<b>Total Effects</b>			
<b>Income (\$/year)</b>	<b>\$757,777</b>	<b>\$757,777</b>	<b>\$1,000,333</b>
<b>Jobs</b>	<b>22.2</b>	<b>22.2</b>	<b>29.2</b>

Table 5. Economic Impacts of Refuge Non Salary Expenditures in Brown County

<b>Brown County</b>	Alternative 1	Alternative 2	Alternative 3
<b>Non Salary Impacts</b> <i>(65% of total non salary expenditures spent locally)</i>			
Direct Effects			
Income (\$/year)	\$50,882	\$50,882	\$122,771
Jobs	4.1	4.1	9.8
Indirect and Induced Effects ( <i>in Brown County Economy</i> )			
Income (\$/year)	\$31,738	\$31,738	\$76,577
Jobs	1.3	1.3	3.1
<b>Total Effects</b>			
<b>Income (\$/year)</b>	<b>\$82,620</b>	<b>\$82,620</b>	<b>\$199,348</b>
<b>Jobs</b>	<b>5.4</b>	<b>5.4</b>	<b>12.9</b>

Table 6 presents the combined economic impacts associated with refuge staffing and non salary spending in Brown County. Refuge management activities currently generate 27.6 jobs and over \$840,000 in personal income in Brown County. This accounts for less than one-tenth of one percent (0.1%) of total employment in Brown County. Refuge management activities associated with Alternative 2 would generate the same as Alternative 1. The higher staffing and spending levels associated with Alternative 3 would generate more jobs and income than Alternative 1.

Table 6. Combined Refuge Staffing and Non Salary Expenditures in Brown County

<b>Brown County</b>	Alternative 1	Alternative 2	Alternative 3
<b>Total Refuge Staffing and Budgeting Impacts</b> <i>(salary and non-salary)</i>			
Direct Effects			
Income (\$/year)	\$634,478	\$634,478	\$893,169
Jobs	18.7	18.7	29.1
Indirect and Induced Effects <i>(in Brown County Economy)</i>			
Income (\$/year)	\$205,919	\$205,919	\$306,512
Jobs	8.9	8.9	13.1
<b>Total Effects</b>			
<b>Income (\$/year)</b>	<b>\$840,397</b>	<b>\$840,397</b>	<b>\$1,199,681</b>
<b>Jobs</b>	<b>27.6</b>	<b>27.6</b>	<b>41.2</b>
<i>% of Total County</i>			
<i>Income</i>	<i>0.08%</i>	<i>0.08%</i>	<i>0.12%</i>
<i>% of Total County</i>			
<i>Jobs</i>	<i>0.10%</i>	<i>0.10%</i>	<i>0.15%</i>

### Recreation Activities

The Refuge offers a wide variety of year round accessible recreational opportunities that are wildlife compatible. Wildlife observation, bird watching, education, photography, hunting and fishing are all popular activities. The Refuge is a nationally recognized wildlife sanctuary and offers opportunities for the big game hunter, upland game hunters, and waterfowl hunters. Pheasant hunting draws outdoorsmen from across the country each fall, and duck and goose hunters set decoys on the many small lakes and marshes that dot the prairie pothole country. Fishing is allowed year round at five locations on the Refuge.

Major visitor expenditure categories include lodging, food, and supplies. To determine the local economic impacts of visitor spending, only spending by persons living outside the local area (Brown County) are included in the analysis. The rationale for excluding local visitor spending is two fold. First, money flowing into Brown County from visitors living outside is considered new money injected into the Brown County economy. Second, if Brown County residents visit Sand Lake NWR more or less due to the management changes, they will correspondingly change their spending of their money elsewhere in Brown County, resulting in no net change to the local economy. These are standard assumptions made in most regional economic analyses at the local level.

In order to accurately estimate the amount of spending associated with Refuge visitation, visitors must be divided by type of activity and place of residence (local County residents, non local South Dakota residents, and nonresidents). Sand Lake NWR annual visitation was estimated based on the 2003 Refuge annual visitation estimates. The Refuge bases visitation estimates on visitors entering the Visitor Center/Office and general observation. Estimates on the percentage of visitors by place of residence were provided by Refuge personnel. Table 7 summarizes estimated Refuge visitation by type of visitor activity and percentage of visitors by place of residence.

