# Glossary

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

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

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

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

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

**annual**—Plant that flowers and dies within 1 year of germination.

**ATV**—All-terrain vehicle.

**acre-foot—**Amount of water it takes to cover a level acre of land (43,560 square feet) to a depth of 1 foot; about 43,560 cubic feet of water or 325,851 gallons.

**avian—**Relating to or characteristic of birds.

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

**basin—**Referring to the landform that acts as a water catchment; here used generically to refer to the hydric footprint that pools water.

**the basin—***See* Rainwater Basin.

**bioenergetics—**Study of energy transformation in living systems.

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

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

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

**CAFO—**Concentrated animal-feeding operation.

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

**catabolized (catabolism)—**Breakdown of more complex substances into simpler ones, with the release of energy.

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

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

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

**COMLG**—Conservation Order for Mid-continent Light Geese.

**compatibility determination**—*See* compatible use.

**compatible use**—Wildlife-dependent recreational use or any other use of a refuge or district 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 or district (The Fish and Wildlife Service Manual, 603 FW 3.6). A compatibility determination supports the selection of compatible uses and identified stipulations or limits necessary to ensure compatibility.

**comprehensive conservation plan (CCP)**—Document that describes the desired future conditions of the

refuge or district and provides long-range guidance and management direction for the refuge or wetland district manager to accomplish the purposes of the refuge or district, contribute to the mission of the Refuge System, and to meet other relevant mandates (The Fish and Wildlife Service Manual, 602 FW 1.5).

**concern**—*See* issue.

**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.

**coteau**—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.

**critical habitat—**Area essential to the survival of a species; includes all air, land, and water that a species requires to carry out its normal living patterns, as well as other living things used by the species for food, shelter, or other necessary activities.

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

**CWCS**—Comprehensive wildlife conservation strategy.

**cyanobacteria—**Blue-green algae; widely distributed group of predominantly photosynthetic prokaryotic organisms of the subkingdom Cyanophyta, resembling phototrophic bacteria, occurring singly or in colonies in diverse habitats: some species can fix atmospheric nitrogen.

**dense nesting cover**—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.

**the district—***See* wetland management district.

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

**DUD—**Duck use-day; number of days that an area can support a duck's energetics' needs.

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

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

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

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

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

**endogenous—**Stored reserves of lipids, proteins, and other nutrients; energy generated from mobilizing these reserves.

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

**epizootic**—Pertaining to a disease that affects large numbers of animals throughout a large area and spreads with great speed.

**erosion—**Wearing away of the land surface by various natural processes such as wind and moving water in the form of rivers, streams, rain, and melting snow.

**eutrophication—**Overenrichment of a waterbody with nutrients, resulting in the excessive growth of organisms and the depletion of oxygen.

**evaporation—**Physical process by which a liquid or solid is transformed to a gas.

**exogenous—**Pertaining to a nutrient that is not stored and is readily available.

**exotic—**Nonnative species of plants or animals often brought into an area by human activity.

**extinction**—Complete disappearance of a species from the earth; no longer existing.

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

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

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

**FGDC**—Federal Geographic Data Committee.

**flood—**Unusual accumulation of water above the ground caused by heavy rain, melting snow, or rapid runoff; a temporary condition of partial or complete inundation of lands that normally do not pool water throughout the entire year.

**floodplain—**Low-lying, nearly level area along a river or stream that is periodically subject to being flooded by water from any source.

**flora—**Plants, specifically plants within a particular set of boundaries that may be geographical, temporal, or biological.

**flyway—**Pathway taken by migrating birds to or from their nesting grounds in northern North America to their overwintering grounds in southern parts of the United States; a broad, well-defined grouping of migration corridors.

**FMP**—Fire management plan.

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

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

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

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

**groundwater recharge—**Act of adding water to the aquifer by surface water movement downward through the soil.

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

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

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

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

**hydric soil—**Soil that is saturated, flooded, or pooled long enough during the growing season to develop conditions that do not require oxygen and that favor the growth and regeneration of hydrophytic vegetation; hydric soils suggest the presence of wetlands.

**hydrophyte—**Plant that is adapted to grow in water; a wetland plant species.

**hydrophytic vegetation**—Visible plants growing in water or on a substrate and periodically deficient in oxygen as a result of excessive water content.

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

**Improvement Act**—National Wildlife Refuge System Improvement Act of 1997.

**indigenous**—Originating or occurring naturally in a particular place.

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

**"interseed"**—Mechanical seeding of one or several plant species into existing stands of established vegetation.

**interspersion**—Diversity of vegetation spread throughout a stand.

**interstitial flow—**Movement of surface water into the ground by flowing through individual soil grains and eventually adding to the groundwater levels.

**introduced species**—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**—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.

**invertebrate—**Animal without an backbone.

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

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

**issue**—Unsettled matter that requires a management decision; for example, a Service initiative, opportunity, resource management problem, a threat to the resources of the unit, conflict in uses, public concern,

or the presence of an undesirable resource condition (The Fish and Wildlife Service Manual, 602 FW 1.5).

**limiting factor—**Chemical or physical factor that limits the growth, abundance, or distribution of the population of a species in an ecosystem and determines whether or not an organism can survive.

**lipids—**Group of organic compounds including the fats, oils, waxes, sterols, and triglycerides that are insoluble in water but soluble in nonpolar organic solvents, are oily to the touch, and together with carbohydrates and proteins constitute the principal structural material of living cells.

**macropore flow—**Movement of surface water through large holes in the ground such as animal burrows, desiccation cracks, root tubes and solution pipes, eventually adding to the groundwater levels.

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

**ME**—*See* metabolized energy.

**metabolized energy (ME)—**Energy produced by digestion.

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

**migratory birds**—Birds that follow a seasonal movement from their breeding grounds to their wintering grounds; includes waterfowl, shorebirds, raptors, and songbirds.

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

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

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

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

**NASS—**Natural Agricultural Statistics Service.

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

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

**National Wildlife Refuge System Improvement Act of 1997 (Improvement Act)**—Sets the mission and the administrative policy for all units of 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, 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 unit of the Refuge System by the year 2012. This act amended portions of the Refuge Recreation Act and National Wildlife Refuge System Administration Act of 1966.

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

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

**NDEQ**—Nebraska Department of Environmental Quality.

**NEPA**—National Environmental Policy Act.

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

**NGPC—**Nebraska Game and Parks Commission.

**niche partitioning—**Distribution of species by preference of habitat conditions and needs.

**NOI**—Notice of intent; published in the "Federal Register."

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

**noxious weed,** *also* **invasive plant**—Any living stage (including seeds and reproductive parts) of a parasitic or other plant of a kind that is of foreign origin (new to or not widely prevalent in the 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 (such as an invasive plant) is one that causes disease or has adverse effects on humans or the human environment and, therefore,

is detrimental to the agriculture and commerce of the United States and to public health, and is listed as such on Nebraska Noxious Weed List.

**NVCS**—National Vegetation Classification System.

**NWR**—*See* national wildlife refuge.

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

**ORP**—Outdoor recreation planner.

**palustrine—**Pertaining to nonflowing wetlands that can be dominated by emergent or submergent plant wetlands with less than 0.5% salinity.

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

**pathogen**—Agent that causes disease, especially a living microorganism such as a bacterium or fungus.

**pelagic waters**—The surface waters and middle depths of the open ocean, extending from the edge of the continental shelf.

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

**periphyton**—Complex matrix of organisms such as algae and microbes that are attached to submerged plants; serves as an important food source for invertebrates and some fish; important indicator of water quality.

**PILT**—Payments in lieu of taxes.

**PL**—Public law.

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

**playa—**Nearly level, flat area that is temporarily covered with water, at the bottom of an undrained basin.

**PM**—Particulate matter.

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

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

**proposed action**—Alternative proposed to best achieve the purpose, vision, and goals of a refuge or district (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**—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 and district management.

**purpose of the district**—Reason for and role of a district that 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 district or district subunit such as a waterfowl production area (The Fish and Wildlife Service Manual, 602 FW 1.5).

**Rainwater Basin (the basin)—**Geographic area in south-central Nebraska that contains closed-basin wetlands with characteristic clay soils that have very low transmissivity.

**raptor**—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).

**RWBJV**—Rainwater Basin Joint Venture.

**refuge—***See* national wildlife refuge.

**Refuge Operating Needs System (RONS)—**National database that contains the unfunded operational needs of each refuge and district. Projects included are those required to carry out approved plans and meet goals, objectives, and legal mandates.

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

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

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

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

**riparian area** *or* **riparian zone**—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 Operating Needs System.

**SAMMS**—*See* Service Asset Maintenance Management System.

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

**scouring**—Removal of earth or rock by the action of running water or wind eroding material.

**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.

**sedimentation**—Deposit of waterborne particles, resulting from a decrease in water's transport capacity.

**seeping**—Movement of water into or through porous material.

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

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

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

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

**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**—Special authorization from the refuge or wetland district manager that is required for any refuge and district service, facility, privilege, or product of the soil provided at refuge or district 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**—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 population declines, small or restricted populations, or dependence on restricted or vulnerable habitats.

**step-down management plan**—Plan that provides the details necessary to carry out management strategies identified in the comprehensive conservation plan (The Fish and Wildlife Service Manual, 602 FW 1.5).

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

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

**succession**—Natural replacement of one biotic community by another; a slow but continuous process, beginning with the invasion of a patch of open ground or newly created body of water by pioneer species. Succession continues through a series of recognizable stages known as seres, ending with the formation of a climax community in which the mix of species forming the community no longer changes with successive generations; late successional communities can also be climax communities.

**SWG**—State wildlife grant.

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

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

**tree harvest**—Commercial or private removal of trees for economic or personal benefit.

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

**UNL—**University of Nebraska–Lincoln.

**USC**—United States Code.

**USDA**—U.S. Department of Agriculture.

**USDOE**—U.S. Department of Energy.

**USEPA**—U.S. Environmental Protection Agency.

**U.S. Fish and Wildlife Service (Service, USFWS)**—Federal agency of the U.S. Department of the Interior that is 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 wetland management districts 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)**—Federal agency of the U.S. Department of the Interior 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.

**USGS–BRD**—Biological Research Division of the U.S. Geological Survey.

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

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

**watershed**—Area that drains into a river, a river system, or a body of water.

**wetland—**Area of land that pools water long enough annually to support hydrophytic vegetation.

**wetland management district (the 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.

**wet meadow—**Area where wetland and upland plants can occur, usually along the edge of a wetland; may have pooled water for a short period of time, usually in the spring or after a heavy rain event.

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

**wildland fire**—Free-burning fire requiring a suppression response; all fire other than prescribed fire that occurs on wildlands (Draft, The Fish and Wildlife Service Manual 621 FW 1.7).

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

**WMA**—Wildlife management area.

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

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

**WPA**—Waterfowl production area.

# Appendix A

*Key Legislation and Policies*

Administration of units of the National Wildlife Refuge System is governed by (1) bills passed by the U.S. Congress and signed into law by the president of the United States, and (2) by regulations developed by the various branches of the government. Following are brief descriptions of some of the most pertinent laws and statutes establishing legal parameters and policy direction for the Refuge System.

*In alphabetical order of the name of the act, order, or regulation.*

**American Indian Religious Freedom Act:** Affirms the right of Native Americans to have access to their sacred places. If a place of religious importance to Native Americans may be affected by an undertaking, the act promotes consultation with Native American religious practitioners, which may be coordinated with section 106 consultation.

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

**Antiquities Act (June 8, 1906; 16 USC 431–433; 34 Stat. 225):** Authorizes the president to designate as national monuments objects or areas of historic or scientific interest on lands owned or controlled by the United States. Requires that a permit be obtained for examination of ruins, excavation of archaeological sites, and the gathering of objects of antiquity on lands under the jurisdiction of the Secretaries of Interior, Agriculture, and Army, and provided penalties for violations.

**Archaeological Resources Protection Act (Public Law [PL] 96-95; October 31, 1979; 16 USC 470aa–470ll; 93 Stat. 721):** Protects archaeological resources and sites on public (federal) lands and Native American lands. The act calls for the preservation of objects and associated records in a suitable repository once recovered from a site. The act sets guidelines for proper procedures to obtain permission and permits to excavate archaeological sites on public lands by qualified individuals.

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

**Archeological and Historic Preservation Act (PL 86-523; June 27, 1960; 16 USC 469–469c; 74 Stat. 220 [as amended by PL 93-291; May 24, 1974; 88 Stat. 174]):** Carries out the policy established by the Historic Sites, Buildings and Antiquities Act; directs federal agencies to notify the Secretary of the Interior whenever they find a federal or federally assisted, licensed, or permitted project may cause loss or destruction of significant scientific, prehistoric, or archaeological data. Authorizes use of appropriated, donated, and transferred funds for the recovery, protection, and preservation of such data.

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

**Criminal Code of Provisions of 1940 (as amended, 18 USC 41):** States the intent of Congress to protect all wildlife within federal sanctuaries, refuges, fish hatcheries, and breeding grounds. Provides that anyone (except in compliance with rules and regulations promulgated by authority of law) who hunts, traps, or willfully disturbs any such wildlife, or willfully injures, molests, or destroys any property of the United States on such land or water, shall be fined up to $500 or imprisoned for not more than 6 months or both.

**Emergency Wetland Resources Act of 1986:** Authorizes the purchase of wetlands from Land and Water Conservation Fund monies, removing a prior prohibition on such acquisitions. Requires the Secretary to establish a national wetlands priority conservation plan, requires the states to include wetlands in their comprehensive outdoor recreation plans, and transfers to the Migratory Bird Conservation Fund amount equal to import duties on arms and ammunition.

**Endangered Species Act of 1973 and recent amendments (16 USC 1531–1543, 87 Stat. 884; as amended):** Provides for conservation of threatened and endangered species of fish, wildlife, and plants by federal action and by encouraging state programs. Specific provisions include the listing and determination of critical habitat for endangered and threatened species and consultation with the Service on any federally funded or licensed project that could affect any of these agencies; prohibition of unauthorized taking, possession, sale, transport, etc., of endangered species; an expanded program of habitat acquisition; establishment of cooperative agreements and grants-in-aid to states that establish and maintain an active, adequate program for endangered and threatened species; assessment of civil and criminal penalties for violating the act or regulations.

**Environmental Education Act of 1990 (PL 101-619; November 16, 1990; 20 USC 5501–5510; 104 Stat. 3325):** Establishes the Office of Environmental Education within the USEPA to develop and administer a federal environmental education program. Responsibilities of the office include developing and supporting programs to improve understanding of the natural and developed environment and the relationships between humans and their environment; supporting the dissemination of educational materials; developing and supporting training programs and environmental education seminars; managing a federal grant program; and administering an environmental internship and fellowship program. Requires the office to develop and support environmental programs in consultation with other federal natural resource management agencies including the Service.

**EO 11644—Use of Off-road Vehicles on Public Lands (1972):** Provides policy and procedures for regulating off-road vehicles.

**EO 11988—Floodplain Management (May 24, 1977):** Prevents federal agencies from contributing to the "adverse impacts associated with occupancy and modification of floodplains" and the "direct or indirect support of floodplain development." In the course of fulfilling their respective authorities, federal agencies "shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by floodplains."

**EO 11990—Protection of Wetlands.**

**EO 12996—Management and General Public Use of the National Wildlife Refuge System (1996):** Defines the mission, purpose, and priority public uses of the Refuge System; presents four principles to guide management of the system.

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

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

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

**Federal Water Pollution Control Act of 1972, Section 401 (PL 92-500, USC 1411, 86 Stat. 816.33):** Requires any applicant for a federal license or permit to conduct any activity which may result in a discharge into navigable waters to obtain a certification from the state in which the discharge originates or will originate, or, if appropriate, from the interstate water pollution control agency having jurisdiction over navigable waters at the point where the discharge originates or will originate, that the discharge will comply with applicable effluent limitations and water quality standards. Requires that a certification obtained for construction of any facility must also pertain to subsequent operation of the facility.

**Federal Water Pollution Control Act of 1972, Section 404 (PL 92-500, 86 Stat. 816):** Authorizes the Secretary of the Army, acting through the Chief of Engineers, to issue permits, after notice and opportunity for public hearing, for discharge of dredged or fill material into navigable waters of the United States, including wetlands, at specified disposal sites. Requires that selection of disposal sites be in accordance with guidelines developed by the Administrator of the USEPA in conjunction with the Secretary of the Army. States that the Administrator can prohibit or restrict use of any defined area as a disposal site whenever she/he determines, after notice and opportunity for public hearings, that discharge of such materials into such areas will have an unacceptable adverse effect on municipal water supplies, shellfish beds, fishery areas, wildlife, or recreational areas.

**Fish and Wildlife Act of 1956 (16 USC 742a–742j, 70 Stat. 1119; as amended):** Establishes a comprehensive fish and wildlife policy and directs the Secretary of the Interior to provide continuing research and extension and conservation of fish and wildlife resources.

**Fish and Wildlife Conservation Act of 1980 (PL 96366; September 29, 1980; 16 USC 2901–2911; as amended 1986, 1988, 1990, and 1992):** Creates a mechanism for federal matching funding of the development of state conservation plans for nongame fish and wildlife. States that subsequent amendments to this law require that the Secretary monitor and assess migratory nongame birds, determine the effects of environmental changes and human activities, identify birds likely to be candidates for endangered species listing, and identify conservation actions that would prevent this from being necessary. In 1989, Congress also directed the Secretary to identify lands and waters in the Western Hemisphere, the protection, management, or acquisition of which would foster conservation of migratory nongame birds. All of these activities are intended to assist the Secretary in fulfilling the Secretary's responsibilities under the Migratory Bird Treaty Act and the Migratory Bird Conservation Act, and provisions of the Endangered Species Act implementing the Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere.

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

**Fish and Wildlife Improvement Act of 1978:** Improves the administration of fish and wildlife programs and amends several earlier laws including the Refuge Recreation Act, the National Wildlife Refuge System Administration Act, and the Fish and Wildlife Act of 1956. Authorizes the Secretary to accept gifts and bequests of real and personal property on behalf of the United States. Authorizes the use of volunteers for Service projects and appropriations to carry out volunteer programs.

**Historic Sites, Buildings and Antiquities Act (August 21, 1935; 16 USC 461–462, 464–467; 49 Stat. 666; known as the "Historic Sites Act" [as amended by PL 89-249; October 9, 1965; 79 Stat. 971]):** Declares it a national policy to preserve historic sites and objects of national significance, including those located at refuges and districts. Provides procedures for designation, acquisition, administration, and protection of such sites. Provides for designation of National Historic and Natural Landmarks.

**Land and Water Conservation Fund Act of 1965:** Provides funds from leasing bonuses, production royalties, and rental revenues for offshore oil, gas, and sulphur extraction to the Bureau of Land Management, the USDA Forest Service, the U.S. Fish and Wildlife Service, and state and local agencies for purchase of lands for parks, open space, and outdoor recreation.

**Migratory Bird Conservation Act of 1929 (16 USC 715–715d, 715e, 715f–715r):** Establishes the Migratory Bird Conservation Commission, which consists of the Secretaries of the Interior (chair), Agriculture, and Transportation; two members from the House of Representatives; and an ex-officio member from the state in which a project is located. States that the commission approves acquisition of land and water, or interests therein, and sets the priorities for acquisition of lands by the Secretary of the Interior for sanctuaries or for other management purposes. Requires that, to acquire lands or interests therein, the state concerned must consent to such acquisition by legislation. Such legislation has been enacted by most states.

**Migratory Bird Conservation Act of 1929 (16 USC 715s, 45 Stat. 1222, as amended):** Authorizes acquisition, development, and maintenance of migratory bird refuges; cooperation with other agencies in conservation; and investigations and publications on North American birds. Authorizes payment of 25% of net receipts from administration of national wildlife refuges to the country or counties in which such refuges are located.

**Migratory Bird Hunting and Conservation Stamp Act of 1934 (March 16, 1934; 16 USC 718–718h; 48 Stat. 51; known as The "Duck Stamp Act"; as amended):** Requires each waterfowl hunter 16 years of age or older to possess a valid federal hunting stamp. Authorizes the requirement of an annual stamp for the hunting of waterfowl; proceeds go toward the purchase of habitat for waterfowl and other wildlife. Duck stamps are also purchased (1) for entry into some refuges, (2) by conservationists, and (3) for stamp collections. Receipts from the sale of the stamp are deposited in a special Treasury account known as the Migratory Bird Conservation Fund and are not subject to appropriations.

**Migratory Bird Treaty Act of 1918 (16 USC 703–711; 50 CFR, subchapter B; as amended):** Implements treaties with Great Britain (for Canada) and Mexico for protection of migratory birds whose welfare is a federal responsibility. Provides for regulations to control taking, possession, selling, transporting, and importing of migratory birds and provides penalties for violations. Enables the setting of seasons and other regulations (including the closing of areas, federal or nonfederal) related to the hunting of migratory birds.

**National and Community Service Act of 1990 (PL 101-610; November 16, 1990; 42 USC 12401; 104 Stat. 3127):** Authorizes several programs to engage citizens of the United States in full and part-time projects designed to combat illiteracy and poverty, provide job skills, enhance educational skills, and fulfill environmental needs. Provides for grants to states for the creation of programs for citizens over 17 years of age. Programs must be designed to fill unmet educational, human, environmental, and public safety needs. Initially, participants will receive postemployment benefits of up to $1,000 per year for part-time participants and $2,500 for full-time participants.

Several provisions are of particular interest to the Service:

> *American Conservation and Youth Service Corps:* As a federal grant program established under subtitle C of the law, the corps offers an opportunity for young adults between the ages of 16 and 25, or in the case of summer programs, between 15 and 21, to engage in approved human and natural resources projects that benefit the public or are carried out on federal or Indian lands. To be eligible for assistance, natural resources programs will focus on improvement of wildlife habitat and recreational areas, fish culture, fishery assistance, erosion, wetlands protection, pollution control, and similar projects. A stipend of not more than 100% of the poverty level will be paid to participants. A commission established to administer the Youth Service Corps will make grants to states, the Secretaries of Agriculture and Interior, and the Director of ACTION to carry out these responsibilities.
>
> *Thousand Points of Light:* Creates a nonprofit Points of Light Foundation to administer programs to encourage citizens and institutions to volunteer to solve critical social issues, discover new leaders, and develop institutions committed to serving others.

**National Environmental Policy Act of 1969 (PL 91-190; January 1, 1970; 42 USC 4321–4347; 83 Stat. 852 [as amended by PL 94-52; July 3, 1975; 89 Stat. 258] [as amended by PL 94-83; August 9, 1975; 89 Stat. 424]):** Requires all agencies, including the Service, to examine the environmental impacts of their actions, incorporate environmental information, and use public participation in the planning and the implementation of all actions, federal agencies must integrate the act with other planning requirements, and to prepare appropriate documents to facilitate better environmental decision making (40 CFR 1500). Declares national policy to encourage a productive and enjoyable harmony between humans and their environment.

Section 102 of that act directs that "to the fullest extent possible the policies, regulations, and public laws of the United States shall be interpreted and administered in accordance with the policies set forth in this act, and all agencies of the Federal Government shall ... insure that presently unquantified environmental amenities and values may be given appropriate consideration in decision making along with economic technical considerations."

Section 102(2)c of the NEPA requires all federal agencies, with respect to major federal actions significantly affecting the quality the quality of the human environment, to submit to the Council on Environmental Quality a detailed statement of the environmental impact of the proposed action; any adverse environmental effect that cannot be avoided should the proposal be implemented; alternatives to the proposed action; the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity; any irreversible and irretrievable commitments of resources that would be involved in the proposed action, should it be implemented.

**National Historic Preservation Act of 1966 (PL 89-665; October 15, 1966; 16 USC 470–470b, 470c–470n; 80 Stat. 915; and repeatedly amended):** Instructs federal agencies to consider the effect their undertakings have on cultural resources. The act is comprehensive legislation with many components, with the most important aspect to management being section 106. The purpose of section 106 is stated in 36 CFR 800.1: "The section 106 process seeks to accommodate historic preservation concerns with the needs of Federal undertakings through consultation among the agency official and other parties with an interest in the effects of the undertaking on historic properties." Historic property is defined in 36 CFR 800.16(l) as "any prehistoric or historic district, site, building, structure, or object in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior." Another important section, section 110, directs federal agencies to inventory cultural resources on public lands—not necessarily in relationship to a project or undertaking—so cultural resources can be evaluated and managed.

**National Wildlife Refuge System Administration Act of 1966 (PL 89-669; 16 USC 668dd–668ee; 80 Stat. 929; as amended):** Defines the Refuge System as including wildlife refuges, areas for protection and conservation of fish and wildlife that are threatened with extinction, wildlife ranges, game ranges, wildlife management areas, and waterfowl production areas. Authorizes the Secretary to permit any use of an area provided such use is compatible with the major purposes for which such area was established. States that purchase considerations for rights-of-way go into the Migratory Bird Conservation Fund for the acquisition of lands. By regulation, up to 40% of an area acquired for a migratory bird sanctuary may be opened to migratory bird hunting unless the Secretary finds that the taking of any species of migratory game birds in more than 40% of such area would be beneficial to the species. Requires an act of Congress for the divestiture of lands in the system, except for (1) lands acquired with Migratory Bird Conservation Commission funds, and (2) lands that can be removed from the System by land exchange, or if brought into the System by a cooperative agreement, then pursuant to the terms of the agreement.

**National Wildlife Refuge System Improvement Act of 1997 (PL 105-57; October 9, 1997; Amendment to the National Wildlife Refuge System Administration Act of 1966):** Sets the mission and the administrative policy for all units in the Refuge System. Clearly defines a unifying mission for the Refuge System; establishes the legitimacy and appropriateness of the six priority public uses (hunting, fishing, wildlife observation, photography, environmental education, and interpretation); establishes a formal process for determining appropriateness and compatibility; establishes the responsibilities of the Secretary of the Interior for managing and protecting the Refuge System; and requires a CCP for each refuge by the year 2012. Also amended portions of the Refuge Recreation Act and the National Wildlife Refuge System Administration Act of 1966.

Key provisions include the following:

- a requirement that the Secretary of the Interior ensures maintenance of the biological integrity, diversity, and environmental health of the Refuge System;
- the definition of compatible wildlife-dependent recreation as "legitimate and appropriate general public use of the [National Wildlife Refuge] System";
- the establishment of hunting, fishing, wildlife observation, photography, environmental education, and interpretation as "priority public uses" where compatible with the mission and purpose of individual national wildlife refuges;
- the refuge managers' authority to use sound professional judgment in determining which public uses are compatible at national wildlife refuges and whether or not they will be allowed

(a formal process for determining "compatible use" is currently being developed);

– the requirement of open public involvement in decisions to allow new uses of national wildlife refuges and renew existing ones, as well as in the development of CCPs for national wildlife refuges.

**National Wildlife Refuge Regulations (50 CFR 25-35, 43 CFR 3103.2 and 3120.3–3):** Provides regulations for administration and management of national wildlife refuges including mineral leasing, exploration, and development.

**Rights-of-way General Regulations (50 CFR 29.21; 34 CFR 19907, December 19, 1969):** Provides for procedures for filing applications. Provides terms and conditions under which rights-of-way over, above, and across lands administered by the Service may be granted.

**National Wildlife Refuge System Volunteer and Community Partnership Enhancement Act of 1998 (PL 105-242, 112 Stat. 1575):** Encourages the use of volunteers to assist the Service 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 those resources. Encourages donations and other contributions by persons and organizations to the Refuge System.

**Native American Graves Protection and Repatriation Act:** Provides a process for museums and federal agencies to return certain Native American cultural items—human remains, funerary objects, sacred objects, and objects of cultural patrimony—to lineal descendants, culturally affiliated Indian tribes, and Native Hawaiian organizations.

**North American Wetlands Conservation Act (PL 101-233; December 13, 1989; 16 USC 4401–4412; 103 Stat. 1968):** Provides for the conservation of North American wetland ecosystems, waterfowl and other migratory birds, fish, and wildlife that depend on such habitats. Establishes a council to review project proposals and provided funding for the projects. Provides funding and administrative direction for implementation of the North American Waterfowl Management Plan and the Tripartite Agreement on wetlands between Canada, United States, and Mexico. Converts the Pittman-Robertson account into a trust fund, with the interest available without appropriation through the year 2006 to carry out the programs authorized by the act, along with an authorization for annual appropriation of $15 million plus an amount equal to the fines and forfeitures collected under the Migratory Bird Treaty Act. Available funds may be expended, upon approval of the Migratory Bird Conservation Commission, for payment of not to exceed 50% of the United States share of the cost of wetlands conservation projects in Canada, Mexico, or the United States (or 100% of the cost of projects on federal lands). At least 50% and no more than 70% of the funds received are to go to Canada and Mexico each year.

**Refuge Recreation Act of 1962:** Authorizes the Secretary of the Interior to administer refuges, hatcheries, and other conservation areas for recreational use, when such uses do not interfere with the areas' primary purposes. Authorizes construction and maintenance of recreational facilities and the acquisition of land for incidental fish- and wildlife-oriented recreational development or protection of natural resources. Authorizes the charging of fees for public uses.

**Refuge Recreation Act of 1966 (PL 87-714, 16 USC 460k et seq., 76 Stat. 653–654):** Authorizes appropriate, incidental, or secondary recreational use at conservation areas administered by the Secretary of the Interior for fish and wildlife purposes.

**Refuge Recreation Act of 1969 [16 USC 460k–460k4], as amended.**

**Refuge Revenue Sharing Act, Section 401 (June 15, 1935; 16 USC 715s; 49 Stat. 383):** Provides for payments to counties in lieu of taxes, using revenues derived from the sale of products from refuges. Related legislation follows:

*PL 88-523 (August 30, 1964; 78 Stat. 701):* Makes major revisions by requiring that all revenues received from refuge products such as animals, timber and minerals, or from leases or other privileges, be deposited in a special Treasury account and net receipts distributed to counties for public schools and roads.

*PL 93-509 (December 3, 1974; 88 Stat. 1603):* Requires that monies remaining in the fund after payments be transferred to the Migratory Bird Conservation Fund for land acquisition under provisions of the Migratory Bird Conservation Act.

*PL 95-469 (October 17, 1978; 92 Stat. 1319):* Expands the revenue-sharing system to include national fish hatcheries and Service research stations. Includes in the Refuge Revenue Sharing Fund receipts from the sale of salmonid carcasses. Establishes payments to counties as follows:

On acquired land, the greatest amount calculated on the basis of 75 cents per acre, ¾ of 1% of the appraised value, or 25% of the net receipts produced from the land.

– On land withdrawn from the public domain, 25% of net receipts and basic payments under PL 94-565 (31 USC 1601–1607, 90 Stat. 2662), payment in lieu of taxes on public lands.

– This amendment also authorizes appropriations to make up any difference between the amount in the fund and the amount scheduled for payment in any year. The stipulation that payments be used for schools and roads was

removed, but counties were required to pass payments along to other units of local government within the county that suffer losses in revenues due to the establishment of Service areas.

**Refuge Revenue Sharing Act of 1978 (PL 95-469; October 17, 1978; amended 16 USC 715s; 50 CFR, part 34):** Changes the provisions for sharing revenues with counties in a number of ways. Makes revenue sharing applicable to all lands administered by the Service, whereas previously it was applicable only to areas in the Refuge System. Makes payments available for any governmental purpose, whereas the old law restricted the use of payments to roads and schools. For lands acquired in fee simple, provides a payment of 75 cents per acre, ¾ of 1% of fair market value or 25% of net receipts, whichever is greatest, whereas the old law provided a payment of ¾ of 1% adjustment cost or 25% of net receipts, whichever was greater. Makes reserve (public domain) lands entitlement lands under PL 94-565 (16 USC 1601–1607) and provides for a payment of 25% of net receipts. Authorizes appropriations to make up any shortfall in net receipts, to make payments in the full amount for which counties are eligible. The old law provided that if net receipts were insufficient to make full payment, payment to each county would be reduced proportionality.

**Refuge Trespass Act of June 28, 1906 (18 USC 41, 43 Stat. 98; 18 USC 145):** Provides the first federal protection for wildlife at national wildlife refuges. Makes it unlawful to hunt, trap, capture, willfully disturb, or kill any bird or wild animal, or take or destroy the eggs of any such birds, on any lands of the United States set apart or reserved as refuges or breeding grounds for such birds or animals by any law, proclamation, or executive order, except under rules and regulations of the Secretary. The act also protects government property on such lands.

**Refuge Trespass Act of June 25, 1948 (18 USC 41, Stat. 686; Section 41 of the Criminal Code, Title 18):** Consolidates the penalty provisions of various acts from January 24, 1905 (16 USC 684–687, 33 Stat. 614) through March 10, 1934 (16 USC 694–694b, 48 Stat. 400) and restates the intent of Congress to protect all wildlife within federal sanctuaries, refuges, fish hatcheries, and breeding grounds. Provides that anyone (except in compliance with rules and regulations promulgated by authority of law) who hunts, traps, or willfully disturbs any wildlife on such areas, or willfully injures, molests, or destroys any property of the United States on such lands or waters, shall be fined, imprisoned, or both.

**Rehabilitation Act of 1973 (October 1, 1973; 29 USC 794 [as amended by PL 93-112, Title 5; 87 Stat. 355]):** Prohibits discrimination on the basis of handicap under any program or activity receiving federal financial assistance.

**Transfer of Certain Real Property for Wildlife Conservation Purposes Act of 1948:** Provides that, upon determination by the Administrator of the General Services Administration, real property no longer needed by a federal agency can be transferred without reimbursement to the Secretary of the Interior if the land has particular value for migratory birds, or to a state agency for other wildlife conservation purposes.

**U.S. Department of the Interior Order No. 3226 (January 19, 2001):** Directs bureaus and offices of the Department to analyze the potential effects on climate change when undertaking long-range planning, when setting priorities for scientific research, and when making major decisions about use of resources.

**Wilderness Act of 1964 (PL 88-577; September 3, 1964):** Directs the Secretary of the Interior, within 10 years, to review every roadless area of 5,000 or more acres and every roadless island (regardless of size) within the Refuge System and National Park Service for inclusion in the National Wilderness Preservation System.

**Wilderness Preservation and Management (50 CFR 35; 16 USC 1131-1136; 43 USC 1201; 78 Stat. 890):** Provides procedures for establishing wilderness units under the Wilderness Act of 1964 at units of the Refuge System.

# Appendix B

*Compatibility Determinations*

## DISTRICT NAME

Rainwater Basin Wetland Management District

## ESTABLISHING AND ACQUISITION AUTHORITIES

Migratory Bird Hunting and Conservation Stamp Act (16 USC 718 [c])

Migratory Bird Conservation Act (16 USC 715d[2], 715i[a])

Consolidated Farm and Rural Development Act (7 USC 2002 [a])

Emergency Wetlands Resources Act (16 USC 3901 [b])

Public Land Order 7206 (June 24, 1996)

Public Land Order 6979 (May 25, 1993)

## DISTRICT PURPOSES

*"Small areas, to be designated as 'Waterfowl Production Areas' may be acquired without regard to the limitations and requirements of the Migratory Bird Conservation Act, but all of the provisions of such Act which govern the administration and protection of lands acquired thereunder, except the inviolate sanctuary provisions of such Act, shall be applicable to areas acquired pursuant to this subsection."* Migratory Bird Hunting and Conservation Stamp Act (16 USC 718 [c])

*"For use as an inviolate sanctuary, or for any other management purpose, for migratory birds."* Migratory Bird Conservation Act (16 USC 715d[2])

*"Areas of lands, waters, or interests therein acquired or reserved pursuant to this subchapter shall … be administered … to conserve and protect migratory birds in accordance with treaty obligations with Mexico, Canada, Japan and the Union of Soviet Socialist Republics, and other species of wildlife found thereon, including species that are listed … as endangered or threatened species, and to restore and develop adequate wildlife habitat."* Migratory Bird Conservation Act (16 USC 715i[a])

*"For conservation purposes any real property, or interest therein … that has marginal value for agricultural production; is environmentally sensitive; or has special management importance."* Consolidated Farm and Rural Development Act (7 USC 2002 [a])

*"It is the purpose of this chapter to promote … the conservation of the wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations in various migratory bird treaties and conventions with Canada, Mexico, Japan, the Union of Soviet Socialist Republics, and with various countries in the Western Hemisphere."* Emergency Wetlands Resources Act (16 USC 3901 [b])

*"The following described public lands are hereby withdrawn from settlement, sale, location or entry under the general land laws, including the U.S. mining law, but not from leasing under the mineral leasing laws, to protect waterfowl production areas. This withdrawal will expire 50 years from the effective date of this order unless … the Secretary determines that the withdrawal shall be extended."* Public Land Order 7206 (June 24, 1996)

*"To protect waterfowl production areas."* Public Land Order 6979 (May 25, 1993)

## NATIONAL WILDLIFE REFUGE SYSTEM MISSION

The mission of the 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

The district will 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.

Between 400 and 700 acres are farmed each year. Farming is conducted for the sole purpose of grassland restoration. Grazing with livestock is used as a tool for grassland and wetland management.

About two-thirds of the WPAs receive some type of grazing treatment. Grazing does not occur over the entire WPA but involves rotational grazing over portions of a WPA. Wetlands are the most common habitat grazed. Area grazed ranges between 7,000 and 9,000 acres annually over the past 5 years. Approximately 450 acres are hayed annually. Haying is sporadically used as a grassland management tool to control invasive plants and prepare areas for upland restoration and prescribed burns.

The CCP will continue grassland restoration activities within the district. The amount of farming done will be in direct relation to the amount of land acquired and the availability of native seed. Over time, farming is expected to decrease as areas are restored to grassland. Cooperative farming activities will be compatible only at areas that do not have established stands of native grasses and forbs. Farming will allow the district to establish seedbeds relatively free of noxious plants, maximizing the likelihood that grassland restoration will be successful. Soybean is the crop generally used during farming.

The CCP will use grazing as a management tool for wetland and upland habitats. Specific acreages have not been identified in the CCP because habitat conditions within wetland and upland areas can change dramatically on a yearly basis due to precipitation and temperatures. An adaptive approach will be used to prescribe grazing treatments for habitats.

### Availability of Resources

The resources necessary to administer haying, grazing, and farming programs are sufficient at current staffing and funding levels. Haying, grazing, and farming programs are conducted through special use permits or cooperative farming agreements, which minimizes the need for staff time and district assets to complete work.

### Anticipated Impacts of the Use

Over a 5-year period, grazing has been conducted on 7,000–9,000 acres annually. While annual acreages have not been specified in the CCP, it is expected that future refuge grazing will fall into this range. Farmed acres will remain in the range of 400–700 acres per year, but will slowly decrease as uplands are restored to grass. Haying is anticipated to increase as a management tool to prepare for prescribed burns and control of invasive plants. Haying is expected to increase to about 600 acres.

Without management, wetland and upland habitat conditions will deteriorate due to long periods of rest. Cool-season invasive plants will likely increase and infest additional areas without the use of spring grazing. While all these activities disturb habitat and wildlife in the short term, long-term habitat and wildlife benefits outweigh these disturbances. Farming will cause decreases in wildlife habitat availability; however, habitat conditions will improve following grassland restoration activities.

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

### Determination

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

### Stipulations Necessary to Ensure Compatibility

- Monitor vegetation and wildlife to assess the effects of the management tools.
- Require general and special conditions for each permit to ensure consistency with management objectives.
- Restrict the use of vehicles and motorized equipment to the minimum necessary to conduct haying, grazing, and farming.
- 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.

