Chapter 4. Affected Environment

The complex includes three refuges and 79 waterfowl production areas scattered throughout Burleigh, Emmons, and Kidder counties, located in the south-central part of the State. Long Lake NWR serves as the complex's headquarters and largest parcel of land. The refuge is situated in the partially buried valley of the ancestral Cannonball River and is part of the Missouri Coteau physiographic region and the Collapsed Glacial Outwash ecoregion.

This ecoregion's topographic variation is the result of gravel and sand deposited by glacial melt-water and precipitation runoff over stagnant ice, and it is characterized by many large, alkaline lakes. The refuge consists of gently rolling native uplands, tamegrass fields, scattered tree plantings, and numerous temporary, seasonal, and semi-permanent natural wetlands, in addition to a 16,000-acre impoundment. Refuge wildlife consists of a wide variety of wetland- and grassland-dependent species, as well as a lesser number of arboreal species. This chapter describes the complex's environmental resources that may be affected by the implementation of the CCP.

The complex's other fee-title lands are located in the Coteau Slope physiographic region (25 WPAs) and the Missouri Coteau physiographic region (two refuges, 54 WPAs). In addition to the Collapsed Glacial Outwash ecoregion (two refuges, 43 WPAs), fee-title lands are also located in the Missouri Coteau Slope (nine WPAs), Missouri Coteau (26 WPAs), and River Breaks (one WPA) ecoregions. The northeastern one-third of the complex is comprised of the Missouri Coteau ecoregion, which has a higher density of wetlands, fewer streams, and more varied topography than the Missouri Coteau Slope ecoregion that lies to the south and west. The River Breaks ecoregion makes up only the western-most portion of the complex and consists of broken terraces and uplands that descend to the Missouri River and its major tributaries. Although the frequency of occurrence and density of certain wildlife species does vary somewhat between the complex's two physiographic regions and four ecoregions, the same principal wildlife species occur across all Service lands throughout the complex.

The area included in the complex exhibits a negative precipitation:evaporation ratio and therefore, is considered semi-arid (Rau et al. 1962, Kume and Hansen 1965) and is characterized by relatively short, hot summers and relatively long, cold winters (Kantrud et al. 1989). Temperature fluctuates both seasonally and daily. Summer temperatures occasionally climb above 100 °F, while winter temperatures may drop to -30°F, with wind chills as low as -100°F. The annual average number of days with maximum and minimum temperatures of ≥90°F and ≤32°F, respectively, is 25 and 73. The growing season, defined as the long-term average number of consecutive days that the minimum temperature does not fall below 32°F, ranges from 99–47, which correlates well with an average frost-free period of 120 days reported for the central portion of the State (Winter et al. 1984). Average annual total precipitation is 16 inches, of which 73 percent occurs from May to September. During the summer, most rainfall is associated with thunderstorms (average of 25–30 days/year; Shjeflo 1968). In contrast, average monthly precipitation during winter is only 0.95 inches and occurs mostly as snow.

Geology and Soils

Surface bedrock composition in Burleigh and Kidder counties is somewhat similar, with the former having a slightly more diverse composition than the later. Surface bedrock across the two-county area includes the Late Cretaceous Pierre (marine shale), Fox Hills (marine sandstone), and Hell Creek (sandstone, mudstone, siltstone, lignite, carbonaceous shale) formations, as well as the Tertiary Paleocene Fort Union Group consisting of the Ludlow (continental sandstone, lignite, and shale), Cannonball (marine sandstone, siltstone, shale, and limestone), and Tongue river (continental sandstone, claystone, siltstone, shale, limestone, and lignite) formations (Kume and Hansen 1965).

Glacial till material that overlies the bedrock in Burleigh and Kidder counties is similar with respect to physical characteristics (Rau et al. 1962, Kume and Hansen 1965). In Kidder County, most of the till has reddish-yellow spots caused by oxidation of iron oxide and a white mottling caused by concentration of calcium carbonate (Rau et al. 1962). Burleigh County till is oxidized to depths of 20–30

feet and exhibits a mottled appearance due to calcium carbonate concentrations. Additionally, free pebbles are typically encrusted with caliche and particles of shale and lignite are common (Kume and Hansen 1965). Conversely, glaciofluvial sediments in both counties are comprised primarily of stratified sands and gravel that range in size from fine sand to pebbles, whereas glaciolacustringe sediments primarily consist of clays and silts.

The principal parent materials of soils on Long Lake NWR, Slade NWR, and Florence Lake NWR are glacial outwash, glacial till, and sediments of glaciofluvial and glaciolacustrine origin. Soils on these three refuges belong to more than 20 series and nine subgroups (Stout et al. 1974, Seelig and Gulsvig 1988). The 20 soils series form 10 associations (i.e., areas with a proportional pattern of soils that normally consist of one or more major soils and at least one minor soil) that make up the terrestrial land base of the refuges. Of these, the dominant associations on all three refuges are loams and sands derived from glacial outwash and till that are generally deep, medium to moderately coarse in texture, range in available water capacity from very low to high, and are susceptible to erosion by either water or wind (Stout et al. 1974, Seelig and Gulsvig 1988). The soils that underlie Long Lake NWR's uplands are clays and sands, compared to a sand-silt mix on Slade NWR, and sandy loam underlain by gravel on Florence Lake NWR. Nearly all soil associations found throughout the three refuges can be characterized as nearly level to rolling or gently rolling.

Water Resources

Surface Water

The Long Lake Creek watershed is the primary source of supply for Long Lake NWR. This watershed has a contributing area of approximately 460 square miles. Annual evaporation in the area is 33 to 40 inches and average annual precipitation is approximately 16 inches. This yields a negative precipitation: evaporation ratio in areas administered by the complex and a subsequent semiarid designation. Water levels in Refuge impoundments are greatly dependent on spring runoff.

A series of dikes with control structures impound approximately 15,000 acres of wetlands in three water management units when at capacity. These impoundments have a maximum depth of six feet and an average depth of less than three feet. Gaging stations operated by USGS monitored flows into the Refuge from Long Lake Creek south of the refuge boundary and out of the refuge in the overflow channel for a relatively short period of time. Because there are a number of other small tributaries that provide other surface water supplies which are ungaged, there has never been an accurate accounting of water supplies other than to determine that the Long Lake Creek Watershed contributes approximately 68 percent of the water for Long Lake.

Long Lake captures surface water from several minor tributaries and watersheds during periods of runoff in impoundments referred to as unit 2 Marsh, G-12, G-19, and G-19a. Other water management units have been developed on WPAs and satellite refuges where tributaries and watersheds allow for the capture of runoff. These impoundments function as small artificial freshwater wetlands. Overwhelmingly, surface waters occurring under the jurisdiction of the complex exist as natural, undeveloped wetland basins.

Background

Prior to being established as a refuge in 1932, Long Lake was a relatively shallow (elevation ranges from 1,710 feet–1,716 feet above MSL), alkaline lake that exhibited dynamic water level fluctuations, based on variable seasonal and annual surface water inputs (e.g., rainfall, snowmelt runoff). Although speculative, during years of low inflow, surface water likely was not discharged from the lake and was lost only by evaporation and transpiration (Laubhan et al. 2006). However, in years of high inflows, surface waters breached a natural sill and water was discharged downstream.

Although the valley encompassing Long Lake NWR retains many historic features, the area has been modified by both ongoing natural processes and anthropogenic forces. Perhaps the greatest change that has impacted the NWR is hydrologic alteration aimed at reducing the occurrence of botulism. In the mid–1930s the Civilian Conservation Corps (CCC) built three earthen dikes (denoted as A, B, and C) in order to improve the water management capability of Long Lake. At their present level (1,720ft above MSL), these dikes have raised the full pool level more than three feet above its historic elevation, creating three separate management units (denoted as unit I, unit II, and unit III) which make up the >17,000 acre

impoundment (acreage includes nonrefuge portions of Long Lake).

Groundwater
Essentially all water in this region is derived from precipitation; however, a portion of this water either enters the ground through direct or indirect percolation or is transported along the ground surface to topographically lower areas. For example, many river and stream valleys function to collect excess surface water that cannot be absorbed into soils at local scales. In general, groundwater is abundant in both Burleigh and Kidder counties (Rau et al. 1962, Kume and Hansen 1965,); however, the amount of groundwater recharge that occurs varies locally and depends on numerous factors, including topography, climatic variables (e.g., precipitation and temperature patterns), and soil characteristics (e.g., available water capacity). In general, groundwater recharge tends to be greatest during periods of major precipitation that result in large amounts of surface runoff (Randich and Hatchett 1966).

Additionally, since the mid-1990s, the acreage of planted potatoes has increased dramatically in certain parts of the State, including Kidder County. For example, in 1995, 1,300 acres of potatoes were planted in Kidder County. By 2000, this acreage had increased to 7,500 acres (USDA 2002). Along with these increases in potato production have come an equally large increase in irrigation (100 percent of all Kidder county potato fields have been irrigated since 1995; USDA 2002). Consequently, irrigation systems have been installed in the uplands directly adjacent to wetlands protected by easements. In 2001 Euliss et al. (2003) conducted a study to determine the impact of ground-water pumping on a single protected (easement) wetland in Kidder County. Although Euliss et al. (2003) were not able to observe a reduction in the length of time that the easement wetland contained water in 2001 that could be directly related to pumping of groundwater (likely due to the relatively small amount of pumping that occurred in 2001 and the difficulty in separating pumping-induced drawdowns from natural drawdowns observed in control [reference] wetlands), they did document altered wetland hydrology during irrigation events. During pumping the treatment wetland changes from a ground-water flow-through wetland to a "recharge" wetland. Pumping in the treatment wetland also altered the chemical characteristics (e.g., salinity) of the treatment wetland. In summary, Euliss et al (2003) recommend that if the goal of purchasing wetland easements is to protect the unique biotic and abiotic characteristics of these wetlands for the benefit of waterfowl and other wildlife species then actions that alter the natural hydrological characteristics (i.e., pumping for agricultural irrigation) should be avoided whenever possible.

Wetlands
Wetlands are lands where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface (Cowardin et al. 1979). It is estimated that the contiguous United States contained 221 million acres of wetlands just 200 years ago (Dahl1990). By the mid-1970s only 46 percent of the original acreage remained (Tiner 1984). Wetlands now cover about five percent of the landscape of the lower 48 states. Wetlands are extremely productive and important to both migratory and resident wildlife. They serve as breeding and nesting habitat for migratory birds and as wintering habitat for many species of resident wildlife. Humans also benefit from wetlands as these habitats improve water quality and quantity, reduce flooding effects, and provide areas for recreation.

Wetlands are classified using a number of attributes including vegetation, water regimes (the length of time water occupies a specific area), and water chemistry. Prairie potholes are described using the following nontidal water regime modifiers (Cowardin et al 1979):

- Temporarily flooded—surface water is present for brief periods during the growing season. The water table usually lies below the soil surface most of the season, so plants that grow in both uplands and wetlands are characteristic.
- Seasonally flooded—surface water is present for extended periods especially early in the growing season, but is absent by the end of the season in most years. When surface water is absent, the water table is often near the surface.
- Semi-permanently flooded—surface water persists throughout the growing season in most years. When surface water is absent, the water table is usually at or very near the land surface.
- Permanently flooded—water covers the land throughout the year in nearly all

years. Vegetation is composed of obligate hydrophytes, such as cattails.