Table 7. Estimated Annual Refuge Visitation by Visitor Activity and Place of Residence.

	Total # of Visitors	Percentage of Local Brown County Visitors	Percentage of Non Local South Dakota Visitors	Percentage of Nonresident Visitors (live outside of South Dakota)
Total Estimated Visitors	43,281			
Non-Consumptive Users				
Interpretation/ Observation	32,140	50%	25%	25%
Environmental Education	3,862	80%	10%	10%
Hunting				
Migratory Bird	3,200	40%	30%	15%
Upland Game	3,600	50%	45%	20%
Big Game	4,100	60%	30%	10%
Fishing	2,900	90%	9%	1%

A key step in estimating total visitor spending is the development of visitor spending profiles. Average daily travel related expenditure profiles for various recreation activities derived from the 1996 National Survey of Hunting, Fishing and Wildlife Related Recreation (U.S. Dept. of Interior 1996) by the U.S. Forest Service (Niccolucci and Winter 2002) were used in this analysis. For each type of visitor activity, the Survey reports trip related spending of state residents and non residents for several different recreational activities. State resident and nonresident spending profiles for big game hunting, small game hunting, migratory bird hunting, and fresh water fishing were used for the Sand Lake NWR hunting and fishing related visitor activities. The state resident and nonresident spending profiles for non-consumptive wildlife recreation (observing, feeding, or photographing fish and wildlife) were used for interpretation/observation and environmental education visitors at Sand Lake NWR. For each visitor activity, spending is reported in the categories of lodging, food & drink, transportation, and other expenses. Total spending per day for state residents and nonresidents by visitor activity is reported in Table 8.

Table 8. Time Spent on the Refuge and Spending per Day for Each Visitor Activity.

	Average State Resident Spending per Day	Average Nonresident Spending per Day
Interpretation/Observation and Environmental Education	\$7	\$104
Waterfowl Hunting	\$17	\$23
Upland Game Hunting	\$18	\$208
Big Game Hunting	\$20	\$31
Fishing	\$25	\$44

Source: Niccolucci and Winter 2002

Visitor spending is typically estimated on an average per day (eight hours) or average per trip basis. In order to properly account for the amount of spending associated with each type of refuge visitor, it is important to determine the average length of trip. Refuge personnel estimate that visitors participating in interpretation/observation and environmental education activities typically spend 4 hours on the Refuge, visitors participating in fishing activities spend 3 hours, waterfowl hunters usually spend a half day (4 hours), upland game hunters spend 6 hours, and big game hunters spend a day (8 hours) on the Refuge. Because the visitor spending profiles are for an 8 hour visitor day, the number of 8 hour state resident and nonresident visitor days for each visitor activity must be calculated. The current number of visitor days per activity is shown in Table 9.

Table 9. Annual Number of Non Local Visitor Days per Activity for Alternative 1.

	Number of Non Local South Dakota Visitors	Number of Non-resident Visitors	Estimated time spent at Sand Lake NWR	Number of Non Local South Dakota Resident Visitor Days (1 day = 8 hours)	Number of Non-resident Visitor Days (1 day = 8 hours)
Interpretation/Observation	8,035	8,035	4 hours	4,018	4,018
Environmental Education	386	386	4 hours	193	193
Waterfowl Hunting	960	480	4 hours	480	240
Upland Game Hunting	1,620	720	6 hours	1,215	540
Big Game Hunting	1,230	410	8 hours	1,230	410
Fishing	261	29	3 hours	98	11
<b>Total</b>				<b>7,233</b>	<b>5,411</b>

Total visitor spending is determined by multiplying the total spending per day (Table 8) by the number of non local visitor days for each visitor activity (Table 9). Current Refuge visitors spend about \$655,500 annually in the Brown County economy. Table 10 shows the economic impacts associated with current visitation and anticipated changes in visitation by management alternative. The current level (Alternative 1) of visitor spending directly generates over \$152,000 in personal income and 9.4 jobs for local businesses accommodating visitors (hotels, restaurants, supply stores, and gas stations).