### Justification

To maintain and enhance the habitat for migratory birds and other wildlife, some habitat manipulation needs to occur. Upland and wetland habitat conditions will deteriorate without the use of a full range of management tools. Migratory bird habitat and ecological diversity will decrease as habitat suitability declines. Exotic and invasive plant species will increase and habitat diversity will decrease if grazing practices did not continue at the WPAs. Farming will provide a means to restore degraded grasslands for the benefit of grassland-dependent species.

**Mandatory 15-year Reevaluation Date:** 2022

## *2. Description of Proposed Use: Environmental Education and Interpretation*

All of the district's WPAs are open to environmental education and interpretation in accordance with the Migratory Bird Hunting and Conservation Stamp Act. The district will provide opportunities for environmental education and interpretation. Environmental education will consist of activities conducted by district staff and volunteers. Interpretation will occur in less formal activities with refuge staff and volunteers or through exhibits, educational trunks, signs, and brochures. The lack of an outdoor recreation planner and the scattering of the WPAs across 14 counties will not allow the

district to adequately address education and interpretation opportunities. Based on the CCP, the district will hire an outdoor recreation planner and increase education and interpretation for all visitors through the following actions:

- Construct an additional accessible blind for people with disabilities and an interpretive trail in the eastern portion of the district.
- Construct entrance signs at 50% of the WPAs.
- Develop five WPAs as focus areas for education and interpretation.
- Develop watchable wildlife brochures.
- Construct additional interpretive panels to be placed along trails and at parking lots.

### Availability of Resources

Implementing the new facilities outlined in the CCP is closely tied to funding requests for RONS and SAMMS projects (see appendix O). Existing programs such as district signs and brochures will be updated with available resources.

### Anticipated Impacts of Use

All of the WPAs are open to environmental education and interpretation in accordance with the Migratory Bird Hunting and Conservation Stamp Act. Minimal disturbances to wildlife and wildlife habitat will result from these uses at the current and proposed levels. Some disturbance to wildlife will occur in areas frequented by visitors. There will be littering, minor damage to vegetation, and increased maintenance.

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

### Determination

Environmental education and interpretation are compatible.

### Stipulations Necessary to Ensure Compatibility

- Prohibit vehicle access beyond parking lots.
- Prohibit permanent and overnight blinds.
- Develop trails and viewing areas that have minimal impact on wildlife and their habitats.
- Annually review environmental education and interpretation activities to ensure these activities are compatible.

### Justification

Based on biological effects described previously and in the EA and draft CCP, it is determined that environmental education and interpretation within the Rainwater Basin Wetland Management District will not interfere with or detract from the purposes for which the district was established.

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

**Mandatory 15-year Reevaluation Date:** 2022

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

All of the district's WPAs are open to wildlife observation and photography in accordance with the Migratory Bird Hunting and Conservation Stamp Act. The district will provide opportunities that support wildlife-dependent recreation. Wildlife observation and photography are facilitated by one hiking trail and two wildlife observation blinds.

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

- Construct an additional accessible blind for people with disabilities and a hiking trail in the eastern portion of the district.
- Construct entrance signs at 50% of the WPAs.
- Develop a wildlife brochure/bird guide that identifies the WPAs, as well as seasons that offer exceptional wildlife observation and photography opportunities.
- Update existing interpretive kiosks.
- Develop five WPAs as focus areas for wildlife observation and photography.

### Availability of Resources

Implementing the new facilities outlined in the CCP is closely tied to funding requests for RONS and SAMMS projects (see appendix O). Existing programs such as district signs and brochures will be updated with available resources.

### Anticipated Impacts of Use

All of the WPAs are open to wildlife observation and photography in accordance with the Migratory Bird Hunting and Conservation Stamp Act. Minimal disturbances to wildlife and wildlife habitat will result from these uses at the current and proposed levels. Some disturbance to wildlife will occur in areas frequented by visitors. There will be littering, minor damage to vegetation, and increased maintenance.

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

### Determination

Wildlife observation and photography are compatible.

### Stipulations Necessary to Ensure Compatibility

- Prohibit vehicle access beyond parking lots.
- Prohibit permanent and overnight blinds.
- Develop trails and viewing areas that have minimal impact on wildlife and their habitats.
- Annually review wildlife observation and photography activities to ensure these activities are compatible.

### Justification

Based on the anticipated biological effects described previously and in the EA and draft CCP, it is determined that wildlife observation and photography at Rainwater Basin Wetland Management District will not interfere with the habitat goals and objectives or purposes for which it was established.

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

**Mandatory 15-year Reevaluation Date:** 2022

## *4. Description of Use: Recreational Fishing*

All of the district's WPAs are open to recreational fishing in accordance with the Migratory Bird Hunting and Conservation Stamp Act. The district will continue to provide for recreational fishing in accordance with state regulations.

Generally, fisheries do not exist at the WPAs. Wetlands in the Rainwater Basin are shallow, temporary or seasonal wetlands that normally are dry during the summer months. It is only during a series of excessively wet years that the wetlands support fish. Fish that have occurred in the wetlands are black bullhead and European carp. Boating with electric motors will be allowed.

### Availability of Resources

The current fishing program will be administered using available resources. The CCP does not call for the implementation of any new fishing programs.

### Anticipated Impacts of Use

Fishing and other human activities cause disturbance to wildlife. All of the WPAs will be open to recreational fishing in accordance with the Migratory Bird Hunting and Conservation Stamp Act.

### Determination

Recreational fishing is compatible.

### Stipulations Necessary to Ensure Compatibility

- Require that fishing follow state and federal regulations.
- Monitor existing use to ensure that facilities are adequate and disturbance to wildlife continues to be minimal.

### Justification

Based on the biological effects addressed previously and in the EA and draft CCP, it is determined recreational fishing will not interfere with the habitat goals and objectives or purposes for district establishment. Fishing is a priority public use as listed in the Improvement Act.

**Mandatory 15-year Reevaluation Date:** 2022

## *5. Description of Use: Recreational Hunting*

The district will continue to allow hunting of all species according to state regulations. All of the WPAs are open to recreational hunting in accordance with the Migratory Bird Hunting and Conservation Stamp Act.

### Availability of Resources

Currently, sufficient resources are available to carry out the proposed recreational hunting program.

### Anticipated Impacts of Use

Some wildlife disturbance will occur during recreational hunting activities. All of the WPAs will be open to recreational hunting in accordance with the Migratory Bird Hunting and Conservation Stamp Act.

### Determination

Recreational hunting is compatible.

### Stipulations Necessary to Ensure Compatibility

- Require the use of nontoxic shot, in accordance with current regulations for migratory bird and upland game hunting.
- Prohibit vehicle access beyond parking lots.
- Prohibit permanent and overnight hunting blinds
- Prohibit the use of horses.
- 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.
- Annually review recreational hunting activities to ensure these activities are compatible.

### Justification

Hunting on Refuge System lands has been identified as a priority public use in the Improvement Act. Hunting is a legitimate wildlife management tool that can be used to manage populations. Hunting will harvest a small percentage of the renewable resources, which is in accordance with wildlife objectives and principles.

Based on the biological effects described previously and in the EA and draft CCP, it is determined that recreational hunting in the district will not interfere with or detract from the purposes for which the district was established or its habitat goals and objectives.

**Mandatory 15-year Reevaluation Date:** 2022

## *6. Description of Proposed Public Use: Timber Harvest*

The district will continue timber harvest that is conducted under a special use permit by private individuals. Timber harvest will be used as a management tool to reduce the invasion of woody vegetation in grassland and wetland habitats.

### Availability of Resources

The CCP does not propose any changes in timber harvest activities allowed with special use permits. The resources necessary to administer a timber harvest program will be sufficient at current staffing and budgetary levels.

### Anticipated Impacts of the Use

Timber harvest will have short-term impacts by causing disturbance to wildlife and disturbance to ground cover. The removal of trees will reduce the effects of shading and robbing of soil moisture, and thereby encourage warm-season grassland species to grow. The absence of trees will reduce nest and chick mortality for ground-nesting birds that are commonly preyed on by raptors, raccoon, and skunk.

### Determination

The use of timber harvest (under special use permit) as a habitat management tool is compatible.

### Stipulations Necessary to Ensure Compatibility

- Require general and special conditions for each permit to ensure consistency with management objectives.
- Restrict the use of vehicles and motorized equipment to the minimum necessary to conduct timber harvest.
- Require trees be cut to ground level and the stumps be treated with approved herbicide to prevent regrowth.
- Require slash to be removed or piled according to the manager's discretion.

### Justification

Soil and climatic conditions are suitable to grow trees on any land left undisturbed. In addition, larger, mature trees that have timber value are the primary source of seed for new seedlings. Tree removal is vital to the maintenance of quality wetlands and uplands. The spread of saplings will (1) increase the costs of vegetation management that are associated with prescribed burning and (2) reduce haying as a management option. Invasive, cool-season grasses will be commonly associated with shaded woodland areas. Bird predators such as owls, red-tailed hawk, raccoon, and skunk will benefit from shelterbelts and volunteer trees.

**Mandatory 15-year Reevaluation Date:** 2022

---

**Submitted to:** Gene D Mack

Gene Mack, Project Leader — Date 8-20-07
Rainwater Basin Wetland
Management District, NE

**Approved by:** Richard A Coleman 8/21/07

Richard A. Coleman, PhD, — Date
Assistant Regional Director
Region 6, National Wildlife
Refuge System, CO

**Reviewed by:** Dave Lueshen 8-21-07

Rod Krey, Refuge Supervisor — Date
Region 6, National Wildlife
Refuge System, CO

# Appendix C

*Preparers*

This CCP is the result of the efforts by members of the planning team for the Rainwater Basin Wetland Management District.

| *Name* | *Title* | *Agency* |
|---|---|---|
| Mike Artmann | GIS specialist | USFWS |
| Susann Cayouette | administrative officer | USFWS |
| Jeff Drahota | wildlife biologist | USFWS |
| Mark Ely | GIS specialist | USFWS |
| Bernardo Garza | planning team leader | USFWS |
| Kyle Graham | private lands biologist | USFWS |
| Steve Karel | refuge operations specialist | USFWS |
| Brad Krohn | biological technician | USFWS |
| Brice Krohn | supervisory range technician | USFWS |
| Ted LaGrange | wetland program manager | NGPC |
| Gene Mack | project leader | USFWS |
| Mindy Meade | private lands biologist | USFWS |
| Steve Moran | RWBJV coordinator | USFWS |
| Paul Nelson | maintenance worker | USFWS |
| Mark Pfost | biological technician | USFWS |
| Ryan Reker | GIS specialist | USFWS |
| Ronnie Sanchez | deputy project leader | USFWS |
| Richard Schroeder | wildlife biologist/ecologist | USGS–BRD |
| Mark Vrtiska | waterfowl program manager | NGPC |
| Bruce Winter | prescribed fire specialist | USFWS |

# Appendix D

*Public Involvement*

The Service began preparation of this "Comprehensive Conservation Plan for the Rainwater Basin Wetland Management District" with the preplanning process in September 2005. On November 10, 2005, the Service contacted state and tribal representatives to invite them to participate in the planning process for the district's CCP. The planning team was formed during the kickoff meeting in Kearney, Nebraska, December 6–7, 2005, with the following team members: Service personnel from the district and the regional office; representatives from the NGPC and RWBJV; and personnel from USGS–BRD (see appendix C, preparers).

## PUBLIC SCOPING

The notice of intent to prepare the CCP for the Rainwater Basin Wetland Management District was published in the *Federal Register* on November 30, 2005. The public scoping process was completed in December 2005. Four public open-house meetings were held from 7:00 to 9:00 p.m. during consecutive nights throughout the Rainwater Basin, as follows:

- Kearney, NE; December 5, 2005
- York, NE; December 6, 2005
- Clay Center, NE; December 7, 2005
- Holdrege, NE; December 8, 2005

Notification of dates and times of the public open house meetings was distributed through press releases and a planning update mailed out to everyone in the CCP mailing list.

Of the 51 people who attended these meetings, 38 were non-Service individuals. Written comments were received from 17 individuals. Comments received identified biological, recreational, and economic concerns about management of the district.

Those who attended provided both written and oral comments. They were informed that comprehensive planning was an open process and they could submit their comments at any time and by any means (for example, by letter, telephone, and email) until the time the CCP was final. Additional written comments were received by the planning team via mail.

Over the course of preplanning and scoping, the planning team collected available information on the resources of the district and the surrounding areas as well as what are the issues facing the district and of importance to the public. This information is summarized in chapter 2 ("The District") and chapter 3 ("District Resources and Description").

The planning team revisited the purposes for which the district was created and drafted issues and qualities lists, as well as the vision and goals, for the district during a workshop held in Kearney, Nebraska, October 13–14, 2005.

Between February and April 2006, the planning team developed a range of alternatives that included two alternatives for management of the district. A subsequent assessment of each alternative's environmental consequences guided the team in choosing the alternative that would best fulfill the purposes, vision, and goals for the district. Once the Service identified the proposed action, the planning team developed the objectives, strategies, and rationales for each of the goals set out by the district.

## PUBLIC REVIEW OF THE DRAFT CCP

The Service released the draft CCP and EA for a 30-day public comment period starting July 18, 2007. During this public comment period, the planning team held a public meeting in Hastings, Nebraska (July 31, 2007, from 12:00 to 8:00 p.m.). An announcement of this meeting and the release of the draft CCP and EA for public comment was published in the *Federal Register* on July 18, 2007, as well as in local media. Six members of the public, including a local television station reporter and a congressional aid, attended the public meeting.

The public comment period closed August 18, 2007. Two printed letters, a personal communication with the project leader, three personal comments during the public meeting, and an email message were the only comments received from the public. The following summarizes the comments received and the Service's responses.

### *Comments and Responses*

***Comment 1***—The district staff is doing a much better job than in the early part of the 1990s. There are no problems or concerns.

***Response 1***—(None needed.)

*Comment 2*—The grazing and farming programs (as a preparatory technique for restoration to native habitats) administered by district staff have improved waterfowl habitat by changing the plant community from less desirable to more desirable species (for example, from cattails to barnyard grass and reduction in the commonly occurring reed canarygrass and other noxious weeds) at several WPAs.

*Response 2*—The district staff will continue to carry out these and other habitat management techniques that help restore and maintain the habitat conditions required by the migrating and resident wildlife species found in the Rainwater Basin.

*Comment 3*—Food plots should not be considered among the district's habitat management activities because these plots benefit an introduced species (pheasant), plus there is already plenty of leftover grain on lands adjacent to the district's WPAs for pheasant to feed on.

*Response 3*—The district staff will not plant food plots during the implementation of the CCP because food in the form of grain is not a limiting factor in the life or ecology of pheasant or any other species within the Rainwater Basin. More limiting is the diversity and abundance of natural food associated with native plant communities—native plant seeds and insects.

*Comment 4*—The CCP should include information about how wetlands managed by the district help recharge groundwater in the Rainwater Basin.

*Response 4*—There is not adequate information to fully determine the role played by the district's wetlands in the recharging of groundwater in the Rainwater Basin. The CCP addresses the need for further research into the role that the district's wetlands have on groundwater recharge and other ecological benefits to the environment of the Rainwater Basin, such as the quantity and quality of surface and subsurface water resources.

*Comment 5*—Comments provided during the public review period should receive serious consideration and not be not merely a step in an already-completed process.

*Response 5*—All comments provided during the planning process have received serious consideration and have been instrumental in the development of the vision, goals, objectives, and strategies in the final CCP. The Service has adhered to the guidelines and spirit of the NEPA in fully developing and equally analyzing and considering a range of alternatives for the management of the resources of the district. The development and analysis of the range of alternatives and selection of a preferred alternative for this final CCP has not been predecisional.

*Comment 6*—What is to prevent future managers from interpreting this CCP to fit their goals? The CCP may be changed, creatively interpreted, or ignored if it suits the goals of the decision maker.

*Response 6*—This 15-year CCP is a congressionally mandated plan that district and refuge managers must adhere to when making management decisions. The Refuge System's administrative structure will ensure continuity of management and compliance with goals and objectives in this CCP (for example, through oversight by refuge supervisors).

*Comment 7*—Alternative A is the only realistic option. Alternative B offers lofty goals that are unrealistic with available funding and management capabilities. A third option should be introduced in which alternative B management would be fully implemented and further improvements would be undertaken if funding becomes available. Adding additional land without having additional funding will lead to further degradation of the current WPAs and the degradation of new properties acquired. This CCP means nothing without the long-term commitment of funding and personnel to carry out the plan.

*Response 7*—Through this planning process, the Service has determined that carrying out alternative B with its aim to improve and expand management capabilities through partnerships is realistic and feasible. Addition of more land to the district will only occur if the district staff is capable of managing it in accordance with the goals and objectives in this CCP.

*Comment 8*—There is concern that some Service personnel are not concerned with production of waterfowl, but only with migrating waterfowl, particularly during spring migration. The result of this CCP will depend on current and future interpretation and actions, and those will change with changes of personnel.

*Response 8*—The district is located on the critical bottleneck of the hourglass-shaped Central Flyway. All bird species migrating through the flyway converge in the Rainwater Basin during spring and fall migrations—the basin provides a vital resting and staging point for millions of migratory birds. Many wetland habitats in the basin have been converted to urban and agricultural landscapes. The remaining wetlands, both within and outside the district, are now required to provide all the necessary resting and feeding grounds for all the migrating birds that converge in the Rainwater Basin. Thus, a main concern for the Service is to provide the necessary habitat conditions required by migrating birds. The Service is not solely concerned with providing migrating habitat, but given the overall habitat conditions present throughout the basin, the district staff gives priority to ensuring migrating birds can find the best possible habitat during their migrations. In addition, the district staff works incessantly to restore upland habitats (nesting habitat). As noted in response 6, this 15-year

CCP is a congressionally mandated plan that district and refuge managers must follow when making management decisions, and there is administrative oversight to ensure compliance.

***Comment 9***—The government needs to fully fund "payments in lieu of taxes" on all lands to an amount equal to what a private landowner would have paid at the higher of either agricultural production value or recreational value. Paying the full "in lieu of taxes" could help fund better local law enforcement.

***Response 9***—"Payments in lieu of taxes" are paid by the Service through the provisions of the Revenue Sharing Act. However, the Service's ability to make these payments depends on designated funding appropriated by Congress. The Service makes the best possible use of the resources that Congress allocates to the agency. The Service agrees that payment in full "in lieu of taxes" could translate into better local law enforcement.

***Comment 10***— The federal government needs to be a leader in funding and managing its own properties, which means funding the management needs of all currently owned lands in the district.

***Response 10***—As noted in response 9, the Service prioritizes management needs and makes the best possible use of the resources that Congress allocates to the agency.

***Comment 11***—Alternative B does not address how funding will be provided other than with partnerships, local cooperation, and volunteerism. This implies that the Service is transferring its funding and staffing to the local communities, but does not allow local decision making about the management actions. This will also decrease funding and staffing for privately managed wildlife habitat.

***Response 11***—Only the Service has decision-making authority for management within the district; the Service cannot transfer this responsibility or authority. The Service is committed to providing adequate funding and personnel to manage lands in the district. This includes finding new, innovative solutions to current and future management, funding, and personnel challenges—partnerships can be some of the solutions. The Service focus on partnerships aims to fulfill the goals and objectives in this CCP. Partnerships that the district staff seek and maintain will be mutually beneficial, depending on the needs of each individual partner.

***Comment 12***—The Service needs to develop and maintain contact information for adjoining landowners and tenants, plus residents within 2 miles of district properties. The Service needs to annually send each of these contacts a letter that outlines district management plans for the properties near them, how to contact the Service if there is a problem arising from such management as burning or livestock grazing. When grazing is being used, the Service needs to provide the local sheriff's office and adjoining farmers and residents with the livestock owners' contact information. The Service needs to use the local and county newspapers, as well as regional and state newspapers, to promote district management and inform the public.

***Response 12***—This CCP (a public document readily available in printed format at the district office and as a ready-to-download PDF document at the Service's region 6 refuge planning website) outlines the different techniques used by the district's staff to manage lands administered by the Service. The Service will continue to contact fire departments and other appropriate entities to inform them of management activities on Service lands. The district staff, within its budgetary and personnel capabilities, will attempt to develop better means to keep its neighbors informed. This task will be more easily accomplished once the Service can allocate more personnel to the district.

***Comment 13***—Nebraska is sometimes known as the "Tree Planter State"—it is home of Arbor Day. The Service needs to recognize that this is part of the local culture and heritage and, therefore, preserve planted trees, shelterbelts, windbreaks, and border trees. These treed areas are habitats that provide food, shelter, and nesting and resting areas for nonwaterfowl migratory birds. There could be a win-win situation by protecting large trees, along with carrying out early control of seedling trees instead of destroying the large-tree habitat that takes 30–60 years to replace.

***Response 13***— Most of the land in the Rainwater Basin is in private property and contains vast treed habitats that ensure the preservation of the local culture and heritage. For the district's WPAs, the Service's responsibility is to manage for the purpose for which the district was established—for waterfowl and other migratory birds—by restoring wetland and grassland conditions needed by these species. The majority of bird species that migrate through the Central Flyway depend on the mosaic of grasslands and wetlands to provide them with sustenance and rest amidst their long flights. While the current mosaic of extended areas of trees used in shelterbelts, windbreaks, and border trees is conducive to some native and introduced wildlife species, and even to some migrating Neotropical birds, it is not adequate resting and feeding habitat for most migrating species. Prior to human settlement of the Rainwater Basin, the vastly predominant mosaic of habitats in this area were prairie grasslands dotted with numerous complexes of wetlands. Treed areas were sparse and mostly confined to the margins of rivers and creeks. Shelterbelts provide habitat for some species of wildlife; however, shelterbelts and other trees and shrubs decrease the size of grassland blocks and result in fragmented habitats. Shelterbelts are unnatural in grasslands and provide habitat for both

avian and mammalian predators. Recent studies have shown that many grassland-nesting birds and upland-nesting waterfowl either avoid areas adjacent to trees or have lower nest success due to predation. Furthermore, treed areas tend to deplete surface water from wetlands and harbor migratory bird predators. Service activities at the district focus on restoration of presettlement habitat conditions in the lands administered by the district.

*Comment 14*—Large trees provide habitat for the bald eagle, which is America's national bird and symbol and is highly regarded in the culture of Native Americans. It is important for the youth and others who live in or visit this area to see this majestic bird alive and free on public land, not just as a picture in a book. Observation of bald eagles is one of the thrills cited by visitors to this area during migration. The bald eagle is being driven from these public lands by current and proposed management activity; it takes many years to replace large-tree habitat.

*Response 14*—As described in response 13, the purpose for which the district was established is to manage WPAs for waterfowl and other migratory birds by restoring wetland and grassland conditions needed by these species. Bald eagles benefit from the presence of the migratory birds that rest and feed in the Rainwater Basin. Bald eagle populations throughout the United States have grown steadily to the point that this species has been taken off the endangered species list. This majestic American symbol uses and will continue to use the basin so long as there are adequate food resources (migrating waterfowl and other migratory species) that sustain its individuals. Bald eagles make use of all adequate habitats, whether public or private lands. There are vast treed areas within the basin that the bald eagles will use for nesting and roosting even after the Service has restored to grassland and wetland all the lands it administers in the district.

*Comment 15*—There is value in the observation of young wildlife; young ducklings and goslings are an attraction to bird watchers and hunters. The Moger WPA produced wood ducks before their nesting trees were removed.

*Response 15*—As described in response 14, wildlife make use of habitats in the Rainwater Basin so long as they provide adequate food, nesting, loafing and resting resources, whether on public or private lands. Geese, while able to use treed areas for nesting, is primarily a prairie-wetland complex species that will continue to use the basin after the Service has restored the lands it administers to a prairie-wetland complex. To keep trees around wetlands, the Service would need to shift its mission, to one of providing nonhistorical habitat for a species such as the wood duck that was not numerous in grasslands of the Central Flyway. All this would be at the expense of those species that historically relied on the open wetland-grassland landscape.

*Comment 16*—The Service must commit itself to meeting the goals and expectations of partners. In the past, partnerships have meant local funding for Service responsibilities. Other government or nongovernmental groups might not provide funding or other assistance if there is no way to be assured that the Service will maintain what has been provided. Past tree plantings funded by nonfederal groups were destroyed when management changed.

*Response 16*— The Service is committed to meeting the goals and expectations it enters into with its partners. The definition that the Service uses to describe a partnership is, "a contract or agreement entered into by two or more individuals, groups of individuals, organizations or agencies in which each agrees to furnish a part of the capital or some in-kind service, such as labor, for a mutually beneficial enterprise." As noted in response 11, the partnerships that the district staff will seek and maintain will be mutually beneficial, depending on the needs of each partner. Partnerships will aim to fulfill the goals and objectives in this CCP.

*Comment 17*—When partnerships and cooperation are needed, the partners and cooperators must be full partners, where their concerns or ideas are given full consideration. In the past, cooperation with the Service has often meant that a local landowner or government agrees to do something for little or no benefit to the landowner or government.

*Response 17*—Cooperation is essential to effective partnerships; thus, response 16 applies here. The Service considers, respects, and pays attention to the concerns and ideas expressed by its partners and cooperators. In fact, the partnership-driven management scheme for the district finds its roots in ideas and comments provided to the Service by its neighbors, partners, and cooperators.

*Comment 18*—The Service needs to give greater consideration to the concerns of local government and input provided by community leaders. People from the county where the property is located must be given a greater voice, and the Service must yield to local needs if a mutually acceptable compromise cannot be found.

*Response 18*—The Service gives full consideration to the concerns of local government and community leaders. However, neither the Service or the district can deviate from their congressionally mandated mission and purpose. Furthermore, as stated in response 11, only the Service has decision-making authority for management within the district; the Service cannot transfer this responsibility or authority.

*Comment 19*—The Service needs to involve local school and youth groups in construction and maintenance activities at the district. This would develop feelings of pride and ownership in the persons involved. The Little Blue NRD has used this as a method to lessen vandalism on some areas.

***Response 19***—The district staff will seek ways to carry out this helpful idea.

***Comment 20***—The Service needs to contact local schools and offer to provide them guides for field trips to areas in the district.

***Response 20***— The district staff will seek ways to provide local schools with information about school visits and use of the district's facilities. The implementation of this idea will be facilitated when the district is allocated further personnel, especially an outdoor recreation planner.

***Comment 21***—Drought, wet years, burning, grazing, insects, and diseases are some of nature's methods of control that need to be respected. Multi-year drought on private lands has had an impact on the infestation of cattails and rushes. The Service needs to allow basins to go through a drought cycle of more than a few months—many irrigated basins have not undergone a multiyear drought since being purchased. The Service should rotate water-pumping in basins to provide multiyear drought cycles, but not all basins should be left dry at the same time. This management will provide more natural conditions and be more cost effective.

***Response 21***—Drought and extended periods of dry conditions are natural phases of a healthy wetland. However, the large-scale loss of wetlands throughout the Rainwater Basin has made it more vital that the remaining 10% contain water at a frequency higher than what historically occurred. It is part of this CCP to increase the number of WPAs that have water-pumping capabilities; those areas that have had annual water-pumping can be allowed to go through some year-long dry conditions. The added pumping capabilities will increase water management flexibility, allowing a better mix of wet and dry wetlands during migration.

***Comment 22***—Five percent of all lands owned by the Service in each township should be maintained specifically for local habitat interests. The availability of food plots, trees, shrubs, or legumes would diversify the habitat for other wildlife that rely on wetlands. This would provide habitat suitable for upland birds, deer, turkey, songbirds, and raptors.

***Response 22***—As noted in response 13, the purpose for which the district was established is to manage WPAs for waterfowl and other migratory birds by restoring wetland and grassland conditions needed by these species. Providing 5% of the district's land for habitat for nontrust species would mean a 5% decline in habitat for migratory waterfowl and other migratory birds. Based on this CCP, management will continue to provide habitat for upland birds and songbirds. The agricultural lands and shelterbelts that currently dominate the Rainwater Basin landscape provide habitat for deer, turkey, raptors, and other woodland birds.

***Comment 23***—The district's buildings and offices should be built on or adjoining an existing WPA. The sites should be landscaped using plants that occur on the adjoining WPA, and the grounds should be maintained exactly like the WPA. The Service needs to design the facility for use as an outdoor classroom for the public. The Service should consider having facilities built by private owners and leased to the Service.

***Response 23***—These facility comments are very helpful and the Service will consider them during design and location of new district buildings. Construction and location will be influenced considerably by the source and intent of the funds received. For example, the funding source could require the district to co-locate with other Service offices or with another agency.

***Comment 24***—The CCP proposes spending almost $2 million on equipment that can only be used on a seasonal basis and is best used by skilled operators. It would be better to use contractors, who can complete projects quickly and efficiently. Some small equipment items on the CCP list should be leased or hired on an as-needed basis.

***Response 24***—The district currently uses contractors and rental equipment as much as possible. However, some equipment is needed on a frequent or immediate basis, which makes it practical to own the equipment. In addition, the seasonality of use for some equipment makes it difficult to locate or rent that piece of equipment because it is in high demand at the same time the district would need to lease it.

***Comment 25***—Given the size of the district and the number of WPAs, one or two law enforcement people would not be enough to provide adequate coverage. Redefining the working hours of current and additional employees would help provide a presence during weekends and evening hours to discourage lawbreaking. These employees could call authorities to make the arrests.

***Response 25***—Even the additional law enforcement staff (1) specified to carry out this CCP would not be adequate to address all law enforcement situations throughout the district. All staff are watchful and report violations they observe while doing their normal work in the district. To redefine work hours of current employees would mean to reduce the amount of staff time available to do their main work. For example, a maintenance person who is redirected to patrol areas would not be available to do maintenance. It would also increase the probability of that individual being involved in a life-threatening situation that he or she was not hired for or trained to respond to.

***Comment 26***—The Service needs to provide an honest comparison between the farming income and "new" recreational income. Areas acquired have a history of use by hunters and bird watchers. The

income from new visitors would need to surpass the income from current users and agriculture. New income for the area is welcome, but not if there is a greater loss to current income; it would be better to maintain the current income and be able to attract additional income.

*Response 26*—The income data and projections in the CCP is from a recent socioeconomic report. The Service used a consulting company—with ample experience in the research and analysis of socioeconomic data—to assess the economic impact of the Service's activities in the Rainwater Basin. The data used in the subsequent socioeconomic analysis is current, accurate, and the best available for the projections stated in the report.

*Comment 27*—The decline of habitat for upland game has reduced the number of hunters using these areas in the fall. The spring goose season has helped offset this change, but does not have the magnitude or duration that upland hunting once had.

*Response 27*—The majority of lands acquired by the Service within the Rainwater Basin was marginal agricultural land containing drained or altered wetlands, which the Service converted to grassland and wetland. The number of hunters using these areas has increased since the land was converted to wildlife habitat. However, the overall decline in upland game habitat over the past decades has reduced the number of hunters in the basin during the fall. This overall decline in upland game habitat has increased the need for district lands to provide recreational opportunities.

*Comment 28*—The CCP does not address the carbon released by the burning and rotting of mature trees removed from borders and windbreaks. Many of these trees are 30–70 years old and have been storing carbon for that period of time. Sediment and tree removal disturb the soil and cause the release of carbon dioxide into the atmosphere. Disking, whether in a farmer's field or in a wetland, exposes the soil for the release of carbon dioxide; it seems that there would be a greater release or carbon when sediments containing large amounts of organic matter is dug up and exposed to the air.

*Response 28*—The carbon balance or cycle is a complicated matter. Although burning and rotting of mature trees do release carbon, these are natural events since no tree lives forever. The conversion of tilled land into nontilled grassland does sequester carbon. Although reducing the amount of carbon emissions is a concern of the district, as well as every individual, it is not the purpose for which this district was established. The Service recognizes that all management practices have pros and cons that need to be considered.

*Comment 29*—Minimal maintenance roads provide valuable access to hunters and nature watchers, as well as providing necessary means for farmers to move between fields. Because these roads are less traveled, they are often safer and more direct routes for farmers moving large equipment. While a couple of miles added to the travel distance (after closure of these types of roads) for an automobile may be a minor inconvenience to some, the added distance for slow-moving equipment would impact local farmers.

*Response 29*—Roads being sought for closure by the district are roads that have outlived their usefulness. They are commonly characterized by little or no maintenance and are located within wetlands. Often the request to close a particular road is initiated by adjoining landowners who are tired of being asked to pull stuck vehicles during hunting season. The process for closing any county or township road involves requesting permission from the appropriate government, providing public notice, and conducting a hearing on the matter. The district follows this process. In general, a road remains open if the local people are opposed to closing it. Roads closed to the public on district lands may have arrangements made to give adjoining landowners farming access, if necessary.

*Comment 30*—Efficient and beneficial use of water resources is important to all of us. However, pumping water for wildlife as well as farm irrigation can impact roads and adjoining properties of this basin. The Service's description of water pumping in wetlands as irrigation would likely not meet Nebraska's definition of irrigation. Currently, rights to underground water do not exist in Nebraska; the Little Blue NRD has initiated the process to change Nebraska law to provide for wildlife uses of underground water. In areas of conflict between surface rights holders and groundwater users, the surface water rights have priority. This CCP states that pumping is done only where the Service controls the entire wetland. However, residents across the road from Moger WPA experience flooding from heavy rains that flood the wetland. In addition, county roads on the south and west sides of the WPA are flooded by heavy rains. Therefore, any water the Service pumps into the Moger WPA adds to the flood potential. It is the goal of the local residents not to have irrigation water run off of their property and to be able to use most if not all of a normal rain.

*Response 30*—Pumping of any groundwater can have an impact on roads and adjoining properties under certain conditions. The district intends to pump enough water into its wetlands to provide migratory bird habitat, but still leave enough water storage area for normal rains and snowmelt. Since waterfowl and shorebirds prefer shallow water, only a small portion of the wetlands' storage capacity is filled by pumping. However, heavy storm events can cause flooding. The district works with county officials and adjoining landowners to resolve such concerns; within the last decade, the district has only had a couple of complaints of this type. The more common complaint is flooding of fields and roads

caused by cornstalks being washed off the fields and plugging road culverts, keeping runoff from reaching wetlands.

***Comment 31***—Many of the invasive plant species have flourished under the management practices of the last 45 years. These plants were not a problem when the Service purchased the property, but became a problem due to lack of management. In the early years of the district it was thought that no management was needed, but it is now recognized that was not true.

***Response 31***—As more information is obtained through the years, management and objectives have changed. In recent years, the adaptive resource management approach has enabled the Service to evaluate and make adjustments on a timely basis.

***Comment 32***—In the past, the Service has resisted the efforts of local groups to build observation towers and blinds; everyone needs to work together.

***Response 32***—About 10 years ago, the district worked with one local group to build an observation blind on Massie WPA. That group maintains the blind for the benefit of wildlife enthusiasts who visit the area. As noted in response 11, only the Service has decision-making authority for management within the district; the Service cannot transfer this responsibility or authority. The Service cannot allow local groups to freely build towers and blinds that are not compatible with the Service's mission. For example, a blind that is restrictive in accessibility to all the public would not be compatible.

***Comment 33***—The pumping of warm water in January and early February led to an increased early migration under more severe conditions and that coincided with the most severe fowl cholera outbreaks. When there is no open water due to drought or cold weather, pumping creates unnatural open water and leads to more overcrowding. Natural adaptation to seasonal changes are a better plan.

***Response 33***—Natural adaptation to seasonal changes is a better plan, but that is unrealistic because of wetland losses within the Rainwater Basin, as well as throughout the Central Flyway. Natural runoff that normally reached wetlands has declined due to alterations within watersheds. Water pumping is currently the only way to replace the natural runoff. There is no known direct relationship between water temperature and avian cholera. Studies within the Rainwater Basin have documented that the bacteria does not remain in the water or soil, but is brought into the area each spring by migratory birds. The rate that water is delivered into a wetland and the area over which the water spreads out allows that water to quickly cool to the natural temperature of the wetland. It takes only one night of freezing temperatures to reduce pumped water to the temperature of the wetland.

***Comment 34***—It is surprising that prairie dogs would be mentioned in this plan because it seems that management is centered on waterfowl that are hunted and that other species are tolerated at best. There is no problem with prairie dogs on this area so long as they do not impact local landowners.

***Response 34***—The Service has a responsibility to manage all types of native wildlife. Although the emphasis is on waterfowl and migratory birds, management is done to help sustain all types of wildlife that naturally occur on district lands, including prairie dogs.

***Comment 35***—The Service should respect the needs and views of citizens, landowners, and governments in the communities where the WPAs are located. In addition, the Service needs to earn respect through timely, honest, and open communication with these citizens, landowners, and governments about district plans and actions.

***Response 35***—The Service agrees with this comment.

***Comment 36***—There is interest in the recharge of aquifers; if the Service can include recharge of aquifers in the plan, there may be related money to support district management.

***Response 36***—As noted in response 4, the district staff does not have adequate information to fully determine the role played by the district's wetlands in the recharge of aquifers (groundwater) in the Rainwater Basin. This CCP addresses the need for further research into the role that the wetlands managed by the district have on groundwater recharge and other ecological benefits to the environment of the Rainwater Basin such as the quantity and quality of surface and subsurface water resources.

***Comment 37***—The draft CCP and EA represents a continuing violation of the NEPA and section 7 of the Endangered Species Act due to the Service not doing the following: (1) preparing and environmental impact statement; (2) engaging in intra-Service consultations on the sport hunting program for the district and the Refuge System; and (3) using data from nonconsumptive and nonhunter surveys provided by the Humane Society. An environmental impact statement should be prepared because of sport hunting and overall recreation programs.

***Response 37***—Some citizens are concerned with hunting on units of the Refuge System. The Refuge System is guided by laws enacted by Congress and the president, as well as policy derived from those laws. The Improvement Act identifies hunting as one of six, priority, wildlife-dependent, recreational uses to be facilitated when compatible with the mission of the Refuge System and the purposes of any of its units. Hunting is consistent with the purposes of the district. The district manages lands acquired with Federal Duck Stamp and other funds as WPAs.

Because the source of funding for land acquisition is from Duck Stamps, the district's WPAs are open to public use including hunting. While the units of the Refuge System are managed first and foremost for wildlife, the focus is on perpetuating populations, not individuals. Hunting does adversely affect individual animals, but is allowed when it will not threaten perpetuation of the population being hunted.

The district has engaged in intra-Service, section 7 (of the Endangered Species Act) consultation with the Service's ecological services office in Grand Island, Nebraska, to ensure that the actions delineated in the CCP do not adversely affect any federally listed species. The conclusion made by the ecological services office is that the implementation of the CCP will not adversely affect federally listed species in the Rainwater Basin.

The preferred alternative (CCP) was not a major federal action that would significantly affect the quality of the human environment within the meaning of section 102(2)(C) of the NEPA. Accordingly, the preparation of an environmental impact statement was not required.

*Comment 38*—The Service should mow instead of using cattle to manage vegetation. Although grazing could help waterfowl, grazing has caused nothing but disaster.

*Response 38*—Like all management practices, grazing can produce results that cannot be achieved by other management actions. And like other practices, it must be used appropriately. The district staff has found, through years of observations, that livestock grazing can target specific plant species. Grazing that coincides with the beginning growth on undesirable plant species has caused that species to be overgrazed and reduced in number and health. The result is that other, preferred plant species can better compete. The more common use of grazing within the district is to control reed canarygrass. If left unmanaged, this species can displace all other plant species, resulting in a monotypic stand. For native, seed-producing plants to begin to return, the canarygrass has to be severely grazed; that level of grazing results in bare soil and torn-up roots. To the casual observer, the management practice appears to be a disaster. Unfortunately for the observer, the benefit is not seen until the next year's growing season.