Even though drainage and other wetland-decimating factors have taken their toll, wetlands are still a prominent feature of the landscape within the complex. Wetlands within the complex occur in a diverse distribution of sizes, types, locations, and associations. The National Wetland Inventory (NWI) has identified 396,105 wetland acres in the wetland management district.

The chemistry of surface waters in wetlands tends to be dynamic because of complex interactions among numerous factors, including the position of the wetland in relation to groundwater flow systems, chemical composition of groundwater, surrounding land uses, and climate (LaBaugh et al. 1987, Swanson et al. 1988, Winter 2004).

The gradient from fresh to hypersaline water is a continuum, and any divisions are arbitrary (Euliss et al. 2004). In addition, salinity levels can fluctuate widely within and among seasons (Stewart and Kantrud 1972). In general, however, surface water in temporary and seasonal wetland basins is usually fresh or slightly brackish (~ <0.8 mS/cm), whereas semi-permanently flooded basins are often brackish (~ 2.0–15 mS/cm), but can range from fresh to subsaline (~ >15 mS/cm) (Stewart and Kantrud 1971).

Although the general effect of increased salinity in any zone of wetland vegetation is a decrease in species diversity, it is difficult to establish meaningful salinity tolerances for individual species in their natural habitats because of the complex interaction of abiotic factors. However, general estimates of the tolerance of many emergent and aquatic plant species to salinity are available (Kantrud et al. 1989).

Water Rights
The following section is a summary of water rights associated with complex lands:

Long Lake NWR holds water rights filed February 17, 1936, claiming 47,955 acre-feet of storage and an additional seasonal use of 51,100 acre-feet. This water right covers water stored and seasonal use to an elevation of 1713.5 feet above MSL.

Long Lake NWR also holds Perfected Water Right # 5549P priority date June 1, 1942, for an additional 21,993 acre-feet of storage and 2,410 acre-feet of annual use from surface water of Long Lake Creek a tributary of Apple Creek. This water right covers the additional water stored and seasonal use to an elevation of 1,716 feet above MSL, the elevation in which facilities were raised during construction of refuge impoundments, which occurred in 1942.

G-19 dam on Long Lake NWR holds a water right/permit # 4628 allocating 70 acre-feet, of which 53 acre-feet will be used to offset evaporative losses. The permit was granted with an exception to the one-time fill rule.

G-19a dam on Long Lake NWR holds a water right/permit # 4249 allocating 88.5 acre-feet, of which 48 acre-feet will be used to offset evaporative losses. The permit was granted with an exception to the one-time fill rule.

G-12 dam on Long Lake NWR holds water right/permit # 4505 allocating 252 acre-feet, 129 acre-feet for storage and 123 acre-feet to offset evaporative losses. The permit was granted with an exception to the one-time fill rule.

Unit 2 marsh on Long Lake NWR holds water right/permit # 3812 allocating 410 acre-feet of storage and 629 acre-feet of seasonal use.
Lake George NWR holds water right dated August 30, 1937, for 773 acre-feet of storage and 468 acre-feet of seasonal use.

Sunburst Lake NWR holds a water right dated September 25, 1964, perfected permit # 1243 for 33 acre-feet of storage and 49.5 acre-feet of storage of seasonal use for a total of 82.5 acre-feet of storage. (Horsehead Creek watershed).

Sunburst Lake NWR holds water rights dated September 1, 1934, for 65.8 acre-feet of storage with additional 47.1 acre-feet for seasonal use (Horsehead Creek watershed).

Slade NWR holds water right # 1259P dated December 21, 1942, for storage to elevation 1,724 feet above MSL with additional 291 acre-feet seasonal use (tributaries to Lake Isabel).

Slade NWR holds water right # 1260P dated December 21, 1942, for storage to normal elevation with additional 1695 acre-feet seasonal use (tributaries to Lake Isabel).

Appert Lake NWR holds water rights dated September 1, 1934, for 365 acre-feet of storage with

additional 309 acre-feet of seasonal use (Long Lake Creek/Missouri River watershed).

Springwater NWR holds water rights dated September 1, 1934, for 64 acre-feet of storage with additional 48 acre-feet of seasonal use. (Clear Creek watershed).

Canfield Lake NWR holds water rights dated September 1, 1934, for 872 acre-feet of storage with additional 654 acre-feet of seasonal use (Apple Creek/Missouri River watershed).

Hutchinson Lake NWR holds water rights dated August 30, 1937, for 90 acre-feet of storage with additional 90 acre-feet of seasonal use (Missouri River watershed).

Florence Lake NWR holds water rights dated September 1, 1934, for 300 acre-feet of storage with additional 300 acre-feet of seasonal use (Missouri River watershed).

Rath WPA holds water rights permit # 4665 dated October 28, 1992, for 157 acre-feet out of which 108.6 acre-feet is for seasonal use (Apple Creek watershed).

The Long Lake WMD holds 1,036 wetland easement contracts protecting 102,646 acres of naturally occurring wetlands.

Vegetation Communities

Wetlands and Associated Vegetative Communities

Wetlands throughout the complex provide both resting cover and food resources for migratory birds. Substantial emergent and submergent acquatic vegetation occurs in freshwater wetlands. Sago pondweed, coontail, and duckweed occur in the deeper, more permanently flooded zones, while cattail, bulrush, burreed, and smartweed grow in shallow areas that may go dry due to a drawdown. Salinity is a limiting factor for wetland plants in individual wetlands scattered throughout the complex. As salinity increases, it limits the growth of certain wetland plants as levels approach and/or exceed an individual species' tolerance level.

Most palustrine basins exhibit concentric zones of vegetation that are dominated by different plant species (Kantrud et al. 1989). The terms commonly used in reference to these zones are, in decreasing order of water permanency, deep marsh, shallow marsh, and wet meadow (Kantrud et al. 1989). The water regime in a deep marsh zone is usually semi-permanent. Dominant plants include cattail, bulrush, submersed or floating plants, and submersed vascular plants, but this zone also may be devoid of vegetation if bottom sediments are unconsolidated. Shallow marsh zones are usually dominated by emergent grasses, sedges, and some forbs, but submersed or floating vascular plants also may occur. Wet meadow zones also are typically dominated by grasses, rushes, and sedges, whereas submersed or floating plants are absent.

Management of wetlands in the complex where facilities have been developed simulates natural (i.e., historic) wet/dry cycles by raising and lowering water levels to meet specific management objectives. This encourages emergent and submergent acquatic vegetation growth, increases invertebrate biomass, improves water clarity, breaks down and cycles accumulated nutrients in bottom sediments, and augments control of common carp. Extensive mudflats are created when wetlands are in the initial drawdown phase. Mudflats provide optimal feeding opportunities for migrating shorebirds, wading birds, and other waterbirds.

The wetland easement program has provided perpetual protection for 102,646 acres of wetlands on private lands in the wetland management district. This has secured a landscape-level habitat base for migratory birds. While normal farming practices may have essentially erased some of the smaller, temporary, and seasonal wetland basins, most of the habitat that has been protected remains intact. Improved GIS technology and landscape modeling have guided the effort to protect essential wetlands to priority areas where those measures have potential to influence migratory bird resources the most (see figures 11, 12, and 13; Long Lake NWR, Florence NWR, and Slade NWR habitat maps at the end of this chapter).

Uplands and Associated Vegetative Communities

Upland vegetation is essential in order to provide nesting habitat for migratory and resident bird species. Upland habitats also provide necessary habitat requirements for resident wildlife throughout the year. The grassland easement program has provided perpetual protection for 41,181 acres of privately owned grassland in the wetland management district. The program is in its infancy and continues to expand the acreage

protected annually. While these lands are often not in optimum condition, they provide a secure landscape-level habitat base. Conversely, fee-title lands sometimes offer an opportunity to provide habitat, which is in optimal condition. The complex currently uses a variety of management techniques to maintain and enhance upland habitat conditions on fee-title uplands including the use of prescribed fire, grazing, haying, native grass seeding, and invasive species management.

During the 1930s, large fields formerly planted to crops were planted with nonnative grasses including smooth brome, crested wheatgrass, and Kentucky bluegrass species to minimize soil erosion.

In the early 1970s, habitat management techniques were developed to provide dense nesting cover for waterfowl. Several areas on the refuge were planted to grass species such as tall and intermediate wheatgrass, sweet clover, and alfalfa. These fields initially provided good cover for nesting birds; however, over time they deteriorated and were prone to invasion by Canada thistle and other problem species (e.g., smooth brome). The complex has begun the process of restoring these grasslands to native grasses and forbs. The native grass restoration process generally involves cropping the field for three or more years to eliminate exotic cool season grass seeds and rhizomes, control Canada thistle and other noxious weeds, and prepare a seed bed for planting native grass seed.

Uplands were historically comprised of warm-season grasses characteristic of the short-grass prairie to the west, and the cool- and warm-season grasses characteristic of the tall-grass prairie to the east (Samson et al. 1998); thus, the area represented a zone of ecotonal mixing that included a diversity of short-, intermediate-, and tall-grass species (Bragg and Steuter 1996). Vegetation composition at regional and local levels was determined by numerous interrelated factors, including elevation, topography, climate, soil characteristics, herbivory, and fire (Hanson and Whitman 1938, Coupland 1950). Based primarily on vegetation and topography, the mixed-grass prairie in the State has been classified into nine major types (Hanson and Whitman 1938). Species typical of the mixed-grass prairie in the State include western wheatgrass, blue grama, prairie junegrass, needle and thread, sandberg bluegrass, little bluestem, needleleaf sedge, and threadleaf sedge (Whitman 1941, Kantrud and Kologiski 1982).

However, even within a classification, local variation exists. For example, in xeric areas the blue grama-needle and thread-threadleaf sedge association also includes western wheatgrass, prairie junegrass, and needleleaf sedge as less important dominant grasses, as well as about 12 dominant forbs (e.g., lotus milkvetch, narrowleaf goosefoot, scarlet beeblossom, flatspine stickseed, stiffstem flax, spiny phlox, woolly plantain; Hanson and Whitman 1938, Coupland 1992). In contrast, more mesic areas in the same association supported more slender wheatgrass, fendler threeawn, sideoats grama, little bluestem, porcupine grass, green needlegrass, and sun sedge, whereas dominant forbs included tarragon, prairie sagewort, white sagebrush, blacksamson echinacea, and white milkwort (Sarvis 1920). Further, grasses in the genus Bouteloua, Stipa, and Carex are dominant on sandy loams and fine sandy loams that typically occur on topographically high areas. In contrast, species such as inland saltgrass, Nuttall's alkaligrass, and foxtail barley tend to occur more often in depressional areas with silt loams and silty clay loams characterized by increased soil moisture and high concentrations of carbonates and soluble salts (Hanson and Whitman 1938).