The associated indirect and induced effects generate an additional 4.3 jobs and over \$102,000 in personal income throughout the Brown County economy for a total economic impact of 13.7 jobs and over \$254,000 in personal income associated with the current level of Refuge visitation. For Alternative 2, Refuge personnel estimate visitation declining by 30% as compared to Alternative 1. For Alternative 3, visitation is anticipated to increase by 25% as compared to Alternative 1. The resulting economic impacts associated with Refuge visitation for Alternatives 2 and 3 are presented in Table 10.

As shown in Table 10, the economic impacts associated with current Refuge visitation are limited in terms of contributing to the overall county income and employment. Any decrease in visitation associated with a change in Refuge management will not have a significant economic effect. An increase in the amount of time current visitors spend on the Refuge will increase the amount of daily

spending that can be attributed to visiting the Refuge. An increase in both the length of stay on the Refuge (and in the local economy) and the number of people visiting the Refuge could have a considerable impact on increasing the role Refuge visitors play in the local economy.

Table 10. Economic Impacts of Sand Lake NWR Visitor Spending by Alternative.

<b>Brown County</b>	Alternative 1	Alternative 2	Alternative 3
<b>Visitor Spending Impacts</b>			
<b>Direct Effects</b>			
Income (\$/year)	\$152,076	\$106,453	\$190,095
Jobs	9.4	6.6	11.8
<b>Indirect and Induced Effects (<i>in Brown County Economy</i>)</b>			
Income (\$/year)	\$102,263	\$71,584	\$127,829
Jobs	4.3	3.0	5.4
<b>Total Effects</b>			
<b>Income (\$/year)</b>	<b>\$254,339</b>	<b>\$178,037</b>	<b>\$317,924</b>
<b>Jobs</b>	<b>13.7</b>	<b>9.6</b>	<b>17.1</b>
<i>% of Total County</i>			
<i>Income</i>	<i>0.03%</i>	<i>0.02%</i>	<i>0.03%</i>
<i>% of Total County</i>			
<i>Jobs</i>	<i>0.05%</i>	<i>0.04%</i>	<i>0.06%</i>

## Summary and Conclusions

Table 11 summarizes the direct and total economic impacts for all Refuge management activities for each management alternative. Under current Refuge management (Alternative 1), economic activity directly related to all Refuge operations would generate an estimated 28.1 jobs and over \$786,500 in personal income in Brown County. Including direct, indirect, and induced effects, all Refuge activities would account for 41.3 jobs and \$1.09 million in personal income in Brown County (Table 11). Current Refuge management activities account for 0.15% of total County employment and 0.11% of County income.

Table 12 summarizes the economic effects associated with management changes from Alternative 1. Alternative 2 will slightly decrease employment by 4.1 jobs and personal income by \$76,000 in Brown County because of anticipated decreases in Refuge visitation. Alternative 3 will increase employment by 17 jobs and personal income by over \$422,000 in Brown County because of proposed increases in staffing, non salary expenditures and Refuge visitation.

Table 11. Summary of all Refuge Management Activities by Alternative.

<b>Brown County</b>	Alternative 1	Alternative 2	Alternative 3
<b>Total Refuge Staffing and Budgeting Impacts</b>			
<b>Direct Effects</b>			
Income (\$/year)	\$634,478	\$634,478	\$893,169
Jobs	18.7	18.7	29.1
<b>Total Effects</b>			
Income (\$/year)	\$840,397	\$840,397	\$1,199,681
Jobs	27.6	27.6	41.2
<b>Recreation Activities</b>			
<b>Direct Effects</b>			
Income (\$/year)	\$152,076	\$106,453	\$190,095
Jobs	9.4	6.6	11.8
<b>Total Effects</b>			
Income (\$/year)	\$254,339	\$178,037	\$317,924
Jobs	13.7	9.6	17.1
<b>Aggregate Impacts</b>			
<b>Direct Effects</b>			
Income (\$/year)	\$786,554	\$740,931	\$1,083,264
Jobs	28.1	25.3	40.9
<b>Total Effects</b>			
Income (\$/year)	\$1,094,736	\$1,018,434	\$1,517,605
Jobs	41.3	37.2	58.3
<i>% of Total County Income</i>	<i>0.11%</i>	<i>0.10%</i>	<i>0.15%</i>
<i>% of Total County Employment</i>	<i>0.15%</i>	<i>0.14%</i>	<i>0.22%</i>

Table 12. Economic Effects Associated with Changing from Alternative 1.