## PLANNING MAILING LIST

The following mailing list was developed for this CCP's planning effort.

### Federal Officials

U.S. Senator Chuck Hagel, Washington DC; Area director, Lincoln, NE

U.S. Senator Ben Nelson, Washington DC; Area director, Lincoln, NE

U.S. Representative Adrian Smith, Washington DC; Area director, Grand Island, NE

### Federal Agencies

Bureau of Reclamation

National Park Service—Homestead National Monument, Beatrice, NE; Lewis and Clark National Trail, Omaha, NE

U.S. Army Corps of Engineers; Kearney, NE

USDA, Forest Service; Chadron, NE

USDA, Natural Resources Conservation Service in Nebraska—Holdrege Service Center, Grand Island Service Center, Clay Center Service Center, Hastings Service Center, Franklin Service Center, Elwood Service Center, York Service Center, Aurora Service Center, Geneva Service Center, Wilbur Service Center

USFWS in Nebraska—Ecological Services, Grand Island, NE; Crescent Lake NWR, North Platte NWR, Fort Niobrara NWR, Valentine NWR

USFWS–Northern Prairie Waterfowl Research Center

USFWS—regional offices of regions 1–7 and 9; National Conservation Training Center

USGS–Fort Collins Science Center, Fort Collins, CO; Northern Prairie Research Center; Jamestown, ND

### Nebraska State Officials

Senator Greg Adams, York
Senator Ray Aguilar, Grand Island
Senator Carroll Burling, Kenesaw
Senator Tom Carlson, Holdrege
Senator Annette Dubas, Fullerton
Senator Ray Janssen, Nickerson
Senator Joel Johnson, Kearney
Senator Russ Karpisek, Wilber
Senator Chris Langemeier, Schuyler

### State Government

NDEQ, Lincoln
Nebraska Corn Board, Lincoln
Nebraska Department of Agriculture, Lincoln
Nebraska Department of Natural Resources, Lincoln
Nebraska Department of Roads, Lincoln
Nebraska Department of Water Resources
Nebraska Emergency Management Agency, Lincoln
Nebraska Environmental Trust, Lincoln
Nebraska Forest Service, Lincoln
Nebraska State Historical Society
Nebraska State Historic Preservation Office
NGPC, Lincoln

### Local Government

Buffalo County Weed Board
Central Nebraska Public Power Irrigation District

Central Platte NRD
Clay County Highway Department
Fillmore County Roads Department
Gosper County Weed Control
Hamilton County Board of Supervisors
Little Blue NRD
Lower Loup NRD
Lower Niobrara NRD
Meat Animal Research Center
Phelps County Road Department
Seward County Highway Department
Tri-Basin NRD
Upper Big Blue NRD

## Local Organizations and Business and Civic Groups

The 1980 Anawalt Family Trust
Abengo Energy
A C Feedyards Inc.
Agnes E. Johnson Farms
Audubon Society
Boyd Kaiser Trust
BSL LLC
Burt Partners
Clarence W. Schmidt Trust
Clay Center Critter Care
Crane Meadows Nature Center
C & R Hendrickson Farms Inc.
Cudmore-Kneifl Construction Company Inc.
Daniel R. Stengel Revocable Trust
Dannehl Farms Inc.
Darleen Nielsen Trust
David B. Huber Revocable Trust
David High Farms Ltd.
Donald D. Lovegrove Trust
Donna Linder Trust
Dorothy I. Ebert Estate
Ducks Unlimited
Earl W. Frazier Revocable Trust
Flinthill Farms Ltd.
Gene Lundeen Inc.
Gladys W. Scharmann Trust
H-D Management Company
Kathleen M. Swartz Revocable Trust No. 1
Lauer Ag Inc.
Lazy T Milliron Inc.
Lipovsky Farm Corporation
L & K Irrevocable Living Trust
Marvin W. Volzke Trust
Max A. Gemar Family Trust
M & C Stadler Inc.
ME LLC
The Nature Conservancy
Nebraska Cattlemen
Nebraska Environmental Trust
Nebraska Farm Bureau
Nebraska Farmer
Nebraska Groundwater Foundation
Nebraska Hunters Connection
Nebraska State Historical Society
Nielsen Family Farms LLC
Ostgren Construction Company
Pheasants Forever
Playa Lakes Joint Venture
Prairie Plains Institute
Rainwater Basin Joint Venture
R Lazy K Inc.
R L Kaliff Ranch Company
Rosetta Nelson Family Farms LLC
Ruby L. Real Trust
Semco Land Inc.
Standard Farms of Nebraska Inc.
Stuckey Grandchildren Partnership
Submerged Land Co. Inc.
Sylvia L. Schmidt Irrevocable Trust
Thelma J. Arneson Trust
Thunderbird Farms Inc,
Triple E Farms Inc.
VCK Farms LLC
Whooping Crane Trust
William Seng Trust

## National Organizations

American Bird Conservancy, VA
American Rivers, Washington DC
Defenders of Wildlife, Washington DC
Ducks Unlimited, TN
Isaac Walton League, MD
National Audubon Society; NY, Washington DC
National Trappers Association Inc., WV
National Wildlife Federation, VA
National Wildlife Refuge Association, Washington DC
The Nature Conservancy, CO
Sierra Club, CA
U.S. Humane Society, Washington DC
The Wilderness Society, Washington DC
Wildlife Management Institute; CO, OR, Washington DC

## Media

Aurora News-Register
Bertrand Herald
Blue Hill Leader
Clay County News
Doniphan Herald
Franklin County Chronicle
Friend Sentinel
Gibbon Reporter Office
GI Family Radio
Grand Island Independent
Henderson News
Holdrege Daily Citizen
Kearney Hub
KGFW Radio
KHAS-TV
KOLN/KGIN-TV
KRVN Radio
Lincoln Star Journal
Milford Times
Minden Courier
Nebraska Signal
NTV Network

Omaha World Herald
Tribune-Newspaper
Seward County Independent Newspaper
Shelton Clipper
York News Times/Advantage

## Universities and Colleges

University of Nebraska–Lincoln, Cooperative Unit

## Individuals

352 persons

# Appendix E

*Environmental Compliance*

## Environmental Action Statement

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

Within the spirit and intent of the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act and other statutes, orders, and policies that protect fish and wildlife resources, I have established the following administrative record.

I have determined that the action of implementing the "Comprehensive Conservation Plan for Rainwater Basin Wetland Management District" is found not to have significant environmental effects, as determined by the attached "Finding of No Significant Impact" and the environmental assessment as found with the draft comprehensive conservation plan.

8/22/07

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

Richard A. Coleman 8/21/07

Richard A. Coleman, PhD — Date
Assistant Regional Director, Region 6
National Wildlife Refuge System
U.S. Fish and Wildlife Service
Lakewood, CO

Dave Linehan for 8/21/07

Rod Krey — Date
Refuge Supervisor (KS,NE, ND, SD)
U.S. Fish and Wildlife Service
Lakewood, CO

Gene Mack 8/21/07

Gene Mack — Date
Project Leader
Rainwater Basin Wetland Management District
Kearney, NE

# Finding of No Significant Impact

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

*Fulfill the Comprehensive Conservation Plan for Rainwater Basin Wetland Management District*

Two management alternatives for the Rainwater Basin Wetland Management District were assessed as to their effectiveness in achieving the district's purposes and their impact on the human environment.

- Alternative A, the "no-action" alternative, would continue current management.
- Alternative B, "integrated partnership approach" (the proposed action), would focus on addressing resource management in a holistic manner, with an emphasis on cooperation, coordination, and better exchange of information. An expanded district staff would work with partners to improve the waterfowl production areas across the landscape of the Rainwater Basin. The emphasis would be on adaptive management—as more information is known, management would be changed to improve effects on the environment for the benefit of migratory birds in the Central Flyway.

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

The preferred alternative was selected because it best meets the purposes for which the Rainwater Basin Wetland Management District was established and is preferable to the "no-action" alternative in light of physical, biological, economic, and social factors. The preferred alternative will continue to provide public access for wildlife-dependent recreation, environmental education, and interpretation.

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

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

- The preferred alternative will not adversely impact endangered or threatened species or their habitat.
- The preferred alternative will not adversely impact archaeological or historical resources.
- The preferred alternative will not adversely impact wetlands nor does the plan call for structures that could be damaged by or that would significantly influence the movement of floodwater.
- The preferred alternative will not have a disproportionately high or adverse human health or environmental effect on minority or low-income populations.
- The state of Nebraska has been instrumental in the development of this plan and has been notified and given the opportunity to review the comprehensive conservation plan and associated environmental assessment.

8/22/08

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

Date

# Appendix F

*Black-tailed Prairie Dog Management Plan*

**BLACK TAILED PRAIRIE DOG MANAGEMENT PLAN**

**Rainwater Basin Wetland Management District**

**Written and Revised in 2003 by**
**Tom Koerner, Deputy Refuge Manager**
**&**
**Jeff Drahota, Wildlife Biologist**

***Approvals and Concurrence***

Rainwater Basin Wetland Management District:

***Project Leader***

Gene D. Mack _____

Signature Date

Mountain-Prairie Regional Office:

***National Wildlife Refuge System***

***Refuge Supervisor, Nebraska, Kansas & Colorado***:

Ron Shupe _____

Signature Date

***Regional Wildlife Biologist***:

Wayne King _____

Signature Date

## Description

The scientific name for the black-tailed prairie dog i€*ynomys ludovicianus.* *"L*udovicianus," is the Latin form of Ludwig or Louis, relating back to the Lewis and Clark expedition of 1804-1806, when prairie dogs were first collected for science.

The prairie dog is a burrowing member of the order Rodentia, the largest group of mammals in the world. An adult black-tailed prairie dog is between 12 and 16 inches long and generally weighs between 1.5 and 2.5 pounds. Its tail is covered with hair and is about one-fourth of the animal's total length. Its body is tan to pale brown in color, its underparts are white to buffy white, and its tail is tipped with black. The prairie dog's legs are short, but its feet are large and have well-developed claws, especially on the forefeet. Its head is broad and rounded, and its eyes are fairly large.

## Distribution and Abundance

The black-tailed prairie dog is one of five species of prairie dogs found in North America. It is the most abundant and widely distributed species and is the only prairie dog found in Nebraska. It is found throughout the Great Plains from southern Canada to just inside Mexico. The western edge of its range is along the Rocky Mountains, and the eastern edge follows the natural boundary between tall and mid-grass prairie. In Nebraska, prairie dogs are found roughly in the western two-thirds of the state. Historic towns have been documented on a number of WPAs throughout the WMD; however, the most active towns are found in the west half of the WMD.

Black-tailed prairie dogs live in colonies or "towns" that range in size from as small as one acre to several thousand acres. The largest prairie dog colony on record was in Texas, and was about 100 miles wide, 250 miles long and contained an estimated 400 million animals. It is estimated that in the late 1800s, some 700 million acres of North American rangeland were inhabited by prairie dogs. Habitat changes and extensive eradication efforts have reduced the acreage by about 90 to 95 percent from historic levels.

We believe that on WPAs, the cessation of regular grazing on these towns led to the eventual loss of the town due to the creation of unsuitable habitat. This factor becomes more important the farther east one travels. Increasing precipitation levels, resulting in higher vegetative growth without grazing may results in less suitable habitat.

## Habitat and Home

Areas of short and mid-grass rangeland that are heavily grazed by livestock are the prairie dog's preferred habitat. Prairie dog colonies are most recognizable by the mounds and holes at their burrow entrances. A colony will typically have 30 to 50 burrow entrances per acre.

The animal's burrow system can be quite complex and extensive. Mounds of excavated soil around the burrow entrance are generally cone-shaped and vary from one to three feet in height and from three to 10 feet in diameter. These mounds serve as lookout points and serve to prevent water from entering the burrow system. Tunnels are generally three to six feet below the surface and about 15

feet long, although burrows have been reported to reach depths of 15 feet. Burrow systems typically include several chambers, including one near the entrance where the prairie dog can sit and listen for activity above ground, and one or more nest chambers where they sleep and care for their young.

## Habits

The fact that prairie dogs live in colonies indicates they are highly social animals. The largest social unit is the colony or town. Towns are often divided into "wards" by topographical barriers such as roads, ridges or trees, and are generally five to 10 acres in size. Although prairie dogs in one ward may be able to see and hear animals of an adjacent ward, movement among wards is unusual. Wards are divided into several smaller prairie dog social units, called "coteries." Each coterie generally consists of one adult male, one to four adult females, and any offspring less than two years old. Members of one coterie defend their territory from invasion by members of other coteries.

Prairie dogs are active during the day, usually from about sunrise to sunset, and during summer they spend about one-third to one-half of the daylight hours feeding. Another third is involved in social interactions with other colony members as well as working on burrows and mounds and responding to alarm calls. The remainder of daylight is spent underground, especially during midday when temperatures above ground are high. The black-tailed prairie dog is active all year. In winter, it remains underground for several days when weather is severe, but comes out on sunny afternoons to look for food and bask in the sun.

Black-tailed prairie dogs exhibit an elaborate communication system. At least 11 separate calls have been identified, and a variety of postures and displays are utilized. Calls range from signals of alarm to "all-clear." Physical contact is another method of prairie dog communication. Mouth-to-mouth contact is used to identify coterie members from strangers, and grooming among coterie members is common.

## Food

Grasses are the preferred food of the prairie dog, and generally makes up about three fourths of its diet. In the fall, broadleaf forbs become more important as green grass is less available. In winter, any available green vegetation is consumed. In the spring and summer, each prairie dog consumes up to two pounds of vegetation per week.

In addition to the vegetation it eats, the prairie dog also clips much of the vegetation within its colony. This is probably done to keep the vegetation clipped short to provide an unobstructed view of approaching predators. Over a period of time, clipping, foraging and digging activities can alter the composition of the vegetation in a prairie dog town. Short, native grass like buffalograss and blue grama is favored when present.

## Reproduction

A prairie dog reaches sexual maturity after its first winter and has one litter per year. Breeding takes place in March and early April, and a litter of 4-6 young is born 30 to 35 days later. Young prairie dogs are born hairless, helpless, and with their eyes closed. They remain underground for about six weeks and first emerge from the den in May or June. They are weaned at this time and begin feeding on green vegetation. They reach adult size by fall.

### Mortality

Although the prairie dog has been known to live for at least eight years in captivity, its average life span in the wild is usually three to four years. In addition to actions of man, the prairie dog faces many natural predators. Badgers are probably the main predators, but coyotes, weasels, golden eagles, hawks, swift fox, and other predators take prairie dogs. Bullsnakes and rattlesnakes take young prairie dogs but generally not adults. The black-footed ferret was once a primary prairie dog predator, but it is now considered an endangered species and no wild ferrets have been verified in Nebraska since the 1940s.

A prairie dog is susceptible to a number of diseases, the most notable being plague. Plague is an infectious disease transmitted by the bite of an infected flea. Plague can devastate prairie dog populations, wiping out entire colonies in some areas. This disease was known as "black death" in the 1300s when about one-third of Europe's human population was lost. Although it can be transmitted to humans through the bite of an infected flea, plague has not been found in prairie dogs in Nebraska and is now treatable in humans.

### Importance

In many ways, a prairie dog town can be considered a biological oasis. Many wildlife species associate with prairie dogs. Some species feed on prairie dogs, but others utilize the burrow systems or the unique habitat to fulfill their needs. Vacant burrows are used by cottontail rabbits, several species of small rodents, tiger salamanders, and by burrowing owls. Our most active towns have had successful nesting by burrowing owls. Meadowlarks, grasshopper sparrows, and other birds are found in greater numbers in prairie dog towns than in the surrounding rangeland because they are attracted to the open spaces, where seeds and insects are more accessible. In addition to their importance to other wildlife species, prairie dogs are also important to wildlife observers and photographers.

## SITE DESCRIPTION

Originally, the Rainwater Basin in south central Nebraska contained more than 3,900 wetland basins within a 17-county area. The Basin region covers 4,200 square miles of flat to gently rolling Peorial Loess Plains. Wetland basins are generally large, shallow depressions with deep clay layers in the wetland basin–creating an impervious water barrier. The name Rainwater Basin

comes from the basins' ability to go from dry to flooded conditions quickly–following heavy rainstorms and snow melts. Continual siltation problems result from rapid runoff carrying heavy silt loads from agricultural land resulting in poor water quality. Soils surrounding the basins are very fertile, consisting of heavy silt loams and silty clay. Deep beneath the soil lies the Ogallala Aquifer, which is the source of water for the extensive amount of irrigated corn and soybeans. Water from the Platte River, lying north of the region, is delivered by irrigation canals to irrigate the southwest portion of the region. Agricultural and rural development has destroyed more than 90 percent of the original number of wetlands.

The Fish and Wildlife Service began acquiring wetlands in 1963 with the purchase of Massie Waterfowl Production Area (WPA). By 1966, 7,000 acres were acquired and a management office was established in Hastings, Nebraska. In 1976, the office was moved to its present location: Kearney, Nebraska.

The Rainwater Basin Wetland Management District (WMD) currently manages 63 tracts of land, 61 of which are Waterfowl Production Areas (WPA) totaling 23,059 acres. One of the remaining two areas is McMurtrey Wildlife Management Area that was transferred from the military. Its 1052 acres are closed to public use. The other tract is the Platte River National Wildlife Management Area (438 acres). This property is owned by the state of Wyoming and managed through a memorandum of understanding. WPAs are small isolated tracts of land scattered throughout the District. Most WPAs contain only one large wetland. All WPAs are managed as a grassland/wetland ecosystem. Wetland management is focused toward providing optimum waterfowl and shorebird habitats. The uplands are managed for a high diversity of native tall and mid-grass plant species. Thirty-eight FmHA conservation easements totaling 2350 acres are managed by this office as well.

Spring migration is the primary focus of the Rainwater Basin WMD. Each spring, about six million snow geese, one million Canada geese, 90 percent of the mid-continent white-fronted goose population, millions of ducks, and one-half million sandhill cranes use these wetlands and associated Platte River areas. Habitat becomes very critical during this time of year. Extensive pumping and aggressive wetland management are needed to maintain quality habitat for resting and staging.

In addition, we manage habitats to provide habitat for many other species of migratory birds and resident wildlife which utilize these grasslands and adjacent uplands.

### Soils

Soils throughout the Rainwater Basin vary. In general, they are characterized as Peorial Loess. The soils formed under tall and mid-grass prairies and are characterized as deep, well drained, and fertile. The wetland or hydric soils are scattered throughout the WMD and are generally believed to have formed through a combination of wind and water erosion. Scouring events created a depression and rainfall events caused the migration of clays to the bottom of the basin. These hydric soils (Massie, Scott, and Fillmore soils) have a clay layer from 1 to 10 feet thick. They create an impermeable layer and restrict movement of water.

### Surrounding Land Uses

The major industry and source of income throughout the WMD is crop and livestock production. Nearly every acre has been converted to agricultural use. Small to medium sized communities (25,000 residents) are scattered across the WMD.

### Current Status of Black-tailed Prairie Dogs on WPAs

We currently have 5 WPAs with known active black-tailed prairie dog towns (see Figure 1). These are Prairie Dog (see Figure 2), Atlanta (see Figure 2), McMurtrey (see Figure 4), Hultine (see Figure 5), and Clark (see Figure 6) WPAs. These were surveyed in 1999 and again in 2003. McMurtrey, Atlanta, and Prairie Dog WPAs appear to have viable populations at this time. Atlanta WPA currently has the largest dog town at 24 acres yet, most are less than 8 acres.

On Prairie Dog WPA, a number of abandoned burrows were re occupied after initiating grazing on the sites. Likely, individuals from the active burrows relocated into these abandoned burrows.

The town on Atlanta WPA has remained relatively the same size, and has not expanded outside of the electric fence lines placed to control grazing access. The population on McMurtrey NWR, appears to be well established from re-introductions made in 2001.

The towns on Clark and Hultine WPAs established after several years of heavy grazing. The newly established towns on both sites are small, containing less than 12 burrows each in the summer of 2003. They both have the potential to expand into previously occupied burrows.

## REINTRODUCTION

Reintroduction

A number of additional WPAs have evidence that historic black-tailed prairie dog towns (see Figure 7). Old burrows and mounds can still be found. We propose that re-introductions of black-tailed prairie dogs be made into these historic sites. In addition, several high public use sites on Harvard, Massie, Mallard Haven, and Funk WPAs that have the potential for environmental education and interpretation along with establishing a viable population, are proposed release sites. Although no evidence in the form of mounds or burrows exists at these sites, it is believed that historically black-tailed prairie dogs could be found in the immediate vicinity of these sites. Currently, seven release sights including both historic and new dog towns are proposed (see Figure 8) and will be populated as circumstance allow. We propose re-introductions of black- tailed prairie dogs into these sites under the following conditions:

1. All landowners immediately adjacent to the proposed reintroduction site have been contacted to discuss our intent, management options, and concerns.
2. Private rangeland is not located immediately adjacent to the proposed release site and/or an adequate cultivated barrier exists to minimize movement from the re-introduction site and discourage colonization on adjacent private land.
3. Suitable habitat exists at the time of release. Suitable habitat includes poor stands of grass commonly dominated by introduced grasses.

Intended release sites should provide suitable black-tailed prairie dog habitat at the time of release. This would include vegetation 3" or less in height and a minimum of one “burrow” for every four animals released. The vegetation could be grazed, or mowed if grazing were not possible, through the growing season to keep it short. Burrows could be present from a historic town, or they could be drilled in with the 6" auger attachment on the Bobcat. Drill one burrow for every two dogs released. Both of these conditions will reduce the likelihood that the prairie dogs will abandon the site upon release and would likely result in a higher survival rate of released animals.

**Pre-Capture**

We are occasionally contacted by individuals wishing to remove prairie dogs from their property. They would be willing to allow these prairie dogs to be live trapped for relocation. If we have a suitable re-introduction site where all three conditions stated above have been met, we may consider accepting these prairie dogs for reintroduction purposes. Each proposal will be evaluated on a case by case basis, giving preference to those sites closest to the proposed reintroduction site. If our staff will be required to conduct the trapping and relocation, time budgets of the staff will be given priority and will only be conducted when our workload allows.

Prior to trapping, the prairie dog town that will be trapped should be surveyed for indications of

disease. A walk through should be done looking for signs of dead animals including other species. Remote monitoring of animals should be done using a spotting scope for one hour during midday (at least three hours after sunrise and two hours before sunset) on a sunny day. It is recommended that all burrows be treated 10 days prior to trapping with Delta Dust to kill fleas currently inhabiting the colony. If dead animals are found, two options can be taken: 1) bag the animal and send to the disease lab to determine cause of death; 2) find another trapping sight.

Pre-baiting with should start three days before trapping begins. Live traps can be placed within 3 feet of active burrows and locked open during pre-baiting. Trapping should start after June 1 and can be done until sub-freezing temperatures occur.

Monkey pox was recently a high profile news story with regards to handling of prairie dogs. The origin of the outbreak was traced to a shipment of prairie dogs in the pet trade. These prairie dogs then infected humans which handled them. USDA APHIS immediately placed restrictions on the trade and handling of prairie dogs. At this time, it does not appear that these restrictions apply to the US Fish and Wildlife Service with regards to ongoing research and/or management of wild populations of prairie dogs. This new outbreak should reinforce the need to research the background of any potential capture sites and exclude any that may have had captive black- tailed prairie dogs released on site.

**Capture**

New bait but smaller portions should be used during the trapping stage. Traps should be unlocked with bait placed on the pan or just behind the pan. If needed, flagging should be used to mark traps since they may be difficult to monitor from a distance so not to disturb the colony unless animals have been captured. Traps should not be left unlocked if they cannot be checked at least every 24 hours.

Once animals have been captured, they should be dusted with flea powder (the product Seven is recommended) before the trap is moved. Long gloves should be used to prevent fleas from bitting around the wrist. Traps can then be placed in the back of a pickup and removed from the site and taken to the quarantine site.

A 24-hour quarantine is required after trapping. Captured animals should be left in the traps they were captured in. They should be placed in a cool and dry area such as a pole barn or well ventilated shed. If a longer quarantine is used, apple slices can be used to sustain the animals and will meet their food and water requirements.

Any dead animals found during the quarantine should be handled with extreme caution. These animals should be sent to the disease lab for analysis. If plague is found, these animals should not

be used for reintroduction.

**Post Release**

After release, the site will be periodically surveyed to determine presence or absence of prairie dogs, if vegetation is conducive to expansion, limiting expansion, or maintaining populations. Currently, 8-10 acre prairie dog towns appear to be manageable. Larger towns could be maintained on a few WPA's as long as the station's mission and goals are not jeaprodized. Three or four areas could have up to 30 acre prairie dog towns if further expansion is controllable and the threat of colonization on adjacent land is minimal. It is also necessary to monitor adjacent cropland for potential foraging impacts due to overcrowding, expansion, or changes in forage quantity on WPA's.

**MANAGEMENT**

Management includes any activity conducted to control the size of the prairie dog town, maintain the habitat suitability for black-tailed prairie dogs, and/or ensure its long term viability.

Hunting black-tailed prairie dogs on Federal Waterfowl Production Areas in the Rainwater Basin WMD was closed as of 01/01/2003. We propose to leave this closure in place indefinitely. This decision was made based upon the relatively small size of the towns, small populations, and relative isolation from other active towns. Although significant harvest was not believed to be occurring before the closure, changes in local interest in prairie dog shooting along with decreasing opportunities would likely have led to an increase in harvest.

Active prairie dog towns on Atlanta, Prairie Dog, McMurtrey, Clark, and Hultine WPAs have been managed primarily through heavy grazing over the last four seasons. Grazing cooperators are instructed to place water tanks on the town site. This results in short, clipped vegetation which is more suited to maintaining a viable town. We have interseeded buffalo grass and blue grama on these sites, with the expectation that increased grazing pressure will result in establishment of these two, low growing grasses. Although not widely distributed in the mid and tall grass prairie, buffalo grass and blue grama can be found in areas which are heavily grazed. We plan to continue grazing at a rate sufficient to maintain a vegetative height less than 3" on active towns. If grazing is not an option in some years, mowing may be considered as a possible alternative.

Historic black-tailed prairie dog towns may be re-occupied without re-introductions simply by providing suitable habitat. Prairie dogs, especially the first year class, have been documented to disperse into suitable habitat located several miles away. By grazing these historic towns at a rate sufficient to provide suitable habitat, it is conceivable they may be re-occupied at some point. This is what we believe occurred on Clark and Hultine WPAs.

Our land acquisition program has the potential to acquire new WPAs that may contain active black-tailed prairie dog towns. Should we acquire lands with an active black-tailed prairie dog town, we will manage the sites in a similar fashion to maintain a viable town within a defined boundary.

It has been demonstrated that fence placement alone has been sufficient to prevent the spread of a town outside of the defined boundary on Prairie Dog and Atlanta WPAs (see Figure 2 & 3). We feel that this phenomenon will hold true across the WMD. The grassland vegetation in these precipitation zones grows faster than the prairie dogs can cut it, resulting in unsuitable habitat. If private pasture exists adjacent to the release site, it is conceivable to believe that some prairie dogs would relocate to this pasture and cause damage by their burrowing activities. That is why release under these circumstances will be carefully considered. The majority, however, have adjacent cropland. The annual tillage and tall growth eliminate cropland as potential black- tailed prairie dog habitat.

**Control**

In the event that our assumptions are wrong and that the black- tailed prairie dogs spread outside of the defined boundaries, control measures will be taken. All legal and effective methods for prairie dog control may be considered, excluding the use of any toxicants.

Some options considered but are not limited too:

| | |
|---|---|
| Box traps | Although relatively ineffective at capturing large numbers, this may be considered where individual animals may want to be salvaged for some purpose. |
| Leghold traps | Placed in front of burrow entrances, may be relatively effective at reducing a small number of animals. |

Management

| | |
|---|---|
| Visual barriers | The use of snow fence, hay bales, or other visual obstructions have proven successful in some places with reducing or eliminating the spread of prairie dogs from a defined boundary. |
| Raptors | The installation of raptor perches along the perimeter of prairie dog towns has proven successful at some locations for reducing the spread of the town. |
| Shooting | Shooting individual animals which have spread outside of the designated boundaries could prove effective. This could be accomplished by US Fish and Wildlife Service staff or by an individual through a Special Use Permit. |

## REFERENCES

Black-tailed Prairie Dog Surveys for 1999 and 2003. Rainwater Basin Wetland Management District. Unpublished report.

Boddicker, Major L. Prevention and Control of Wildlife Damage. B-75 to B-84 Prairie Dogs.

Hyngstrom, Scott E., and Dallas R. Virchow. Prairie Dogs and the Prairie Ecosystem.

Luce, Bob, et. al. A Multi-State Conservation Plan for the Black-tailed Prairie Dog, *Cynomys ludovicianus*, in the United States. 2002.

Nebraska Game and Parks Commission Website:
http://www.ngpc.state.ne.us/wildlife/pdogs.html

Van Pelt, William E. The Black-tailed Prairie Dog Conservation Assessment and Strategy.

.

References

Page 13

# 2003 Active Prairie Dog Towns on WPAs



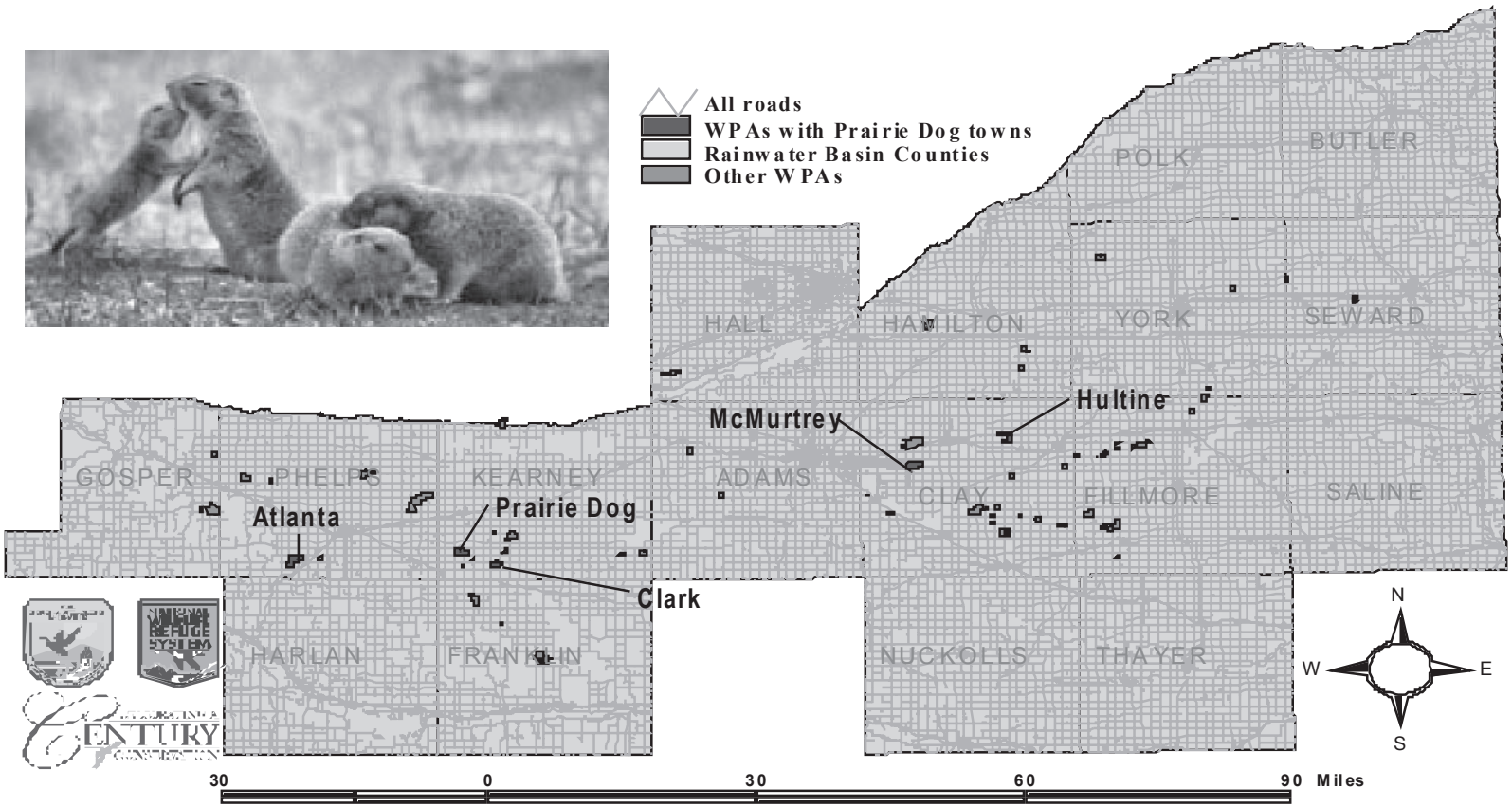



Figure 1

# Historic Black-tailed Prairie Dog Towns on WPAs

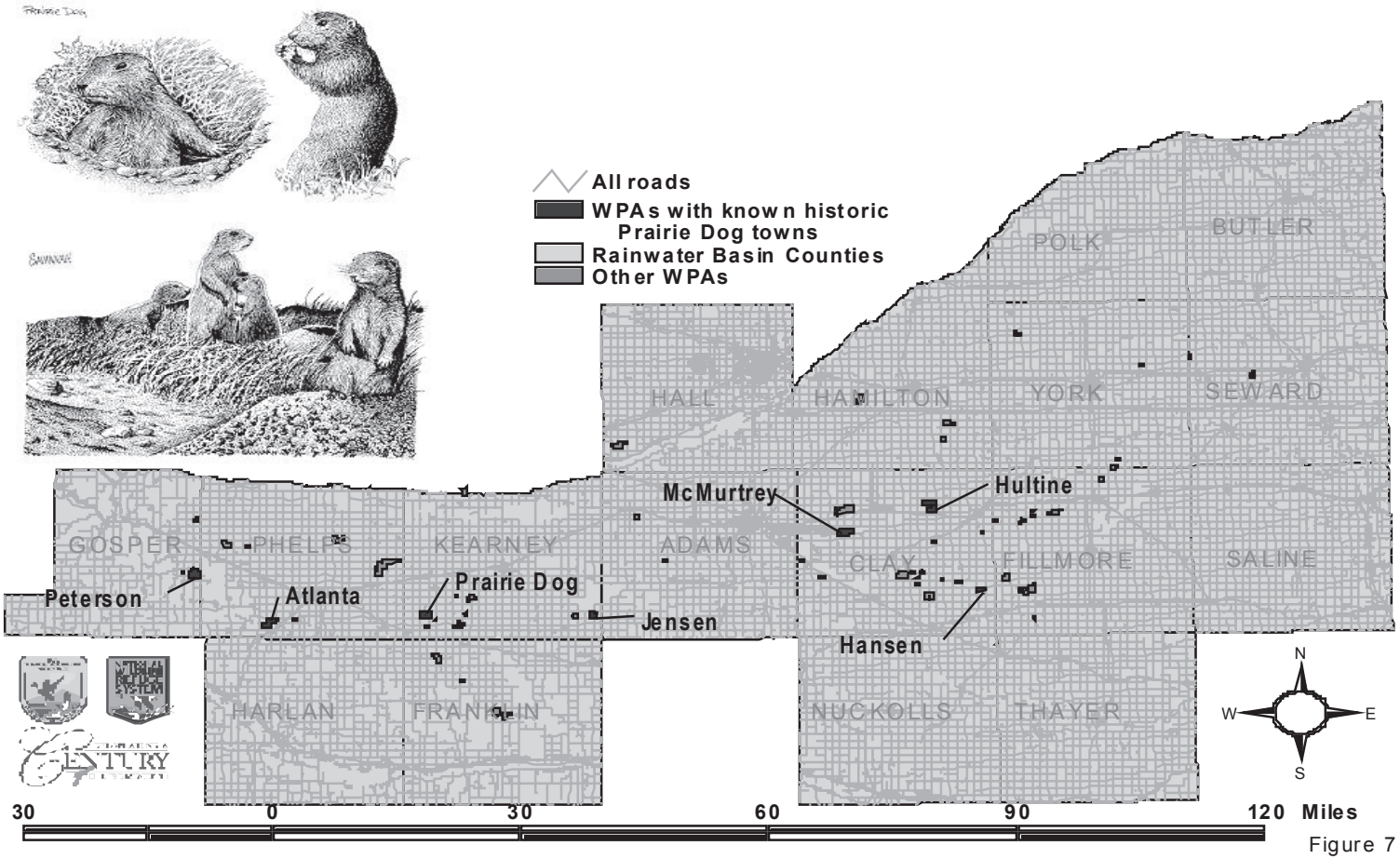



Figure 7

# Proposed Black-tailed Prairie Dog Release Areas

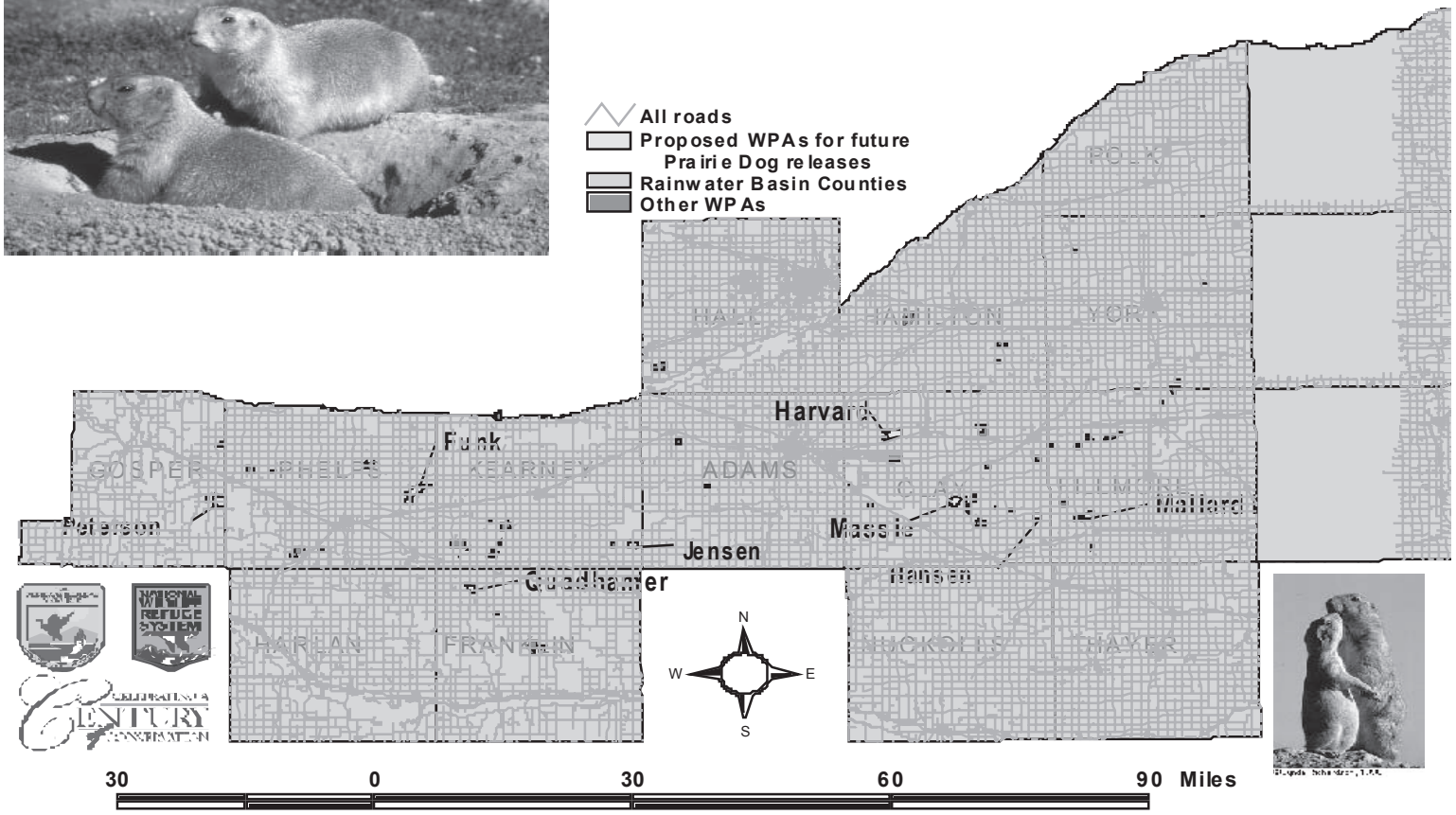





Figure 8

# Appendix G

*Section 7 Biological Evaluation*

**INTRA-SERVICE SECTION 7 BIOLOGICAL EVALUATION FORM**
**For**
**Issuance and Implementation of the Comprehensive Conservation Plan for the**
**U.S. Fish and Wildlife Service**
**Rainwater Basin Wetland Management District**

FISH AND WILDLIFE SERVICE
SEP 0 4 2007
RECEIVED
GRAND ISLAND, NEBRASKA

**Originating Person: Gene Mack**
**Jeff Drahota**
**Bernardo Garza**
**Telephone Number: (308) 236-5015**
**Date: August 31, 2007**

**I. Region:** 6

**II. Service Activity (Program):** Rainwater Basin Wetland Management District (WMD), Comprehensive Conservation Plan (CCP).