Shrub and Tree Plantings (Shelterbelts)
The complex has scattered tree rows, shelterbelts and block plantings of shrubs and trees. By Service policy, trees are no longer planted except for shelterbelts that are allowed near refuge housing, buildings and the headquarters to provide protection from the wind. As time and funding allow, current management direction targets removing the shrub and tree plantings and restoring these areas to perennial grass cover.

Native Shrubs and Trees
Buffaloberry, chokecherry, Juneberry, and other low-growing native shrubs occur sporadically in native uplands, primarily in coulees and/or drainages where aspect and relief combine to provide microclimates for these woody species to develop and thrive.

Western snowberry and silverbrush are native shrubs that sometimes dominate native grassland areas and can become management problem/considerations when fire and/or grazing are excluded or not applied at regular intervals.

Riparian areas and wetland fringes hold native trees including green ash and cottonwood. Rare landforms have allowed aspen and other low shrubs to develop and extend their range south into some areas in the northern part of the wetland management district.

Management objectives target maintaining native shrubs and trees within an acceptable composition range, where they are allowed to thrive within the microclimates and/or normal native range site, but not to expand and/or dominate range site locations where grasses would otherwise be the normal composition under historical burning/grazing regimes.

Wildlife

Mammals

Representative species for the complex include the coyote, red fox, white-tailed jackrabbit, deer mouse, badger, raccoon, mink, muskrat, white-tailed deer, thirteen-lined ground squirrel, striped skunk, long-tailed weasel, masked shrew, and meadow vole. The complex staff anticipates that 34 mammal species likely occur regularly or periodically on complex lands (Appendix G). A checklist of State mammals (Wiehe and Cassel 1978) lists 10 species (including four bats, one mouse, two voles) with a statewide distribution that have not been documented by complex staff on Service lands in the complex. Undoubtedly, the limited amount of Service-owned land in Burleigh, Kidder, and Emmons counties does not provide habitat sufficient to support some of these 10 species (i.e., bobcat, river otter, hoary bat).

In addition to this area's common mammal species, there are occasionally confirmed sightings of moose, elk, and pronghorns on, or adjacent to, Service lands in the complex. Additionally, the complex staff has received unconfirmed reports of mountain lions and gray wolves on Service lands within the complex.

In 2002, the small mammal population on Long Lake NWR was systematically inventoried. The inventory was conducted to determine the species composition and abundance of small mammals in both upland- and wetland-edge habitats. Large- and medium-sized mammals (e.g., deer, rabbits, skunks) and bats were not sampled. Live trapping was conducted at 16 different study fields throughout the refuge from late June to late September. Ten different mammal species were captured. The deer mouse was the most frequently captured species, with 38.34 captures (C) per 100 trap nights (TN), followed by the masked shrew (2.68 C/100 TN), northern short-tailed shrew (1.87 C/100 TN), and thirteen-lined ground squirrel (1.06 C/100 TN), respectively.

Reptiles and Amphibians

The complex staff expects that eight reptiles and amphibians likely occur regularly or periodically on complex lands (appendix G). Hoberg and Gause (1991) provide range distributions for all State amphibians and reptiles.

From 2001 to 2003, complex staff worked with the Service's ecological services division to capture juvenile (metamorph) northern leopard frogs on Sisco-Fallgatter and Schiermeister WPAs, in Emmons County. These frogs were examined for potential malformations. The impetus for this work stemmed from the heightened nationwide concern over amphibian malformations that began when a group of Minnesota junior high school students discovered numerous malformed frogs in a local wetland in 1995 (Meteyer 2000). In 2001, complex staff collected 180 leopard frog metamorphs from the two Emmons County WPAs. Two frogs from Schiermeister and one frog from Sisco-Fallgatter were determined to be malformed via radiology. Two of these three malformations were classified as asynchronous metamorphosis (involving the mouth and tail), whereas the third was classified as having polymelia of a forelimb (an extra forelimb). The following year, 127 leopard frog metamorphs were collected at Scheirmiester WPA, with no malformations observed. In 2003, 231 leopard frog metamorphs were collected at the two Emmons County WPAs. Two specimens from Schiermeister were considered abnormal (hind foot on both) and forwarded to the University of Wisconsin-LaCrosse for further examination. Final results are unavailable as of this writing.

Birds

More than 314 species of birds have been documented throughout the complex (appendix G). The Long Lake NWR Bird List (May 2002) contains 289 species that had been recorded on or immediately adjacent to the refuge, as of 2001. The bird list includes 18 accidentals (species seen once or only a few times because the refuge is outside of their normal range. There are 118 species that breed on Long Lake NWR. The importance of Long Lake NWR to the avian community is illustrated, in part, by the fact that it was designated both a

Globally Important Bird Area (GIBA) and as a regional shorebird site in the Western Hemisphere Shorebird Reserve Network (WHSRN) in 2002. Additionally, the diversity of birdlife in the complex has resulted in national recognition of both Kidder County (Konrad 1996a) and Long Lake NWR (Konrad 1996b) as two of the top ten birding "hot spots" in the nation.

Twenty-three species of waterfowl are considered either common or uncommon species throughout the complex, with several other waterfowl species being occasional visitors (i.e., greater scaup, American black duck, red-breasted merganser, white-winged scoter. Seventeen waterfowl species breed in the complex. The five most abundant breeding duck species are the mallard, blue-winged teal, gadwall, northern shoveler, and northern pintail. When habitat conditions are favorable, breeding duck densities exceed 100 pairs per square mile in several portions of the complex, especially in Kidder and northeastern Burleigh counties. The Service began conducting annual breeding waterfowl population surveys throughout the Dakotas and northeastern Montana in 1987, focusing on 13 duck species that are the primary breeding species in the PPR. The number of breeding pairs of these species that use both Service and private lands in the complex has ranged from 8,865 in 1990 to 544,017 in 1997, whereas recruitment rates have ranged from 0.40 in 1990 to 0.82 in 1997. A minimum recruitment rate of 0.49 is needed to maintain a duck species' population (Service 1996). Based on survey data, a strong positive relationship exists between wetland condition (i.e., wet area, number of wet ponds) and both breeding pairs and duck recruitment.

Since 2000, the complex staff has investigated upland waterfowl nesting success at both Long Lake NWR and on select WPAs in the complex. In 2001, portions of five WPAs (Wahl, Bernhardt, Basaraba, Rath, North Crimmins) that had breeding duck pair densities exceeding 80 pairs per square mile and surrounding landscapes that had a high degree (>60 percent) of perennial grass cover, were searched using the chain drag method (Klett et al. 1986). Each site was searched either two or three times and 106 nests were found across 350 acres. Nest success was 26.05 percent (Mayfield 1961) across all sites and ranged from 4.2 percent to 38.8 percent at individual sites. In 2002, the complex staff surveyed nesting activity on seven Long Lake NWR management units. Each site was searched three times and 79 nests were found across 415 acres. Nest success was 3 percent (Mayfield 1961) across all sites and ranged from 0.4 percent to 17.8 percent at individual sites. Nest success rates ranging from 15–20 percent (Mayfield 1961) are thought to be a minimum requirement for population stability of the five most abundant breeding duck species in the complex (Cowardin et al. 1985, Klett et al. 1988).

During the fall migration, the average, waterfowl numbers at Long Lake NWR peak at 25,000 ducks and 35,000 geese; however, in some years, fall refuge populations of both duck and geese exceed 100,000 each. Migrant populations of Canada geese, cackling geese, white-fronted geese, snow geese, and tundra swans are joined on the refuge by an average of 10,000 sandhill cranes. The refuge serves as a principle staging area for members of the mid-continent population of sandhill cranes, and their numbers exceed 25,000 individuals on the refuge in some years.

Long Lake NWR's designation as a WHSRN site is due to the documented abundance of shorebirds (>20,000 annually) that utilize the refuge at some time of the year, as either a migratory stopover or breeding area. Twenty-five species of shorebirds are considered either common or uncommon species throughout the complex, with several other species being occasional visitors (e.g., black-bellied plover, western sandpiper, Hudsonian godwit, buff-breasted sandpiper). Nine shorebird species are regular breeders throughout the complex.

Since 2001, shorebird surveys have been conducted on two survey routes at Long Lake NWR, following Manomet Center for Conservation Sciences International Shorebird Survey (ISS) protocol.

From 2001 to 2003, 28 shorebird species were recorded annually on the refuge during formal surveys. Based on ISS data, the most abundant spring migrants at the refuge include the Wilson's phalarope and marbled godwit; whereas the most abundant fall migrants include the Wilson's phalarope, long-billed and short-billed dowitchers, American avocets, and killdeer. Both refuge shorebird diversity and abundance has varied seasonally and annually since ISS began. Abundance has ranged from 17,685 in spring 2004 to 1,551 in spring 2003, whereas Simpson's Diversity Index (Simpson 1949; range=0.0 [low] to 1.0 [high]) values have varied from a seasonal low of 0.4978 to an annual high of 0.8218. The substantial variation in shorebird abundance likely is related to wetland

conditions at scales greater than the refuge. During years when numerous prairie wetlands are flooded and the water level in Long Lake is high (i.e., spring 2003), relatively few shorebirds use the refuge. Conversely, substantially more shorebirds use the refuge during years of minimal spring runoff (i.e., spring 2004) because preferred habitat on the surrounding landscape is mostly dry and Long Lake provides a wealth of suitable shorebird habitat. The landscape that surrounds Long Lake NWR, which includes numerous other Service lands, is also of tremendous importance to a host of shorebird species, for a multitude of reasons. For example, a portion of the Collapsed Glacial Outwash ecoregion within the complex has recently been designated as a priority fall migration staging area as part of the Marbled Godwit Conservation Plan (Melcher et al. 2005). Twenty-five WPAs and two refuges are included within the boundaries of this conservation area.

The importance of Service lands in the complex to colonial nesting waterbirds was recently investigated. In 2003, the complex staff conducted an extensive survey of waterbird colonies on fee-title lands throughout the complex to determine the distribution and estimate the abundance of breeding colonial waterbirds, and also develop a monitoring protocol that can be followed in subsequent years with reduced effort. An aerial survey of all wetland basins (n = 864) on fee title lands in the complex was completed and each wetland was assigned to one of three categories (high probability [HPC], moderate probability [MPC], and low probability [LPC], based on the likelihood that it would support one or more waterbird colonies that year. Category assignments were based on a combination of habitat conditions, including: 1) wetland cover type (Steward and Kantrud 1971); 2) hydrologic regime and basin size, and; 3) special features (e.g., islands, dead trees in wetlands). All HPC wetlands (n = 68) were ground surveyed for colonies, whereas only 50 percent of the MPC wetlands (n = 83) and 5 percent of the LPC wetlands (n=32) were ground surveyed. When a waterbird colony was located, species composition was determined, nests were tallied, the perimeter of the colony was delineated, and general habitat variables were measured. Forty colonies were located on 16 WPAs and two refuges during the survey, including 31 (77.5 percent) marsh colonies, eight (20 percent) ground/island colonies, and one (2.5 percent) tree/shrub colony. Seven WPAs and one refuge contained multiple, ranging from two to nine, colonies. Twenty-four (60.0 percent) of the 40 colonies consisted of only one species, 11 (27.5 percent) contained two species, three (7.5 percent contained three species, and two (5.0 percent) contained between five and eight species. Fourteen separate waterbird species were recorded and only the double-crested cormorant utilized multiple colony types. The number of total breeding pairs of each species detected during the survey ranged from three (snowy egret) to 310 (California gull). Thirty-eight colonies were located on HPC wetlands, whereas only two (5 percent) were located on MPC wetlands and no colonies were located on LPC wetlands. The apparent success of the wetland stratification scheme provided a breeding colonial waterbird population estimate for the complex that had a low variance and provided an accurate estimate of use of Service lands during 2003.