<b>Brown County</b>	Alternative 2	Alternative 3
<b>Total Refuge Staffing and Budgeting Impacts</b>		
<b>Direct Effects</b>		
Income (\$/year)	\$0	+\$258,691
Jobs	0	+10.4
<b>Total Effects</b>		
Income (\$/year)	\$0	+\$359,284
Jobs	0	+13.6
<b>Recreation Activities</b>		
<b>Direct Effects</b>		
Income (\$/year)	-\$45,623	+\$38,019
Jobs	-2.8	+2.4
<b>Total Effects</b>		
Income (\$/year)	-\$76,302	+\$63,585
Jobs	-4.1	+3.4
<b>Aggregate Impacts</b>		
<b>Direct Effects</b>		
Income (\$/year)	-\$45,623	+\$296,710
Jobs	-2.8	+12.8
<b>Total Effects</b>		
Income (\$/year)	-\$76,302	+\$422,869
Jobs	-4.1	+17.0

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# Appendix I—Refuge Operations Needs System Projects

<i>RONS<sup>1</sup></i> <i>Number</i>	<i>Project Description</i>	<i>First-Year Need (\$1,000)</i>	<i>Recurring Annual Need (\$1,000)</i>	<i>Personnel FTE<sup>2</sup></i>
R-01003	Increase habitat management capability (refuge manager)	139.0	74	1.0
R-97015	Provide station administrative assistance (administrative clerk)	110.0	45	1.0
R-03001	Expand the station's law enforcement program (law enforcement officer)	136.0	71	1.0
R-97016	Expand the station's law enforcement program (law enforcement officer)	65.5	32	0.5
R-97011	Evaluate and monitor wildlife response to applied management using GIS technology (resource specialist)	139.0	74	1.0
R-98001	Reestablish area and capacity data for Sand Lake National Wildlife Refuge	249.0	0	—
R-00004	Design and update all refuge brochures into the Service's graphic standards format	32.0	4	—

<sup>1</sup>*RONS=refuge operations needs system*

<sup>2</sup>*FTE=full-time equivalent*



# Appendix J—Maintenance Management System Projects

<i>MMS<sup>1</sup></i> <i>Number</i>	<i>Description</i>	<i>Cost</i> <i>(\$1,000)</i>
<i>Deferred Maintenance</i>		
R-90034	Replace outdated educational and interpretive signs and aerial photos	26
R-92003	Replace garages	79
R-99003	Replace Mud Lake water control structure	419
R-00004	Replace station two-way radio system with narrow-band system	151
R-01043	Replace 1,000-gallon, aboveground, Convault storage tank	34
R-01044	Replace 2 bay, 1,000-gallon, aboveground, Convault storage tanks	34
<i>Large Construction</i>		
R-99002	Construct education center—Centennial Legacy Project (design and construction)	1,036
<i>Heavy Equipment</i>		
R-01013	Replace 1978 John Deere front-end loader	121
R-01019	Replace worn-out 1980 GMC equipment truck	66
R-01035	Replace 1980 auto car, 6x4 diesel tractor (semitruck)	91
R-01037	Replace 1995 Ford 6x4 truck tractor	81
R-01070	Replace 1980 IHC 684 farm tractor	35
R-01046	Replace 1978 John Deere 4440 agricultural tractor	66
R-01047	Replace 1979 IHC TD15 tracked crawler-tractor	152
R-01048	Replace 1992 John Deere 2555 agricultural tractor with front-end loader	40
R-01049	Replace 1996 John Deere 7400 agricultural tractor with loader	66
R-01068	Replace 1999 John Deere tracked excavator	152
R-02003	Replace grader	113
R-02005	Replace 2002 Ford dump truck	80
R-02006	Replace loader, backhoe	55
R-95008	Replace worn-out 1989 Chevrolet extended-cab pickup	28
R-00003	Replace Bobcat loader	48
R-93004	Replace worn-out lowboy trailer	58
R-00005	Replace worn-out 1993 pickup	29
R-01002	Replace worn-out 4-wheel ATV <sup>2</sup>	6
R-01003	Replace worn-out 4-wheel ATV	6
R-01006	Replace 1997 Honda 4-wheel ATV	6
R-01009	Replace 1979 John Deere disc	12
R-01010	Replace 1987 native grass drill	22
R-01011	Replace 1965 Clark forklift	15
R-01012	Replace 1985 disc harrow	17
R-01014	Replace worn-out 1999 Dodge Ram 4x4 pickup	30
R-01017	Replace worn-out 1997 John Deere 48-inch deck mower	9
R-01018	Replace worn-out 1989 Chevrolet diesel 4x4 pickup	32