**III. Pertinent Species and Habitat:**

**A. Listed species and/or their critical habitat within the action area:**
whooping crane (E), piping plover (T), Interior least tern (E)

**B. Proposed species and/or proposed critical habitat within the action area:**
none

**C. Candidate species within the action area:**
none

**IV. Geographic area or station name and action:**
Rainwater Basin National Wildlife Refuge Complex
Issuance and Implementation of the CCP for Rainwater Basin WMD

**V. Location: (map attached)**

**A. Ecoregion number and name:** Platte/Kansas Ecoregion

**B. County and State:** Buffalo County, Nebraska. The Rainwater Basin WMD encompasses 17 counties in south-central Nebraska.

**C. Distance and direction to nearest town:** The Rainwater Basin Complex headquarters is located in Kearney, Nebraska.

**D. Species/habitat occurrence:**

Whooping crane: The Rainwater Basin WMD is a key stopover site for this species migrating through the Central Flyway to their breeding area in the Northwest Territories in the spring and their wintering area on Aransas NWR in the fall. Since

2000 there have been at least eight confirmed fall observations of whooping cranes using Rainwater Basin WMD. Additionally, during recent years, this species has been documented on the Waterfowl Production Areas (WPA) of the complex.

Piping plover: The piping plover breeds and forages along river channels and nest on sparsely vegetated sandbars. It also breeds on large, alkaline lakes. The piping plover may be an uncommon visitor during the migration period, but has not been documented to nest within the Rainwater Basin WMD.

Interior Least tern: The Interior least tern breeds and forages along river channels and nest on sparsely vegetated sandbars. It has been documented on Rainwater Basin WMD, but this is an anomaly, as the majority of this species' habitat use in Nebraska centers on the major river systems such as Missouri River, Platte River, Niobrara River, and Loup River.

**VI. Description of proposed action**:

Implementation of Alternative 2 of the CCP to guide the management of the Rainwater Basin WMD for the next 15 years. Implementation of this CCP comprises implementation of all actions and activities to achieve the stated goals contained in the CCP that will ultimately lead to the fulfillment of the purposes for which Congress established all the units comprising the Rainwater Basin WMD and assist in the fulfillment of the goals of the National Wildlife Refuge System.

**VII. Determination of effects:**

**A. Explanation of effects of the action on species and critical habitats in Items III. A, B and C:**

Whooping crane: Implementing the CCP is not thought to have detrimental effects on this migrant crane. In fact, the continued preservation and management of WPAs for the benefit of wildlife species should enhance loafing, feeding and resting sites for whooping cranes.

Interior least Tern/

Piping plover: Implementing the CCP is not thought to have detrimental effects on either the Interior least tern or piping plover. In fact, the continued preservation and management of WPAs, especially grazing management may increase this species use of WPAs.

**B. Explanation of actions to be implemented to reduce adverse effects:**

None are necessary. All actions delineated in this CCP are thought to follow and be in accordance with provisions of protection and restoration plans for several species, as delineated by the Service and other federal and State agencies. The WMD staff is well acquainted with provisions that would be invoked and be put into effect to protect federally listed species and species of special concern from any public use or management action by WMD staff or visitors to the WMD.

**VIII. Effect determination and response requested:**

**A. Listed species/designated critical habitat:**

| **Determination** | **Response Requested** |
|---|---|
| **may affect, not likely to adversely affect species/adversely modify critical habitat** | |
| Whooping Crane | _X_ Concurrence |
| Least Tern | _X_ Concurrence |
| Piping Plover | _X_ Concurrence |

Gene D Mack 8-31-07

Gene Mack, Project Officer Date

**IX. Reviewing ESO Evaluation:**

A. Concurrence_X_ Nonconcurrence_____

B. Formal Consultation Required_____

C. Conference Required_____

D. Informal Conference Required_____

John Cochran 9/4/07

Assistant Nebraska Field Supervisor Date
Ecological Services
Grand Island, Nebraska

# Appendix H

*List of Plants*

The Service maintains a list of plant species at <http://www.fws.gov/nwi/bha/list88.html> that occur in wetlands. The following list of plants for WPAs managed by the Rainwater Basin Wetland Management District was generated using the region 5 map (1,523 plant species) from this website. The USDA Plants website at <http://plants.usda.gov> listed 9,485 plant species for Nebraska. Both the USDA Plants website and the NatureServe Explorer website at <http://www.natureserve.org/explorer> were used to verify scientific names, common names, and habits for those species not listed on the Service website.

## SCIENTIFIC NAME

Scientific name is the genus and species applied to the taxon by the National List of Scientific Plant Names (1982), USDA Plants, NatureServe Explorer (2006).

## NATIONAL RANGE OF INDICATORS

The national indicators reflect the range of estimated probabilities (expressed as a frequency of occurrence) of a species occurring in wetland versus nonwetland across the entire distribution of the species. A frequency, for example, of 67%–99% (facultative wetland) means that 67%–99% of sample plots containing the species randomly selected across the range of the species would be wetland. A question mark (?) following an indicator denotes a tentative assignment based on the botanical literature and not confirmed by regional review. When two indicators are given, they reflect the range from the lowest to the highest frequency of occurrence in wetlands across the regions in which the species is found. A positive (+) or negative (–) sign was used with the facultative indicator categories to more specifically define the regional frequency of occurrence in wetlands. The positive sign indicates a frequency toward the higher end of the category (more frequently found in wetlands), and a negative sign indicates a frequency toward the lower end of the category (less frequently found in wetlands).

### *NATIONAL WETLAND INDICATOR (INDICATOR CATEGORIES)*

**Obligate Wetland (OBL).** Occur almost always (estimated probability >99%) under natural conditions in wetlands.

**Facultative Wetland (FACW).** Usually occur in wetlands (estimated probability 67%–99%), but occasionally found in nonwetlands.

**Facultative (FAC).** Equally likely to occur in wetlands or nonwetlands (estimated probability 34%–66%).

**Facultative Upland (FACU).** Usually occur in nonwetlands (estimated probability 67%–99%), but occasionally found on wetlands (estimated probability 1%–33%).

**Obligate Upland (UPL).** Occur in wetlands in another region, but occur almost always (estimated probability >99%) under natural conditions in nonwetlands on the region specified. If a species does not occur in wetlands in any region, it is not on the National List.

The wetland indicator categories should not be equated to degrees of wetness. Many obligate wetland species occur in permanently or semipermanently flooded wetlands, but a number of obligates also occur and some are restricted to wetlands that are only temporarily or seasonally flooded. The facultative upland species include a diverse collection of plants that range from weedy species adapted to exist in a number of environmentally stressful or disturbed sites (including wetlands) to species in which a portion of the gene pool (an ecotype) always occurs in wetlands. Both the weedy and ecotype representatives of the facultative upland category occur in seasonally and semipermanently flooded wetlands.

### *REGION 5 WETLAND INDICATOR (REGIONAL INDICATOR FOR 5—CENTRAL PLAINS NE, KS, CO [EASTERN])*

The regional indicator reflects the estimated probability (likelihood) of a species occurring in wetlands versus nonwetlands in the region. Regional indicators reflect the unanimous agreement of the Regional Interagency Review Panel. If a regional panel was not able to reach a unanimous decision on a species, NA (no agreement) was recorded on the regional indicator field. An NI (no indicator) was recorded for those species for which insufficient information was available to determine an indicator status. A nonoccurrence (NO) designation indicates that the species does not occur in that region. An asterisk (*) following a regional indicator identifies tentative assignments based on limited information from which to determine the indicator status.

## HABIT

Habit indicates the plant characteristics and life forms assigned to each species in the National List of Scientific Plant Names (1982) and by the Soil Conservation Service. Family names are listed alphabetically under specific life forms restricted to these families. The habit symbols are combined to describe the life form of the species (for example, ANG means annual native grass and IT means introduced tree).

| *Habit Symbol* | *Characteristic or Life Form* | |
|---|---|---|
| A | Annual | |
| B | Biennial | |
| C | Clubmoss | Lycopodiaceae<br>Selaginellaceae |
| E | Emergent | |
| F | Forb | |
| / | Floating | |
| F3 | Fern | Adiantaceae<br>Aspleniaceae<br>Blechnaceae<br>Cyatheaceae<br>Davalliaceae<br>Dennstaedtiaceae<br>Dryopteridaceae<br>Gleicheniaceae<br>Grammitidaceae<br>Hymenophyllaceae<br>Lomariopsidaceae<br>Marattiaceae<br>Ophioglossaceae<br>Osmundaceae<br>Parkeriaceae<br>Polypodiaceae<br>Psilotaceae<br>Pteridaceae<br>Schizaeaceae |
| G | Grass | Poaceae |
| GL | Grasslike | Cyperaceae<br>Juncaceae |
| H | Partly woody | |
| HS | Half shrub | |
| H2 | Horsetail | Equisetaceae |
| I | Introduced | |
| N | Native | |
| P | Perennial | |
| + | Parasitic | |
| P3 | Pepperwort | Marsileaceae |
| Q | Quillwort | Isoetaceae |
| S | Shrub | |
| – | Saprophytic | |
| Z | Submerged | |
| $ | Succulent | |
| T | Tree | |
| V | Herbaceous vine | |
| W | Waterfern | Azollaceae<br>Salviniaceae |
| WV | Woody vine | |

| *Scientific Name* | *Common Name* | *Region 5 Wetland Indicator* | *National Wetland Indicator* | *Habit* |
|---|---|---|---|---|
| *Abutilon theophrasti* | velvetleaf | UPL–FACU– | UPL | AIF |
| *Achillea millefolium* | common yarrow | FACU | FACU | PNF |
| *Agropyron elongatum* | tall wheatgrass | FAC,FACU* | NI | PNG* |
| *Agropyron smithii* | western wheatgrass | FACU | UPL,FAC– | PNG |
| *Agrostis hyemalis (A. antecedens)* | ticklegrass | FACU | FACU,FACW | PNG |
| *Agrostis gigantea* | redtop | FAC+,FACW | FAC+ | PNG |
| *Alisma plantago-aquatica* | European water plantain | OBL | OBL | PNEF |
| *Alisma subcordatum* | American water plantain | OBL | OBL | PNEF |
| *Allium canadense* | meadow onion | FACU–,FACU | FACU | PNF |
| *Allium canadense* var. *lavendulare* | meadow onion | FACU–,FACU | FACU | PNF |
| *Alopecurus carolinianus* | Carolina foxtail | FACW | FAC+,FACW | ANG |
| *Amaranthus arenicola* | sandhill amaranth | UPL,FAC | FACU | ANF |
| *Amaranthus retroflexus* | redroot amaranth | FACU | FACU–,FAC– | ANF |
| *Amaranthus rudis* | amaranth | FACW | FACU–, FACW | ANF |
| *Ambrosia artemisiifolia* | annual ragweed | FACU | FACU–,FACU+ | ANF |
| *Ambrosia grayi* | woollyleaf burr ragweed | FAC | FAC,FACW | PNF |
| *Ambrosia psilostachya* | naked-spike ragweed | FAC | FACU–, FAC | PNF |
| *Ambrosia trifida* | great ragweed | FACW | FAC,FACW | ANF |
| *Ammannia coccinea* | valley redstem | OBL | FACW+,OBL | ANF |
| *Amorpha canescens* | leadplant | FAC* | NI | PNF* |
| *Andropogon gerardii* | big bluestem | FAC– | FACU,FAC | PNG |
| *Apocynum cannabinum* | clasping-leaf dogbane | FAC | FACU,FAC+ | PNF |
| *Argemone* spp. *(polyanthemos)* | crested pricklypoppy | UPL | | PNF |
| *Aristida oligantha* | three-awn grass | FACU* | NI | PNG* |
| *Artemisia ludoviciana* | white sagebrush | FACU– | UPL,FACU | PNFH |
| *Asclepias stenophylla* | slim-leaved milkweed | FACU* | NI | PNF* |
| *Asclepias syriaca* | common milkweed | FACW–* | NI | PNF |
| *Asclepias verticillata* | whorled milkweed | UPL | | PNF |
| *Asclepias viridiflora* | woolly milkweed | UPL | | PNF |
| *Asclepias viridis* | green antelopehorn | UPL | | PNF |
| *Aster junciformis* | rush aster | OBL | OBL | PNF |
| *Aster* spp. (see *Symphyotrichum)* | wild aster | UPL,OBL* | NI | PINF* |
| *Astragalus canadensis* | Canadian milkvetch | FACU | FACU,FACW– | PNF |
| *Astragalus crassicarpus* | groundplum milkvetch | UPL | | PNF |

| *Scientific Name* | *Common Name* | *Region 5 Wetland Indicator* | *National Wetland Indicator* | *Habit* |
|---|---|---|---|---|
| *Azolla mexicana* | Mexican mosquito fern | OBL | OBL | PN/W |
| *Bacopa rotundifolia* | disk water-hyssop | OBL | OBL | PNF |
| *Baptisia bracteata* | long-bract indigo | UPL | | PNF |
| *Berula erecta* | water parsnip | OBL | OBL | PIF |
| *Bidens cernua* | nodding beggar-ticks | OBL | FACW+,OBL | AIF |
| *Bidens comosa* | leafy-bract beggar-ticks | FACW | FACW | ANF |
| *Bidens frondosa* | devil's beggar-ticks | FACW | FACW,FACW+ | ANF |
| *Bidens vulgata* | big devil's beggar-ticks | | | ANF |
| *Boltonia asteroides* | white boltonia | FACW | FACW,OBL | PNF |
| *Bouteloua curtipendula* | sideoats grama | FACU* | NI | PNG* |
| *Bouteloua gracilis* | blue grama | UPL* | NI | PNG* |
| *Brickellia eupatorioides* | false boneset | UPL | | PNF* |
| *Bromus inermis* | smooth brome | UPL* | NI | PNG* |
| *Bromus japonicus* | Japanese brome | FACU | FACU,UPL | AIG |
| *Bromus tectorum* | downy brome | UPL* | NI | ANG* |
| *Bryophyte* spp. | moss | NI | NI | NI |
| *Buchloe dactyloides* | buffalograss | FACU | FACU–,FACU | PNG |
| *Calamagrostis canadensis* | bluejoint | OBL | FAC,OBL | PNG |
| *Calamovilfa longifolia* | prairie sandreed | UPL | | PNG |
| *Callirhoe alcaeoides* | light poppymallow | UPL | | PNF |
| *Callirhoe involucrata* | purple poppymallow | UPL | | PNF |
| *Calylophus serrulatus* | yellow sundrops | UPL | | PNF |
| *Calystegia sepium (Convolvulus sepium)* | hedge false bindweed | FAC | | PNFV |
| *Cannabis sativa* | hemp | FAC+* | NI | ANF* |
| *Capsella bursa-pastoris* | common shepherd's purse | FACU | FACU,FAC | AIF |
| *Cardus nutans* | musk thistle | UPL | | B/PIF* |
| *Carex bicknellii* | Bicknell's sedge | FACU,FACW | FACU | PNGL |
| *Carex brevior* | short-beak sedge | FAC | UPL,OBL | PNEGL |
| *Carex cristatella* | crested sedge | FACW | FAC,FACW+ | PNGL |
| *Carex gravida* | heavy sedge | OBL* | | PNGL |
| *Carex laeviconica* | smooth-cone sedge | OBL | OBL | PNEGL |
| *Carex lanuginosa (C. pellita)* | woolly sedge | OBL | OBL | PNGL |
| *Carex tribuloides* | blunt broom sedge | FACW,OBL | FACW | PNGL |
| *Carex vulpinoidea* | fox sedge | OBL | OBL | PNEGL |

| *Scientific Name* | *Common Name* | *Region 5 Wetland Indicator* | *National Wetland Indicator* | *Habit* |
|---|---|---|---|---|
| *Carex × stipata* | stalk-grain sedge | OBL | OBL | PNGL |
| *Cassia chamaecrista* | showy partridge pea | UPL | | ANF |
| *Ceanothus americanus* | New Jersey tea | UPL | | PNF |
| *Ceanothus herbaceus* | Jersey tea | UPL | | PNS |
| *Celtis occidentalis* | hackberry | | | PNT |
| *Celtis occidentalis* | common hackberry | UPL | | PNT |
| *Cenchrus longispinus* | sandbur | FAC* | NI | ANG* |
| *Chenopodium album* | lambsquarters | FAC | FACU,FAC | AIF |
| *Chenopodium desiccatum* | aridland goosefoot | UPL | | ANF |
| *Chenopodium leptophyllum* | narrowleaf goosefoot | NI | UPL,FAC | ANF |
| *Cichorium intybus* | chicory | | | BPIF |
| *Circaea* spp. | enchanter's nightshade | FACW,UPL | | PNF |
| *Cirsium altissimum* | roadside thistle | FAC* | NI | BNF* |
| *Cirsium arvense* | Canada thistle | FACU | FACU–,FAC | PIF |
| *Cirsium canescens* | prairie thistle | UPL | | BNF* |
| *Cirsium flodmanii* | Flodman's thistle | NI | FACU? | PNF |
| *Cirsium ochrocentrum* | yellowspine thistle | UPL | | BPNF |
| *Cirsium* spp. | thistles | FAC+* | NI | ABINF* |
| *Cirsium undulatum* | wavy-leaf thistle | FACU | FACU,FAC | BPNF |
| *Cirsium vulgare* | bull thistle | UPL | UPL,FAC | BIF |
| *Comandra umbellata* | umbellate bastard toad-flax | UPL,FACU | UPL | PN+F |
| *Convolulus* spp. | field bindweed | FAC* | NI | PNF* |
| *Convolvulus arvense* | field bindweed | FAC* | NI | PNF* |
| *Conyza canadensis* | Canada horseweed | FACU– | UPL,FAC | ANF |
| *Conyza ramosissima* | dwarf horseweed | FAC* | NI | ANF |
| *Coreopsis tinctoria* | golden tickseed | FAC | FACU,FAC | ANF |
| *Crepis runcinata* | hawksbeard dandelion | FAC | FACU,FACW | PNF |
| *Cyperus acminatus* | short-point flatsedge | OBL | OBL | ABPNGL |
| *Cyperus aristatus* | awned flatsedge | OBL | FACW+,OBL | ANGL |
| *Cyperus erythrorhizos* | redrooted cyperus | OBL | FACW+,OBL | APNEGL |
| *Cyperus esculentes* | chufa | FACW | FAC,FACW | PNGL |
| *Cyperus lupulinus* | Houghton flatsedge | FACU | | PNG |
| *Dalea candida* | white prairie clover | UPL | | PNF |
| *Dalea purpurea* | violet prairie clover | UPL | | PNF |

| *Scientific Name* | *Common Name* | *Region 5 Wetland Indicator* | *National Wetland Indicator* | *Habit* |
|---|---|---|---|---|
| *Dalea villosa* | silky prairie clover | UPL | | PNFHS |
| *Delphinium carolinianum* | Carolina larkspur | UPL | | PNF |
| *Delphinium virescens* | prairie larkspur | UPL | | PNF |
| *Desmanthus illinoensis* | prairie bundleflower | FACU | UPL,FAC | PNF |
| *Desmodium canadense* | showy tick-trefoil | FAC | FACU,FAC | PNF |
| *Desmodium illinoense* | Illinois tick-trefoil | UPL | | PNF |
| *Dianthus armeria* | Deptford pink | UPL | | PNF |
| *Dichanthelium acuminatum* | panic grass | FAC,FACW | FAC | PNG |
| *Dichanthelium oligosanthes* | Heller's witchgrass | FACU | FACU,FAC | PNG |
| *Digitaria sanguinalis* | hairy crabgrass | FACU | FACU–,FAC– | AIG |
| *Echinacea angustifolia* | blacksamson echinacea | UPL | | PNG |
| *Echinochloa crusgalli* | barnyard grass | FACW | FACU,FACW | AIG |
| *Echinochloa muricata* | rough barnyard grass | OBL | FAC,OBL | ANG |
| *Elatine rubella* | red waterwort | | | ANF |
| *Eleocharis compressa* | flat-stem spikerush | FACW | FACW, FACW+ | PNEGL |
| *Eleocharis erythropoda* | bald spikerush | OBL | OBL | PNGL |
| *Eleocharis obtusa* | blunt spikerush | OBL | OBL | APNEGL |
| *Eleocharis ovata* | ovate spikerush | OBL | OBL | ANEGL |
| *Eleocharis palustris* | creeping spikerush | OBL | OBL | PNEGL |
| *Eleocharis smallii* | Small's spikerush | OBL | OBL | PNGL |
| *Elymus canadensis* | nodding wild rye | FACU | FACU, FAC+ | PNG |
| *Elymus smithii* | western wheatgrass | FACU | | PNG |
| *Elymus trachycaulus* | slender wheatgrass | FACU | | PNG |
| *Elymus virginiana* | Virginia wild rye | FAC | FAC,FACW | PNG |
| *Eragrostis spectabilis* | purple lovegrass | FACU | UPL,FACU | PNG |
| *Erigeron annuus* | white-top fleabane | FACU | FACU,FAC | ANF |
| *Erigeron philadelphicus* | Philadelphia fleabane | FACU | FACU,FAC | ANF |
| *Erigeron strigosus* | prairie fleabane | FAC | FACU,FAC | ANF |
| *Eupatorium perfoliatum* | common boneset | OBL | FACW+,OBL | PNF |
| *Euphorbia cyathophora* | fire-on-the-mountain | UPL | | NAPF |
| *Euphorbia dentata* | toothed spurge | UPL | | AIF |
| *Euphorbia maculata (Chamaesyce maculata)* | spotted broomspurge | FACU– | UPL,FACU | ANF |
| *Euphorbia marginata* | snow-on-the-mountain | UPL,FACU | FACU | ANF |
| *Euphorbia nutans* | eyebane broomspurge | FACU–,FACU | FACU– | AIF |

| *Scientific Name* | *Common Name* | *Region 5 Wetland Indicator* | *National Wetland Indicator* | *Habit* |
|---|---|---|---|---|
| *Festuca arundinacea* | Kentucky fescue | FACU | UPL,FACW– | PIG |
| *Festuca saximontana* | Rocky Mountain fescue | | | NPG |
| *Fragaria virginiana* | Virgina strawberry | UPL,FAC | FACU | PNF |
| *Fraxinus pennsylvanica* | green ash | FACW | FAC,FACW | NT |
| *Gaillardia pulchella* | blanketflower | UPL | | PNF |
| *Galium aparine* | catchweed bedstraw | FACU | FACU,FAC– | ANF |
| *Gaura coccinea* | scarlet gaura | UPL | | PNS/F |
| *Gaura parviflora* | velvet-leaf butterfly-weed | FACU? | NI | ANF |
| *Gleditsia triacanthos* | honey-locust | FAC | FACU,FAC | NTS |
| *Glyceria striata* | fowl mannagrass | OBL | OBL | PNEG |
| *Glycine max* | soybean | UPL* | NI | AI* |
| *Glycyrrhiza lepidota* | American licorice | FACU | UPL,FAC+ | PNF |
| *Grindelia squarrosa* | curly-cup gumweed | FACU– | UPL,FACU | ABPNF |
| *Gutierrezia sarothrae* | broom snakeweed | UPL | | PNS/F |
| *Hedeoma hispida* | rough false pennyroyal | UPL | | ANF |
| *Helianthus annuus* | common sunflower | FACU | FACU,FAC | ANF |
| *Helianthus grosseserratus* | saw-tooth sunflower | FACW | FAC,FACW | PNF |
| *Helianthus maximiliani* | Maximilian's sunflower | UPL | UPL,FACU | PNF |
| *Helianthus petiolaris* | prairie sunflower | UPL | | ANF |
| *Helianthus rigidus* | stiff sunflower | UPL | | PNF |
| *Hesperis matronalis* | dames rocket | | | IBPF |
| *Hesperostipa spartea* | porcupinegrass | UPL | | PNG |
| *Hesperostipa viridula* | green needlegrass | UPL | | NG |
| *Heteranthera limosa* | blue mud-plantain | OBL | OBL | ANEF |
| *Heteranthera multiflora* | bouquest mud-plantain | OBL | | ANF |
| *Heterotheca villosa* | hairy goldaster | UPL | | PNF |
| *Hieracium longipilum* | hairy hawkweed | FACU | | PNF |
| *Hordeum jubatum* | fox-tail barley | FACW | FAC,FACW | PNG |
| *Hordeum pusillum* | little barley | FAC | FACU,FAC | ANG |
| *Hypoxis hirsuta* | eastern yellow stargrass | FAC,FACW | FACW | PNF |
| *Ipomoea hederacea* | ivyleaf morning-glory | FACU,FAC | FACU | AIV |
| *Ipomoea leptophylla* | bush morning-glory | UPL | | PNF |
| *Ipomoea pandurata* | wild sweet-potato vine | FACU,FAC– | FAC– | PNF |
| *Ipomoea purpurea* | common morning-glory | UPL,FAC | FACU | AIV |

| *Scientific Name* | *Common Name* | *Region 5 Wetland Indicator* | *National Wetland Indicator* | *Habit* |
|---|---|---|---|---|
| *Juncus dudleyi* | Dudley rush | | | PNG |
| *Juncus interior* | inland rush | FAC | FACU,FACW | PNGL |
| *Juncus* spp. | rush | FACW* | NI | PNGL* |
| *Juniperus virginiana* | eastern red cedar | FACU– | FACI–,FACU | NT |
| *Kochia scoparia* | Mexican summer-cypress | FACU | UPL,FAC | AIF |
| *Koeleria macrantha* | prairie Junegrass | UPL | | PNG |
| *Kuhnia eupatoriodes* | false boneset | FAC,FACU* | NI | PNF* |
| *Lactuca canadensis* | tall yellow lettuce | FACU | FACU–,FAC+ | ABNF |
| *Lactuca ludoviciana* | biannual lettuce | FAC | UPL,FAC | BPNF |
| *Lactuca serriola* | prickly lettuce | FAC | FACU,FAC | ABIF |
| *Lactuca tatarica* | blue lettuce | FAC | | BPNF |
| *Leersia oryzoides* | rice cutgrass | OBL | OBL | PNG |
| *Lemna minor* | lesser duckweed | OBL | OBL | PN/F |
| *Lemna trisulca* | star duckweed | OBL | OBL | PN/F |
| *Lepidium densiflorum* | common pepperweed | FAC | | ABNF |
| *Lepidium virginicum* | Virginia pepperweed | UPL,FAC– | FACU | ABNF |
| *Leptochloa fascicularis* | bearded sprangletop | OBL | FACW,OBL | ANG |
| *Lespedeza capitata* | round-head bushclover | UPL | UPL,FACU | PNF |
| *Liatris punctata* | dotted gayfeather | FACU | | PNF |
| *Liatris pycnostachya* | cattail gayfeather | FAC | FACU,FAC+ | PNF |
| *Limosella aquatica* | northern mudwort | OBL | OBL | APNEF |
| *Lindernia dubia* | yellowseed false pimpernel | OBL | OBL | ANF |
| *Linum rigidum* | stiffstem flax | | | APNF |
| *Lithospermum incisum* | narrow-leaved puccoon | UPL | | PNF |
| *Lomatium foeniculaceum* | wild parsley | UPL | | PNF |
| *Lotus corniculatus* | bird's-foot trefoil | FACU | FACU–,FAC | PIF |
| *Lotus purshianus* | prairie trefoil | FACU* | NI | ANF* |
| *Lotus unifoliolatus* | American bird's-foot trefoil | | | ANF |
| *Ludwigia palustris* | marsh seedbox | OBL | OBL | PNEF |
| *Lycopus americanus* | American bugleweed | OBL | OBL | PNF |
| *Lygodesmia juncea* | rush skeletonplant | UPL | | PNF |
| *Lythrum salicaria* | purple loosetrife | FACW+,OBL | OBL | PIF |
| *Marsilea vestita* | hairy water fern | OBL | OBL | PNEP3 |
| *Medicago sativa* | alfalfa | | | APIF |

| *Scientific Name* | *Common Name* | *Region 5 Wetland Indicator* | *National Wetland Indicator* | *Habit* |
|---|---|---|---|---|
| *Melilotus alba* | white sweetclover | FACU | FACU–,FACU+ | ABIF |
| *Melilotus officinalis* | yellow sweetclover | FACU | FACU–,FACU+ | ABIF |
| *Mirabilis linearis* | narrowleaf four o'clock | | | PNFHS |
| *Mirabilis nyctaginea* | heartleaf four o'clock | UPL | UPL,FACU | PNF |
| *Mollugo verticillata* | green carpet-weed | FAC | FAC–,FAC | ANF |
| *Monarda fistulosa* | wild bergamot | UPL,FAC+ | FACU– | PNF |
| *Morus alba* | white mulberry | UPL,FAC | FAC | IT |
| *Morus rubra* | red mulberry | FACU | FACU, FAC | NT |
| *Muhlenbergia mexicana* | Mexican muhly | FACW | FAC,FACW | PNG |
| *Muhlenbergia racemosa* | green muhly | FACW | FACU,FACW | PNG |
| *Myosurus minimus* | tiny mouse-tail | FACW | FACW–OBL | ANF |
| *Nepeta cataria* | catnip | FACU | FACU–,FACW– | PIF |
| *Oenothera biennis* | common evening-primrose | FACU | FACU–,FACU+ | BIF |
| *Oenothera villosa* | hairy evening-primrose | FAC | FACU,FACW | BPNF |
| *Oligoneuron rigidum* | goldenrod | UPL | | PNF |
| *Oxalis dillenia* | gray-green woodsorrel | FACU* | NI | PNF* |
| *Oxalis stricta* | yellow woodsorrel | FACU* | | PNF |
| *Oxalis violacea* | violet woodsorrel | UPL | | PNF |
| *Panicum capillare* | witchgrass | FAC | FACU,FAC | ANG |
| *Panicum dichotomiflorum* | fall panic grass | FAC | FAC,FACW | ANG |
| *Panicum virgatum* | switchgrass | FAC | FAC,FACW | PNG |
| *Parientaria pensylvanica* | Pennsylvania pellitory | FAC | FACU–,FACW– | ANF |
| *Penstemon grandiflorus* | large-flower beardtongue | UPL | | PNF |
| *Phalaris arundinacea* | reed canarygrass | FACW+ | FACW,OBL | PNG |
| *Phleum pratense* | timothy | FACU | FACU | PIG |
| *Phyla cuneifolia* | wedgeleaf fog-fruit | FAC | | PNS/F |
| *Physalis heterophylla* | clammy groundcherry | UPL | | PNF |
| *Physalis longifolia* | longleaf groundcherry | UPL | | PNF |
| *Physalis* spp. | groundcherry | FAC* | NI | AP* |
| *Physalis virginiana* | Virginia groundcherry | UPL | | PNF |
| *Poa compressa* | Canada bluegrass | FACU | FACU–,FAC | PIG |
| *Poa pratensis* | Kentucky bluegrass | FACU | FACU,FAC– | PNG |
| *Polygala alba* | white milkwort | | | PNF |
| *Polygonum arenastrum* | knotweed | UPL* | NI | APNF* |

| *Scientific Name* | *Common Name* | *Region 5 Wetland Indicator* | *National Wetland Indicator* | *Habit* |
|---|---|---|---|---|
| *Polygonum bicorne (P. pensylvanicum)* | pink smartweed | FACW+ | FACW–,OBL | ANEF |
| *Polygonum coccineum* | water smartweed | OBL | OBL | PNE/F |
| *Polygonum hydropiper* | swamp smartweed | OBL | OBL | PNEF |
| *Polygonum lapathifolium* | curlytop knotweed | OBL | FAC,OBL | ANF |
| *Polygonum persicaria* | spotted ladysthumb | OBL | FAC,OBL | AIF |
| *Polygonum punctatum* | dotted smartweed | OBL | FACW,OBL | PNEF |
| *Polygonum ramosissimum* | bushy knotweed | FAC | FACU–,FACW | ANF |
| *Populus deltoides* | eastern cottonwood | FAC | FAC,FACW | NT |
| *Portulaca oleracea* | common purslane | FAC | FACU,FAC | AN$F |
| *Potamogeton gramineus* | variable pondweed | OBL | OBL | PNZF |
| *Potamogeton nodosus* | longleaf pondweed | OBL | OBL | PNZF |
| *Potentilla arguta* | tall cinquefoil | FACU | UPL,FACU+ | PNF |
| *Potentilla norvegica* | Norwegian cinquefoil | FAC | FACU,FAC | ABPNF |
| *Potentilla recta* | sulphur cinquefoil | FACU* | NI | PNF* |
| *Prenanthes racemosa* | glaucous rattlesnake-root | FAC | FACU–,FACW | PNF |
| *Prunella vulgaris* | heal-all | FAC | FACU,FACW | PIF |
| *Prunus americana* | American plum | UPL | UPL,FACU | NST |
| *Prunus virginiana* | chokecherry | FACU | FACU–,FAC | NST |
| *Psoralea argophylla* | silver-leaf scurfpea | FACU* | NI | PNF* |
| *Psoralea tenuiflora* | few-flowered scurfpea | UPL | | PNF |
| *Psoralidium lanceolatum* | lemon scurfpea | UPL | | PNF |
| *Pulsatilla patens* | pasqueflower | UPL | | PNF |
| *Ranunculus flabellaris* | yellow water buttercup | OBL | OBL | PNEF |
| *Ranunculus longirostris* | longbeak buttercup | OBL | OBL | PNZ/F |
| *Ranunculus pensylvanicus* | Pennsylvania buttercup | FACW,OBL | OBL | APNEF |
| *Ranunculus sceleratus* | cursed buttercup | OBL | OBL | APNEF |
| *Ratibida columnifera* | upright prairie coneflower | UPL | | PNF |
| *Rhus glabra* | smooth sumac | UPL | | NT |
| *Riccia fluitans* | liverwort | | | |
| *Robinia pseudoacacia* | black locust | UPL | UPL,FAC | NT |
| *Rorippa palustris* | bog yellowcress | OBL | FAC,OBL | ANEF |
| *Rorippa sessiliflora* | stalkless yellowcress | OBL | FACW+,OBL | ANEF |
| *Rorippa sinuata* | spreading yellowcress | FACW | FAC+,FACW | PNF |
| *Rosa arkansana* | wild prairie rose | NI | FAC? | NSH |

| *Scientific Name* | *Common Name* | *Region 5 Wetland Indicator* | *National Wetland Indicator* | *Habit* |
|---|---|---|---|---|
| *Rosa multiflora* | multiflora rose | UPL,FACU | UPL | IS |
| *Rosa woodsii* | Woods' rose | UPL,FAC– | FACU | NS |
| *Rudbeckia hirta* | black-eyed susan | FACU–,FACU | FACU | BPNF |
| *Rumex altissimus* | pale dock | FAC | FAC,FACW+ | PNF |
| *Rumex crispus* | curly dock | FACW | FACU,FACW | PIF |
| *Sagittaria brevirostra* | shortbeak arrowhead | OBL | OBL | PNEF* |
| *Sagittaria calycina* | hooded arrowhead | OBL | OBL | PNEF |
| *Sagittaria cuneata* | arumleaf arrowhead | OBL | OBL | PNEF* |
| *Sagittaria graminea* | grassy arrowhead | OBL | OBL | PNEF |
| *Sagittaria latifolia* | broadleaf arrowhead | OBL | OBL | PNEF* |
| *Sagittaria longiloba* | longbarb arrowhead | OBL | OBL | PNEF |
| *Sagittaria rigida* | sessilefruit arrowhead | OBL | OBL | PNEF |
| *Salix amygdaloides* | peach-leaf willow | FACW | FACW | NT |
| *Salsola kali* | Russian thistle | FACU–,FACU+ | FACU | AIF |
| *Salvia azurea* | blue sage | UPL | | PNF |
| *Schizachyrium scoparium* | little bluestem | FACU | FACU–,FACU+ | PNG |
| *Schoenoplectus fluviatilis* | river bulrush | OBL | OBL | PNEGL |
| *Schoenoplectus heterochaetus* | slender bulrush | OBL | OBL | PNEGL |
| *Schoenoplectus pungens* | three-square bulrush | FACW+,OBL | OBL | PNEGL |
| *Scirpus acutus* | hard-stem bulrush | OBL | OBL | PNEGL |
| *Scirpus validus* | soft-stem bulrush | OBL | OBL | PNEGL |
| *Scutellaria parvula* | small skullcap | UPL,FACU | FACU | PNF |
| *Senecio plattensis* | prairie groundsel | UPL,FACU | FACU | BPNF |
| *Setaria glauca* | yellow foxtail grass | FACU,FAC | FAC | AIG |
| *Setaria pumila* | yellow bristle grass | FAC | FACU,FAC | AIG |
| *Setaria viridis* | green foxtail | FAC* | NI | ANG* |
| *Silene antirrhina* | sleepy silene | UPL | | ANF |
| *Silphium integrifolium* | wholeleaf rosinweed | UPL | | PNF |
| *Silphium laciniatum* | compassplant | UPL | | PNF |
| *Silphium perfoliatum* | cup-plant | FACU,FACW | FAC | PNF |
| *Sinapis alba* | white mustard | UPL | | AIF |
| *Sinapis arvensis* | corn mustard | | | AIF |
| *Sisyrinchium campestre* | blue-eyed grass | UPL | | PNF |
| *Sisyrinchium montanum* | strict blue-eyed grass | FACU,FACW | FAC | PNF |

| *Scientific Name* | *Common Name* | *Region 5 Wetland Indicator* | *National Wetland Indicator* | *Habit* |
|---|---|---|---|---|
| *Solanum carolinense* | Carolina nightshade | UPL,FACU | UPL | NSF |
| *Solanum interius* | inland nightshade | | | ANF |
| *Solanum ptycanthum* | black nightshade | FAC+* | NI | ANF* |
| *Solanum rostratum* | buffalobur nightshade | FAC* | NI | ANF* |
| *Solidago canadensis* | Canada goldenrod | FACU | FACU,FACU+ | PNF |
| *Solidago gigantea* | giant goldenrod | FAC,FACW | FACW | PNF |
| *Solidago graminifolia (Euthamia graminifolia)* | flat-top goldenrod | UPL | | PNF |
| *Solidago missouriensis* | Missouri goldenrod | FACU* | NI | PNF |
| *Solidago rigida* | stiff goldenrod | FACU | UPL,FACU | PNF |
| *Sonchus arvensis* | field sowthistle | UPL,FAC | FAC | PIF |
| *Sonchus oleraceus* | common sowthistle | UPL,FACU | FACU | AIF |
| *Sorghastrum nutans* | Indiangrass | FACU | UPL,FACW | PNG |
| *Sorghum bicolor* | milo | UPL* | NI | AIG* |
| *Sparganium eurycarpum* | giant burreed | OBL | OBL | PNEF |
| *Spartina pectinata* | prairie cordgrass | FACW | FACW,OBL | PNG |
| *Sphaeralcea coccinea* | false red mallow | | | BPNFHS |
| *Sphenopholis obtusata* | prairie wedgegrass | FAC–,FACW+ | FACW | APNG |
| *Spirodela polyrrhiza* | greater duckweed | OBL | OBL | PNF |
| *Sporobolus asper* | tall dropseed | UPL,FACU | FACU | PNG |
| *Sporobolus cryptandrus* | sand dropseed | FACU– | UPL,FACU | PNG |
| *Sporobolus vaginiflorus* | poverty dropseed | FACU | UPL,FACU | ANG |
| *Stachys palustris* | marsh hedgenettle | FACW,OBL | OBL | PIF |
| *Strophostyles leiosperma* | slickseed fuzzybean | | | ANFV |
| *Symphoricarpos occidentalis* | western snowberry | | | PNS |
| *Symphoricarpos orbiculatus* | coralberry | UPL,FAC– | FACU– | NS |
| *Symphyotrichum ericoides* | white heath aster | FACU | UPL,FACU | PNF |
| *Symphyotrichum lanceolatum* | panicled aster | FACW | FACW | PNF |
| *Symphyotrichum novae-angliae* | New England aster | FACW | FACW–, FACW | PNF |
| *Symphyotrichum praealtum* var. *nebraskense* | Nebraska aster | FACW | FACW–, FACW | PNF |
| *Tamarix ramosissima* | saltcedar | FAC,FACW | FACW | IT |
| *Taraxacum officinale* | common dandelion | FACU | FACU–,FACU+ | PIF |
| *Teucrium canadense (T. occidentale)* | American germander | FACW | FAC+,FACW | PNEF |
| *Thalictrum dioicum* | early meadow-rue | FACU+,FACW | FAC | PNF |
| *Thinopyrum intermedium* | intermediate wheatgrass | UPL | | PIG |

| *Scientific Name* | *Common Name* | *Region 5 Wetland Indicator* | *National Wetland Indicator* | *Habit* |
|---|---|---|---|---|
| *Thlaspi arvense* | field pennycress | FACU? | NI | AIF |
| *Toxicodendron radicans* | poison ivy | FACU,FACW | FACU | NWVS |
| *Toxicodendron rydbergii* | Rydberg poison ivy | FACU,FACW | FAC | NHS |
| *Tradescantia bracteata* | longbract spiderwort | UPL,FAC | FAC | PNF |
| *Tragopogon dubius* | goatsbeard | FACU* | NI | BIF* |
| *Tribulus terrestris* | puncturevine | UPL | | AIF |
| *Trifolium pratense* | red clover | FACU | FACU–,FAC | BPIF |
| *Trifolium repens* | white clover | FACU | FACU–,FAC | PIF |
| *Triodanis perfoliata* | claspleaf Venus' looking-glass | UPL,FAC | FAC | ANF |
| *Tripsacum dactyloides* | eastern gama grass | FAC,FACW | FAC | PNG |
| *Typha angustifolia* | narrowleaf cattail | OBL | OBL | PNEF |
| *Typha latifolia* | broadleaf cattail | OBL | OBL | PNEF |
| *Typha × glauca* | hybrid cattail | OBL | OBL | PNEF |
| *Ulmus americana* | American elm | FAC,FACW | FAC | NT |
| *Ulmus pumila* | Siberian elm | FACU* | NI | IT* |
| *Utricularia vulgaris* | bladderwort | OBL | OBL | PNZF |
| *Verbascum thapsus* | common mullein | UPL | | PNF |
| *Verbena bracteata* | prostrate vervain | FACU | UPL,FACW | APNF |
| *Verbena hastata* | blue vervain | FAC,FACW+ | FACW | PNF |
| *Verbena urticifolia* | white vervain | UPL,FAC+ | UPL | APNF |
| *Verbena stricta* | hoary vervain | FAC,FACU* | NI | PNF* |
| *Vernonia baldwinii* | Baldwin's ironweed | UPL,FACW– | FACW– | PNF |
| *Vernonia fasciculata* | prairie ironweed | FAC | FAC,FACW | PNF |
| *Veronica peregrina* | purslane speedwell | FACU–,OBL | OBL | ANEF |
| *Vicia americana* | American purple vetch | FAC? | NI | PNFV |
| *Viola pedatifida* | prairie violet | UPL,FACU | FACU | PNF |
| *Viola pratincola* | blue prairie violet | FACU,FAC | FAC– | PNF |
| *Wolffia columbiana* | Columbian watermeal | OBL | OBL | PN/F |
| *Xanthium strumarium* | rough cocklebur | FAC | FAC–, FAC+ | ANF |
| *Yucca gloriosa* | moundlily yucca | FAC | NI | NT |
| *Zea mays* | corn | | | AIF |