Service lands throughout the complex hold substantial importance for grassland-nesting passerines, especially given the current rate of grassland conversion to cropland throughout the Dakotas. From 2001 to 2004, the complex staff surveyed the relative abundance and species composition of this bird group at 50 randomly selected 328-foot (100-meter) radius points at Long Lake NWR. Relative abundance (mean number of breeding pairs/point), estimated mean pairs per 247 acres (100 hectares), and frequency of occurrence (percentage of points at which a species was detected) were calculated for all species. The number of grassland-nesting passerine species detected from 2001 to 2004 ranged from 10–14, whereas the number of breeding grassland-nesting passerine pairs ranged from 258 in 2003 to 378 in 2004. Ten grassland-nesting passerine species were detected at survey points during all 4 years (table 2), three (Baird's sparrow, Nelson's sharp-tailed sparrow, Sprague's pipit) were detected during two years, and the vesper sparrow and lark bunting were detected during only one year. The species with the four highest mean frequencies of occurrence across all four survey years were the bobolink, clay-colored sparrow, red-winged blackbird, and grasshopper sparrow, respectively.

In 2005, the diversity of grassland-nesting passerines was surveyed at Florence Lake NWR and Slade NWR, using area search methodology (Ralph et al. 1993). Surveys were conducted in three different vegetative community types (native prairie, old cropland, seeded natives) at each refuge. Each 7.4-acre (3-hectare) search plot was surveyed three separate times during the summer,

for 20 minutes per survey. Grassland passerine abundance at Florence Lake NWR was similar on the native prairie and seeded native plots, with nine breeding pairs detected in each. The grasshopper sparrow was the most abundant species at the native sod plot, whereas the bobolink was the most abundant species at the seeded native plot. Grassland passerine use of the tamegrass plot at Florence Lake NWR was considerably less that the other two plots, with only three breeding pairs (two savannah sparrow, one grasshopper sparrow) detected. Conversely, at Slade NWR, grassland passerine abundance was similar in all three plots, but was highest in the tamegrass plot (nine breeding pairs). The red-winged blackbird was the most abundant species in the tamegrass plot. Eight grassland passerine pairs were detected in the Slade NWR seeded native plot, with the bobolink, clay-colored sparrow, and grasshopper sparrow sharing the greatest abundance. In the native prairie plot, seven grassland passerine pairs were tallied; the grasshopper sparrow was the most abundant.

The sharp-tailed grouse is a native gamebird species that is abundant both on Long Lake NWR and other Service lands throughout the complex. Each spring the male of this polygamous species engages in communal breeding displays at leks, where they defend their territories. Upland areas on Long Lake NWR and more importantly, private lands immediately adjacent to Long Lake NWR that are annually grazed, serve as host sites for several leks each year. The complex staff attempts to survey sharp-tailed grouse attendance at these leks each April. The first formal sharp-tailed grouse survey at Long Lake NWR that was completed in cooperation with the NDGF was conducted in 1981, although informal refuge surveys were completed in prior years. With the exception of 1994, counts have been conducted at the refuge annually since 1981. Throughout the years, sharp-tailed grouse have been documented on as many as 25 different leks, either on, or immediately adjacent to, the refuge. From 1981 to 2005, the number of observed active leks has ranged from 6 to 17 each year and averaged 12.75 (SE±0.590). Given the presumed 1:1 sex ratio of males to females (Ammann 1957, Connelly et al. 1998) and the much more reliable lek detection rate of males, often total numbers of males only are reported. Total males in the Long Lake NWR survey area have varied widely (36–247), based on a variety of factors, but the mean total is 160.38 (SE±12.403), across all years.

Fish

The complex staff anticipates that seven species of fish occur in Service-owned wetlands in the complex (Appendix G). Although systematic fishery inventories have not been completed on Service lands within the complex, wetland habitat capable of supporting populations of certain fish species is present, at least during nondrought periods, on several tracts throughout the complex.

Great blue herons, double-crested cormorants, American bitterns, black-crowned night-herons, and grebes frequently forage for fish in Long Lake NWR waters. Additionally, several gull species take advantage of plentiful winter-killed common carp on Long Lake during ice-out in some years.

Threatened and Endangered Species

There are four federally listed threatened and endangered species that have been observed on Service lands within the complex. The endangered least tern has been documented on Long Lake NWR, but this is an anomaly, as the majority of this species' habitat use in the State centers on the Missouri River. Conversely, the threatened piping plover and bald eagle and the endangered whooping crane regularly use various WPAs and refuges in the complex.

The piping plover breeds on the shoreline of the large, alkaline lakes that are common throughout the northeastern one-third of the complex. In the summer of 2002, the Service's Ecological Services Division designated eleven different tracts of land, of which at least portions are owned by the Service and administered by the complex, as Piping Plover Critical Habitat. These Critical Habitat areas consist of Long Lake NWR, three Kidder County WPAs, and seven Burleigh County WPAs. The complex staff annually surveys Long Lake NWR and WPAs that are known piping plover breeding areas.

Additionally, since 2002, staff has erected predator exclosures (Melvin et al. 1992) over most observed piping plover nests in an effort to increase nest success. They have also conducted vegetation removal practices on portions of Long Lake NWR, to enhance traditional breeding areas.

Table 2. Relative abundance, estimated breeding pairs per 247 acres, and frequency of occurrence for 15 grassland/wetland edge-nesting passerines on Long Lake National Wildlife Refuge Complex, 2001-2004

SPECIES	*RELATIVE ABUNDANCE*[1]				*ESTIMATED PAIRS / 247ac*				*FREQUENCY OF OCCURRENCE*			
	2001	*2002*	*2003*	*2004*	*2001*	*2002*	*2003*	*2004*	*2001*	*2002*	*2003*	*2004*
Baird's sparrow	0.02 (0.020)	0.00	0.00	0.02 (0.020)	0.6	0.00	0.00	0.6	2	0	0	2
bobolink	1.72 (0.179)	1.34 (0.182)	1.26 (0.151)	1.68 (0.255)	54.8	42.7	40.1	53.5	80	66	74	66
chestnut-collared longspur	0.02 (0.020)	0.04 (0.028)	0.02 (0.020)	0.06 (0.034)	0.6	1.3	0.6	1.9	2	4	2	6
clay-colored sparrow	0.94 (0.172)	0.92 (0.169)	0.86 (0.146)	1.00 (0.185)	29.9	29.3	27.4	31.9	50	48	54	56
common yellowthroat	0.34 (0.093)	0.32 (0.088)	0.22 (0.066)	0.62 (0.117)	10.8	10.2	7.0	19.7	26	24	20	44
grasshopper sparrow	0.36 (0.109)	0.68 (0.126)	0.88 (0.136)	1.66 (0.224)	11.5	21.7	28.0	52.9	22	40	58	66
lark bunting	0.00	0.00	0.00	0.02 (0.020)	0.00	0.00	0.00	0.6	0	0	0	2
Le Conte's sparrow	0.04 (0.028)	0.12 (0.028)	0.02 (0.020)	0.02 (0.020)	1.3	3.8	0.6	0.6	4	10	2	2
Nelson's sharp-tailed sparrow	0.04 (0.028)	0.00	0.00	0.04 (0.027)	1.3	0.00	0.00	1.3	4	0	0	4
red-winged blackbird	1.06 (0.224)	1.14 (0.249)	0.78 (0.141)	1.06 (0.224)	33.8	36.3	24.8	33.8	44	46	50	46
Savannah sparrow	0.54 (0.125)	0.34 (0.084)	0.38 (0.099)	0.50 (0.132)	17.2	10.8	12.1	15.9	34	28	26	28
sedge wren	1.18 (0.203)	0.56 (0.157)	0.26 (0.114)	0.30 (0.096)	37.6	17.8	8.3	9.6	56	26	12	24
Sprague's pipit	0.02 (0.020)	0.00	0.00	0.02 (0.020)	0.6	0.00	0.00	0.6	2	0	0	2
vesper sparrow	0.00	0.00	0.04 (0.028)	0.00	0.00	0.00	1.3	0.00	0	0	4	0
western meadowlark	0.30 (0.082)	0.06 (0.034)	0.44 (0.082)	0.57 (0.100)	9.6	1.9	14.0	18.2	24	6	40	46

[1]Number in parentheses is standard error (±SE).

The bald eagle is a relatively common migrant during the spring and fall migrations. Bald eagle observations on the complex's refuges and WPAs can usually be tied to large concentrations of migrant waterfowl. The peregrine falcon, which was delisted in 1999, is not as common as the bald eagle, within the complex, but it uses Service habitats during a similar timeframe and in a similar fashion.

Long Lake NWR is a key stopover site for whooping cranes 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 (Beyersbergen et al. 2004). Since 2000, there have been at least eight confirmed observations (all during the fall) of whooping cranes using Long Lake NWR. Additionally, during recent years, whooping cranes have been documented on WPAs in the complex (e.g., Seventh Day Adventist, spring 2003). The complex biologist serves as the Service's key whooping crane contact for State observations. Additionally, complex staff follows guidelines presented in the Whooping Crane Contingency Plan (Service 2001) to minimize risks to whooping cranes that utilize lands within the complex's boundaries during the fall.

Although there has not been confirmed documentation of federally endangered gray wolves in Burleigh, Emmons, or Kidder counties in recent history, the complex staff does occasionally receive unconfirmed gray wolf reports from the public.

The Dakota skipper is a prairie-obligate butterfly that became a candidate for listing on the federal Endangered Species List in 2002. To date, this species has not been documented in Burleigh, Emmons, or Kidder counties, but there is potential for it to occur on Service lands in these locations. The complex staff classified the degree of Dakota skipper habitat potential that presently exists on Service lands within the complex, according to guidelines in a Service Conservation Strategy for Dakota skippers in North Dakota and South Dakota (Murphy 2005). It was determined that only a single fire-management unit on one tract of land (Schiermeister WPA) presently has habitat characteristics (i.e., size, vegetative species composition) that indicate possible Dakota skipper occurrence. Upland habitat management of this WPA unit will follow guidelines presented in the Service Conservation Strategy (Murphy 2005).

The State does not have an official threatened and endangered species list. However, in 2004, the NDGF designated its 100 Species of Conservation Priority (birds, mammals, reptiles, amphibians, fish, freshwater mussels) as part of its Comprehensive Wildlife Conservation Strategy. The Species of Conservation Priority that are known to occur in the complex are listed in Appendix J.