<sup>1</sup>MMS=maintenance management system

<sup>2</sup>ATV=all-terrain vehicle

<i>MMS Number</i>	<i>Description</i>	<i>Cost (\$1,000)</i>
<i>Heavy Equipment</i>		
R-01020	Replace 1998 Chevrolet 4x4 pickup	30
R-01021	Replace 1999 Dodge ¾-ton, 4x4 pickup	30
R-01022	Replace 1999 Dodge ½-ton, 4x4 pickup	30
R-01023	Replace 1999 Chevrolet ¾-ton, 4x4 pickup	30
R-01025	Replace 1992 Dodge Dakotah 4x2 pickup	25
R-01026	Replace 1991 Chevrolet 4x4 dual pickup	30
R-01030	Replace 1993 Chevrolet 4x4 pickup	30
R-01032	Replace 1995 Ford 4x4 pickup	30
R-01034	Replace 1995 Ford 4x4 pickup	30
R-01038	Replace 1999 Chevrolet Suburban	32
R-01039	Replace 300-gallon Western fire pumper	15
R-01040	Replace 1988 300-gallon Wajax Pacific fire pumper	15
R-01041	Replace 1997 Arctic Cat snowmobile	5
R-01042	Replace 1991 300-gallon Wajax Pacific fire pumper	15
<i>Small Equipment</i>		
R-01050	Replace 1990 Trail Eze tilt-bed implement trailer	51
R-01052	Replace 1999 Honda 4-wheel ATV	6
R-01053	Replace 1999 Honda 4-wheel ATV	6
R-01054	Replace 1999 Honda 4-wheel ATV	6
R-01055	Replace 2000 Wildcat snow blower	9
R-01056	Replace 1999 Blumhardt weed sprayer	6
R-01057	Replace 2000 forward hydraulic hoist	10
R-01058	Replace 2000 Honda 4-wheel AT V2	6
R-01059	Replace 2000 Honda 4-wheel ATV	6
R-01060	Replace 2000 Blumhardt weed sprayer	6
R-01061	Replace 2000 John Deere riding lawn mower	8
R-01062	Replace 2000 John Deere riding lawn mower	9
R-01063	Replace 2000 Chevrolet Tahoe	33
R-01065	Replace 1999 Dodge ¾-ton, 4x4 pickup	30
R-01067	Replace 2001 Chevrolet ¾-ton, 4x4 pickup	30
R-01069	Replace 1999 Truax grass drill	25
R-02007	Replace Canon Image Runner 330 Copier	13
R-02001	Replace 2002 Chevrolet pickup	20
R-02004	Replace 2002 Ford fire truck and tank	41
<i>Road Rehabilitation</i>		
R-91009	Preliminary engineering (route 12,101;18 miles)	400
R-02002	Preliminary engineering and construction (Sand Lake Recreation Area Road and three parking lots (route 100, 901-03; 18 miles)	340
R-99003	Preliminary engineering and construction (route 010, 0.49 mile, parking lot 900)	283
R-03001	Construction (route 12, 101; 18 miles)	4,000
R-03002	Construction (route 11, 14.9 miles)	4,000
R-03003	Preliminary engineering (route 11, 14.9 miles)	400

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