# Appendix I

*List of Amphibians, Reptiles, and Mammals*

## AMPHIBIANS

| *Common Name* | *National Status in Nebraska* |
|---|---|
| American toad | critically imperiled |
| Great Plains toad | secure |
| Woodhouse's toad | secure |
| northern cricket frog | secure |
| Cope's gray treefrog | secure |
| western chorus frog | secure |
| Great Plains narrowmouth toad | imperiled |
| plains leopard frog | secure |
| bullfrog | secure |
| northern leopard frog | secure |
| smallmouth salamander | critically imperiled |
| tiger salamander | secure |

## REPTILES

| *Common Name* | *National Status in Nebraska* |
|---|---|
| snapping turtle | secure |
| smooth softshell | secure |
| spiny softshell | secure |
| yellow mud turtle | vulnerable |
| painted turtle | secure |
| Blanding's turtle | apparently secure |
| false map turtle | vulnerable |
| western box turtle | secure |
| lesser earless lizard | secure |
| greater short-horned lizard | vulnerable |
| sagebrush lizard | critically imperiled |
| fence/prairie/plateau lizard | secure |
| six-lined racerunner | secure |
| five-lined skink | critically imperiled |
| many-lined skink | secure |
| Great Plains skink | vulnerable |
| prairie skink | secure |
| slender glass lizard | critically imperiled |
| glossy snake | imperiled |
| worm snake | secure |
| racer | secure |
| ringneck snake | secure |
| corn snake | apparently secure |

| *Common Name* | *National Status in Nebraska* |
|---|---|
| western ratsnake | apparently secure |
| fox snake | secure |
| western hognose snake | secure |
| eastern hognose snake | apparently secure |
| prairie kingsnake | vulnerable |
| common kingsnake | imperiled |
| milk snake | secure |
| smooth green snake | critically imperiled |
| coachwhip | vulnerable |
| northern water snake | secure |
| gopher snake | secure |
| Graham's crayfish snake | imperiled |
| brown snake | vulnerable |
| redbelly snake | critically imperiled |
| plains black-headed snake | critically imperiled |
| western terrestrial garter snake | apparently secure |
| western ribbon snake | imperiled |
| plains garter snake | secure |
| common garter snake | secure |
| lined snake | secure |
| copperhead | critically imperiled |
| western rattlesnake | apparently secure |

## MAMMALS

| *Common Name* | *National Status in Nebraska* |
|---|---|
| Townsend's big-eared bat | critically imperiled |
| big brown bat | secure |
| silver-haired bat | secure |
| eastern red bat | secure |
| hoary bat | secure |
| western small-footed myotis | apparently secure |
| little brown bat | apparently secure |
| northern myotis | vulnerable |
| fringed myotis | critically imperiled |
| fringe-tailed myotis | critically imperiled |
| long-legged myotis | imperiled |
| evening bat | vulnerable |
| eastern pipistrelle | critically imperiled |
| Brazilian free-tailed bat | unranked |
| black-tailed prairie dog | apparently secure |
| woodchuck | apparently secure |
| eastern fox squirrel | secure |
| Wyoming ground squirrel | possibly extirpated |
| Franklin's ground squirrel | secure |
| spotted ground squirrel | apparently secure |
| thirteen-lined ground squirrel | secure |
| least chipmunk | vulnerable |

| *Common Name* | *National Status in Nebraska* |
|---|---|
| American beaver | secure |
| plains pocket gopher | secure |
| northern pocket gopher | apparently secure |
| hispid pocket mouse | secure |
| Ord's kangaroo rat | secure |
| olive-backed pocket mouse | vulnerable |
| plains pocket mouse | secure |
| silky pocket mouse | apparently secure |
| meadow jumping mouse | secure |
| prairie vole | secure |
| meadow vole | secure |
| woodland vole | vulnerable |
| house mouse | exotic |
| muskrat | secure |
| northern grasshopper mouse | secure |
| white-footed mouse | secure |
| deer mouse | exotic |
| Norway rat | exotic |
| western harvest mouse | secure |
| plains harvest mouse | apparently secure |
| hispid cotton rat | vulnerable |
| southern bog lemming | apparently secure |
| northern short-tailed shrew | vulnerable |
| short-tailed shrew | vulnerable |
| least shrew | apparently secure |
| prairie shrew | apparently secure |
| Merriam's shrew | critically imperiled |
| eastern mole | secure |
| Virginia opossum | secure |
| mule deer | secure |
| white-tailed deer | secure |
| black-tailed jackrabbit | secure |
| white-tailed jackrabbit | secure |
| European rabbit | exotic |
| eastern cottontail | secure |
| coyote | secure |
| swift fox | imperiled |
| red fox | secure |
| bobcat | secure |
| northern river otter | imperiled |
| long-tailed weasel | secure |
| black-footed ferret | extirpated |
| least weasel | secure |
| American mink | secure |
| American badger | secure |
| striped skunk | secure |
| eastern spotted skunk | secure |
| northern raccoon | secure |

# Appendix J

*List of Birds*

The order of bird species follows the AOU Check-list of North American Birds (American Ornithological Union 2004).

Seasonal abundance codes follow each species name, in order of seasons (spring, summer, fall, winter). The letter "*m*" is used to indicate that the species is not present during a particular season. For example, "American coot *acar*" (abundant in spring, common summer, abundant in fall, and rare in Winter) or "California gull *omom*" (occasional in spring, not present in summer or winter, and occasional in fall).

Nesting species documented at the WPAs are marked with an asterisk (*) in front of the species name. Species accounts may indicate presence during the nesting season, but may not be marked as nesting. For example, frequent nesters in the area such as northern rough-winged swallow are not marked as nesters because WPAs do not provide preferred nesting habitat. For the most part, cavity nesters are excluded (the red-bellied woodpecker prefers mature, natural woodlands) due to the absence of mature or dying trees that typically provide cavities. The district's WPAs are managed as grassland–playa lake ecosystems. Nonnative trees and shrubs have been removed at most WPAs. Due to remaining shelterbelts at WPAs, a few woodland nesters are marked as nesting if they are known to use shelterbelts.

## SEASONAL ABUNDANCE DEFINITIONS

Seasons are listed below. Seasonal abundance codes for some species such as shorebirds may be misleading because their fall migration starts in July or August (summer). For example, "pectoral sandpiper *cccm*" (common in spring, summer due to peak migration occurring mid-August, and fall; not present in winter).

### *Seasons*

Spring (March–May)
Summer (June–August)
Fall (September–November)
Winter (December–February)

### *Seasonal Abundance*

*a* = abundant (occur in large numbers)
*c* = common (certain to be seen in suitable habitat)
*u* = uncommon (present, but not certain to be seen)
*o* = occasional (seen only a few times during the season)
*r* = rare (seen at intervals of 2–5 years)
*h* = hypothetical (within normal range, but never documented)
*x* = outside normal range (but has been documented)

## SWANS, GEESE, AND DUCKS

black-bellied whistling-duck *xxxm*
bean goose *xmmm*
greater white-fronted goose *arao*
emperor goose *xmmm*
snow goose *aoao*
Ross' goose *crco*
*Canada goose *auac*
brant *rmrm*
trumpeter swan *hxmh*
tundra swan *omrm*
wood duck *cucm*
*gadwall *cuco*
Eurasian wigeon *rmrm*
*American wigeon *aoao*
American black duck *rmrr*
*mallard *acac*
*blue-winged teal *acar*
*cinnamon teal *uoum*
*northern shoveler *acar*
*northern pintail *auao*
garganey *xmmm*
*green-winged teal *aoao*
canvasback *umum*
*redhead *cucm*
ring-necked duck *crum*
greater scaup *umrm*
lesser scaup *cocm*
white-winged scoter *xmmm*
black scoter *xmmm*
bufflehead *cmcm*
common goldeneye *omum*
Barrow's goldeneye *mmxm*
hooded merganser *urum*
common merganser *omoo*
*ruddy duck *cucm*

## GALLINACEOUS BIRDS

*ring-necked pheasant *cccc*
sharp-tailed grouse *rhro*
*greater prairie-chicken *ooou*
*northern bobwhite *cccc*

## LOONS
common loon *omrm*

## GREBES
Clark's grebe *xmrm*
*pied-billed grebe *cccm*
horned grebe *uhrm*
red-necked grebe *hmrm*
*eared grebe *cocm*
western grebe *rmrm*

## PELICANS
American white pelican *cocm*

## CORMORANTS
double-crested cormorant *cucm*

## BITTERNS, HERONS, AND EGRETS
*American bittern *ucum*
*least bittern *uuom*
*great blue heron *cccr*
great egret *omom*
snowy egret *uuum*
little blue heron *orrm*
tricolored heron *hrrm*
cattle egret *uoum*
*green heron *cucm*
*black-crowned night-heron *cocm*
yellow-crowned night-heron *rmrm*

## IBISES AND SPOONBILLS
white ibis *hxxm*
glossy ibis *xmmm*
white-faced ibis *uurm*
roseate spoonbill *mxmm*

## NEW WORLD VULTURES
black vulture *mxmm*
turkey vulture *cucm*

## OSPREY, KITES, HAWKS, AND EAGLES
osprey *omom*
white-tailed kite *xmxm*
Mississippi kite *xmxm*
bald eagle *cmco*
*northern harrier *cucu*
sharp-shinned hawk *uruu*
Cooper's hawk *umur*
northern goshawk *rmrr*
red-shouldered hawk *mrrx*
broad-winged hawk *mxmm*
*Swainson's hawk *cuur*
*red-tailed hawk *cucu*
ferruginous hawk *uxuo*
rough-legged hawk *uhuu*
golden eagle *omoo*

## FALCONS AND CARACARAS
*American kestrel *cccc*
merlin *umuo*
gyrfalcon *mmmr*
peregrine falcon *omor*
prairie falcon *omou*

## RAILS
yellow rail *rmrm*
black rail *xxmm*
king rail *rrmm*
*Virginia rail *uuum*
*sora *cccm*
purple gallinule *xmmm*
*common moorhen *uurm*
*American coot *acar*

## CRANES
*sandhill crane *crum*
common crane *xmmm*
whooping crane *omom*

## PLOVERS
black-bellied plover *umum*
American golden-plover *umum*
snowy plover *rrmm*
semipalmated plover *umum*
piping plover *rhrm*
*killdeer *cccm*

## STILTS AND AVOCETS
*black-necked stilt *rrrm*
*American avocet *urum*

## SANDPIPERS AND PHALAROPES
greater yellowlegs *cocm*
lesser yellowlegs *cucm*
solitary sandpiper *ccum*
willet *uoum*
spotted sandpiper *cccm*
*upland sandpiper *uuum*
Eskimo curlew *hmhm*
whimbrel *omrm*
long-billed curlew *rmrm*
Hudsonian godwit *umxm*
marbled godwit *umrm*
ruddy turnstone *rmrm*
red knot *xmrm*
sanderling *omom*
semipalmated sandpiper *aucm*
western sandpiper *room*
least sandpiper *cccm*
white-rumped sandpiper *coom*
Baird's sandpiper *acum*
pectoral sandpiper *cccm*
sharp-tailed sandpiper *mmxm*
dunlin *umum*
curlew sandpiper *mxmm*
stilt sandpiper *accm*

buff-breasted sandpiper *uuum*
ruff *xmxm*
short-billed dowitcher *uurm*
long-billed dowitcher *aucm*
*Wilson's snipe (common) *cocm*
American woodcock *rmrm*
*Wilson's phalarope *aocm*
red-necked phalarope *rmrm*
red phalarope *mxmm*

## SKUAS, JAEGERS, GULLS, AND TERNS

laughing gull *xmmm*
Franklin's gull *arcm*
Bonaparte's gull *rmrm*
mew gull *rmmm*
ring-billed gull *acco*
California gull *omom*
herring gull *umuu*
common tern *umum*
Forster's tern *cucm*
least tern *rrrm*
*black tern *acam*

## PIGEONS AND DOVES

rock pigeon *cccc*
European collared-dove *oooo*
white-winged dove *mrmm*
*mourning dove *aaao*
Inca dove *mmxm*

## CUCKOOS AND ANIS

black-billed cuckoo *ooom*
*yellow-billed cuckoo *uuum*

## BARN OWLS

barn owl *oooo*

## TYPICAL OWLS

eastern screech-owl *uuuu*
*great horned owl *cucu*
snowy owl *mmmx*
*burrowing owl *uuum*
barred owl *rrrr*
long-eared owl *oroo*
short-eared owl *uruu*
boreal owl *mmxm*

## NIGHTJARS

*common nighthawk *cccm*
chuck-will's-widow *mrmm*

## SWIFTS

chimney swift *aacm*

## HUMMINGBIRDS

ruby-throated hummingbird *ooom*
broad-tailed hummingbird *hrrm*
rufous hummingbird *mmrm*

## KINGFISHERS

belted kingfisher *uuur*

## WOODPECKERS

Lewis' woodpecker *rmxm*
*red-headed woodpecker *ccco*
red-bellied woodpecker *uuuu*
*downy woodpecker *cccc*
hairy woodpecker *cccr*
*northern flicker *cccc*

## TYRANT FLYCATCHERS

olive-sided flycatcher *omom*
eastern wood-pewee *ooom*
yellow-bellied flycatcher *rmrm*
Acadian flycatcher *rmrm*
alder flycatcher *rmrm*
willow flycatcher *orom*
least flycatcher *umum*
Hammond's flycatcher *mmxm*
eastern phoebe *uuum*
Say's phoebe *urrm*
*great crested flycatcher *cocm*
*western kingbird *cccm*
*eastern kingbird *cccm*
*scissor-tailed flycatcher *rxrm*

## SHRIKES

*loggerhead shrike *cccc*
northern shrike *mmuu*

## VIREOS

white-eyed vireo *rmmm*
*Bell's vireo *uoum*
yellow-throated vireo *rxrm*
*warbling vireo *cucm*
Philadelphia vireo *umum*
red-eyed vireo *urum*

## CROWS, JAYS, AND MAGPIES

*blue jay *cccc*
pinyon jay *mmmx*
*black-billed magpie *uuuu*
*American crow *aoac*

## LARKS

*horned lark *acaa*

## SWALLOWS

purple martin *cucm*
tree swallow *cocm*
violet-green swallow *xmmm*
northern rough-winged swallow *cccm*
bank swallow *uuum*
cliff swallow *ccam*
barn swallow *aaam*

## TITMICE AND CHICKADEES

*black-capped chickadee *cccc*
tufted titmouse *xxxm*

## NUTHATCHES

red-breasted nuthatch *mxmo*
white-breasted nuthatch *ooou*

## CREEPERS

brown creeper *mooo*

## WRENS

Carolina wren *roor*
Bewick's wren *xmmm*
*house wren *cccm*
winter wren *rmro*
*sedge wren *rurm*
*marsh wren *uuur*

## KINGLETS

golden-crowned kinglet *umur*
ruby-crowned kinglet *omom*

## OLD WORLD WARBLERS

blue-gray gnatcatcher *orom*

## THRUSHES

*eastern bluebird *cucr*
mountain bluebird *omor*
Townsend's solitaire *rmro*
veery *rmmm*
gray-cheeked thrush *umrm*
Swainson's thrush *cmum*
hermit thrush *rmrm*
wood thrush *rmrm*
*American robin *acac*

## MIMIC THRUSHES

*gray catbird *uuur*
northern mockingbird *uuum*
*brown thrasher *cccr*

## STARLINGS

*European starling *aaac*

## WAGTAILS AND PIPITS

American (water) pipit *cmcr*
Sprague's pipit *omom*

## WAXWINGS

Bohemian waxwing *mmmr*
cedar waxwing *cucu*

## WOOD WARBLERS

golden-winged warbler *rmmm*
Tennessee warbler *cmcm*
orange-crowned warbler *cmcm*
Nashville warbler *umum*
northern parula *umrm*
*yellow warbler *cccm*
chestnut-sided warbler *umum*
magnolia warbler *umum*
black-throated blue warbler *rmrm*
yellow-rumped warbler *cmcm*
black-throated gray warbler *xmmm*
black-throated green warbler *omom*
Townsend's warbler *rmrm*
Blackburnian warbler *omom*
yellow-throated warbler *rmrm*
pine warbler *hmrm*
prairie warbler *rmrm*
palm warbler *omrm*
bay-breasted warbler *omom*
blackpoll warbler *cmrm*
black-and-white warbler *cmum*
American redstart *cocm*
prothonotary warbler *rmrm*
ovenbird *umum*
northern waterthrush *umum*
Louisiana waterthrush *rmhm*
Kentucky warbler *rmhm*
Connecticut warbler *rmxh*
mourning warbler *rmhm*
MacGillivray's warbler *omrm*
*common yellowthroat *cccm*
hooded warbler *rmrm*
Wilson's warbler *umum*
Canada warbler *rmrm*
yellow-breasted chat *ooom*

## TANAGERS

summer tanager *rmxm*
scarlet tanager *omom*

## SPARROWS AND TOWHEES

green-tailed towhee *rmrm*
spotted towhee *uoum*
eastern towhee *umum*
Cassin's sparrow *xmmm*
American tree sparrow *aoaa*
*chipping sparrow *aoar*
clay-colored sparrow *chcr*
Brewer's sparrow *rmrm*
field sparrow *cucr*
*vesper sparrow *cocx*
lark sparrow *cccm*
*lark bunting *ouom*
Savannah sparrow *cmch*
*grasshopper sparrow *cccm*
Baird's sparrow *umum*
Henslow's sparrow *rrrm*
Le Conte's sparrow *umcm*
Nelson's sharp-tailed sparrow *rmum*
fox sparrow *omor*
song sparrow *cucu*
Lincoln's sparrow *crcm*
*swamp sparrow *uoum*

white-throated sparrow *cour*
Harris' sparrow *cocu*
white-crowned sparrow *cruo*
golden-crowned sparrow *rmrm*
dark-eyed junco *cmca*
McCown's longspur *rmrm*
Lapland longspur *amaa*
Smith's longspur *omur*
chestnut-collared longspur *omom*
snow bunting *rmro*

## CARDINALS, GROSBEAKS, AND ALLIES

*northern cardinal *cccc*
rose-breasted grosbeak *uurm*
black-headed grosbeak *crcm*
*blue grosbeak *uuum*
lazuli bunting *xmxm*
indigo bunting *uuum*
painted bunting *rmxm*
*dickcissel *cacm*

## BLACKBIRDS AND ORIOLES

*bobolink *cccm*
*red-winged blackbird *acao*
*eastern meadowlark *uuuo*
*western meadowlark *acac*
*yellow-headed blackbird *aocr*
rusty blackbird *cour*
*Brewer's blackbird *cuco*
*common grackle *aaao*
*great-tailed grackle *cccr*
*brown-headed cowbird *acar*
orchard oriole *cccm*
*Baltimore oriole *cccm*
Scott's oriole *mxmm*

## FINCHES

pine grosbeak *xmxm*
purple finch *umuo*
*house finch *cccc*
red crossbill *mrmo*
common redpoll *ormo*
pine siskin *uouu*
*American goldfinch *cccc*
evening grosbeak *rmrr*

## OLD WORLD SPARROWS

*house sparrow *aaaa*

# Appendix K

*Rainwater Basin Vegetation Classification*

The National Vegetation Classification System (NVCS) for the United States was used to classify vegetation communities at the Rainwater Basin Wetland Management District in 2004. The NVCS is the system mandated by the USGS–National Park Service Vegetation Mapping Program. In addition, the Federal Geographic Data Committee (FGDC) adopted the NVCS to the formation level as a standard for federal agencies (FGDC 1997). This system provides a national (versus regional, state, or local) vegetation classification system that facilitates resource stewardship by ensuring the same plant associations get the same names throughout the Refuge System. The strengths of the NVCS include the following:

- is vegetation based
- uses a systematic approach to classify a continuum
- emphasizes natural and existing vegetation
- uses a combined physiognomic-floristic hierarchy
- identifies vegetation units based on both qualitative and quantitative data
- is appropriate for mapping at multiple scales

The NVCS was established primarily by The Nature Conservancy and is being implemented and updated by NatureServe in support of the network of natural heritage programs (Grossman et al. 1998). Development and refinement of the classification is an ongoing process and proposed revisions are reviewed both locally and nationally. The Nature Conservancy published two volumes describing the classification of United States vegetation as of April 1997 (Grossman et al. 1998). This publication can be found on the Internet at <http://www.natureserve.org/publications/icec/index.html>. NatureServe posts regular updates to the list of plant associations in the United States and Canada on their online database server at <http://www.natureserve.org/explorer>.

## CLASSIFICATION PROCEDURE

The procedure for classifying vegetation followed guidelines described in the "vegetation classification standard" (FGDC 1997), which was derived from the NVCS. The NVCS is a species-based, hierarchical system with seven levels (Grossman et al. 1998). The highest—"coarse"—levels of the hierarchy have a broad geographic perspective and use physiognomic features to distinguish among groups of plant communities. The lowest—"finest"—levels have a local and site-specific perspective and are based on floristic features (figure I-1). The finest level (association) was used in the "Rainwater Basin Vegetation and Monitoring Project."

The association is defined as "a plant community of definite floristic composition, uniform habitat conditions, and uniform physiognomy" (see Flahault and Schroter 1910 in Moravec 1993). Associations are separated from alliances through the use of total floristic composition and are named by the most dominant or indicator species. If two or more dominant species occur in the same stratum, a dash (–) is used between the names. If the species occur in different strata, a slash (/) is used. Parentheses ( ) indicate that a diagnostic species is not always present.

Alliances are physiognomically uniform groups of plant associations that share dominant or diagnostic species, usually found in the uppermost stratum of the vegetation. For forested types, the alliance is roughly equivalent to the "cover type" of the Society of American Foresters. Alliances also include nonforested types.

Unlike classifications based on habitat types or potential vegetation, the NVCS strives to describe existing vegetation, whether natural or cultural vegetation. However, due in part to the conservation focus of The Nature Conservancy and NatureServe, the classification of natural vegetation types is often better developed than that of cultural or modified types. The NVCS is unique in that the association is the basic unit, with the higher levels of the hierarchy representing aggregations of units in the lower levels. This differs from other types that work from the top down.

## PREPARING THE DATA FOR ANALYSIS

The vegetation classification for the Rainwater Basin began with the vegetation mapping team completing a literature review of all associations identified in Nebraska and the Great Plains region to identify associations that were present in the basin. From this list, the associations that occurred at WPAs were identified. This was done by bringing together all biologists working in the area and having them identify the known associations, as well as creating map units to delineate species of management concern. The following summaries show the lineage for each plant community for the basin starting with the NVCS community names (see also table I-1).

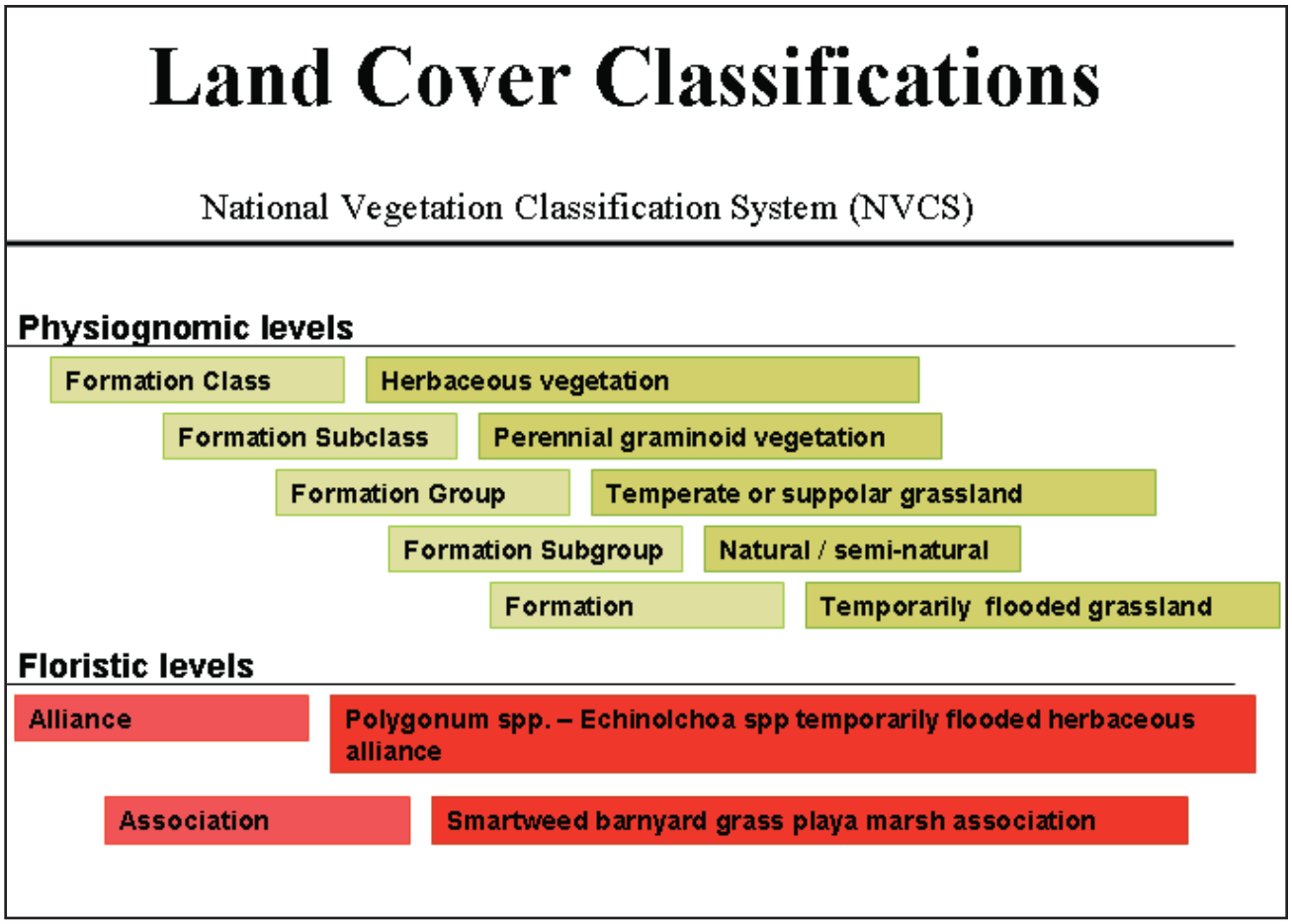



**Figure I-1. An example of the NVCS physiognomic-floristic classification hierarchy.**

**Table I-1.**

| *Formation Name* | *Alliance Name* | *Alliance Code* | *Unique Identifier* | *Association Name* | *Association Code* | *Common Name* |
|---|---|---|---|---|---|---|
| Formation Class/Subclass: Shrubland/Deciduous Shrubland | | | | | | |
| Temporarily flooded, cold-deciduous shrubland | *Salix* (*exigua*, *interior*) temporarily flooded shrubland | III.B.2.N.d.6 | CEGL001203 | *Salix exigua*/mesic graminoids shrubland | d.6 | sandbar willow/ mesic graminoids shrubland |
| Temporarily flooded, cold–deciduous shrubland | *Cornus sericea* temporarily flooded shrubland | III.B.2.N.d.27 | CEGLOO5219 | *Cornus drummondii–Amorpha fruiticosa–Cornus sericea* shrubland | d.27 | sumac–dogwood shrubland |
| Formation Class/Subclass: Woodland/Deciduous Woodland | | | | | | |
| Temporarily flooded, cold–deciduous woodland | *Populus deltoides* temporarily flooded woodland | II.B.2.N.b.4 | CEGL000659 | *Populus deltoides–*(*Salix amygdaloides*)/ *Salix* (*exigua*, *interior*) woodland | b.4 | cottonwood–peachleaf willow, floodplain woodland |
| Formation Class/Subclass: Herbaceous Vegetation/Perennial Graminoid Vegetation | | | | | | |
| Semipermanently flooded, temperate or subpolar grassland | *Carex pellita* seasonally flooded herbaceous vegetation | V.A.5.N.k.53 | CEGL005272 | *Carex* spp.–(*Carex pellita*, *Carex vulpinoidea*) herbaceous vegetation | k.53 | central Midwest, sedge meadow |
| Semipermanently flooded, temperate or subpolar grassland | *Eleocharis palustris* seasonally flooded herbaceous vegetation | V.A.5.N.k.61 | CEGL001833 | *Eleocharis palustris* herbaceous vegetation | k.61 | creeping spikerush, wet meadow |
| Semipermanently flooded, temperate or subpolar grassland | *Pascopyrum smithii* intermittently flooded herbaceous vegetation | V.A.5.N.i.1 | CEGL002038 | *Pascopyrum smithii–Buchloe dactyloides–*(*Phyla cuneifolia*, *Oenothera canescens*) herbaceous vegetation | i.1 | wheatgrass, playa grassland |
| Semipermanently flooded, temperate or subpolar grassland | *Phalaris arundinacea* seasonally flooded herbaceous vegetation | V.A.5.N.k.20 | CEGL001474 | *Phalaris arundinacea* western herbaceous vegetation | k.20 | reed canarygrass, wet meadow |
| Semipermanently flooded, temperate or subpolar grassland | *Polygonum* spp.–*Echinochloa* spp. temporarily flooded herbaceous vegetation | V.A.5.N.j.12 | CEGL002039 | *Polygonum* spp.–*Echinochloa* spp.–*Distichlis spicata* playa lake, herbaceous vegetation | j.12 | playa marsh |

**Table I-1.**

| *Formation Name* | *Alliance Name* | *Alliance Code* | *Unique Identifier* | *Association Name* | *Association Code* | *Common Name* |
|---|---|---|---|---|---|---|
| Semipermanently flooded, temperate or subpolar grassland | *Typha* (*angustifolia*, *latifolia*)–(*Schoenoplectus* spp.) semipermanently flooded, herbaceous vegetation | V.A.5.N.l.9 | CEGL002389 | *Typha* spp. Great Plains, herbaceous vegetation | l.9 | northern Great Plains, cattail marsh |
| Semipermanently flooded, temperate or subpolar grassland | *Typha* spp.–(*Schoenoplectus* spp., *Juncus* spp.) seasonally flooded vegetation | V.A.5.N.k.33 | CEGL002026 | *Schoenoplectus tabernaemontani*–*Typha* spp.–(*Sparganium* spp., *Juncus* spp.) herbaceous vegetation | k.33 | bulrush–cattail–burreed, shallow marsh |
| Semipermanently flooded, temperate or subpolar grassland | *Potamogeton* spp.–*Ceratophyllum* spp.–*Elodea* spp. permanently flooded, herbaceous vegetation | V.C.2.N.a.14 | CEGL002044 | *Potamogeton* spp.–*Ceratophyllum demersum* Great Plains herbaceous, central Midwest vegetation | a.14 | Great Plains, pondweed, submerged, aquatic wetland |
| Short-sod, temperate or subpolar grassland | *Bouteloua gracilis* herbaceous alliance | V.A.5.N.e.9 | CEGL001756 | *Bouteloua gracilis*–*Buchloe dactyloides* herbaceous vegetation | e.9 | blue grama–buffalograss, short-grass prairie |
| Tall-sod, temperate grassland | *Andropogon gerardii*–(*Sorghastrum nutans*) herbaceous alliance | V.A.5.N.a.2 | CEGL002025 | *Andropogon gerardii*–*Sorghastrum nutans*–*Hesperostipa spartea* loess hills, herbaceous vegetation | a.2 | central tall-grass, big bluestem, loess prairie |
| Medium- to tall-sod, temperate or subpolar grassland | *Schizachyrium scoparium*–*Bouteloua curtipendula* herbaceous alliance | V.A.5.N.c.20 | CEGL002035 | *Schizachyrium scoparium*–*Bouteloua curtipendula*–*Bouteloua hirsuta*–(*Yucca glauca*) herbaceous vegetation | c.20 | loess hills, little bluestem, dry prairie |

### Association (Scientific) Name: *Carex* spp. (*Carex pellita, Carex vulpinoidea*) Herbaceous Vegetation

*Translated Scientific Name:* Sedge species (woolly sedge, fox sedge) herbaceous vegetation

*Common Name:* Central Midwest sedge meadow

*Unique Identifier:* CEGL005272

*Classification Code:* V.A.5.N.k.53

*Association Classification Confidence Level:* Weak

*Association Summary:* This sedge, wet meadow type is found in the central midwestern United States. Stands occur on nearly level floodplains, often in bands surrounding channels, or in basins. Soils are poorly drained, silty and clay loams formed in alluvium. Stands are flooded for much of the growing season, but may dry out in late summer. The vegetation cover is quite dense and may be patchy. The structure is dominated by graminoids 20–60 inches (0.5–1.5 m) tall. Typical species include *Carex cristatella*, *Carex molesta*, *Carex pellita (=Carex lanuginosa)*, *Carex stipata*, *Carex tribuloides*, and *Carex vulpinoidea* (a dominant in southeast Nebraska meadows). Other frequent emergent graminoids include *Eleocharis* spp., *Juncus interior*, *Juncus torreyi* and *Scirpus atrovirens*. *Leersia oryzoides* may be common where the stand borders a marsh. Forbs are common and may be conspicuous. Among the more common are *Apocynum cannabinum*, *Symphyotrichum lanceolatum (=Aster lanceolatus)*, *Lycopus americanus*, *Lythrum alatum*, and *Verbena hastata*. *Phalaris arundinacea* may invade this community to the point of excluding many of the native species.