Cultural Resources

Prehistoric Resources

On April 4, 2005, RMC Consultants, Inc. under contract with the Service completed a Cultural Resource Overview and Site Sensitivity Analysis for the complex in the south-central portion of the State. The goal of that overview was to provide a tool for the Service to assist in preparation of a CCP and EA with regards to management of cultural resources. The objective of the study was to characterize the distribution of known cultural resources in the study area, create a sensitivity model for prehistoric and historic archaeological site location in the study area, and develop recommendations for the management of cultural resources within the study area.

Four surveys have been carried out on Long Lake NWR in response to various small development projects. A cultural resources inventory of a township road in the refuge in 1981 resulted in the recording of a single prehistoric archaeological site (Peterson 1981). A cultural resources inventory of approximately six acres for a tour road in 1992 resulted in no cultural resources being recorded (Lewis 1992). Cultural resources inventories of four borrow areas and two peninsula cutoffs totaling 74 acres at Long Lake NWR in 2001 (Olson 2001) resulted in the recording of a prehistoric site lead (32KDX69) at Pintail Point. A subsequent inventory of approximately twenty-one acres for the proposed borrow area on Pintail Point recorded the lead as prehistoric archaeological site 32KD82 (Morrison 2001).

Six sites have been recorded in the WPAs lying within the Long Lake WMD during two inventories. Of the six sites recorded, five (32BL95, 32BL96, 32BL98, 32BL99, 32BL100) were recorded during a survey of the East Lost Lake WDA by the University of North Dakota in 1990 (Driscoll et al 1991). Three of the sites are prehistoric archaeological sites (32BL95, 32BL96, 32BL100). More information is needed on two of the sites (32BL95, 32BL100) before an evaluation of their

significance and management recommendations can be made. No further work is recommended on the third site (32BL96). The other two sites (32BL98, 32BL99) recorded during the inventory are historic archaeological sites at which no further work is recommended.

Five unique, Depression-era structures and a shelter have been documented and evaluated at Long Lake NWR (Speulda and Lewis 2003)

Analysis of the prehistoric and historic cultural resources within Long Lake WMD revealed a total of 407 recorded sites of which 197 were prehistoric sites and 221 were historic sites (the sum of the prehistoric and historic sites exceeds the overall site total by 11 because there are 11 sites that have both prehistoric archaeological and historical archaeological components). Two sites were located at Long Lake NWR.

Open archaeological sites are the most predominant prehistoric site type that has been recorded in both the Coteau Slope and the Missouri Coteau physiographic regions. Open camps are the second most numerous prehistoric site type followed by open lithic scatters. A few graves have been recorded in the Coteau Slope but none have been recorded in the Missouri Coteau.

Farmsteads are the most numerous historic site type on the Coteau Slope followed by cemeteries and transportation sites. The site data is heavily skewed towards sites located along the Missouri River and thus within the Coteau Slope physiographic region. In Long Lake WMD, 376 sites have been recorded in the Coteau Slope physiographic region compared to only 33 sites recorded in the Missouri Coteau.

Based on the site sensitivity analysis conducted by RMC Consultants Inc., inventories for refuges are prioritized below:

1. Canfield Lake NWR and Long Lake NWR
2. Lake George NWR
3. Florence Lake NWR
4. Slade NWR

The priority order for conducting tract inventories in the wetland management district are prioritized below:

1. Kurtz WPA
2. Wahl WPA
3. Braun WPA

Other waterfowl production areas (and one WDA) should be inventoried in order of their average site sensitivity as appears in figure 44 of the April 4, 2005, Cultural Resource Overview and Site Sensitivity Analysis, which lists each tract in order of priority.

All known sites within waterfowl production areas (and one WDA) should be documented and evaluated for eligibility to the National Register of Historic Places. Six sites have been recorded within Long Lake WMD. All but two have been evaluated as not eligible. Those two sites are on East Lost Lake WDA and both sites are prehistoric and archaeological sites. It is recommended that these sites be evaluated through a program of test excavations.

Special Management Areas

Long Lake NWR has been designated as a WHSRN site of regional significance because of its importance to shorebirds. It has also been designated as a GIBA by the American Bird Conservancy.

A number of colonial-nesting waterbird colonies are distributed throughout the complex. These areas are important for recruitment for the following migratory bird species:

- Black-crowned night-heron
- Black tern
- California gull
- Cattle egret
- Clark's grebe
- Common tern
- Double-crested cormorant
- Eared grebe
- Forster's tern
- Franklin's gull
- Red-necked grebe
- Snowy egret
- Western grebe
- White-faced ibis

Eleven tracts of land within the complex have been designated as critical habitat for piping plovers. Five unique Depression-era structures and a shelter have been documented on Long Lake NWR.

Visitor Services

The Improvement Act emphasizes the importance of compatible wildlife-dependent recreation. The Act identifies these six priority public uses: hunting, fishing, wildlife observation, wildlife

photography, environmental education, and interpretation.

Hunting
Centuries ago, Long Lake was considered a prominent landmark to the Plains Indians and early European settlers who camped and hunted waterfowl and other game species along its shores. With bison extirpated from the landscape, and Long Lake under federal ownership, certain hunting restrictions now apply.

Because the principle purpose of the complex is to provide habitat for migratory birds, hunting waterfowl and other migratory birds is prohibited. A map showing areas open to hunting and regulatory text is available for Long Lake NWR.

Most of Long Lake NWR is open to upland bird (i.e., ring-necked pheasant, sharp-tailed grouse, gray partridge) hunting. To reduce hunting-group conflicts and migratory bird disturbance, this season does not open until late November. Long Lake NWR also offers archery, rifle, and muzzleloader deer hunting. Additionally, Slade NWR is only open to deer hunting and Florence Lake NWR is closed to all hunting.

All WPAs in the wetland management district are open to hunting for a variety of game, including migratory birds. Only federally approved non toxic shot is permitted on WPAs. All other State regulations apply on WPAs.

Fishing
Nationally, refuges receive approximately seven million angling visits annually. Long Lake NWR is one of the 270 refuges where anglers can enjoy their sport.

Fishing is permitted year-round on Long Lake NWR in designated areas. Fishing is only allowed on unit 1 of Long Lake and Long Lake Creek. Available species include northern pike, black bullhead, common carp, and occasionally walleye and yellow perch. Fishing is usually best at the mouth of the creek where it enters Long Lake. The lake itself is shallow and generally does not support gamefish, except when water flows into the lake at high levels. These high flows improve water quality and potentially allow fish to survive for several years. However, decreased water quality and winter killscan rapidly erase fish populations.

Canoes and small boats are restricted to Long Lake Creek. Boats may be used on the creek from May 1 through September 30 only. Shallow depths restrict motors to small outboards (maximum of 25 horsepower) and to electric motors. No boat ramps are available, limiting boat access to "lift in, lift out."

Currently, fishing facilities include an accessible dock, and accessible rest room, table, and informational kiosk, all located just south of the refuge headquarters on Long Lake Creek.

Fishing is prohibited on both Slade NWR and Florence Lake NWR. WPAs offer marginal fishing opportunities. Certain climatic conditions (i.e., periods of deluge) create periodic fish (e.g., yellow perch, northern pike) populations and therefore, public fishing opportunities on some WPAs. On WPAs there are no fishing facilities for anglers, and vehicle access is limited to designated trails.

State regulations apply to fishing on Long Lake NWR and WPAs.

Wildlife Observation and Photography
Long Lake NWR provides outstanding opportunities for viewing wildlife. It offers optimum viewing for waterfowl, marshbirds, and shorebirds from April through early June and from late August through October. Seasonal highlights include sharp-tailed grouse and western grebe courtship dancing in the spring shorebird migration in the spring and fall, daily movements of thousands of sandhill cranes each fall, and winter activities of various bird and mammal species. Many wildlife species can be observed from public roads on the refuge. The Butte Viewing Area offers a commanding view of the surrounding countryside. Public viewing blinds are available, by reservation in the spring to observe the sharp-tailed grouse on their leks. Bird watchers and photographers can also be authorized by the refuge manager to hike in and place temporary observation blinds within the refuge.

Environmental Education and Interpretation
Currently, a small visitor center is located in the administrative headquarters at Long Lake NWR. This visitor center includes two exhibits and a variety of informational pamphlets about the Service, the Refuge System, the complex, and other natural resources-related information. These pamphlets are available in the office entry foyer during and after business hours. There is a kiosk

located in front of the headquarters that contains information about prairie wetlands and wildlife species found throughout the complex. Refuge staff provides educational talks and tours for schools and other groups, upon request. The complex's environmental education and outreach program expands beyond the boundaries of the complex. The staff is involved in local, regional, and statewide programs.

Trapping

The complex staff developed a Predator Management Plan in 1993. This plan authorized predator control, performed by personnel and their authorized agents, outside the normal trapping season. It authorized public trapping on refuges administered under the complex, through issuance of SUPs to permittees for trapping during the State trapping season. Trapping targets predator management and infrastructure maintenance objectives.

Recreational trapping is available on all WPAs in the wetland management districts in accordance with State trapping regulations.

Fire and Grazing History

Historically, grasslands in the northern Great Plains coevolved with various disturbance regimes such as fire and large-mammal grazing. Whether lightning-induced or deliberately set by Native Americans, historical fires have influenced the composition of the plant communities on complex lands. A handful of fire-tolerant shrubs such as chokecherry, American plum, and leadplant were present, while other fire-sensitive woody species were restricted to areas that were protected from fire. The plant community was dominated by a number of grass and forb species.

It is believed that the historical wildfire frequency for the mixed-grass prairie was 5–7 years although little information is available on the occurrence of wildfire during the early years of the refuge. Potential exists for fairly large wildfires to occur; however, this has generally not been the case. Local fire departments and area ranchers aggressively suppress wildfire. It is also complex policy to control all wildfires occurring on Service lands.

The complex staff now uses prescribed fire to simulate the historical influence wildfire had on the plant communities. Wildfires help manage invading cool-season grasses, open up shorelines, and provide areas of attractive green browse for migrant waterfowl.

Most prescribed fires occur in the spring through early summer period or in early fall to allow for some vegetative recovery before winter. These times of year present opportunities to complete prescribed burns necessary to manage invading cool-season grasses and to open up shorelines and provide areas of attractive green browse areas for migrant waterfowl. Historically, wildfires likely would also have occurred during the summer and fall. During the last 15 years, however, prescribed fire has been increasingly used, and refuge staff now completes 10–20 prescribed burns each year covering 1,500 to 3,000 acres.

Grazing also greatly influences the structure and composition of grassland communities. Herbivores such as bison, elk, deer, pronghorn, and black-tailed prairie dog interact with soils, plants, other animals, and other processes to produce unique successional patterns in the northern Great Plains landscape at multiple scales.

Most plant species have growing points located at or near the ground surface, which allows the plant to be clipped off without killing it. Some contain bitter or toxic substances that cause animals to avoid grazing on them. Some species have spines to cause injury to grazing animal's mouths. Small mammals and deer presently graze on plants in the complex; however, it is believed that the historic impact from large grazing mammals (e.g., bison) was significant.