### Association (Scientific) Name: *Bouteloua gracilis–Buchloe dactyloides* Herbaceous Vegetation

*Translated Scientific Name:* Blue grama–buffalograss herbaceous vegetation

*Common Name:* Blue grama–buffalograss, short-grass prairie

*Unique Identifier:* CEGL001756

*Classification Code:* V.A.5.N.e.9

*Association Classification Confidence Level:* Moderate

*Association Summary:* This blue grama–buffalograss, short-grass prairie type is common across much of the central and southern Great Plains of the United States. Stands occur on flat to rolling uplands. The surface soil may be sandy loam, loam, silt loam, or loamy clay. The subsoil is often finer than the surface soil. This community is characterized by a moderate to dense sod of short grasses with scattered mid-grasses and forbs. The dominant species are *Bouteloua gracilis* and *Buchloe dactyloides*. The foliage of these species is 2.8–7.6 inches (7–19 cm) tall, while the flowering stalks of *Bouteloua gracilis* may reach 18 inches (45 cm). The mid-grasses are usually stunted by the arid conditions and often do not exceed 28 inches (0.7 m). Other short graminoids found in this community are *Bouteloua hirsuta*, *Carex duriuscula*, *Carex inops*, *Carex heliophila*, and *Carex filifolia* (in Nebraska). Several mid-grasses occur regularly, such as *Aristida purpurea*, *Bouteloua curtipendula*, *Pascopyrum smithii*, *Schizachyrium scoparium*, *Elymus elymoides*, *Sporobolus cryptandrus*, *Hesperostipa comata* (=*Stipa comata*), and *Vulpia octoflora*. Forbs such as *Astragalus* spp., *Gaura coccinea*, *Machaeranthera pinnatifida* var. *pinnatifida*, *Opuntia polyacantha*, *Plantago patagonica*, *Psoralidium tenuiflorum*, *Ratibida columnifera*, and *Sphaeralcea coccinea* are common throughout this community. Shrubs are very rare except in the southern part of this community's range where scattered individuals may occur. In Oklahoma, other characteristic species include *Ambrosia artemisiifolia*, *Aristida oligantha*, *Machaeranthera tanacetifolia*, *Melampodium leucanthum*, *Muhlenbegria torreyi*, *Sporobolus compositus*, *Sporobolus cryptandrus*, and *Zinnia grandiflora*. In Texas, associated species include *Prosopis glandulosa*, *Bouteloua curtipendula*, and *Sporobolus cryptandrus*.

### Association (Scientific) Name: *Andropogon gerardii–Sorghastrum nutans–Hesperostipa spartea* Loess Hills Herbaceous Vegetation

*Translated Scientific Name:* Big bluestem–yellow Indiangrass–porcupine grass, loess hills, herbaceous vegetation

*Common Name:* Central tall-grass, big bluestem, loess prairie

*Unique Identifier:* CEGL002025

*Classification Code:* V.A.5.N.a.2

*Association Classification Confidence Level:* Moderate

*Association Summary:* This big bluestem, tall-grass prairie type is found in the west-central, tall-grass prairie region of the United States, including the Loess Hills. Stands occur on moderately steep mid- to upper slopes of loess hills and along ridges. It is most common on southern and western aspects. The soil is well-drained, acidic to neutral, and shallow to deep loess (16–40 inches [40–100 cm]). The parent material is a deep loess or glacial till and other deeply weathered substrates. This community is virtually lacking in shrubs and trees. Woody vegetation that is present, such as *Amorpha canescens*, is usually less than 20 inches (0.5 m) tall. The dominant vegetation is tall grasses. Of the dominant species, *Andropogon gerardii*, *Sorghastrum nutans*, and *Hesperostipa spartea* (=*Stipa spartea*) typically exceed 40 inches (1 m). *Schizachyrium scoparium*, also very common, is shorter. In Missouri, some other species that are usually found in this community are *Echinacea pallida*, *Potentilla arguta*, *Silphium laciniatum*, and *Sporobolus compositus* var. *compositus*.

### Association (Scientific) Name: *Schizachyrium scoparium–Bouteloua curtipendula–Bouteloua hirsuta–(Yucca glauca)* Herbaceous Vegetation

*Translated Scientific Name:* Little bluestem–sideoats grama–hairy grama–(soapweed yucca) herbaceous vegetation

*Common Name:* Loess hills, little bluestem, dry prairie

*Unique Identifier:* CEGL002035

*Classification Code:* V.A.5.N.c.20

*Association Classification Confidence Level:* Moderate

*Association Summary:* This bluestem-grama grass, dry prairie type is found on the loess bluffs along the east side of Missouri River in the central midwestern United States. The soil is somewhat rapidly drained and very shallow (0–16 inches [0–40 cm]). The vegetative structure is comprised of a single layer of dominant grasses intermixed with forbs. Shrubs, especially *Yucca glauca*, are sometimes present. This community is a short- to midgrass prairie dominated by the bunchgrasses *Andropogon gerardii*, *Bouteloua curtipendula*, and *Schizachyrium scoparium*. *Bouteloua hirsuta* can be common. *Sporobolus cryptandrus*, *Dalea leporina*, *Dalea candida*, *Dalea enneandra*, *Astragalus lotiflorus*, and *Astragalus missouriensis* can also be common. Other herbaceous species include *Pulsatilla patens* ssp. *multifida* (=*Anemone patens*), *Symphyotrichum sericeum* (*Aster sericeus*), *Buchloe dactyloides*, *Bouteloua gracilis*, *Delphinium carolinianum*, *Gaura coccinea*, and *Pediomelum argophyllum*, and the lichens *Dermatocarpon lachneum* and *Psora decipiens*.

### Association (Scientific) Name: *Eleocharis palustris* Herbaceous Vegetation

*Translated Scientific Name:* Marsh spikerush, herbaceous vegetation

*Common Name:* Creeping spikerush, wet meadow

*Unique Identifier:* CEGL001833

*Classification Code:* V.A.5.N.k.61

*Association Classification Confidence Level:* Strong

*Association Summary:* This spikerush, wet meadow community is found in the central Great Plains of the United States and Canada and in the western United States. Stands occur in small depressions in intermittent streambeds or depression ponds that flood early in the season and may dry out by summer. Stands comprise submersed and emergent rooted vegetation under 40 inches (1 m) tall that is dominated by *Eleocharis palustris*, often in nearly pure stands. Soils are generally fine-textured.

### Association (Scientific) Name: *Pascopyrum smithii–Buchloe dactyloides–(Phyla cuneifolia, Oenothera canescens)* Herbaceous Vegetation

*Translated Scientific Name:* Western wheatgrass–buffalograss–(wedgeleaf frogfruit, spotted evening-primrose) herbaceous vegetation

*Common Name:* Wheatgrass, playa grassland

*Unique Identifier:* CEGL002038

*Classification Code:* V.A.5.N.i.1

*Association Classification Confidence Level:* Moderate

*Association Summary:* This wheatgrass, playa grassland community represents the common vegetation type of playa lake basins (depressional wetlands) under rangeland conditions in the southern and central Great Plains of the United States. In the central plains soils are dense silts and clays, occasionally loess-derived, that flood in winter and dry out by early summer. Perennial herbaceous graminoids and forbs less than 40 inches (1 m) tall dominate the community, with composition varying depending on water levels. In the central plains *Pascopyrum smithii* is most abundant, with *Agrostis hyemalis*, *Eleocharis palustris*, *Eleocharis macrostachya*, *Elymus virginicus*, and *Hordeum jubatum* locally abundant. *Buchloe dactyloides* can be abundant in grazed sites. Early season ephemeral annuals include *Alopecurus carolinianus*, *Elatine rubella*, *Myosurus minimus*, *Veronica peregrina* ssp. *xalapensis*, and, more westward, *Limosella aquatica* and *Plagiobothrys scouleri*. Perennial forbs including *Ambrosia grayi*, *Phyla cuneifolia*, *Oenothera canescens*, *Rorippa sinuata*, and *Vernonia fasciculata* are conspicuous in places. In the southern plains, species characteristic of the type include *Buchloe dactyloides*, *Distichlis spicata*, and *Panicum obtusum*.

### Association (Scientific) Name: *Potamogeton* spp.–*Ceratophyllum demersum* Great Plains Herbaceous Vegetation

*Translated Scientific Name:* Pondweed species–coontail, Great Plains herbaceous vegetation

*Common Name:* Great Plains pondweed, submerged aquatic wetland

*Unique Identifier:* CEGL002044

*Classification Code:* V.C.2.N.a.14

*Association Classification Confidence Level:* Weak

*Association Summary:* This community type is found in the Great Plains of the United States in shallow to relatively deep (40 inches [1 m]) freshwater basins or bands in marshes or bays that remain flooded in all but the driest years. Vegetation varies from sparse to dense, with submersed rooted and free-floating macrophytes. Species composition varies with substrate, water depth, water chemistry, turbidity, water temperatures, and other factors, but these are poorly understood. Dominant species in Nebraska include narrow-leaved pondweeds (*Potamogeton foliosus*, *Stuckenia pectinata (=Potamogeton pectinatus)*, *Potamogeton pusillus*, *Najas guadalupensis*, and *Zannichellia palustris*. *Ceratophyllum demersum* and *Utricularia macrorhiza* can be locally abundant. In quiet bays, *Potamogeton nodosus* and *Lemna* spp. are common. In clear water with sandy bottoms *Chara* spp. may also be common.

### Association (Scientific) Name: *Phalaris arundinacea* Western Herbaceous Vegetation

*Translated Scientific Name:* Reed canarygrass, western herbaceous vegetation

*Common Name:* Reed canarygrass, wet meadow

*Unique Identifier:* CEGL001474

*Classification Code:* V.A.5.N.k.20

*Association Classification Confidence Level:* Strong

*Association Summary:* This association is reported from throughout Washington, Colorado, Nebraska, Montana, Idaho, and into northeastern Utah, and is likely more widespread in the western United States. Its distribution as a natural type is complicated because this native species is widely cultivated as a forage crop

and has escaped and established in wetlands and riparian areas, displacing the local flora. Elevations range from near sea level to 5,576 feet (1,700 m). Stands are found along riparian areas, pond and lake margins, wet meadows, and intermittent drainages. Soils are commonly fine-textured and may be flooded for brief to extended periods. The vegetation is characterized by a dense, tall herbaceous layer (often greater than 80% canopy cover and 60–80 inches [1.5–2 m] tall) that is dominated by *Phalaris arundinacea*, which tends to occur in monocultures. Associated species may include *Equisetum arvense*, *Muhlenbergia asperifolia*, *Mentha arvensis*, *Schoenoplectus acutus (=Scirpus acutus)*, and many other species in trace amounts where disturbed. Introduced species such as *Lepidium latifolium*, *Cirsium arvense*, *Sonchus oleraceus*, *Euphorbia esula*, and *Phleum pratense* are common in some stands.

### Association (Scientific) Name: *Polygonum* spp.–*Echinochloa* spp.–*Distichlis spicata* Playa Lake Herbaceous Vegetation

*Translated Scientific Name:* Smartweed species–barnyard grass species–saltgrass playa lake herbaceous vegetation

*Common Name:* Playa marsh

*Unique Identifier:* CEGL002039

*Classification Code:* V.A.5.N.j.12

*Association Classification Confidence Level:* Weak

*Association Summary:* This wetland community is found in the central Great Plains of the United States, where it occurs in shallow depressions on gently to moderately sloping topography. Soils are deep to moderately deep loams or clay loams underlain by a dense clay sublayer. Ponds often draw down periodically in these playa-type habitats. Annual herbaceous graminoids and forbs, mostly less than 40 inches (1 m) tall, dominate the exposed mud flats, and species composition and extent of the community fluctuate from site to site and year to year. In Nebraska, graminoids include *Cyperus acuminatus*, *Eleocharis engelmannii*, and *Echinochloa muricata*, and forbs include *Bacopa rotundifolia*, *Coreopsis tinctoria*, *Elatine rubella*, *Heteranthera limosa*, *Limosella aquatica*, *Lindernia dubia*, *Mollugo verticillata*, *Polygonum pensylvanicum (=Polygonum bicorne)*, *Polygonum lapathifolium*, *Rumex stenophyllus*, and *Sagittaria calycina*. In Kansas, graminoids include *Hordeum jubatum*, and forbs include *Ambrosia grayi*, *Symphyotrichum subulatum (=Aster subulatus)*, and *Chenopodium berlandieri*. The frequent water fluctuations and thick clay pan prevent establishment of most perennial hydrophytes, such as *Schoenoplectus* spp. (=*Scirpus* spp.) and *Typha* spp.

### Association (Scientific) Name: *Typha* spp. Great Plains Herbaceous Vegetation

*Translated Scientific Name:* Cattail species, Great Plains herbaceous vegetation

*Common Name:* Northern Great Plains cattail marsh

*Unique Identifier:* CEGL002389

*Classification Code:* V.A.5.N.l.9

*Association Classification Confidence Level:* Moderate

*Association Summary:* This cattail community type is found throughout the northern Great Plains of the United States and Canada. Stands occur in shallow (less than 20 inches [0.5 m]) or deep depressions, stock ponds, and seepy drainages. The vegetation is dominated by relatively pure stands of *Typha* spp., either *T. latifolia* or *T. angustifolia* or both. Many associates can occur including *Eleocharis* spp. and *Sagittaria latifolia*. This type may simply be a less diverse variation of *Typha* spp.–*Schoenoplectus* spp.–mixed herbs, Great Plains herbaceous vegetation (CEGL002228) that arises in disturbed wetland areas.

### Association (Scientific) Name: *Schoenoplectus tabernaemontani*–*Typha* spp.–(*Sparganium* spp., *Juncus* spp.) Herbaceous Vegetation

*Translated Scientific Name:* Softstem bulrush–cattail species–(burreed species, rush species) herbaceous vegetation

*Common Name:* Bulrush-cattail-burreed shallow marsh

*Unique Identifier:* CEGL002026

*Classification Code:* V.A.5.N.k.33

*Association Classification Confidence Level:* Weak

*Association Summary:* This shallow marsh, mixed emergent community ranges broadly over the midwestern United States and adjacent Canada. It is found in basin-like depressions, backwater areas of floodplains, and shallow margins of lakes or ponds. Soils are shallow to deep, very poorly drained, consisting of peats, mucks, or mineral materials, and often found in alluvium. Vegetation varies from zones dominated by tall emergents 40–80 inches (1–2 m) tall to those with hydrophytic annual and perennial forbs less than 40 inches (1 m) tall. In the tall emergent zone, *Schoenoplectus tabernaemontani (=Scirpus tabernaemontani)*, *Schoenoplectus fluviatilis (=Scirpus fluviatilis)*, *Schoenoplectus acutus (=Scirpus acutus)*, *Typha angustifolia*, and *Typha latifolia* may dominate, mixed with a variety of other herbaceous species such as *Leersia oryzoides*, *Eleocharis palustris*, *Juncus* spp., and *Sparganium* spp. The hydrophytic annual and perennial forb zone is dominated by *Alisma subcordatum*, *Alisma plantago-aquatica*, *Sagittaria latifolia*, *Sparganium eurycarpum*, and *Pontederia cordata*, along with *Bacopa rotundifolia* and *Heteranthera limosa*. Occasional floating-leaved aquatics are sometimes present including *Azolla caroliniana*, *Lemna* spp., *Spirodela polyrrhiza*, and *Utricularia macrorhiza*.

### Association (Scientific) Name: *Populus deltoides*–(*Salix amygdaloides*)/*Salix* (*exigua, interior*) Woodland

*Translated Scientific Name:* Eastern cottonwood–(peachleaf willow)/(coyote willow, sandbar willow) woodland

*Common Name:* Cottonwood–peachleaf willow floodplain woodland

*Unique Identifier:* CEGL000659

*Classification Code:* II.B.2.N.b.4

*Association Classification Confidence Level:* Moderate

*Association Summary:* This cottonwood-willow woodland is found widely in the central Great Plains of the United States. Stands occur on recently deposited alluvial material along rivers and streams. The soils are derived from alluvial sand, silt, and clay and are poorly developed. The water table fluctuates with the level of the adjacent river or stream. *Populus deltoides* is the dominant species in this community, although *Salix exigua* and/or *Salix interior* is generally more dominant in the initial stage following a major flood event. *Salix amygdaloides* is rare to codominant. The shrub/sapling layer is conspicuous, especially near the streambank, and consists mainly of *Salix exigua*, *Populus deltoides*, and *Salix amygdaloides*, or occasionally *Salix lutea*. In the more easterly parts of the range, *Salix interior* may replace *Salix exigua*. On the older margins of this community *Fraxinus pennsylvanica* is often found as a sapling or small canopy tree. The herbaceous stratum is variable. Graminoids typical of undisturbed sites include *Carex emoryi*, *Carex pellita (=Carex lanuginosa)*, *Pascopyrum smithii*, and *Spartina pectinata*. *Equisetum arvense* and *Glycyrrhiza lepidota* are common forbs in these sites. Widely distributed species that are adapted to these sites include *Ambrosia psilostachya*, *Artemisia campestris* ssp. *caudata*, *Artemisia ludoviciana*, *Calamovilfa longifolia*, *Cenchrus longispinus*, *Chamaesyce serpyllifolia (=Euphorbia serpyllifolia)*, *Euphorbia esula*, *Grindelia squarrosa*, *Helianthus petiolaris*, *Heterotheca villosa*, *Phyla lanceolata (=Lippia lanceolata)*, *Opuntia macrorhiza*, *Poa pratensis*, and *Sporobolus cryptandrus*. These sites are prone to invasion by exotic grasses and forbs, the most widely established being *Agrostis stolonifera*, *Bromus tectorum*, *Cirsium arvense*, *Bassia scoparia (=Kochia scoparia)*, *Melilotus* spp., *Taraxacum officinale*, and *Tragopogon dubius*.

### Association (Scientific) Name: *Salix exigua*/Mesic Graminoids Shrubland

*Translated Scientific Name:* Coyote willow/mesic graminoids shrubland

*Common Name:* Sandbar willow/mesic graminoids shrubland

*Unique Identifier:* CEGL001203

*Classification Code:* III.B.2.N.d.6

*Association Classification Confidence Level:* Strong

*Association Summary:* This riparian association is found primarily in the central Great Plains, but also occurs in parts of the Rocky Mountains and the Intermountain Region's semidesert areas. It generally occurs along backwater channels and other perennially wet, but less scoured sites such as floodplain swales and irrigation ditches. In Nebraska, this community is found on sandbars, islands, and shorelines of stream channels and braided rivers. The vegetation is characterized by the dominance of *Salix exigua* in a moderately dense tall-shrub canopy with a dense herbaceous layer dominated by graminoids. Other common shrubs include saplings of *Populus deltoides* or *Salix amygdaloides*, *Salix eriocephala*, *Salix lutea*, and *Amorpha fruticosa*. Tall perennial grasses can appear to codominate the stand when *Spartina pectinata*, *Panicum virgatum*, or other tall grasses are present. Other mesic graminoids such as *Carex* spp., *Eleocharis* spp., *Juncus* spp., *Pascopyrum smithii*, *Schoenoplectus pungens (=Scirpus pungens)*, and *Sphenopholis obtusata* may be present. Common forb species include *Bidens* spp., *Lobelia siphilitica*, *Lycopus americanus*, *Lythrum alatum*, *Polygonum* spp., and *Xanthium strumarium*. Diagnostic features of this association include the nearly pure stands of *Salix exigua* shrubs, with a dense herbaceous layer of at least 30% cover of mesic graminoids.

## FIELD VEGETATION ASSOCIATION PLANT COMMUNITY SUMMARY

The NVCS clearly defines plant communities that can be discriminated on the landscape and at the association level is of fine enough detail to allow evaluation of management actions.

### *NVCS Associations in the Rainwater Basin Wetland Complex*

The following is a listing of the NVCS associations as they are used in the GIS data layer for plant communities that occur in the Rainwater Basin. The categories were divided into five representative classes: wet meadow, wetland plants, shrubs, trees, and uplands.

#### Wet Meadow

k.53 *Carex* spp.–(*C. pellita, C. vulpinoidea*) herbaceous vegetation (sedge species–[woolly sedge, fox sedge] herbaceous vegetation)

This sedge wet meadow type is found in the central midwestern United States. Stands occur on nearly level floodplains, often in bands surrounding channels, or in basins. Soils are poorly drained silty and clay loams formed in alluvium. Stands are flooded for much of the growing season, but may dry out in late summer. The vegetation cover is quite dense and may be patchy. The structure is dominated by graminoids 20–60 inches (0.5–1.5 m) tall. Typical species include *Carex cristatella*, *Carex molesta*, *Carex pellita (=Carex lanuginosa)*, *Carex stipata*, *Carex tribuloides*, and *Carex vulpinoidea* (a dominant in southeast Nebraska meadows). Other frequent emergent graminoids include *Eleocharis* spp., *Juncus interior*, *Juncus torreyi* and *Scirpus atrovirens*. *Leersia oryzoides* may be common where the stand borders a marsh. Forbs are common and may be conspicuous. Among the more common are *Apocynum cannabinum*, *Symphyotrichum lanceolatum (=Aster lanceolatus)*, *Lycopus americanus*, *Lythrum alatum*, and *Verbena hastata*. *Phalaris arundinacea* may invade this community to the point of excluding many of the native species.

k.61 *Eleocharis palustris* herbaceous vegetation (creeping spikerush, wet meadow)

This spikerush, wet meadow community is found in the central Great Plains of the United States and Canada and in the western United States. Stands occur in small depressions in intermittent streambeds or depression ponds that flood early in the season and may dry out by summer. Stands are composed of submersed and emergent rooted vegetation under 40 inches (1 m) tall that is dominated by *Eleocharis palustris*, often in nearly pure stands. Soils are generally fine-textured.

i.1 *Pascopyrum smithii–Buchloe dactyloides–(Phyla cuneifolia, Oenothera canescens)* herbaceous vegetation, western wheatgrass–buffalograss–(wedgeleaf frogfruit, spotted evening-primrose) herbaceous vegetation

This wheatgrass, playa grassland community represents the common vegetation type of playa lake basins (depressional wetlands) under rangeland conditions in the southern and central Great Plains of the United States. In the central plains, soils are dense silts and clays, occasionally loess-derived, that flood in winter and dry out by early summer. Perennial herbaceous graminoids and forbs less than 40 inches (1 m) tall dominate the community, with composition varying depending on water levels. In the central plains, *Pascopyrum smithii* is most abundant with *Agrostis hyemalis*, *Eleocharis palustris*, *Eleocharis macrostachya*, *Elymus virginicus*, and *Hordeum jubatum* locally abundant. *Buchloe dactyloides* can be abundant in grazed sites. Early season ephemeral annuals include *Alopecurus carolinianus*, *Elatine rubella*, *Myosurus minimus*, *Veronica peregrina* ssp. *xalapensis*, and more westward *Limosella aquatica* and *Plagiobothrys scouleri*. Perennial forbs including *Ambrosia grayi*, *Phyla cuneifolia*, *Oenothera canescens*, *Rorippa sinuata*, and *Vernonia fasciculata* are conspicuous in places. In the southern plains, species characteristic of the type include *Buchloe dactyloides*, *Distichlis spicata*, and *Panicum obtusum*.

## Wetland Plants

k.20 *Phalaris arundinacea* western herbaceous vegetation (reed canarygrass, western herbaceous vegetation)

This association is reported from throughout Washington, Colorado, Nebraska, Montana, Idaho, and into northeastern Utah, and is likely more widespread in the western United States. Its distribution as a natural type is complicated because this native species is widely cultivated as a forage crop and has escaped and established in wetlands and riparian areas, displacing the local flora. Elevations range from near sea level to 5,576 feet (1,700 m). Stands are found along riparian areas, pond and lake margins, wet meadows, and intermittent drainages. Soils are commonly fine-textured and may be flooded for brief to extended periods. The vegetation is characterized by a dense, tall herbaceous layer (often >80% canopy cover and 60–80 inches [1.5–2 m] tall) that is dominated by *Phalaris arundinacea*, which tends to occur in monocultures. Associated species may include *Equisetum arvense*, *Muhlenbergia asperifolia*, *Mentha arvensis*, *Schoenoplectus acutus (=Scirpus acutus)*, and many other species in trace amounts where disturbed. Introduced species such as *Lepidium latifolium*, *Cirsium arvense*, *Sonchus oleraceus*, *Euphorbia esula*, and *Phleum pratense* are common in some stands.

j.12 *Polygonum* spp.–*Echinochloa* spp.–*Distichlis spicata* playa lake, herbaceous vegetation (smartweed species–barnyard grass species–saltgrass, playa lake, herbaceous vegetation)

This wetland community is found in the central Great Plains of the United States, where it occurs in shallow depressions on gently to moderately sloping topography. Soils are deep to moderately deep loams or clay loams underlain by a dense clay sublayer. Ponds often draw down periodically in these playa-type habitats. Annual herbaceous graminoids and forbs, mostly less than 40 inches (1 m) tall, dominate the exposed mud flats, and species composition and extent of the community fluctuate from site to site and year to year. In Nebraska, graminoids include *Cyperus acuminatus*, *Eleocharis engelmannii*, and *Echinochloa muricata*. Forbs include *Bacopa rotundifolia*, *Coreopsis tinctoria*, *Elatine rubella*, *Heteranthera limosa*, *Limosella aquatica*, *Lindernia dubia*, *Mollugo verticillata*, *Polygonum pensylvanicum (=Polygonum bicorne)*, *Polygonum lapathifolium*, *Rumex stenophyllus*, and *Sagittaria calycina*. In Kansas, graminoids include *Hordeum jubatum* and forbs include *Ambrosia grayi*, *Symphyotrichum subulatum (=Aster subulatus)*, and *Chenopodium berlandieri*. The frequent water fluctuations and thick clay pan prevent establishment of most perennial hydrophytes, such as *Schoenoplectus* spp. (=*Scirpus* spp.) and *Typha* spp.

l.9 *Typha* spp. Great Plains herbaceous vegetation (CEGL002389) (cattail species, Great Plains herbaceous vegetation)

This cattail community type is found throughout the northern Great Plains of the United States and Canada. Stands occur in shallow (less than 20 inches [0.5 m]) or deep depressions, stock ponds, and seepy drainages. The vegetation is dominated by relatively pure stands of *Typha* spp., either *T. latifolia* or *T. angustifolia* or both. Many associates can occur, including *Eleocharis* spp. and *Sagittaria latifolia*. This type may simply be a less diverse variation of *Typha* spp.–*Schoenoplectus* spp.–mixed herbs, Great Plains herbaceous vegetation (CEGL002228) that arises in disturbed wetland areas.

k.33 *Schoenoplectus tabernaemontani–Typha* spp.–(*Sparganium* spp., *Juncus* spp.) herbaceous vegetation (softstem bulrush–cattail species–[burreed species, rush species] herbaceous vegetation)

This shallow marsh, mixed emergent community ranges broadly over the midwestern United States and adjacent Canada. It is found in basin-like depressions, backwater areas of floodplains, and shallow margins of lakes or ponds. Soils are shallow to deep, very poorly drained, consisting of peats, mucks, or mineral materials, and often found in alluvium.

Vegetation varies from zones dominated by tall emergents 40–80 inches (1–2 m) tall to those with hydrophytic annual and perennial forbs less than 40 inches (1 m) tall. In the tall emergent zone, *Schoenoplectus tabernaemontani (=Scirpus tabernaemontani)*, *Schoenoplectus fluviatilis (=Scirpus fluviatilis)*, *Schoenoplectus acutus (=Scirpus acutus)*, *Typha angustifolia*, and *Typha latifolia* may dominate, mixed with a variety of other herbaceous species such as *Leersia oryzoides*, *Eleocharis palustris*, *Juncus* spp., and *Sparganium* spp. The hydrophytic annual and perennial forb zone is dominated by *Alisma subcordatum*, *Alisma plantago-aquatica*, *Sagittaria latifolia*, *Sparganium eurycarpum*, *Pontederia cordata*, along with *Bacopa rotundifolia* and *Heteranthera limosa*. Occasional floating-leaved aquatics are sometimes present, including *Azolla caroliniana*, *Lemna* spp., *Spirodela polyrrhiza*, and *Utricularia macrorhiza*.

#### a.14 *Ceratophyllum demersum* Great Plains herbaceous vegetation (Great Plains pondweed, submerged aquatic wetland)

This community type is found in the Great Plains of the United States in shallow to relatively deep (40 inches [1 m]) freshwater basins or bands in marshes or bays that remain flooded in all but the driest years. Vegetation varies from sparse to dense, with submersed rooted and free-floating macrophytes. Species composition varies with substrate, water depth, water chemistry, turbidity, water temperatures, and other factors, but these are poorly understood. Dominant species in Nebraska include narrow-leaved pondweeds (*Potamogeton foliosus*, *Stuckenia pectinata (=Potamogeton pectinatus)*, *Potamogeton pusillus)*, *Najas guadalupensis*, and *Zannichellia palustris*. *Ceratophyllum demersum* and *Utricularia macrorhiza* can be locally abundant. In quiet bays, *Potamogeton nodosus* and *Lemna* spp. are common. In clear water with sandy bottoms *Chara* spp. may also be common.

### Trees

#### b.4 *Populus deltoides*–(*Salix amygdaloides*)/*Salix* (*exigua, interior*) woodland (eastern cottonwood–[peachleaf willow]/[coyote willow, sandbar willow] woodland)

This cottonwood-willow woodland is found widely in the central Great Plains of the United States. Stands occur on recently deposited alluvial material along rivers and streams. The soils are derived from alluvial sand, silt, and clay and are poorly developed. The water table fluctuates with the level of the adjacent river or stream. *Populus deltoides* is the dominant species in this community, although *Salix exigua* and/or *Salix interior* is generally more dominant in the initial stage following a major flood event. *Salix amygdaloides* is rare to codominant. The shrub/sapling layer is conspicuous, especially near the streambank, and consists mainly of *Salix exigua*, *Populus deltoides*, and *Salix amygdaloides*, or occasionally *Salix lutea*. In the more easterly parts of the range, *Salix interior* may replace *Salix exigua*. On the older margins of this community *Fraxinus pennsylvanica* is often found as a sapling or small canopy tree. The herbaceous stratum is variable. Graminoids typical of undisturbed sites include *Carex emoryi*, *Carex pellita (=Carex lanuginosa)*, *Pascopyrum smithii*, and *Spartina pectinata*. *Equisetum arvense* and *Glycyrrhiza lepidota* are common forbs in these sites. Widely distributed species that are adapted to these sites include *Ambrosia psilostachya*, *Artemisia campestris* ssp. *caudata*, *Artemisia ludoviciana*, *Calamovilfa longifolia*, *Cenchrus longispinus*, *Chamaesyce serpyllifolia (=Euphorbia serpyllifolia)*, *Euphorbia esula*, *Grindelia squarrosa*, *Helianthus petiolaris*, *Heterotheca villosa*, *Phyla lanceolata (=Lippia lanceolata)*, *Opuntia macrorhiza*, *Poa pratensis*, and *Sporobolus cryptandrus*. These sites are prone to invasion by exotic grasses and forbs, the most widely established being *Agrostis stolonifera*, *Bromus tectorum*, *Cirsium arvense*, *Bassia scoparia (=Kochia scoparia)*, *Melilotus* spp., *Taraxacum officinale*, and *Tragopogon dubius*.

### Shrubs

#### d.6 *Salix exigua*/mesic graminoids shrubland (coyote willow/mesic graminoids shrubland)

This riparian association is found primarily in the central Great Plains, but also occurs in parts of the Rocky Mountains and Intermountain Region's semidesert areas. It generally occurs along backwater channels and other perennially wet, but less scoured, sites such as floodplain swales and irrigation ditches. In Nebraska, this community is found on sandbars, islands, and shorelines of stream channels and braided rivers. The vegetation is characterized by the dominance of *Salix exigua* in a moderately dense tall-shrub canopy with a dense herbaceous layer dominated by graminoids. Other common shrubs include saplings of *Populus deltoides* or *Salix amygdaloides*, *Salix eriocephala*, *Salix lutea*, and *Amorpha fruticosa*. Tall perennial grasses can appear to codominate the stand when *Spartina pectinata*, *Panicum virgatum* or other tall grasses are present. Other mesic graminoids, such as *Carex* spp., *Eleocharis* spp., *Juncus* spp., *Pascopyrum smithii*, *Schoenoplectus pungens (=Scirpus pungens)*, and *Sphenopholis obtusata*, may be present. Common forb species include *Bidens* spp., *Lobelia siphilitica*, *Lycopus americanus*, *Lythrum alatum*, *Polygonum* spp., and *Xanthium strumarium*. Diagnostic features of this association include the nearly pure stands of *Salix exigua* shrubs, with a dense herbaceous layer of at least 30% cover of mesic graminoids.

### Uplands

#### e.9 *Bouteloua gracilis–Buchloe dactyloides* herbaceous vegetation (blue grama–buffalograss)/purple three-awn, sideoats grama, sixweeks fescue

This blue grama–buffalograss, short-grass prairie type is common across much of the central and southern Great Plains of the United States. Stands occur on flat to rolling uplands. The surface soil may be sandy

loam, loam, silt loam, or loamy clay. The subsoil is often finer than the surface soil. This community is characterized by a moderate to dense sod of short grasses with scattered mid-grasses and forbs. The dominant species are *Bouteloua gracilis* and *Buchloe dactyloides*. The foliage of these species is 2.8–7.6 inches (7–19 cm) tall, while the flowering stalks of *Bouteloua gracilis* may reach 18 inches (45 cm). The mid-grasses are usually stunted by the arid conditions and often do not exceed 28 inches (0.7 m). Other short graminoids found in this community are *Bouteloua hirsuta*, *Carex duriuscula*, *Carex inops* ssp. *heliophila*, and *Carex filifolia* (in Nebraska). Several mid-grasses occur regularly, such as *Aristida purpurea*, *Bouteloua curtipendula*, *Pascopyrum smithii*, *Schizachyrium scoparium*, *Elymus elymoides*, *Sporobolus cryptandrus*, *Hesperostipa comata* (=*Stipa comata*), and *Vulpia octoflora*. Forbs such as *Astragalus* spp., *Gaura coccinea*, *Machaeranthera pinnatifida* var. *pinnatifida*, *Opuntia polyacantha*, *Plantago patagonica*, *Psoralidium tenuiflorum*, *Ratibida columnifera*, and *Sphaeralcea coccinea* are common throughout this community. Shrubs are very rare except in the southern part of this community's range where scattered individuals may occur. In Oklahoma, other characteristic species include *Ambrosia artemisiifolia*, *Aristida oligantha*, *Machaeranthera tanacetifolia*, *Melampodium leucanthum*, *Muhlenbegria torreyi*, *Sporobolus compositus*, *Sporobolus cryptandrus*, and *Zinnia grandiflora*. In Texas, associated species include *Prosopis glandulosa*, *Bouteloua curtipendula*, and *Sporobolus cryptandrus*.

### a.2 *Andropogon gerardii–Sorghastrum nutans–Hesperostipa spartea* loess hills herbaceous vegetation (big bluestem–yellow Indiangrass)

Stands occur on moderately steep mid- to upper slopes of loess hills and along ridges. It is most common on southern and western aspects. The soil is well-drained, acidic to neutral, and shallow to deep loess (16–40 inches [40–100 cm]). The parent material is a deep loess or glacial till and other deeply weathered substrates. This community is virtually lacking in shrubs and trees. Woody vegetation that is present, such as *Amorpha canescens*, is usually less than 20 inches (0.5 m) tall. The dominant vegetation is tall grasses. Of the dominant species, *Andropogon gerardii*, *Sorghastrum nutans*, and *Hesperostipa spartea* (=*Stipa spartea*) typically exceed 40 inches (1 m). *Schizachyrium scoparium*, also very common, is shorter. In Missouri, some other species that are usually found in this community are *Echinacea pallida*, *Potentilla arguta*, *Silphium laciniatum*, and *Sporobolus compositus* var. *compositus*.

### c.20 *Schizachyrium scoparium–Bouteloua curtipendula–Bouteloua hirsuta*–(*Yucca glauca*) herbaceous vegetation (little bluestem–sideoats grama)–hairy grama–(soapweed yucca) herbaceous vegetation

This bluestem-grama grass, dry-prairie type is found on the loess bluffs along the east side of Missouri River in the central midwestern United States. The soil is somewhat rapidly drained and very shallow (0–16 inches [0–40 cm]). The vegetative structure comprises a single layer of dominant grasses intermixed with forbs. Shrubs, especially *Yucca glauca*, are sometimes present. This community is a short- to midgrass prairie dominated by the bunchgrasses *Andropogon gerardii*, *Bouteloua curtipendula*, and *Schizachyrium scoparium*. *Bouteloua hirsuta* can be common. *Sporobolus cryptandrus*, *Dalea leporina*, *Dalea candida*, *Dalea enneandra*, *Astragalus lotiflorus*, and *Astragalus missouriensis* can also be common. Other herbaceous species include *Pulsatilla patens* ssp. *multifida* (=*Anemone patens*), *Symphyotrichum sericeum* (*Aster sericeus*), *Buchloe dactyloides*, *Bouteloua gracilis*, *Delphinium carolinianum*, *Gaura coccinea*, and *Pediomelum argophyllum*, and the lichens *Dermatocarpon lachneum* and *Psora decipiens*.

## VEGETATION TRANSECT NOMENCLATURE

The final method of delineating plant communities was to use common name plant associations found within the basin. These communities were grouped into 11 categories. These categories then have representative plant communities commonly found in the basin.

Field codes that provide land managers with common names that they are familiar with were added to this hierarchy, allowing easy data recording during transect data collection. Table I-2 shows all of the local plant associations in the basin.

**Table I-2. Rainwater Basin vegetation mapping polygon descriptions.**

| *Field Code* | *Examples or Includes* | *NVCS Code* |
|---|---|---|
| annual weed | sunflower, foxtail | weeds |
| building | McMurtrey, Cottonwood | infrastructure |
| Canada thistle | dominated by Canada thistle | noxious weed |
| cattail | native and hybrid | l.9 |
| cedar tree | planted and volunteer cedars with multiple trees averaging 6 feet or taller and <32.5 feet (10 m) basal proximity | introduced |
| cropland | farmed, row crops | crop |
| introduced forb | perennial forbs, alfalfa, sweetclover, vetch | introduced |
| invasive cool-season plant | downy brome, Japanese brome, Kentucky bluegrass, smooth brome, intermediate | introduced |
| leafy spurge | mapped all patches regardless of size | noxious weed |
| moist-soil plant | annual early successional plants | j.12 |
| musk thistle | dense patches that can be mapped | noxious weed |
| native grassland | untilled remnant prairie with mostly native, warm- or cool-season species | a.2, c.20, e.9 |
| newly seeded vegetation | <2 years old with annual weeds or wild rye | a.2, c.20, e.10 |
| parking lot | —— | infrastructure |
| reed (*Phragmites* spp.) | all mapped patches of reed (*Phragmites* spp.) | noxious weed |
| planted, high-diversity, seeded vegetation | seeded native grass with 70+ native species included in mix | a.2, c.20, e.9 |
| planted, native, cool-season vegetation | dike mix, other small patches | a.2, c.20, e.9 |
| planted, native, warm-season vegetation | five species, old plantings with low diversity | a.2, c.20, e.9 |
| prairie dog town | active dog towns | e.9 |
| reed canarygrass | —— | k.20 |
| road | McMurtrey, well roads | infrastructure |

**Table I-2. Rainwater Basin vegetation mapping polygon descriptions.**

| *Field Code* | *Examples or Includes* | *NVCS Code* |
|---|---|---|
| bulrush *(Scirpus* spp.) | *Schoenoplectus fluviatilis* (three square) | k.33 |
| shrub | American plum, chokecherry, dogwood, sumac | d.6, d.27 |
| tree | cottonwood, green ash, willow | b.4 |
| water or mud flat | dirt, water, mud, void of vegetation (submergent plant communities) | a.14, or other dominant plants |
| wet meadow | rushes, sedges, or western wheatgrass | k.53, k.61, i.1 |

# Appendix L

*Fire Management Program*

The U.S. Fish and Wildlife Service has management and administrative responsibility, including fire management, for approximately 24,000 acres of waterfowl production areas in the Rainwater Basin Wetland Management District.

## FIRE—A CRITICAL NATURAL PROCESS

In prairie ecosystems of the Great Plains, vegetation has evolved under periodic disturbance and defoliation from herbivores and fire, with minor weather events such as drought. This periodic disturbance is what kept the ecosystem diverse and healthy while maintaining significant biodiversity for thousands of years.

Historically natural fire, which includes Native American ignitions, has played an important disturbance role in many ecosystems: (1) removal of fuel accumulations; (2) decrease in undesirable plant communities; and (3) reduction in encroachment potential including trees, stimulating regeneration, cycling critical nutrients, and providing a diversity of habitats for wildlife. Higgins (1984) pointed out that 73% of historical lightning fires were started between July and August; the remaining 27% were started between April and June. Native American–set fires occurred mostly from February to June (most in April) and from July to November (most in October) (Higgins 1986).

When fire is excluded on a broad scale (over several decades) as it has been in many areas, the unnatural accumulation of living and dead fuel can contribute to degraded plant communities and wildlife habitats. These fuel accumulations often change the fire regime characteristics. Fuel accumulations have created the potential for uncharacteristically severe wildland fires in many areas across the country. These catastrophic wildland fires often pose risks to the safety of the public and firefighters. In addition, wildland fires threaten property and resource values such as wildlife habitat, grazing opportunities, timber, soils, water quality, and cultural resources.

Return of fire is essential for healthy vegetation and wildlife habitat in grassland and wetland ecosystems. When integrated back into an ecosystem, fire can help restore and maintain healthy systems. To facilitate fire's natural role in the environment, fire must be integrated into land and resource management plans on a broad scale.

Fire can do the following:

- improve waterfowl habitat through reduction of plant density, removal of organic material, and maintenance of early successional vegetation
- promote sediment removal in wetlands by wind scouring
- sustain biological diversity
- improve soil fertility
- improve the quality and amount of livestock forage
- reduce invasive plant communities including nonnative trees
- reduce the susceptibility of plants (caused by moisture and nutrient stress) to insects and disease
- improve water yield from off-site areas

## WILDLAND FIRE MANAGEMENT POLICY AND GUIDANCE

In 2001, the Secretaries of Interior and Agriculture completed and approved an update of the 1995 Federal Fire Policy. The 2001 Federal Wildland Fire Management Policy directs federal agencies to achieve a balance between (1) fire suppression to protect life, property, and resources and (2) fire use to regulate fuels and maintain healthy ecosystems. In addition, it directs agencies to use the appropriate management response for all wildland fires regardless of the ignition source. This policy provides eight guiding principles that are fundamental to the success of the fire management program:

- Firefighter and public safety is the first priority in every fire management activity.
- The role of wildland fires as an essential ecological process and natural change agent will be incorporated into the planning process.
- Fire management plans (FMPs), programs, and activities support land and resource management plans and their implementation.
- Sound risk management is a foundation for all fire management activities.
- Fire management programs and activities are economically viable, based on values to be protected, costs, and land and resource management objectives.

- FMPs and activities are based on the best available science.
- FMPs and activities incorporate consideration of public health and environmental quality. Federal, state, tribal, local, interagency, and international coordination and cooperation are essential.
- Standardization of policies and procedures among federal agencies is an ongoing objective.

Fire management considerations, guidance, and direction should be addressed in land use, resource management plans (such as a CCP). FMPs are step-down processes from the land use plans and habitat plans, with more detail on fire suppression, fire use, and fire management activities.

## MANAGEMENT DIRECTION

The Rainwater Basin Wetland Management District will protect life, property, and other resources from wildland fire by safely suppressing all wildland fires. Fire is an important management tool that can be used to accomplish habitat management objectives. If not used properly, fire can also quickly damage or destroy natural resources, equipment, buildings, and property and hurt or kill those that work with it. Prescribed fire and manual or mechanical fuels treatments will be used to reduce hazardous fuels and on district lands to reduce the intensity and severity of wildland fires. Special attention will be given to wildland–urban interface areas, both on Service-owned and adjacent lands, to reduce the risk of wildland fires to communities and improvements.

Prescribed fire and manual or mechanical fuel treatments will be used in an ecosystem management context for habitat management and to protect federal and private property. Fuel reduction activities will be applied where needed, especially in areas with a higher proportion of residences that may be considered "wildland–urban interface" areas. The prescribed fire program is outlined in the Rainwater Basin Fire Monitoring Plan.

All aspects of the fire management program will be conducted in a manner consistent with applicable laws, policies, and regulations. The district will maintain an FMP and carry out the plan to accomplish resource management objectives. Prescribed fire and fuel treatments will be applied in a scientific way under selected weather and environmental conditions to restore and maintain desired habitat conditions and control nonnative vegetation and the spread of woody vegetation. Up to approximately 6,500 acres of grasslands and wetlands will be treated annually to help accomplish habitat management objectives.

### *Fire Management Goal*

Use fire as an ecosystem process within wetland and grassland habitats and reach the needed level of prescribed fire management at the WPAs to control invasive plants, encourage desirable native plants, and maintain productive wetlands that can benefit migratory birds.

#### Fire Management Objective A

Through the duration of this CCP, increase the use of prescribed fire to 5,000–7,000 acres. Its use will shift from being a management tool to control woody and other undesirable invasive plants to being a management tool to maintain healthy grassland and wetland habitats.

#### Fire Management Objective B

Through the duration of this CCP, increase the public's awareness and support of fire as a management tool.

#### Fire Management Objective C

Through the duration of this CCP, increase the number of fire-qualified partners and interagency prescribed burning.

#### Fire Management Strategies

- Use strategies and tactics that consider public and firefighter safety as well as resource values at risk.
- Apply fire at a rate and intensity that takes the district from a restoration need (every 1–3 years) to a historical level of fire frequency (every 5–7 years).
- Apply fire in a mosaic pattern that leaves portions of treated WPAs unburned.
- Allow fire to travel through select shelterbelts to reduce cool-season grasses and litter.
- Work with district partners to provide demonstrations, written information, and other methods of communication to inform the public of the benefits of prescribed fire.
- Work with professional instructors and local colleges and universities to conduct classes in basic firefighter training.
- Work with the appropriate agencies to develop interagency agreements that will allow mutual assistance on prescribed burns.
- Develop detailed prescribed burn plans that describe the following:
  - burn units and their predominant vegetation;
  - the primary objectives for the units and specific objectives of the fire
  - acceptable range of results
  - site preparation requirements
  - weather requirements
  - safety considerations and measures to protect sensitive features
  - burn-day activities
  - communications and coordination for burns
  - ignition techniques

- smoke management procedure
- postburn monitoring

Methods (manual or mechanical means, timing, and monitoring) for wildland fire suppression, wildland fire use, and prescribed fire can be found in a more detailed list in the district's step-down FMP.

### Fire Management Rationale

Fire frequency in south-central Nebraska has been estimated to have occurred once every 5–7 years. Madden et al. (1999) assessed the effects of fire on grassland. They found that maximal grassland bird diversity is best attained by creating a mesic, mixed-grass prairie with areas of varying fire return intervals. Grassland birds such as Baird's sparrow, bobolink, grasshopper sparrow, and western meadowlark responded to burned areas. Other species such as common yellowthroat and clay-colored sparrow preferred prairie unburned for 8–10 years. The settlement of the Rainwater Basin has suppressed fire across the landscape.

Current fire at the WPAs is not frequent enough to control invading trees and shrubs. Past burns at the WPAs have shown that it takes three to four consecutive spring burns to remove woody plant invasion. This level of application is needed at approximately 20 WPAs, covering over 3,000 acres.

One of the problems that keep the district from reaching a greater fire frequency is the limited personnel available. A burn that is close to heavy fuel such as a shelterbelt requires a large fire crew to conduct the burn. Removal of shelterbelts will not only benefit grassland wildlife but will (1) eliminate the need to establish fire lines, (2) reduce the needed size of a fire crew, and (3) reduce hazardous fuels.

Prescribed fire temporarily reduces air quality by reducing visibility and releasing several components through combustion. The four major components are carbon monoxide, carbon dioxide, hydrocarbons, and particulates. Varying amounts of particulate content are generated in different types of fuels, for example, wildlife habitat improvement burns versus fuel reduction burns. The district will meet the Clean Air Act emission standards by adhering to the requirements of the Nebraska State Implementation Plan during all prescribed fire activities.

## FIRE MANAGEMENT ORGANIZATION, CONTACTS, AND COOPERATION

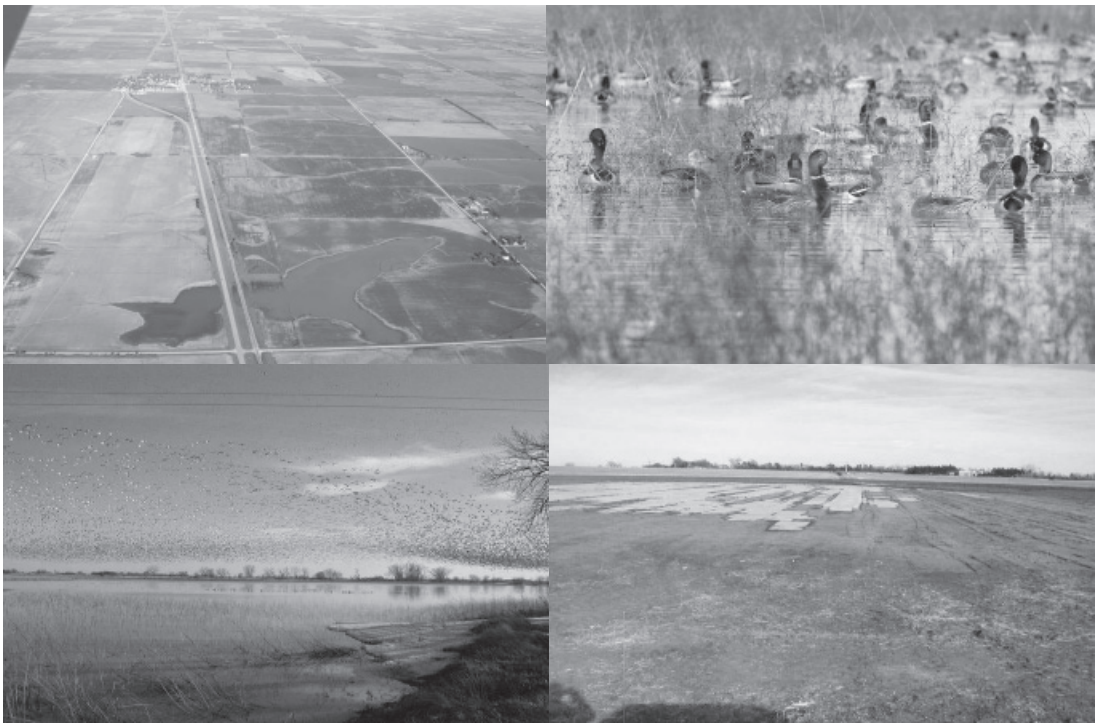
Region 6 has established qualified, technical oversight and support for fire management using the "fire management district" approach. Under this approach, an established modeling system (based on the fire management workload of a group of refuges and possibly even that of interagency partners) has determined an appropriate fire management staffing organization. The fire management workload consists of (1) historical wildland-fire suppression activities and (2) historical and planned fuels treatment workload. Depending on funds, fire management staff and support equipment may be located at the district or at other units in the district and shared between all units.

Wherever possible, fire management activities will be conducted in a coordinated and collaborative manner with federal and nonfederal partners.

# Appendix M

*Rainwater Basin Joint Venture Private Lands Program: Best Management Practices Eligibility Criteria and Cost Share*

**Rainwater Basin Joint Venture Private Lands Program**
**Best Management Practices Eligibility Criteria and Cost Share**



**Compiled by the Rainwater Basin Joint Venture**
**Private Lands Workgroup**

**Approved by the Rainwater Basin Joint Venture Management Board**
**March 14, 2006**

RAINWATER BASIN
JOINT VENTURE

**The Rainwater Basin Joint Venture Private Lands Workgroup developed the following programs and criteria to assist in the delivery and evaluation of Joint Venture (JV) programs on private lands. The proposed programs and criteria were developed with the JV objectives in mind, and will help ensure consistent and effective wetland habitat benefits through JV offerings. The Private Lands Work Group also recognizes that many wetland projects will not fit all of the criteria for a certain program, and will evaluate those projects with unique situations and information on a case-by-case basis to determine the program eligibility, applicable practices, and landowner benefits.**

## (1) Wetland Stewardship Program

This program targets non-cropped wetland areas ***only*** and provides incentives to landowner's that maintain and manage these habitats.

**Wetland Criteria:**

1) Wetland is functioning properly. No hydrologic restoration is needed.
2) Vegetative community is mostly native species with less than 5% of the wetland dominated by invasives (e.g. trees, reed canary grass, noxious weeds).
3) Wetland has not been cropped since 1985.
4) Eligible wetland area will be determined by state and federal biologists using tools such as, but not limited to, historic photos, hydric soil maps, topography information, presence of hydric vegetation, etc.
5) Areas determined to be cropland ***are not*** eligible for stewardship payment.

**Practices:**

✓ Landowner will maintain wetland hydrology, no hydrologic alteration is allowed.
✓ Landowner will continue to manage and maintain the native plant community.
✓ Landowner will manage and control invasive species.

**Benefits:**

1) A $25/acre/year stewardship payment for the hydric footprint (wetland area) over the 10-year agreement period with a $500 minimum/year.
2) Landowner continues to manage the land.
3) Landowner controls hunting access.
4) This program includes technical assistance from JV partners during the agreement period.
5) No minimum wetland size.

## (2) Restoration and Management Program

This is a 10-year program that focuses on ***restoring and managing*** quality wetland habitat.

**Wetland Criteria:**

1) Landowner must be willing to restore hydrology to the maximum extent feasible within the basin and the vegetative community on non-cropped areas via pit filling, ditch plugs, water

control structures, fill or sediment removal, tree removal, installation of a variable flow tail water recovery system, etc.

2) Landowner enters a 10-year agreement that allows the Joint Venture Partners to manage the wetland for the duration of the agreement.

**Practices:**

- ✓ Landowner is given the first opportunity to perform actual management on the property.
- ✓ Reimbursement Rates:
  - Haying/Shredding: $10/acre
  - Grazing Incentives: $10/acre/year

    Grazing must be concentrated in the wetland with preferred grazing during the growing season. Grazing payments only made when JV asks cooperator to graze wetland with specific timing/rate/goals.

    These grazing cost-share incentives may be possible:

    i. Fencing
       1. Standard electric
       2. High tensile electric
       3. Permanent barbed wire

    ii. Water source for cattle

    iii. Mineral blocks/tubs
  - Prescribed Fire: $15/acre or donation to local fire department.
  - Disking: $15/acre/pass with minimum of 2 passes using a standard farm disk.
  - Heavy Disking: $35/acre/pass with a minimum of 2 passes using a >30" heavy construction disk.
  - Chemical Applications: Negotiated based on chemical cost. Labor and equipment rates determined by NRCS docket.
- ✓ Landowner has the right to defer management actions to a private contractor. The JV will help facilitate hiring the contractor to accomplish the objectives.

**Benefits:**

1) Landowner receives a "land use payment" for wetland restoration and vegetation management according to the following table:

| Current Landuse | Fm, Fo | Sc, Sd | Ma, M, | Buffer |
|---|---|---|---|---|
| Cropped | $60/A | $50/A | $50/A | $60/A |
| Non-cropped | $50/A | $50/A | $50/A | $50/A |

Payment is in exchange for the right of JV partners to restore the wetland and direct management on the project area for the 10-year agreement period. Land use payments are made annually and are not contingent on the amount of management during that year. They are contingent on the landowner's willingness to participate. Wetland area may be over 25 acres in size; however land use payment will be capped at $1,250/year (based on available funding). Management cost share will be available for the entire wetland area.

2) Landowner is allowed to continue farming if the area has previously been cropped. ***Exception***: grasslands, pasture, or native prairie may not be brought into production.
3) Landowner may perform management on the project area without requesting permission from the JV. Grazing wetlands is encouraged as a way to supplement farm income.
4) Landowner controls hunting access. Access payments may be available from other partners.
5) Includes technical assistance from JV partners during the agreement period.
6) Center pivots are permitted as long as wheel crossing(s) do not interfere with wetland hydrology.

## (3) Hydrology Restoration Program (HRP-Pilot)

The purpose of this program is to restore wetland hydrology to the fullest extent possible targeting temporary and seasonal wetlands. To participate, the landowner would agree to restore wetland hydrology and sign a 10-year agreement in exchange for an annual land use payment. Due to funding limitations, two focus areas have been identified for this ***pilot program***. Maps of the focus areas have been made available to staff working directly with private landowners in these areas.

**Wetland Criteria:**

1) Only high priority wetlands (as determined by the RWB-JV Wetland Prioritization Model) are eligible. If all landowners owning the highest priority wetlands (red) are enrolled and funding still remains, landowners owning wetlands in the second highest priority level (salmon) will be contacted.
2) During the pilot period, basins that are 20 acres or smaller will be targeted.
3) Wetlands with severely altered hydrology (e.g. drains, pits) will be targeted first. These wetlands should have either no, or a low functionality.
4) Hydrology within the basin must be restored.

**Practices:**

✓ JV partners will provide economic and technical assistance necessary to restore the wetland.

**Benefits:**

1) Annual payments begin once restoration is complete. Payment rates follow the HRP table below.
2) JV partners provide restoration cost share.
3) No use restrictions for the project area.
4) Landowner controls hunting access.

**HRP-Pilot Payment Rates**

| Current Land Use | Fm, Fo | Sc, Sd | Ma, M, | Buffer |
|---|---|---|---|---|
| Irrigated cropped | $128/A | $96/A | $64/A | $128/A |
| Dryland cropped | $60/A | $50/A | $50/A | $60/A |
| Pasture managed | $15/A | $15/A | $15/A | $15/A |

## (4) Seasonal Habitat Improvement Program (SHIP)

This program targets cropped wetland and allows the landowner to maintain cropping during the growing season. SHIP takes advantage of an opportunity to provide wetland habitat during times that the producer is not growing a crop. Ponding water on hydric soils during the winter months has little effect on the crop production of these sites. On hydric soils most crop loss occurs during May through July primarily due to saturation after rainfall events even if wetland drainage has occurred. This program provides a financial incentive to landowners who provide at least the opportunity to pond water on cropped areas during the off season.

**Wetland Criteria:**

1) Wetland or area to be flooded must be drained, but be capable of holding water utilizing a control structure.
2) On cropland, the landowner must allow natural runoff to pond in the area immediately following harvest. Water on the cropped area may be released after March 31 of each year. On pastureland, the landowner must allow natural runoff to pond on the area beginning November 1. Water may then be released after April 30 of each year. Instances where a SHIP occurs on both cropland and pasture, the water control structure can be adjusted on March 31 so that water is not held on the cropland acres.
3) The landowner understands that during the duration of this 10-year agreement, there is an inherent risk associated with late rains after March 31 that may prevent him from planting during some years.

**Practices:**

- ✓ Water control structure installation and associated dirt work.
- ✓ Cropland areas should have boards placed in control structure after harvest and remain in place at least until March 31.
- ✓ Pastureland should have boards placed in control structure on November 1 and remain in place at least until April 30.

**Benefits:**

1) The landowner, in consultation with the JV Partners, will determine an acceptable pool elevation based on a topographic survey.
2) Annual payment of $50/acre/year for cropland area determined by landowner. This establishes an agreed upon pool elevation. Annual payment of $25/acre/year for grassland and pastureland.
3) Includes technical assistance and restoration cost share provided by JV partners during the agreement period.
4) Center pivots are permitted.
5) Landowner controls hunting access.

## (5) CRP 23A Incentive Bonus Program - Conservation Reserve Enhancement Program

This is a one-time signing bonus to promote enrollment and full restoration of wetlands under CP-23A. This program differs from the Hydrology Restoration Program in that landowners loose the right to crop the property for the duration of the CREP agreement.

**Wetland Criteria:**

1) Must sign up for CRP 23A (CREP would be included).
2) Cropland areas are eligible for incentive if the hydrology is restored (full hydrology restoration on applicant's property).
3) No prioritization needed in order to get as many wetlands restored as possible utilizing USDA funding.
4) Bonus payment paid on March 31 following completion of restoration.
5) Existing wetlands in the RWB that are currently in CRP are eligible for a bonus payment if the wetland hydrology is restored. Payment is based on # years remaining/# years in contract x $500/acre (e.g. 8 yrs remain on a 10 yr contract = 0.8 x $500 = $400/acre).

**Practices:**

- ✓ JV partners, in conjunction with the USDA, will provide economic and technical assistance necessary to restore the wetland.
- ✓ Eligible practices can be found in the CRP contract.

**Benefits:**

1) One-time payment of up to $500/acre. All acres enrolled in the CRP CP23a contract are eligible for the payment. This includes uplands and wetlands. Bonus payment will not be made until restoration is complete. The bonus payment will be made on March 31 following restoration.
2) Cost share is available to assist with restoration costs not payable by the USDA.
3) Pivot can cross the CRP unless otherwise indicated by the USDA.
4) Landowner controls hunting access.

## (6) Short Term Vegetation Management Program

This program differs from the Restoration Management Program in that it does not require wetland restoration. The Short Term Vegetation Management Program does not provide an annual land use payment, or any type of land access fee. The length of the agreement is negotiable.

**Wetland Criteria:**

1) Trees, cattail, reed canary grass, or river bulrush must be a component of the plant community.
2) Landowner allows access to the property for management treatment.
3) Landowner signs a negotiated-length agreement that allows the Joint Venture Partners access for treatment.
4) Financial assistance is limited to reimbursement for treatments only (no incentive payments).
5) Grazing must be concentrated in the wetland with preferred grazing during the growing season.

**Practices:**

- ✓ Landowner agrees to allow any or all of the following: disking, chemical application, haying/shredding, prescribed burning, grazing, silt removal, pit filling, and tree removal activities.
  Reimbursement Rates:
  - Haying/Shredding: $10/acre
  - Intensive Wetland Grazing: $10/acre/year
  - Prescribed Burning: $15/acre
  - Disking: $15/acre/pass with minimum of 2 passes using a standard farm disk.
  - Heavy Disking: $35/acre/pass with a minimum of 2 passes using >30" heavy construction disk.
  - Chemical Applications: Negotiated based on specific chemical cost; labor and equipment rates determined by NRCS docket.

**Benefits:**

1) Will add functional value to the wetland.
2) Additional grazing incentives may be possible such as fencing, installation of a water source, or purchase of mineral block(s).

## (7) General Joint Venture Cost Share Activities

The Joint Venture partners accept certain practices on their own, or in combination with the programs outlined above. Cost share is available for these activities if they provide benefits to wildlife habitat with emphasis on migratory birds, or improve watershed hydrology with direct benefits to a protected wetland. A 10-year agreement is required for cost share assistance.

**Wetland Improvements**

1) Sediment Control Structures
2) Fencing to encourage long term grazing in wetlands
3) Grazing (includes deferments)
4) Variable Flow Tail Water Recovery System
5) Close and Remove Roads
6) Vegetation Management
7) Junk Pile Removal
8) Water Development (wells, pivots, pipe, livestock)
9) Re-size/add/replace culverts
10) Water Control Structures
11) Wetland Creation
12) Wetland Seeding
13) Earthwork
    - ✓ Pit fills
    - ✓ Drain fills
    - ✓ Silt/sediment removal
    - ✓ Filling road/drainage ditches
    - ✓ Power line burial
    - ✓ Pipeline burial
    - ✓ Dikes/berms

- ✓ Tile drain removal

**Watershed Improvements**

1) Pit fills
2) Resize/add/replace culverts
3) Buffers
4) Grassland Restoration
5) Sediment Control Structures
6) Variable Flow Tail Water Recovery System
7) Removing Flow Restrictions
8) Terrace Removal
9) Close and Remove Roads
10) Tile Drain Removal

## (8) Easements

An easement program remains under development until enough properties are secured that an actual program can be evaluated and implemented. JV easements will be prioritized for functioning wetlands without hydrologic modification that are not eligible for NRCS's Wetland Reserve Program. The goal of easement offerings, as with all other JV programs, is to meet wetland protection needs that cannot be met through existing programs. At this time we will follow this format:

A. Hydrologic Restoration/Protection

Provide for on-site restoration of the wetland hydrology, prevent future hydrologic alterations and non-agricultural land use, and place no restrictions on agricultural land use.

B. Pasture/Protection Easement

Provide for on-site restoration of the wetland hydrology, prevent development of any kind, prevent excavation or filling which impacts hydrology, limits land use to pasture, but does not dictate management.

C. Protection/Restoration/Management

Provide for on-site restoration of the wetland hydrology, prevent any hydrologic alterations and non-agricultural land use, and place restrictions on land use and activities for the purpose of assuring maximum wetland habitat values.

The value of the easement will be determined through an appraisal of the value of those rights to be purchased. The minimum length of the easement terms will be 25 years and will be agreed to by the landowner and the entity holding the easement. The USFWS has expressed an interest in holding perpetual restoration easements (example A above). The easement must not restrict the landowner's agricultural rights to the land. In other words, if he is cropping it now he may still try to crop it once the wetland is restored. These easements would have to be perpetual in length.

# Appendix N

## *Wetland Management District Ditch and Tile Maintenance Policy*

This policy applies to existing constructed ditches or tiles that come onto waterfowl production areas (WPAs) where no reservation of a drainage easement exists in the WPA title or deed. If there is a drainage reservation in the deed, the Service will follow the terms of that reservation.

- No new wetland or upland drainage facility will be allowed within a WPA.
- Existing drainage cannot be improved beyond the original construction.
  - Tile may not be replaced with a larger tile.
  - Ditches may not be cleaned out beyond their original depth, width, or length.
  - Ditches may not be replaced with tile lines except where the tile is installed at the same or higher elevation than the original ditch bottom or in other rare exceptions to solve severe erosion.
- All materials cleaned out of a ditch will be removed from the WPA.
- All construction sites at WPAs will be seeded down to a grass mix specified by the Service.
- Cleanout activities will not be allowed during the waterfowl-breeding season (April 1–August 1).
- If silt deposition is a concern, the Service will request that a grassed waterway or silt basin be installed upstream of Service property to help reduce future siltation.
- Cleanout of natural (never ditched) drainage ways will not be allowed.
- Ditch and tile maintenance work at WPAs will only be done after the wetland district manager has approved the project and issued a special use permit. (Note: Compatibility determinations are not necessary since the Service does not control maintenance of the system; the Service only controls the timing and scope of maintenance.)
- Landowners may still be subject to the Swampbuster Provisions and the U.S. Army Corps of Engineers' rules on maintenance and abandonment of ditches.
- Mowing or spraying of approved herbicide in a ditch after August 1 may be permitted in lieu of excavation.
- If the ditch has not been cleaned or a tile has not functioned for more than 25 years, or the watershed above the ditch has been substantially altered since the Service bought the property (significant increase in flows or degradation of water quality), a formal right-of-way request maybe required as determined by the wetland district manager.

# Appendix O

*RONS and SAMMS Projects*

**Refuge Operating Needs System (RONS)**

| *Project Number* | *Project Description* | *First-year Need ($1000s)* | *Recurring Base Need ($1000s)* | *Personnel (FTEs)* |
|---|---|---|---|---|
| 97005 | Control exotic species invasion. | 132 | 30 | 0 |
| 97007 | Improve water management on new waterfowl production areas. | 341 | 30 | 0 |
| 00001 | Establish water rights on refuge lands. | 109 | 5 | 0 |
| 00004 | Livestock confinements and intensive agriculture's effect on water quality. | 162 | 10 | 0 |
| 97012 | Increase public use of refuge lands. | 140 | 75 | 1 |
| 00008 | Private lands coordinator for Nebraska Sandhills. | 169 | 104 | 1 |
| 99002 | Archaeological review of refuge lands. | 70 | 0 | 0 |
| 99005 | Livestock fencing. | 78 | 23 | 0 |
| 97002 | Wetland restoration on refuge lands. | 158 | 66 | 1 |
| 97010 | Endangered species restoration. | 140 | 75 | 1 |
| 99001 | Law enforcement and property protection. | 140 | 75 | 1 |
| 99004 | Interpretive and recreational access to public lands. | 99 | 10 | 0 |
| 00003 | Snow goose impact on migratory bird populations within Rainwater Basin (NE). | 258 | 10 | 0 |
| 97001 | Habitat and population surveys. | 70.5 | 38 | 0.5 |
| 97009 | Wetland restoration on private lands. | 161.5 | 90 | 1 |
| 00006 | Expand prescribed fire program. | 140 | 75 | 1 |
| 06006 | Water delivery to create wetland habitat in CO, NE, ND, MT, and KS. | 380 | 0 | 0 |

**Service Asset Maintenance Management system (SAMMS)**

| *Project Number* | *Project Description* | *Cost ($1000s)* |
|---|---|---|
| Deferred Maintenance | | |
| 00105716 | Repair worn pump engine and gear head at Smith unit, Harvard WPA. | 32 |
| 02120249 | Replace water-pumping station at Clark WPA. | 51 |
| 02120162 | Replace boundary fences at Clay County WPAs. | 42 |
| 00105719 | Replace worn pump engine and gear head on well at Hultine WPA. | 30 |
| 02120273 | Replace water-pumping station at Spring WPA, south. | 51 |
| 02120166 | Replace fences at six WPAs in Fillmore County. | 28 |
| 02120254 | Repair water-pumping station at Cottonwood WPA. | 37 |
| 02120271 | Replace water-pumping station at Heron WPA. | 51 |
| 02120169 | Replace fences at three WPAs in Phelps County. | 73 |
| 00105713 | Replace worn pump engine and gear head on well at Prairie Dog WPA. | 35 |
| 00105710 | Replace worn pump engine and gear head on well at Massie WPA. | 28 |
| 00105714 | Repair worn pump engine and gear head on east well at McMurtrey WPA. | 32 |
| 02120170 | Replace fences at three WPAs in Franklin County. | 57 |
| 02120199 | Replace water-pumping station at Mallard Haven WPA. | 26 |
| 00105715 | Repair worn pump engine and gear head on well at Harvard WPA, north. | 30 |
| 00105717 | Replace worn pump engine and gear head on Knudson well at Harvard WPA. | 38 |
| 02120201 | Repair worn pump and engine on south well at Krause WPA. | 29 |
| 02120200 | Repair worn-out pump and engine on north pumping station at Krause WPA. | 26 |
| 02120198 | Replace worn water-pumping station at Hanson WPA. | 47 |
| 02120257 | Replace water-pumping station at Johnson WPA, east. | 39 |
| 00105712 | Replace worn pump engine and gear head on well at Eckhardt WPA. | 30 |
| 00105718 | Replace worn pump engine and gear head on well at Mallard Haven WPA. | 17 |
| 00105711 | Replace worn pump engine and gear head on north well at Youngson WPA. | 22 |
| 02120206 | Replace water-pumping station at Lindau WPA. | 49 |
| 98105704 | Repair rutted gravel road. | 43 |
| 02120195 | Repair water-pumping station at north well at Hultine WPA. | 33 |
| 02120158 | Repair earthen dike at Springer WPA. | 37 |
| 98109671 | Repair dike. | 278 |
| Heavy Equipment | | |
| 91105702 | Replace worn front-end loader. | 200 |
| 04133918 | Replace Bobcat skid steer loader. | 40 |
| 99105705 | Replace worn 1981 dump truck. | 51 |
| 01116415 | Replace 1990 well maintenance truck. | 51 |
| 01116225 | Replace 1967 bulldozer. | 195 |
| 01116255 | Replace Clark 4x4 hinged tractor-dozer. | 275 |

| **Service Asset Maintenance Management system (SAMMS)** | | |
|---|---|---|
| *Project Number* | *Project Description* | *Cost ($1000s)* |
| 99105707 | Replace worn equipment truck. | 110 |
| 04133810 | Replace 1966 Cuece 1/2 Kaiser jeep. | 50 |
| 01116249 | Replace WABCO earthmoving scraper. | 264 |
| 01116227 | Replace 1996 Caterpillar bulldozer. | 195 |
| 01116250 | Replace Westinghouse model earthmoving scraper. | 264 |
| 01116411 | Replace worn John Deere tractor. | 90 |
| 05139000 | Replace 2003 Freightliner semi-truck. | 200 |
| 05139017 | Replace 1979 flatbed dump truck. | 60 |
| Small Equipment | | |
| 01116271 | Replace 1992 Dodge pickup. | 30 |
| 01116409 | Replace 1993 Chevrolet Blazer. | 30 |
| 01116407 | Replace worn Jeep. | 31 |
| 01116273 | Replace 1994 Ford 1/2-ton pickup. | 29 |
| 01116219 | Replace worn heavy-duty disc used for invasive plant control. | 19 |
| 04133805 | Replace 2001 F-150 Ford pickup. | 31 |
| 04133817 | Replace 2002 Chevrolet Silverado 1/2-ton pickup. | 31 |
| 04133809 | Replace 2001 F-450 Ford fire truck. | 40 |
| 04133820 | Replace 2002 F-250 Ford pickup. | 37 |
| 04133811 | Replace 2002 Chevrolet Suburban. | 37 |
| 04133829 | Replace 2002 F-450 Ford flatbed truck. | 37 |
| 04133816 | Replace 2002 Chevrolet Impala automobile. | 22 |
| 04133830 | Replace 2002 F-250 Ford pickup. | 31 |
| 04133831 | Replace 2004 F-350 Ford pickup. | 37 |
| 99105693 | Replace worn 12-foot farm disc. | 22 |
| 99105696 | Replace worn 4x4 ATV. | 14 |
| 98105703 | Replace worn backhoe utility tractor. | 38 |
| 01116212 | Replace 1991 Panther 16-foot airboat. | 24 |
| 01116216 | Replace crane on well repair truck. | 14 |
| 01116241 | Replace 16-inch Crisafulli pump. | 15 |
| 01116244 | Replace mobile 12-inch gator pump. | 15 |
| 01116254 | Replace John Deere tractor, model 6400. | 58 |
| 01116256 | Replace lowboy trailer. | 18 |
| 01116259 | Replace airboat trailer. | 9 |
| 01116260 | Replace airboat trailer. | 8 |
| 01116262 | Replace worn dump trailer. | 31 |
| 01116266 | Replace 1998 Ford 1-ton pickup. | 31 |

| Service Asset Maintenance Management system (SAMMS) | | |
|---|---|---|
| *Project Number* | *Project Description* | *Cost ($1000s)* |
| 01116267 | Replace 1999 Ford 1-ton fire engine. | 37 |
| 01116406 | Replace 1995 Ford pickup. | 31 |
| 01116410 | Replace 1998 Dodge 4x4 pickup. | 31 |
| 01116412 | Replace 2001 Dodge 4x4 pickup. | 37 |
| 01116413 | Replace 2000 Ford crew cab truck. | 37 |
| 01116414 | Replace John Deere tractor, model 5310. | 42 |
| 04133800 | Replace 1997 sport utility vehicle. | 30 |
| 05138982 | Replace 2001 Ford 4x4 fire truck. | 36 |
| 05138987 | Replace 2001 Ford 4x4 2-ton truck. | 40 |
| 05138989 | Replace John Deere tractor, model 5410. | 65 |
| 05138990 | Replace Hyster forklift, model H60XL. | 60 |
| 05138991 | Replace incinerator. | 25 |
| 05138995 | Replace American Eagle forklift, model AE8122.00. | 100 |
| 05138997 | Replace 2002 Chevrolet 2-ton truck. | 40 |
| 05138999 | Replace Caterpillar road grader. | 220 |
| 05139001 | Replace semi-truck trailer, lowboy model. | 45 |
| 05139004 | Replace 2003 mule ATV. | 8 |
| 05139005 | Replace 2004 Ford crew cab truck. | 40 |
| 05139007 | Replace 2004 Ford super crew 4x4 truck. | 45 |
| 05139010 | Replace 2005 Ford Hybrid Escape automobile. | 30 |
| 05139012 | Replace 2005 Ford cab/chassis. | 28 |
| 05139014 | Replace 2005 Ford super cab 4x4 truck. | 35 |
| 05139016 | Replace 1979 flatbed dump truck. | 50 |
| 05139018 | Replace 1998 Chevrolet 3/4-ton truck. | 35 |
| Roads and Parking Lots (TEA 21) | | |
| 03126571 | PE/CN* (parking lots 9001–3, 9009–16, 9033, 9121–23, 9071–74). | 306 |
| 03126572 | PE/CN (parking lots 9054–61, 9120, 9077–82, 9084–90). | 380 |
| 03126573 | PE/CN (parking lots 9062–69, 9091–9102, 9116–19). | 470 |
| 03126574 | PE/CN (route 100, 0.3 mile; parking lots 9004–08, 9017–32, 9034–42, 9044–53). | 595 |
| Small Construction | | |
| 01116196 | Replace aged storage shed damaged by storm. | 90 |
| 04133864 | Replace fence at Peterson WPA. | 41 |
| 02120274 | Replace water-pumping station at Rauscher WPA. | 51 |
| Large Construction | | |
| 00109809 | Construct new office building [p/d/cc]. | 2400 |

** PE/CN = preliminary engineering and construction.*

# Bibliography


[AOU] American Ornithological Union. 2004. American Ornithological Union's Check-list of North American Birds. 7th ed. [Place of publication unknown]. [Number of pages unknown].

Anderson, J.T.; Smith, L.M. 1998. Protein and energy production in playas: implications for migratory bird management. Wetlands 18:437–46.

———. 1999. Carrying capacity and diel use of managed playa wetlands by nonbreeding waterbirds. Wildlife Society Bulletin 27:281–91.

Anderson, J.T.; Smith, L.M. 2000. Invertebrate response to moist-soil management of playa wetlands. Ecological Applications 10(2):550–8.

Ankney, C.D.; Afton, A.D. 1988. Bioenergetics of breeding northern shovelers: diet, nutrient reserves, clutch size, and incubation. Condor 90:459–72.

Ankney, C.D.; Alisauskas, R.T. 1991. Nutrient-reserve dynamics and diet of breeding female gadwalls. Condor 93:799–810.

Ankney, C.D.; MacInnes, C.C. 1978. Nutrient reserves and reproductive performance of female lesser snow geese. Auk 95:459–71.

Austin, J.E.; Richert, A.L. 2001. A comprehensive review of observational and site evaluation data of migrant whooping cranes in the United States, 1943–99. U.S. Geological Survey Report. Jamestown, ND: U.S. Geological Survey, Northern Prairie Wildlife Research Center. 156 p.

Bakker, K.K. 2000. Avian occurrence in woodlands and grasslands on public areas throughout eastern South Dakota [PhD dissertation]. Brookings, SD: South Dakota State University. [Number of pages unknown].

———. 2003. The effect of woody vegetation on grassland nesting birds: an annotated bibliography. In: The Proceedings of the South Dakota Academy of Sciences; [Place and date of conference unknown]. [Place of publication unknown]: [Publisher name unknown]. 82:119–41.

Baldassarre, G.A.; Bolen, E.G. 2006. Waterfowl ecology and management. 2nd ed. [City of publication unknown], FL: Krieger Publishing Company. 567 p.

Baldassarre, G.A.; Whyte, R.J.; Quinlan, E.E. [et al.] 1983. Dynamics and quality of waste corn available to postbreeding waterfowl in Texas. Wildlife Society Bulletin 11:25–31.

Ballard, B.M.; Thompson, J.E.; Petrie, M.J. [et al.] 2004. Diet and nutrition of northern pintails wintering along the southern coast of Texas. Journal of Wildlife Management 68(2):371–82.