It is likely that herds of bison historically spent a considerable amount of time grazing native mixed-grass prairie found throughout the complex. Their grazing, trampling, trailing, and related activities likely had a significant impact on the development and maintenance of certain plant communities.

Free-ranging bison and elk are no longer present within the complex. Instead, staff works with local ranchers to mimic natural disturbances through livestock grazing. Grazing is generally conducted during the spring and early summer and again in the fall in upland habitats to stress exotic cool-season grasses and favor native grasses and forbs. Specific timing of grazing is also used to stress invading noxious weeds and is prescribed seasonally during periods when specific plants are most palatable to livestock.

Wetland grazing reduces accumulations of organic litter at the surface. A large amount of organic litter often favors invasive species such as Canada thistle. Grazing can also be used as part of an IPM program. The complex staff has determined that cattle will actively graze Canada thistle early in the growing season. Follow-up treatments also tend to be easier to complete and are more effective after grazing. Combination prescribed burning and grazing is a practice used to reduce the accumulation of organic litter. A fire creates a "flush" growth of new vegetation, which is grazed to extend treatment of problem plants such as Kentucky bluegrass and smooth brome. Noxious weeds including Canada thistle, absinth wormwood, and leafy spurge can be managed in a similar fashion. To date, this management strategy has been employed occasionally; however, the application shows promise for more frequent use in the future.

Socioeconomics

Socioeconomics

North Dakota is an important agricultural state, especially as a producer of wheat, much of which finds its way onto the world market. Many segments of the economy are affected by agriculture; for example, a substantial wholesale trade is involved in moving grain and livestock to market. Farm numbers have continued to decline since the 1980s, posing a threat to the vitality of the State's rural lifestyle. Since 1970, 43 of the State's 53 counties have lost population, and for 23 of these the population decline accelerated in the 1990s. The exodus has been aggravated by prolonged drought conditions, which in 2002 helped reduce wheat production (representing a quarter of the State's total agricultural revenues) by 24 percent and disrupted cattle production. It was slightly affected by the national recession and slowdown of 2001 and 2002. By December 2002, State unemployment which had risen to 3.6 percent in October had fallen back to 3.0 percent.

Growth industries include petroleum and the mining of coal, chiefly lignite; It has more coal resources than any other state. Manufacturing is concentrated largely on farm products and machinery.

Its gross state product in 2001 was $19 billion, smallest among the 50 states, to which general services contributed $3.7 billion; trade, $3.5 billion; government, $3 billion; financial services, $2.8 billion; transportation and public utilities, $1.9 billion, and construction, $896 million. The public sector in 2001 constituted 15.7 percent of gross state product, the ninth-highest among the states.

The State's farm marketing totaled $2.98 billion in 2001. Typically, it is the number one producer of hard spring wheat, durum wheat, sunflowers, barley, oats, flax, all dry, edible beans, and pinto beans. In 2002, the State led the Nation in spring wheat, durum wheat, barley, dry edible beans, sunflowers, and was second in the nation in overall wheat production.

The total number of farms has declined over the years as the average size of farming operations has increased. In 2002, the State had approximately 30,000 farms and ranches occupying 39.4 million acres (16 million hectares) and producing 216.6 million bushels of wheat, 57.0 million bushels of barley, 1.71 billion pounds of sunflowers, 12.7 million bushels of oats, 10.6 hundredweight of dry edible beans, 114.4 million bushels of corn, 4.8 million tons of sugar beets, and 23.5 million hundredweight of potatoes. The average farm was 1,313 acres (531 hectares) in size.

The State's farms and ranches had an estimated 1.9 million cattle and calves, valued at $1.58 billion in 2003. During 2002, there were around 154,000 hogs and pigs, worth $11.4 million. Its farmers produced nearly 9.1 million pounds (4.1 million kilograms) of sheep and lambs, which brought in $5.8 million in gross income in 2001, and nearly 42 million pounds (19.1 million kilograms) of turkey were produced in that same year.

The value of nonfuel minerals produced in the State in 2001 was estimated at about $39 million, up about 12 percent from 2000. Construction sand and gravel accounted for more than 70 percent of the value ($27.6 million) of the State's nonfuel mineral output, from a production of 10.6 million metric tons. Recovered elemental sulfur is the second most important mineral produced in the State, in terms of value. Sulfur and other byproducts such as krypton, xenon, anhydrous ammonia, and liquid nitrogen are recovered during natural gas processing at five plants in the western part of the State. Lapidary and collectible materials such as petrified wood, agates, jasper, and flint are also found in the State.

In 1997, the State had 1,963 wholesale establishments, with sales of $9.5 billion. The

leading wholesale lines by sales volume were farm-product raw materials, machinery, equipment, and supplies (especially farm machinery), groceries and related products, and petroleum and petroleum products. The State's 4,810 retail establishments recorded $6.4 billion in sales during 1997. Exports of State origin totaled $750 million in 1998, ranked 45th of all states.

By number of employees, the leading manufacturing industries in the State in 1997 were food and food products; industrial machinery and equipment; printing and publishing; electronic and other electric equipment; transportation equipment; and fabricated metal products. Value of shipments of manufactures in 1997 were estimated at over $5.2 billion, exhibiting the 9th fastest growth in shipments between 1992 and 1997. Earnings of persons employed in the State increased from $9.1 billion in 1997 to $10.2 in 1998, an increase of 11.5 percent. The largest industries in 1998 were services, 26.2 percent of earnings; State and local government, 12.4 percent; and retail trade, 10.5 percent. Of the industries that accounted for at least 5 percent of earnings in 1998, the slowest growing from 1997 to 1998 was construction (6.9 percent of earnings in 1998), which increased 1.9 percent; the fastest was durable goods manufacturing (5.1 percent of earnings in 1998), which increased 11.9 percent.

According to Bureau of Labor Statistics (BLS) provisional estimates, in July 2003 the seasonally adjusted civilian labor force in the State numbered 350,500, with approximately 12,600 workers unemployed, yielding an unemployment rate of 3.6 percent, compared to the national average of 6.2 percent for the same period. Since the beginning of the BLS data series in 1978, the highest unemployment rate recorded was 6.7 percent in May 1986. The historical low was 2.3 percent in October 1997. In 2001, an estimated 4.7 percent of the labor force was employed in construction; 7.3 percent in manufacturing; 5.2 percent in transportation, communications, and public utilities; 20.3 percent in trade; 4.7 percent in finance, insurance, and real estate; 23.6 percent in services; 17.9 percent in government; and 8.5 percent in agriculture.

The U.S. Department of Labor reported that in 2002, 24,000 of the State's 291,000 employed wage and salary workers were members of unions. This represented 8.1 percent of those so employed, up from 7.5 percent in 2001 but down from 9.1 percent in 1998. The national average is 13.2 percent. In all, 28,000 workers (9.8 percent) were represented by unions. In addition to union members, this category includes workers who report no union affiliation but whose jobs are covered by a union contract. The State is one of 22 states with a right-to-work law. (www.city-state.com)

Refer to tables 3, 4 and 5 at the end of this chapter for more detailed information on population, demographics, employment, and income in the State and the counties outlying the refuge complex.

Air Quality

The National Ambient Air Quality Standards include maximum allowable pollution levels for particulate matter, ozone, sulfur dioxide, nitrogen dioxide, lead, and carbon dioxide. Particulate matter is a measure of microscopic liquid or solid particles in the air that is respirable in the lungs.

Air quality in the area of the complex is considered good, with no nearby manufacturing sites or major air pollution sources. Carbon from automobiles and diesel engines; prescribed fire activities throughout the complex, and dust associated with wind-blown sand and dirt from the roadways and fields contribute to particulate matter.

Table 3. Population*

	Population in 2000	*Estimated Population in 2004*	*Change in Population 2000–2004 (%)*	*Native American Population in 2000 (%)*	*African American Population in 2000 (%)*	*White Population in 2000 (%)*	*Hispanics or Latinos in 2000 (%)*	*All Other Races Combined in 2000 (%)*
United States	281,421,906	293,665,404	+4.3	0.9	12.3	75.1	12.5	9.2
North Dakota	642,200	634,366	-1.2	4.9	0.6	92.4	1.2	1.0
Burleigh County	69,416	72,585	+4.6	3.3	0.3	95.0	0.7	0.6
Emmons County	4,331	3,913	-9.7	0.1	data not available	99.1	1.2	0.7
Kidder County	2,753	2,563	-6.9	0.1	0.2	99.5	0.6	0.1

*The total percentage for the population based on racial backgrounds may appear to be more or less than 100 percent. This is due to the fact that Hispanics/Latinos may fall under different categories because their self-identity may be based on language and heritage rather than race or color alone.

Table 4. Demographics and Income

	Land Area (square miles)	*Persons per Square Mile in 2000*	*Households in 2000*	*Home Ownership Rate in 2000 (%)*	*Median Value of Owner-Occupied Housing in 2000 ($)*	*Median Household Income in 1999 ($)*	*Per Capita Money Income in 1999 ($)*	*Persons Below Poverty Line in 1999 (%)*
United States	3,537,438	79.6	105,480,101	66.2	119,600	41,994	21,587	12.4
North Dakota	68,976	9.3	257,152	66.6	74,400	34,604	17,769	11.9
Burleigh County	1,633	42.5	27,670	68.0	98,900	41,309	20,436	7.8
Emmons County	1,510	2.9	1,786	83.4	37,000	26,119	14,604	20.1
Kidder County	1,351	2.0	1,158	81.7	33,400	25,389	14,270	19.8