Baxter, W.L.; Wolfe, C.W. 1973. Life history and ecology of the ring-necked pheasant in Nebraska. Lincoln, NE: Nebraska Game and Parks Commission. 58 p.

BBC Research & Consulting. 2006. Rainwater Basin Wetland Management District socioeconomic impact analysis: preliminary report. Unpublished report on file at Rainwater Basin Wetland Management District, NE. 9 p.

Benning, D.S. 1987. Coordinated mid-continent white-fronted goose survey. Washington DC: U.S. Department of the Interior, Fish and Wildlife Service. U.S. Fish and Wildlife Service annual report. 7 p.

Bergan, J.F.; Smith, L.M. 1993. Survival rates of female mallards wintering in the Playa Lakes Region. Journal of Wildlife Management 57:570–7.

Bishop, A.A. 2005. Rainwater Basin Joint Venture waterfowl habitat use model (Rainwater Basin Joint Venture GIS layer). Unpublished report on file at Rainwater Basin Wetland Management District, Grand Island, NE. 27 p.

Bishop, A.A.; Reker, R. 2006. Landcover within the RWB: a GIS layer created with 2004 data. Unpublished reports on file at Rainwater Basin Wetland Management District, Grand Island, NE.

Bowyer, M.W.; Stafford, J.D.; Yetter, A.P. [et al.] 2005. Moist-soil plant seed production for waterfowl at Chautauqua National Wildlife Refuge, Illinois. The American Midland Naturalist: 154(2):331–41.

Brennan, E.K. 2006. Local and landscape level variables influencing migratory bird abundance, diversity, behavior, and community structure in Rainwater Basin wetlands [PhD dissertation]. [Place of publication unknown]: Texas Technological University. 180 p.

Brown, S.; Hickey, C.; Harrington, B.; editors. 2000. United States Shorebird Conservation Plan. Manomet, MA: Manomet Center for Conservation Sciences. 60 p.

Burger, L.D.; Burger, L.W., Jr.; Faaborg, J. 1994. Effects of prairie fragmentation predation on artificial nests. Journal of Wildlife Management 58(2):249–54.

Butcher, Greg. [Date unknown]. Central mixed-grass prairie executive summary. Partners in Flight. <http://www.blm.gov/wildlife/pl_34sum.htm> [Date of access unknown].

Checkett, J.M.; Drobney, R.D.; Petrie, M.J. [et al.] 2002. True metabolizable energy of moist soil seeds. Wildlife Society Bulletin 30(4):1113–19.

Clark, R.J. 1975. A field study of the short-eared owl, *Asio flammeus* (Pontoppidan), in North America. Wildlife Monographs 47:1–67.

Clayton, K.M.; Schmutz, J.K. 1999. Is the decline of burrowing owls *Speotyto cunicularia* in prairie Canada linked to changes in Great Plains ecosystems? Bird Conservation International 9:163–85.

Connelly, J.W.; Gratson, M.W.; Reese, K.P. 1998. Sharp-tailed grouse (*Tympanuchus phasianellus*). In: Poole, A.; Gill, F.; editors. The Birds of North America, No. 354 [doi:10.2173/bna.354]. Philadelphia: The Academy of Natural Sciences; Washington DC: The American Ornithologists' Union. [Pages unknown].

Cox, R.R., Jr. 1998. Spring-staging ecology of greater white-fronted geese, lesser snow geese, and northern pintails in the central Platte River valley and Rainwater Basin of Nebraska. Northern Prairie Wildlife Research Center preliminary progress report. [Unpublished report]. 4 p.

———. 1999. Spring-staging ecology of waterfowl in Nebraska—then versus now. Waterfowl 2000 12(2):18. Jamestown, ND: Northern Prairie Wildlife Research Center Online. <http://www.npwrc.usgs.gov/resource/birds/ssecol/index.htm> (Version 02DEC99) [Date of access unknown].

Cox, R.R., Jr.; Davis, B.E. 2002. Habitat use, movements, and survival of female northern pintails during spring migration in Nebraska and subsequent potential breeding-site selection in the Prairie Pothole Region [progress report]. Bismarck, ND: U.S. Geological Survey, Northern Prairie Wildlife Research Center. 150 p.

Cox, R.R., Jr.; Samuel, M.D.; Church, K.E. 1999. Body condition of adult lesser snow geese killed by avian cholera [progress report]. 20 p.

Dai, X.; Boutton, T.W.; Hailemichael, M. [et al.] 2006. Soil carbon and nitrogen storage in response to fire in a temperate mixed-grass savanna. Journal of Environmental Quality 35:1620–8.

Davis, S.K. 2004. Area sensitivity in grassland passerines: Effects of patch size, patch shape, and vegetation structure on bird abundance and occurrence in southern Saskatchewan. The Auk 121(4):1130–45.

DeJong, J.R. 2001. Landscape fragmentation and grassland patch size effects on non-game grassland birds in xeric mixed-grass prairies of western South Dakota. Brookings, SD: South Dakota State University. [Pages unknown].

Delnicki, D.; Reinecke, K.J. 1986. Mid-winter food use and body weights of mallards and wood ducks in Mississippi. Journal of Wildlife Management 50:43–51.

Dewey S.L. 1986. Effects of the herbicide atrazine on aquatic insect community structure and emergence. Ecology 67:148–62.

Dodson, S.I.; Merritt, C.M.; Shannahan, J.P. [et al.] 1999. Low exposure concentrations of atrazine increase male production in *Daphnia pulicaria*. Environmental Toxicology and Chemistry 18(7): 1568–73.

Drahota, J. 2000. Results of ground survey 2000 [unpublished report]. On file at Rainwater Basin Wetland Management District. 7 p.

———. 2006. A case for managing Rainwater Basin wetlands [unpublished report]. On file at Rainwater Basin Wetland Management District. 11 p.

Drahota, J.; Bishop, A.; Walters, R. 2004. Rainwater Basin wetland complex south-central Nebraska 2003–2004 vegetation mapping and monitoring project [unpublished report]. On file at Rainwater Basin Wetland Management District, Kearney, NE. 53 p.

Dubovsky, J.A.; Kaminski, R.M. 1994. Potential reproductive consequences of winter-diet restriction in mallards. Journal of Wildlife Management 58(4): 780–6.

Duebbert, H.F.; Lokemoen, J.T. 1977. Upland nesting of American bitterns, marsh hawks, and short-eared owls. The Prairie Naturalist 9(3–4):33–40.

Dugger, B.D.; Dugger, K.M. 2002. Long-billed curlew (*Numenius americanus*). In: Poole, A.; Gill, F.; editors. The Birds of North America, No. 628 [doi:10.2173/bna.628]. Philadelphia, PA: The Academy of Natural Sciences; Washington DC: The American Ornithologists' Union. [Pages unknown].

Ekstein, J.D.; Hygnstrom, S.E. 1996. Fate of wetlands associated with the Central Nebraska Irrigation Canal System. Great Plains Research 6:41–60.

Ermacoff, N. 1968. Marsh and habitat management practices at the Mendota Wildlife Area. [Place of publication unknown]: California Department of Fish and Game. Game Management Leaflet No. 12. 10 p.

Evans, R.D.; Wolfe, C.W., Jr. 1967. Waterfowl production in the Rainwater Basin area of Nebraska. Journal of Wildlife Management 33(4):788–94.

Farmer, A.H.; Parent, F. 1997. Effects of landscape on shorebird movements at spring migration stopovers. Condor 99: 698–707.

Farmer, A.H.; Wiens, J. 1999. Models and reality: time-energy trade-offs in pectoral sandpiper migration. Ecology 80:2566–80.

Farrar, J. 1982. The Rainwater Basin, Nebraska's vanishing wetlands. NEBRASKAland. March [updated and reprinted 1988 February]. Nebraska Game and Parks Commission. 15 p.

———. 1996a. Nebraska's Rainwater Basin. NEBRASKAland. March. Nebraska Game and Parks Commission. 18–35.

———. 1996b. The Troester tunnel: notes from the field. NEBRASKAland. May. Nebraska Game and Parks Commission. 6–7.

Federal Geographic Data Committee. 1997. FGDC vegetation classification and information standards. Reston, VA: [Publisher name unknown]. [Pages unknown].

Fleskes, J.P.; Jarvis, R.L.; Gilmer, D.S. 2002. September–March survival of female northern pintails radiotagged in San Joaquin Valley, California. Journal of Wildlife Management 31:212–9.

Frankforter, J.D. 1996. Nebraska wetland resources. In: Fretwell, J.D.; Williams, J.S.; Redman, P.J.; editors. National water summary of wetland resources. [Place of publication unknown]: U.S. Department of the Interior, U.S. Geological Survey. U.S. Geological Survey Water Supply Paper 2425. 261–6.

Fredrickson, L.H.; Reid, F.A. 1988. Waterfowl use of wetland complexes. [Place of publication unknown]: U.S. Department of the Interior, Fish and Wildlife Service. U.S. Fish and Wildlife Service Leaflet 13.2.1. [Pages unknown].

Fredrickson, L.H.; Taylor, T.S. 1982. Management of seasonally flooded impoundments for wildlife. Washington DC: U.S. Department of the Interior, Fish and Wildlife Service. U.S. Fish and Wildlife Service Resource Publication 148. 29 p.

Fritcher, S.C.; Rumble, M.A.; Flake, L.D. 2004. Grassland bird densities in several stages of mixed-grass prairie. Journal of Range Management 57:351–7.

Fuhlendorf, S.D.; Engle, D.M. 2001. Restoring heterogeneity on rangelands: ecosystem management based on evolutionary grazing patterns. Bioscience 51: 625–32.

———. 2004. Application of the fire-grazing interaction to restore a shifting mosaic on tallgrass prairie. Journal of Applied Ecology 41:604–14.

Gabbert, A.E.; Leif, A.P.; Purvis, J.R. [et al.] 1999. Survival and habitat use by ring-necked pheasants during two disparate winters in South Dakota. Journal of Wildlife Management 63:711–22.

Gaiser, E.E.; Lang, K.L. 1998. Distribution of cladoceran zooplankton among prairie pothole wetlands in northwest Iowa. Lake and Reservoir Management 14(1):37–51.

Gersib, R.A. 1991. Nebraska wetlands priority plan. [Place of publication unknown]: Nebraska Game and Parks Commission. [Pages unknown].

Gersib, R.A.; Cornely, J.; Trout, A. [et al.] 1990. Concept plan for waterfowl habitat protection, Rainwater Basin area of Nebraska. Lincoln, NE: Nebraska Game and Parks Commission. 71 p.

Gersib, R.A.; Dinan, K.F.; Kauffeld, J.D. [et al.] 1992. Looking to the future: an implementation plan for the Rainwater Basin Joint Venture. Lincoln, NE: Nebraska Game and Parks Commission. 56 p.

Gersib, R.A.; Elder, B.; Dinan, K.F. [et al.] 1989a. Waterfowl values by wetland type within Rainwater Basin wetlands with special emphasis on activity time budget and census data. Lincoln, NE: Nebraska Game and Parks Commission; Grand Island, NE: U.S. Department of the Interior, Fish and Wildlife Service. 105 p.

Gersib, R.A.; Raines, R.R.; Rosier, W.S. [et al.] 1989b. A functional assessment of selected wetlands within the Rainwater Basin area of Nebraska. Lincoln, NE: Nebraska Game and Parks Commission. 41 p.

Gilbert, M.C. 1989. Ordination and mapping of wetland communities in Nebraska's Rainwater Basin region. CEMRO Environmental Report 89-1. Omaha, NE: U.S. Army Corps of Engineers, Omaha District. 105 p.

Gleason, H.R.; Euliss, N.H., Jr.; Hubbard, D.E. [et al.] 2003. Effects of sediment load on emergence of aquatic invertebrates and plants from wetland soil egg and seed banks. Wetlands 23:26–34.

Go, V.; Garey, J.; Wolff, M.S. [et al.] 1999. Estrogenic potential of certain pyrethroid compounds in the MCF-7 human breast carcinoma cell line. Environmental Health Perspectives 107(3):173–7.

Gordon, C.C. 1989. The relationship of wetland characteristics to avian cholera (*Pasteurella multocida*) outbreaks in the Rainwater Basin area of Nebraska [master's thesis]. Brookings, SD: South Dakota State University. 126 p.

Gordon C.C.; Flake, L.D.; Higgins, K.F. 1997. Trace metals in water and sediments of wetlands in the Rainwater Basin area of Nebraska. In: The Proceedings of the South Dakota Academy of Sciences; [Place and date of conference unknown]. [Place of publication unknown]: [Publisher name unknown]. 76:253–61.

Grant, R.A. 1965. The burrowing owl in Minnesota. The Loon (3):2–17.

Grossman, D.H.; Faber-Langendoen, D.; Weakley, A.W. [et al.] 1998. International classification of ecological communities: terrestrial vegetation of the United States. Vol. 1 of The National Vegetation Classification Standard. Arlington, VA: The Nature Conservancy. [Pages unknown].

Haug, E.A.; Millsap, B.A.; Martell, M.S. 1993. Burrowing owl (*Speotyto cuniculari*) In: Poole, A.; Gill, F.; editors. The Birds of North America, No. 61 [doi:10.2173/bna.61]. Philadelphia: The Academy of Natural Sciences; Washington DC: The American Ornithologists' Union. [Pages unknown].

Haukos, D.A.; Smith, L.M. 1993. Moist-soil management of playa lakes for migrating and wintering ducks. Wildlife Society Bulletin 21:288–98.

Hayes T.B.; Haston, K.; Tsui, M. [et al.] 2002. Atrazine induced hermaphroditism at 0.1 ppb in American leopard frogs (*Rana pipiens*): laboratory and field evidence. Environmental Health Perspectives 111: 568–75.

Heitmeyer, M.E. 1988. Body composition of female mallards in winter in relation to annual cycle events. Condor 90:669–80.

Heitmeyer, M.E.; Fredrickson, L.H. 1981. Do wetland conditions in the Mississippi delta hardwoods influence mallard recruitment? In: Transactions, North American Wildlife and Natural Resources Conference; [Date and location of conference unknown]. [Place of publication unknown]: [Publisher name unknown]. 46:44–57.

Helzer, C.J. 1996. The effects of wet meadow fragmentation on grassland birds [master's thesis]. Lincoln, NE: University of Nebraska–Lincoln. [Pages unknown].

Helzer C.J.; Jelinski, D.E. 1999. The relative importance of patch area and perimeter-area ratio to grassland breeding birds. Ecological Applications 9(4):1448–58.

Herkert, J.R.; Reinking, D.L.; Wiedenfeld, D.A. [et al.] 2003. Effects of prairie fragmentation on the nest success of breeding birds in the mid-continental United States. Conservation Biology 17(2):587–94.

Herkert, J.R.; Szafoni, R.E.; Kleen, V.M. [et al.] 1993. Habitat establishment, enhancement and management for forest and grassland birds in Illinois. Springfield, IL: Illinois Department of Conservation, Division of Natural Heritage. Natural Heritage Technical Publication 1. [Pages unknown].

Higgins, K.F. 1984. Lightning fires in grasslands in North Dakota and in pine savanna lands in nearby South Dakota and Montana. Journal of Range Management 37:100–3.

———. 1986. Interpretation and compendium of historic fire accounts in the northern Great Plains. Washington DC: U.S. Department of the Interior, Fish and Wildlife Service. Resource Publication 161. [Pages unknown].

Hughes, J.P. 1996. The effect of vegetative structure and landscape composition on avian abundance and reproductive success in CRP fields in northeastern Kansas [master's thesis]. Manhattan, KS: Kansas State University. [Pages unknown].

Jessen, R.L. 1970. Mallard population trends and hunting losses in Minnesota. Journal of Wildlife Management 34:93–105.

Johnsgard, P.A. 1983. The grouse of the world [PhD dissertation]. Lincoln, NE: University of Nebraska–Lincoln. [Pages unknown].

———. 1997. The birds of Nebraska and adjacent plains states. Lincoln, NE: Nebraska Game and Parks Commission. Nebraska Ornithologist's Union Occasional Papers, No. 6. [Pages unknown].

Johnson, R.G.; Temple, S.A. 1990. Nest predation and brood parasitism of tallgrass prairie birds. Journal of Wildlife Management 54:106–11.

Jorde, D.G. 1981. Winter and spring staging ecology of mallards in south central Nebraska [master's thesis]. [City of publication unknown], ND: University of North Dakota. 116 p.

Jorde, D.G.; Krapu, G.L.; Crawford, R.D. 1983. Feeding ecology of mallards wintering in Nebraska. Journal of Wildlife Management 47:1044–53.

Jorde, D.G.; Krapu, G.L.; Crawford, D.C. [et al.] 1984. Effects of weather on habitat selection and behavior of mallards wintering in Nebraska. The Condor 86:258–65.

Jorgensen, J.G. 2004. An overview of shorebird migration in the eastern Rainwater Basin, Nebraska. Lincoln, NE: Nebraska Game and Parks Commission. Nebraska Ornithologist's Union Occasional Papers, No. 8. [Pages unknown].

Kaminski, R.M.; Gluesing, E.A. 1987. Density and habitat-related recruitment in mallards. Journal of Wildlife Management 51:141–8.

Kantrud, H.A. 2006. Cattail management symposium—history of cattails on the prairies: wildlife impacts. <http://www.npwrc.usgs.gov/resource/plants/cattail/kantrud.htm> [Access date unknown].

Keech, C.F.; Dreeszen, V.H. 1959. Geology and ground-water resources of Clay County, Nebraska. Washington DC: U.S. Department of the Interior, U.S. Geological Survey. U.S. Geological Survey Water Supply Paper 1468. 57 p.

Kendeigh, S.C.; Dol'nik, V.R.; Gavrilov, V.M. 1977. Avian energetics. In: Pinowski, J.; Kendeigh, S.C.; editors. Granivorous birds in ecosystems. New York: Cambridge University Press. 127–204.

Kennedy, T.A.; Naeem, S.; Howe, K.M. [et al.] 2002. Biodiversity as a barrier to ecological invasion. Nature 417:636–8.

Kim, I.Y.; Shin, J.H.; Kim, H.S. [et al.] 2004. Assessing estrogenic activity of pyrethroid insecticides using in vitro combination assays. The Journal of Reproduction and Development 50(2):245–55.

Koerner, J.W.; Bookout, T.A.; Denarik, K.E. 1974. Movements of Canada geese color-marked near southwestern Lake Erie. Journal of Wildlife Management 38:275–89.

Krapu, G.L. 1981. The role of nutrient reserves in mallard reproduction. Auk 98:29–38.

Krapu, G.L.; Brandt, D.A.; Cox, R.R., Jr. 2004. Less waste corn, more land in soybeans, and the switch to genetically modified crops: trends with important implications for wildlife management. Wildlife Society Bulletin 32:127–36.

Krapu, G.L.; Reinecke, K.J.; Jorde, D.G. [et al.] 1995. Spring staging ecology of midcontinent greater white-fronted geese. Journal of Wildlife Management 59:736–46.

Kuzila, M.S. 1984. Genesis and morphology of soils in and around large depressions in Clay County, Nebraska [PhD dissertation]. Lincoln, NE: University of Nebraska–Lincoln. [Pages unknown].

———. 1994. Inherited morphologies of two large basins in Clay County, Nebraska. Great Plains Research 4:51–63.

Kuzila, M.S.; Lewis, D.T. 1993. Soils in rain basins of south central Nebraska—properties, genesis and classification. Soil Science American Journal 37:155–61.

LaGrange, T.G. 1985. Habitat use and nutrient reserves dynamics of spring migratory mallards in central Iowa [master's thesis]. [City of publication unknown], IA: Iowa State University. 81 p.

———. 2005. A guide to Nebraska's wetlands and their conservation needs. Lincoln, NE: Nebraska Game and Parks Commission. 59 p.

LaGrange, T.G.; Dinsmore, J.J. 1988. Nutrient reserve dynamics of female mallards during spring migration through central Iowa. In: Waterfowl in Winter. Minneapolis: University of Minnesota Press. 287–97.

Larson, D.L.; McDonald, S.; Fivizzani, A.J. [et al.] 1998. Effects of the herbicide atrazine on *Ambystoma tigrinum* metamorphosis: duration, larval growth, and hormonal response. Physiological Zoology 71(6): 671–9.

Laubhan, M.L.; Fredrickson, L.H. 1992. Estimating seed production of common plants in seasonally flooded wetlands. Journal of Wildlife Management 56(2):329–37.

Laubhan, M.L.; Gleason, R.A.; Knutsen, G.A. [et al.] 2006. A preliminary biological assessment of Long Lake National Wildlife Refuge Complex, North Dakota. Washington DC: U.S. Department of the Interior, Fish and Wildlife Service. Biological Technical Publication, BTP R6006-2006. [Pages unknown].

Laubhan, Murray K.; Koerner, T.M.; Sprenger, M.D. [et al.] 2005. A preliminary biological assessment of Lacreek National Wildlife Refuge, Martin, South Dakota, USA. Jamestown, ND: U.S. Department of the Interior, U.S. Geological Survey. [Pages unknown].

Lavergne, S.; Molofsky, J. 2004. Reed canarygrass (*Phalaris arundinacea* L.) as a biological model in the study of plant invasions. Critical Reviews in Plant Sciences 23:415–29.

Loesch, C.R.; Kaminski, R.M. 1989. Winter body-weight patterns of female mallards fed agricultural seeds. Journal of Wildlife Management 53:1081–7.

Madden, E.M. 1996. Passerine communities and bird-habitat relationships on prescribe-burned, mixed-grass prairie in North Dakota [master's thesis]. Bozeman, MT: Montana State University. [Pages unknown].

Madden, E.M.; Hansen, A.J.; Murphy, R.K. 1999. Influence of prescribed fire history on habitat and abundance of passerine birds in northern mixed-grass prairie. Canadian Field-Naturalist 113(4): 627–40.

McCarthy, C.; Pella, T.; Link, G. [et al.] 1997. Greater prairie chicken nesting habitat, Sheyenne National Grassland, North Dakota. [Place of publication unknown]: U.S. Department of Agriculture, Forest Service. General Technical Report RM-GTR-298. [Pages unknown].

McKee, G.M.; Ryan, R.; Mechlin, L.M. 1998. Predicting greater prairie-chicken nest success from vegetation and landscape characteristics. Journal of Wildlife Management 62:314–21.

McMurtrey, M.D.; Craig, R.; Schildman, G. 1972. Nebraska wetland survey. [City of publication unknown], NE: Nebraska Game and Parks Commission. Habitat Work Plan K-71. 78 p.

Messmer, T.A. 1990. Influence of grazing treatments on non-game birds and vegetation structure in south central North Dakota [PhD dissertation]. Fargo, ND: North Dakota State University. [Pages unknown].

Merrill, M.D.; Chapman, K.A.; Poiani, K.A. [et al.] 1999. Land-use patterns surrounding greater prairie-chicken leks in northwestern Minnesota. Journal of Wildlife Management 63:189–98.

Miller, M.R.; Reinecke, K.J. 1984. Proper expression of metabolizable energy in avian energetics. Condor 86(4):396–400.

Mollhoff, W.J. 2001. The Nebraska breeding bird atlas, 1984–89. Lincoln, NE: Nebraska Game and Parks Commission. Nebraska Ornithologist's Union Occasional Papers, No. 7. 233 p.

Moon, J.A.; Haukos, D.A. 2006. Survival of female northern pintails wintering in the Playa Lakes region of northwestern Texas. Journal of Wildlife Management 70:777–83.

Moravec, J. 1993. Syntaxonomic and nomenclatural treatment of Scandinavian-type associations and sociations. Journal of Vegetation Science 4:833–8.

[NASS] National Agricultural Statistics Service. 2004. Agricultural chemical usage 2003 field crops summary. <http://www.nass.usda.gov/Statistics_by_Subject/Environmental/index.asp> [Access date unknown].

[NDEQ] Nebraska Department of Environmental Quality. 2006. Title 117, Nebraska surface water quality standards. In: Water quality standard for wetlands. [Place of publication unknown]. [Pages unknown]. Chapter 4.

[NGPC] Nebraska Game and Parks Commission. 1977–99 unpublished reports. Lincoln, NE. [Pages unknown].

———. 1997–99 unpublished reports. Lincoln, NE. [Pages unknown].

———. 2000–03 unpublished reports. Lincoln, NE. [Pages unknown].

Nelson K.J.; Esmoil, B.J. 1999. Background contaminants evaluation of Fort Niobrara and Valentine National Wildlife Refuge. Grand Island, NE: U.S. Department of the Interior, Fish and Wildlife Service. U.S. Fish and Wildlife Service Contaminant Report. [Pages unknown].

Olson, R.A.; Flake, L.D. 1975. Nesting of ring-necked pheasants in eastern South Dakota. In: The Proceedings of the South Dakota Academy of Science; [Place and date of conference unknown]. [Place of publication unknown]: [Publisher name unknown]. 54:126–36.

Pampush, G.J.; Anthony, R.G. 1993. Nest success, habitat utilization and nest-site selection of longbilled curlews in the Columbia Basin, Oregon. Condor 95:957–67.

Pederson, R.L.; Jorde, D.G.; Simpson, S.G. 1989. Northern Great Plains. In: Smith, L.M.; Pederson, R.L.; Kaminski, R.M.; editors. Habitat management for migrating and wintering waterfowl in North America. Lubbock, TX: Texas Technological University Press. 281–310.

Petrie, S.A.; Rogers, K.H. 2004. Nutrient-reserve dynamics of white-faced whistling-ducks breeding in a semiarid South Africa. Canadian Journal of Zoology 82:1082–90.

Price, J.I.; Brand, C.J. 1984. Persistence of *Pasteurella multocida* in Nebraska wetlands under epizootic conditions. Journal of Wildlife Diseases 20(2):90–4.

Prince, H.H. 1979. Bioenergetics of postbreeding dabbling ducks. In: Bookhout, T.A.; editor. Waterfowl and wetlands—an integrated review. Proceedings of a symposium of the North Central Section of The Wildlife Society; [Date and location of symposium unknown]. La Crosse, WI: La Crosse Printing. 103–17.

Prose, B.L. 1987. Habitat suitability index models: plains sharp-tailed grouse. Washington DC: Natural Ecology Center. U.S. Fish and Wildlife Service Biological Report 82. [Pages unknown].

Rabbe, M.; Drahota, J.; Bishop, A. 2004. Estimating duck use-days in the Rainwater Basin wetlands—a baseline model for management implications [unpublished report]. On file at Rainwater Basin Wetland Management District, Kearney, NE. [Pages unknown].

Raines, R.R.; Gilbert, M.C.; Gersib, R.A. [et al.] 1990. Regulatory planning for Nebraska's Rainwater Basin wetlands (advanced identification of disposal areas). Prepared for the Rainwater Basin advanced identification study. Kansas City, KS: U.S. Environmental Protection Agency, region 7; Omaha, NE: U.S. Army Engineer District. 46 p.

[RWBJV] Rainwater Basin Joint Venture. 1993. Water management options for wetland development in the Rainwater Basin. [Place of publication unknown]: [Publisher name unknown]. 16 p.

———. 1994. Best management practices for Rainwater Basin wetlands. [Place of publication unknown]: [Publisher name unknown]. Public Lands Work Group. 41 p.

Raveling, D.G. 1978. Dynamics of distribution of Canada geese in winter. In: Transactions, North American Wildlife and Natural Resources Conference; [Date and place of conference unknown]. [Place of publication unknown]: [Publisher name unknown]. 42:206–25.

Raveling, D.G.; Crews, W.E.; Klimstra, W.D. 1972. Activity patterns of Canada geese during winter. Wilson Bulletin 84:278–95.

Raveling, D.G.; Heitmeyer, M.E. 1989. Relationships of population size and recruitment of pintails to habitat conditions and harvest. Journal of Wildlife Management 53:1088–103.

Redmond, R.L.; Bicak, T.K.; Jenni, D.A. 1981. An evaluation of breeding season census techniques for long-billed curlews (*Numenius americanus*). Studies in Avian Biology 6:197–201.

Reid, F.R.; Kelley, J.R., Jr.; Taylor, T.S. [et al.] 1989. Upper Mississippi Valley wetlands: refuges and moist-soil impoundments. In: Smith, L.M.; Pederson, R.L.; Kaminski, R.M.; editors. Habitat management for migrating and wintering waterfowl in North America. Lubbock, TX: Texas Technological University Press. 181–202.

Reinecke, K.J.; Kaminski, R.M.; Moorehead, D.J. [et al.] 1989. Mississippi alluvial valley. In: Smith, L.M.; Pederson, R.L.; Kaminski, R.M.; editors. Habitat management for migrating and wintering waterfowl in North America. Lubbock, TX: Texas Technological University Press. 203–47.

Renken, R.B.; Dinsmore, J.J. 1987. Nongame bird communities on managed grasslands in North Dakota. Canadian Field-Naturalist 101(4):551–57.

Richert, A. 1999. Multiple scale analyses of whooping crane habitat in Nebraska [master's thesis]. Lincoln, NE: University of Nebraska–Lincoln. [Pages unknown].

Rohwer, F.C. 1984. Patterns of egg laying in prairie ducks. Auk 101:603–5.

Samuel, M.D. 1995. Physical and biological factors associated with avian cholera in wetland ecosystems [program report]. Madison, WI: National Wildlife Health Center. [Pages unknown].

Samuel, M.D.; Shadduck, D.J.; Goldberg, D.R. [et al.] 2005. Avian cholera in waterfowl: the role of lesser snow and Ross's geese as disease carriers in the Playa Lakes region. Journal of Wildlife Diseases 41(1):48–57.

Schildman, G.; Hurt, J. 1984. Update of Rainwater Basin wetland survey. Survey of habitat work plan K-83. W-15-R-40. [Place of publication unknown]: Nebraska Game and Parks Commission. 13 p.

Schneider, R.; Humpert, M.; Stoner, K. [et al.] 2005. The Nebraska Natural Legacy Project: A comprehensive wildlife conservation strategy. Lincoln, NE: Nebraska Game and Parks Commission. 245 p.

Schwarz, M.S.; Echols, K.R.; Wolcott, M.J. [et al.] 2004. Environmental contaminants associated with swine concentrated animal feeding operation and implications for McMurtrey National Wildlife Refuge. Grand Island, NE: U.S. Department of the Interior, Fish and Wildlife Service. U.S. Fish and Wildlife Service Contaminant Report. [Pages unknown].

Sharpe, R.S.; Silcock, W.R.; Jorgensen, J.G. 2001. Birds of Nebraska: their distribution and temporal occurrence. Lincoln, NE: University of Nebraska Press. 520 p.

Sharpley, A.N.; Daniel, T.; Sims, T. [et al.] 1999. Agricultural phosphorus and eutrophication. Washington DC: U.S. Department of Agriculture, Agricultural Research Service. ARS-149. [Pages unknown].

Sherfy, M.H.; Kirkpatrick, R.L. 1998. Nutritional value and management of waterfowl and shorebird foods in Atlantic coastal moist-soil impoundments [master's thesis]. <http://scholar.lib.vt.edu/theses/available/etd-033199-130907/unrestricted/chapter1.pdf> [Access date unknown]. [Pages unknown].

Singleton, J.R. 1951. Production and utilization of waterfowl food plants on the east Texas Gulf Coast. Journal of Wildlife Management 15(1):46–56.

Smith, B.J.; Higgins, K.F. 1990. Avian cholera and temporal changes in wetland numbers and densities in Nebraska's Rainwater Basin area. Wetlands 10:1–5.

Smith, B.J.; Higgins, K.F.; Gritzner, C.F. 1989. Land use relationships to avian cholera outbreaks in the Nebraska Rainwater Basin area. Prairie Naturalist 21(3):125–36.

Smith, B.J.; Higgins, K.F.; Tucker, W.L. 1990. Precipitation, waterfowl densities and mycotoxins: their potential effect on avian cholera epizootics in the Nebraska Rainwater Basin area. In: Transactions of North American Wildlife and Natural Resources Conference; [Date and place of conference unknown]. [Place of publication unknown]: [Publisher name unknown]. 55:269–82.

Smith, L.M. 1989. Effects of grazing and burning on nutritive quality of cattail in playas. Journal of Aquatic Plant Management 27:51–3.

———. 1990. Waterfowl habitat management and research in North America. In: Transactions of the 19th International Union of Game Biologist Congress; [Date of congress unknown]; Trondheim, Norway. [Place of publication unknown]: [Publisher name unknown]. 2:468–76.

———. 1998. Research needs for the Rainwater Basin of Nebraska: a hierarchical approach. Lincoln, NE: Nebraska Game and Parks Commission. 22 p.

Snyder, W.D. 1984. Ring-necked pheasant nesting ecology and wheat farming on the high plains. Journal of Wildlife Management 48:878–88.

Solberg, J.W. 1992. Coordinated mid-continent white-fronted goose survey. [Place of publication unknown]: U.S. Department of the Interior, Fish and Wildlife Service. U.S. Fish and Wildlife Service annual report. 6 p.

Sporrong, J.M. 2001. Response of nongame birds and terrestrial invertebrates to restoration of upland grasslands in the Rainwater Basin region, Nebraska [master's thesis]. Eau Claire, WI: University of Wisconsin–Eau Claire. 108 p.

Starks, P.J. 1984. Analysis of rainbasin depressions of Clay County, Nebraska [master's thesis]. Omaha, NE: University of Nebraska. 90 p.

Steinauer, G.; Rolfsmeier, S. 2003. Terrestrial natural communities of Nebraska. [Place of publication unknown]: Nebraska Game and Parks Commission. 143 p.

Stutheit, R.G.; Gilbert, M.C.; Whited, P.M. [et al.]; editors. 2004. A regional guidebook for applying the hydrogeomorphic approach to assessing wetland functions of Rainwater Basin depressional wetlands in Nebraska. ERDC/EL TR-04-4. Vicksburg, MS: U.S. Army Engineer Research and Development Center. 118 p.

Taylor, J.P.; Smith, L.M. 2005. Migratory bird use of belowground foods in moist-soil managed wetlands in the Middle Rio Grande Valley, New Mexico. Wildlife Society Bulletin 33(2):574–82.

Taylor, M.W.; Wolfe, C.W.; Baxter, W.L. 1978. Land use change and ring-necked pheasants in Nebraska. Wildlife Society Bulletin 6:226–30.

Trautman, C.G.; Dahlgren, R.B.; Seubert, J.L. 1959. Pheasant nesting. South Dakota Conservation Digest 26:18–21.

Traylor, Susan S. 2000. Waterfowl migration in south central Nebraska, February–March 2000 [unpublished report]. Lincoln, NE: University of Nebraska; Nebraska Game and Parks Commission. [Pages unknown].

[UNL] University of Nebraska–Lincoln. 2004. Biology and treatment recommendations for field crop pests. Lincoln, NE: Department of Entomology. <http://entomology.unl.edu/fldcrops/pestipm.htm#Item2> [Access date unknown].

———. 2006a. Groundwater map—drought 2000–2006. Lincoln, NE: Institute of Agriculture and Natural Resources, School of Natural Resources, Conservation and Survey Division. <http://csd.unl.edu/csd-esic/GWMapArchives/2006GWMaps/drought2000to2006-300dpi.tif> accessed 25 June 2007.

———. 2006b. Groundwater map—predevelopment to spring 2006. Lincoln, NE: Institute of Agriculture and Natural Resources, School of Natural Resources, Conservation and Survey Division. <http://csd.unl.edu/csd-esic/GWMapArchives/2006GWMaps/predev06-300dpi.tif> accessed 25 June 2007.

U.S. Census Bureau. 2000–2007. State and county quickfacts: Nebraska. <http://quickfacts.census.gov/qfd/states/31000.html> [Access date unknown].

(USDOE) U.S. Department of Energy. 1999. Carbon sequestration research and development. Report No. DOE/SC/FE-1. U.S. Department of Energy, Office of Science, Office of Fossil Energy. <www.osti.gov/bridge/servlets/purl/810722-9s7bTP/native/810722.pdf>. 289 p.

[USFWS] U.S. Department of the Interior, Fish and Wildlife Service. 1954. Wetlands inventory of Nebraska. U.S. Fish and Wildlife Service, Billings, MT. 31 p.

———. 1977–99 unpublished reports. Grand Island, NE. [Pages unknown].

———. 1981. The Platte River ecology study special research report. Jamestown, ND: Northern Prairie Wildlife Research Center Online. <http://www.npwrc.usgs.gov/resource/habitat/plriveco/index.htm> (Version16JUL97) [Access date unknown].

———. 1983–93. Unpublished annual reports. Rainwater Basin Wetland Management District, Kearney, NE. [Pages unknown].

———. 1995. updated 2005. Migratory nongame birds of management concern in the United States: the 1995 list. Washington DC: Office of Migratory Bird Management. 22 p.

———. 2000. [No title]. <http://mountain-prairie.fws.gov/reference/briefing_book_nd_ 2000.pdf> [Access date unknown].

———. 2001. The biological integrity, diversity, and environmental health policy. <http://policy.fws.gov/library01fr3809.pdf> [Access date unknown].

———. 2006. Livestock confinement [Rainwater Basin GIS layer]. Data on file at Rainwater Basin Wetland Management District.

[USFWS et al.] U.S. Department of the Interior, Fish and Wildlife Service; Canadian Wildlife Service; Mexican Ministry of Environment, Natural Resources, and Fisheries. 1998. North American waterfowl management plan, 1998 update—expanding the vision. Washington DC: [Publisher name unknown]. 32 p.

[USFWS and NGPC] U.S. Department of the Interior, Fish and Wildlife Service; Nebraska Game and Parks Commission. 1986. Rainwater Basin of Nebraska migratory bird habitat acquisition plan [unpublished plan]. On file at Rainwater Basin Wetland Management District. 30 p.

[USEPA] U.S. Environmental Protection Agency. 2003. National pollutant discharge elimination system permit regulation and effluent limitation guidelines and standards for concentrated animal feeding operations (CAFOs). Federal Register 68(29):7177–269. <http://cfpub.epa.gov/npdes/afo/cafofinalrule.cfm> [Access date unknown].

van der Burg, Max Post. 2005. Factors affecting songbird nest survival and brood parasitism in the Rainwater Basin region of Nebraska [master's thesis]. Lincoln, NE: University of Nebraska–Lincoln. 71 p.

Volkert, W.K. 1992. Response of grassland birds to a large-scale prairie planting project. The Passenger Pigeon 54(3):191–6.

Warner, K.D.; Nieman, D.J. 1999. [Unpublished preliminary report]. Saskatoon, SK: Canadian Wildlife Service. 4 p.

White, D.H.; James, D. 1978. Differential use of fresh water environments by wintering waterfowl of coastal Texas. Wilson Bulletin 90:99–111.

Wiens, J.A. 1973. Pattern and process in grassland bird communities. Ecological Monographs 43:236–70.

Windingstad, R.M.; Hurt, J.J.; Trout, A.K. [et al.] 1984. Avian cholera in Nebraska's Rainwater Basin. In: Transactions of North American Wildlife and Natural Resources Conference; [Date and location of conference unknown]. [Place of publication unknown]: [Publisher name unknown]. 49:577–83.

Wood, W.W. 2000. Ground-water recharge in the southern high plains of Texas and New Mexico. [Place of publication unknown]: [Publisher name unknown]. U.S. Geological Survey Publication FS-127-99. 4 p.

Zinkl, J.G.; Dey, N.; Hyland, J.M. [et al.] 1997. An epornitic of avian cholera in waterfowl and common crows in Phelps County, Nebraska, in the spring, 1975. Journal of Wildlife Diseases 13:194–8.