Table 5. Income and Employment*

County	*Per Capital Personal Income (PCPI)*	*Total Personal Income (TPI)*	*Components of Total Personal Income (TPI)*	*Earnings by Place of Work*
Burleigh County	In 2004 PCPI was $32,729. This PCPI ranked 4th in the State and was 111% of the State average ($29,494) and 99% of the national average ($33,050). The 2004 PCPI reflected an increase of 6.0% from 2003. The 2003–2004 State change was 2.3% and the national change was 5.0%. In 1994 the PCPI was $20,593 and ranked 8th in the State. The 1994–2004 average annual growth rate of PCPI was 4.7%. The average annual growth rate for the State was 4.5% and for the nation was 4.1%.	In 2004 TPI was $2,374,950. This TPI ranked 2nd in the State and accounted for 12.7% of the State total. In 1994 the TPI was $1,331,097 and ranked 3rd in the State. The 2004 TPI reflected an increase of 7.2% from 2003. The 2003–2004 State change was 2.8% and the national change was 6.0%. The 1994–2004 average annual growth rate of TPI was 6.0%. The average annual growth rate for the State was 4.4% and for the nation was 5.2%.	In 2004 net earnings accounted for 71.2% of TPI (compared with 69.5 in 1994); dividends, interest, and rent were 15.7% (compared with 17.7 in 1994); and personal current transfer receipts were 13.1% (compared with 12.9 in 1994). From 2003–2004 net earnings increased 8.1%; dividends, interest, and rent increased 4.0%; and personal current transfer receipts increased 6.5%. From 1994–2004 net earnings increased on average 6.2% each year; dividends, interest, and rent increased on average 4.7%; and personal current transfer receipts increased on average 6.1%.	Earnings of persons employed in Burleigh increased from $1,884,445 in 2003 to $2,047,484 in 2004, an increase of 8.7%. The 2003–2004 State change was 3.1% and the national change was 6.3%. The average annual growth rate from the 1994 estimate of $1,110,565 to the 2004 estimate was 6.3%. The average annual growth rate for the state was 4.7% and for the nation was 5.5%.
Emmons County	In 2004 PCPI was $24,175. This PCPI ranked 41st in the State and was 82% of the State average, $29,494, and 73% of the national average, $33,050. The 2004 PCPI reflected an increase of 0.5% from 2003. The 2003–2004 State change was 2.3% and the national change was 5.0%. In 1994 the PCPI of Emmons was $14,450 and ranked 47th in the State. The 1994–2004 average annual growth rate of PCPI was 5.3%. The average annual growth rate for the State was 4.5% and for the nation was 4.1%.	In 2004 TPI was $95,006. This TPI ranked 31st in the State and accounted for 0.5% of the State total. In 1994 the TPI of Emmons was $66,224 and ranked 33rd in the State. The 2004 TPI reflected a decrease of 1.6% from 2003. The 2003–2004 State change was 2.8% and the national change was 6.0%. The 1994–2004 average annual growth rate of TPI was 3.7%. The average annual growth rate for the State was 4.4% and for the nation was 5.2%.	In 2004 net earnings accounted for 50.3% of TPI (compared with 53.1% in 1994); dividends, interest, and rent were 26.1% (compared with 24.2% in 1994); and personal current transfer receipts were 23.6% (compared with 22.6 in 1994). From 2003–2004 net earnings decreased 5.6%; dividends, interest, and rent increased 1.0%; and personal current transfer receipts increased 4.9%. From 1994–2004 net earnings increased on average 3.1% each year; dividends, interest, and rent increased on average 4.4%; and personal current transfer receipts increased on average 4.1%.	Earnings of persons employed in Emmons decreased from $55,200 in 2003 to $52,837 in 2004, a decrease of 4.3%. The 2003–2004 State change was 3.1% and the national change was 6.3%. The average annual growth rate from the 1994 estimate of $38,479 to the 2004 estimate was 3.2%. The average annual growth rate for the State was 4.7% and for the nation was 5.5%.

Table 5. Income and Employment*

County	*Per Capital Personal Income (PCPI)*	*Total Personal Income (TPI)*	*Components of Total Personal Income (TPI)*	*Earnings by Place of Work*
Kidder County	In 2004 PCPI was $26,186. This PCPI ranked 31st in the State and was 89% of the State average, $29,494, and 79% of the national average, $33,050. The 2004 PCPI reflected an increase of 6.4% from 2003. The 2003 TPI includes net earnings by place of residence; dividends, interest, and rent; and personal current transfer receipts received by the residents of Kidder. 2004 State change was 2.3% and the national change was 5.0%. In 1994 the PCPI of Kidder was $14,697 and ranked 45th in the State. The 1994-2004 average annual growth rate of PCPI was 5.9%. The average annual growth rate for the state was 4.5% and for the nation was 4.1%.	In 2004 TPI was $67,035. This TPI ranked 39th in the State and accounted for 0.4% of the State total. In 1994 the TPI was $45,383 and ranked 45th in the State. The 2004 TPI reflected an increase of 5.0% from 2003. The 2003–2004 State change was 2.8% and the national change was 6.0%. The 1994–2004 average annual growth rate of TPI was 4.0%. The average annual growth rate for the State was 4.4% and for the nation was 5.2%.	In 2004 net earnings accounted for 58.1% of TPI (compared with 52.7% in 1994); dividends, interest, and rent were 19.9% (compared with 24.4% in 1994); and personal current transfer receipts were 22.1% (compared with 23.0% in 1994). From 2003–2004 net earnings increased 7.0%; dividends, interest, and rent increased 1.0%; and personal current transfer receipts increased 3.5%. From 1994–2004 net earnings increased on average 5.0% each year; dividends, interest, and rent increased on average 1.9%; and personal current transfer receipts increased on average 3.6%.	Earnings of persons employed in Kidder increased from $35,611 in 2003 to $38,107 in 2004, an increase of 7.0%. The 2003–2004 State change was 3.1% and the national change was 6.3%. The average annual growth rate from the 1994 estimate of $24,373 to the 2004 estimate was 4.6%. The average annual growth rate for the State was 4.7% and for the nation was 5.5%.

*All income estimates, with the exception of PCPI, are in thousands of dollars, not adjusted for inflation. Total personal income includes net earnings by place of residence; dividends, interest, and rent; and personal current transfer receipts received by the residents of that county.

U.S. Fish & Wildlife Service

Long Lake National Wildlife Refuge

Burleigh & Kidder Counties, North Dakota

Habitat 2003

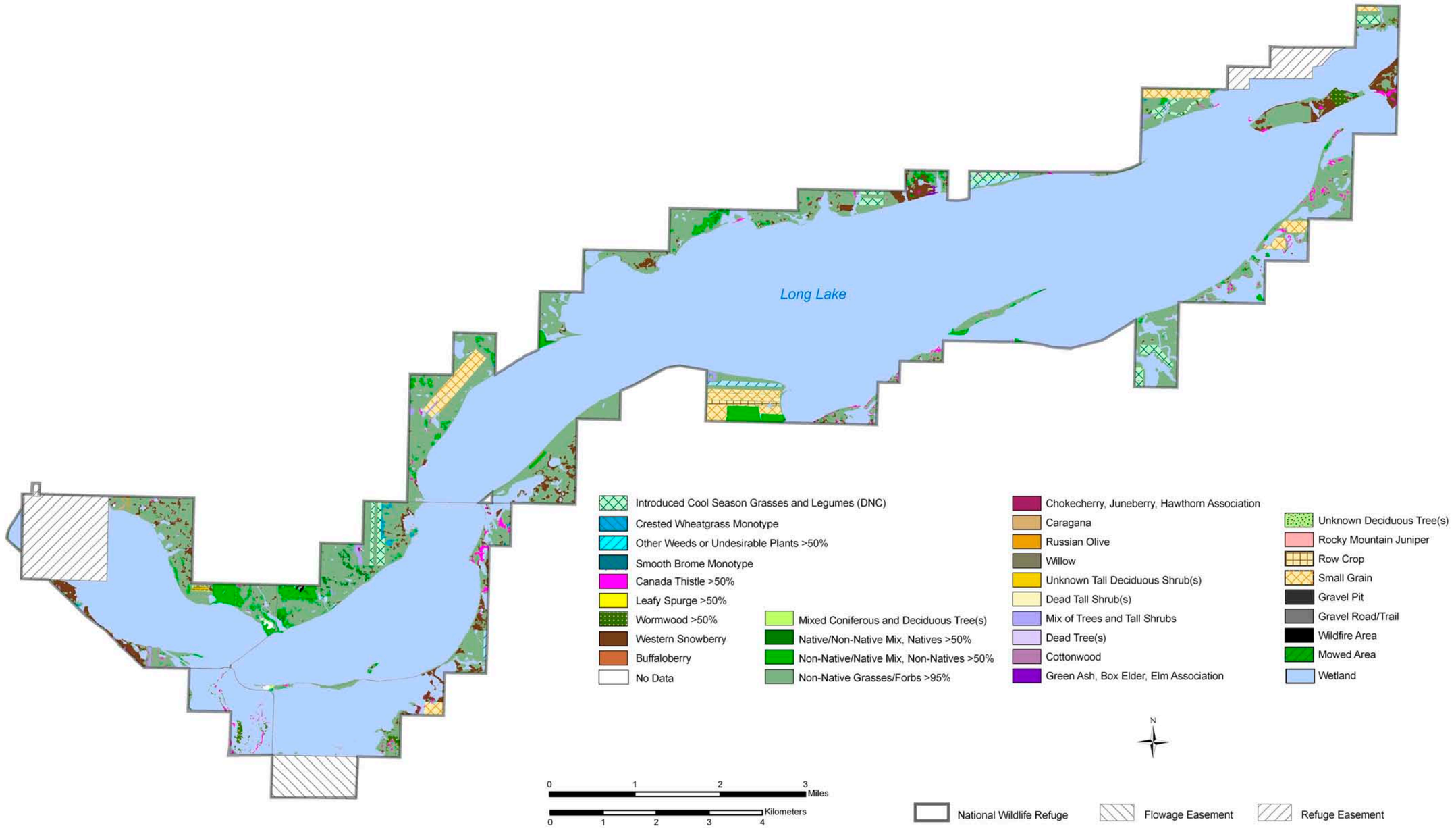

Figure 11: Long Lake National Wildlife Refuge Habitat (2003)

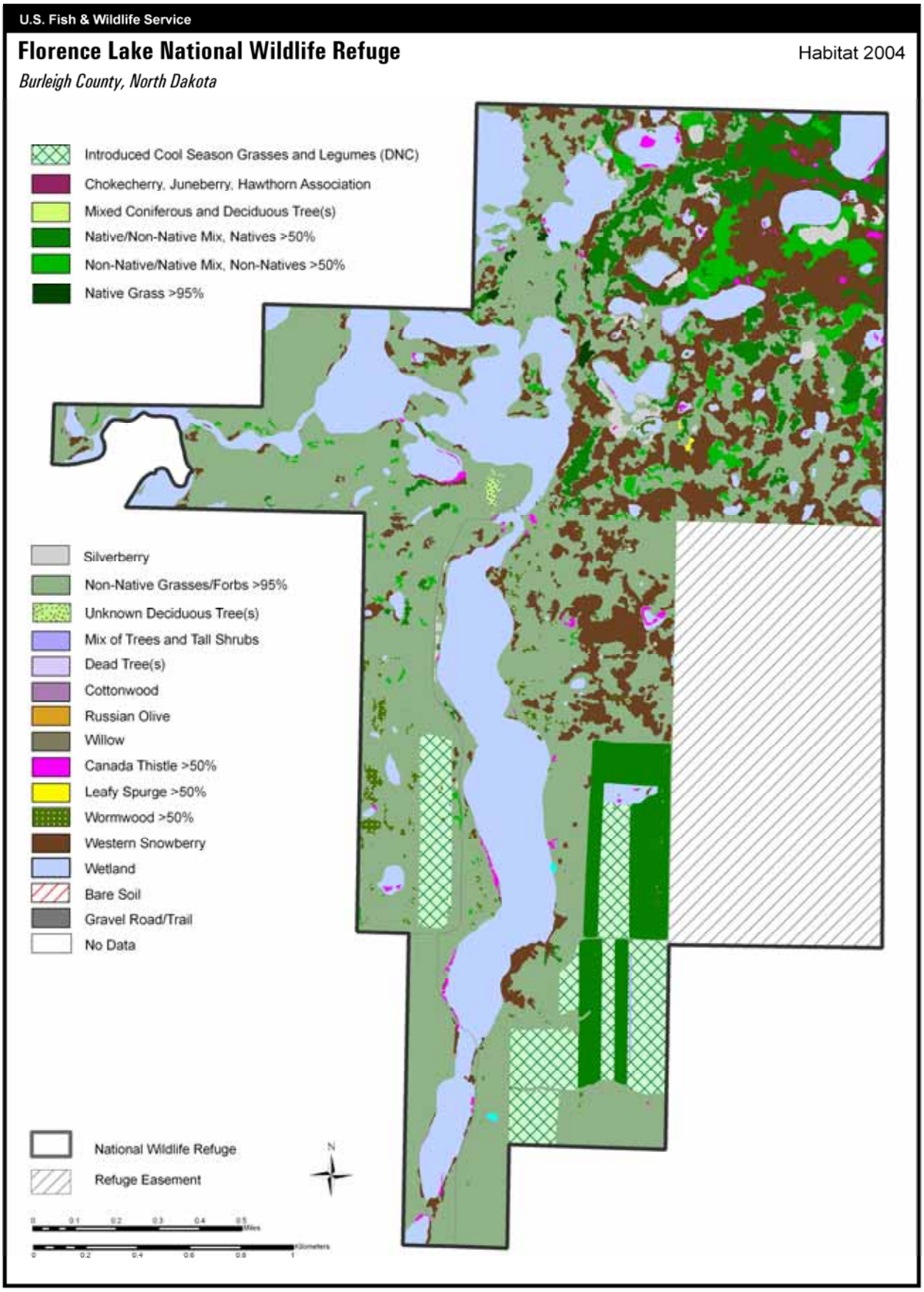

Figure 12: Florence Lake National Wildlife Refuge Habitat

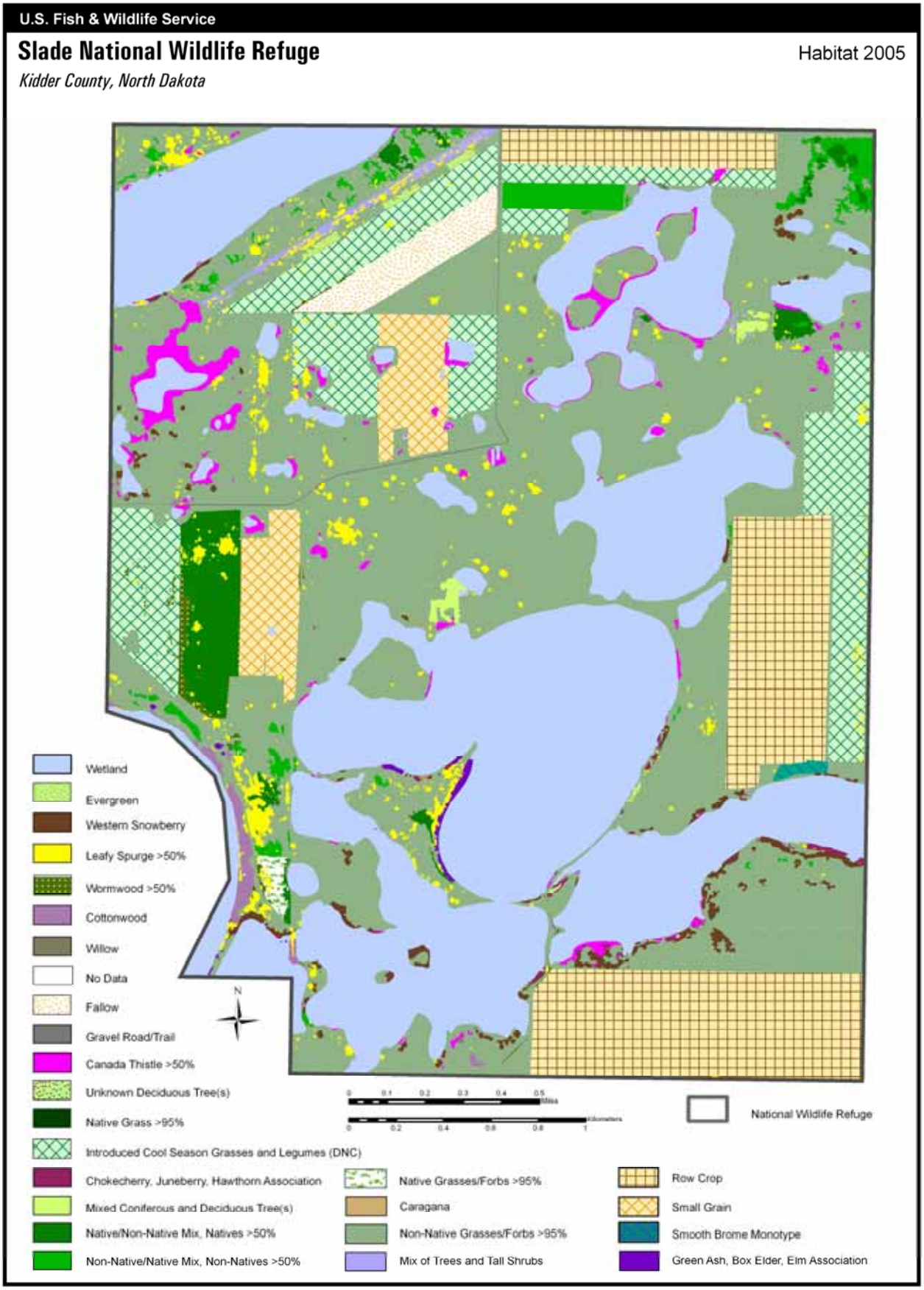

Figure 13: Slade National Wildlife Refuge Habitat

Chapter 5. Environmental Consequences

This chapter discusses environmental consequences, which may result from carrying out the actions of each of the four alternatives. For a better understanding of why these effects may occur, refer to chapters 3 and 4. A description of resource conditions and interactions can be found in Chapter 4: Affected Environment. Chapter 3 (Alternatives) presents management objectives and strategies for each alternative, which could create the consequences described here.

This chapter discusses the effects of each alternative. The issues addressed were identified during the public scoping process as primary areas of concern to the public. For a more comprehensive list of impacts to each resource see tables 6.1-6.6 at the end of this chapter.

Effects Common to all Alternatives

All alternatives would have the same impacts related to air quality, environmental justice, and socioeconomics, as described below.

Air Quality

No adverse effects on air quality are expected. Short-term effects on air quality from prescribed burning on the refuge should not vary significantly among any of the alternatives.

Environmental Justice

None of the alternatives considered would pose adverse environmental effects on minority or low-income populations. There is no fee to enter the refuges; they are open to everyone.

Socioeconomic Impacts

Economic impacts are typically measured in terms of numbers of jobs lost or gained and the associated result on income. None of the alternatives would significantly impact the economics of the local area.

Summary of Effects by Alternative

The following section and tables provide an analysis of effects resulting from the four alternatives.

ALTERNATIVE A—No Action

Wildlife and Habitat Management

Developed Wetlands

Continuing the current water management regime would reduce the potential for a botulism outbreak and dramatically lessen the severity of one, if it occurred. While other resource benefits may occur as a result of this management, they are not the primary target of water management planning and annual operations.

In the smaller Long Lake NWR impoundments, which are independent of Long Lake proper, the Service anticipates a positive impact on one or more of the following: waterfowl production, shorebird migration, waterfowl and sandhill crane migration, and production of wetland plant and animal foods.

Impoundments in the wetland management districts would continue to be managed in drawdown to simulate natural cycles of wetlands, and would therefore maintain high levels of productivity.

Wetlands without Water Control Structures

Since these wetlands are dependent on climactic conditions (i.e., periods of drought and deluge) it is not possible to tell what impacts would occur.

The Service's management of these wetlands will continue to consists of 1) maintaining perennial grass cover around their perimeters to minimize negative anthropogenic impacts (i.e., sedimentation); 2) allowing prescribed fire and permit grazing to consume wetland vegetation for the purpose of either nutrient recycling or noxious weed control, and; 3) actively managing noxious weed infestations (e.g., Canada thistle) in dry wetland basins or wetland edge areas.

Native Upland Habitats (including woody species)

As a result of this alternative the refuge would see a decrease in the number of invasive native and nonnative plants (including exotic plants) and shrubs and an increase in the growth of native plant species.

This effort would affect approximately 2,500 acres per year, altogether.

Disturbed Upland Habitats
Converting disturbed upland habitat to a cleaner, more natural habitat would increase the ability of migratory birds to use it as a nesting habitat

Nonnative Trees and Shrubs
The removal of volunteer trees and shrubs from grassland areas to retain the native, early-successional character of mixed-grass prairie would benefit grassland-dependent migratory birds (e.g., Baird's sparrow, marbled godwit, northern pintail). Additionally, the removal of select sentinel trees that serve as perches for various raptors (e.g., great horned owl, red-tailed hawk) would continue to have a positive impact on both migratory bird-nesting habitats and migratory concentration areas.

Predator Management
Maintaining the current level of predator management would allow the Service to continue targeting predators which harm wildlife, infrastructure and cause predation problems for adjacent landowners.

The Service's partnership with trappers does not have as great an impact on predators as is ideal because trappers are interested in predators only during periods when their fur is of value; however, this generally occurs in fall and winter when removal of predators is less effective in managing their populations than during the nesting season.

Wildlife Disease
Under this alternative, the Service's aggressive approach to monitoring and managing disease outbreaks, along with its water management agenda, would greatly lessen the possibility of disease outbreaks and dramatically lessen their severity, if they occur.

Public Use, Education, and Interpretation

Hunting
The hunting program on Service lands in the complex would continue to be valued as one of the six priority public uses and would provide hunters with ample opportunity to hunt without compromising Refuge System mission and goals.

Fishing
The fishing program on Service lands in the complex would continue to be valued as one of the six priority public uses and would provide fishermen/women with ample opportunity to fish without compromising Refuge System mission and goals.

Environmental Education and Interpretation
The environmental education and interpretation program on Service lands in the complex would continue to be valued as priority public uses and would provide visitors with ample opportunity to learn about the refuges.

Wildlife Observation and Photography
Wildlife observation and photography on Service lands in the complex would continue to be valued as priority public uses and will provide visitors with ample opportunity to learn about the refuges.

Trapping
This alternative would maintain the trapping program at its existing level and would, therefore, provide limited assistance to predator management.

Research and Monitoring

Wildlife and Habitat
By maintaining the current level of monitoring, inventory, and research, Service staff would continue to be able to use available information and sound science to make informed management decisions.

Socioeconomics
Under this alternative, research and monitoring of current socioeconomic conditions at the complex and in the communities surrounding the complex would continue to be negligible and would result in missed opportunities to educate the public on the purposes of the complex, the mission of the Refuge System, or to create new opportunities for partnerships, friends groups, and volunteers to the complex.

Cultural Resources
The Service would continue to place a high priority on documenting and protecting new cultural resources as they are found. Staff would also protect existing known resources from vandalism, theft, and destruction. Sites with historical significance would continue to be properly maintained and preserved.

Refuge Operations

Staffing
This alternative maintains staffing at existing levels (currently 8.8 FTEs). See table 1 for current staffing.

Operations and Maintenance
This alternative would continue with the current level of operations and maintenance, including the maintenance of equipment and vehicles in good working conditions to achieve management goals. Staff would continue to operate with available funding and resources.

Infrastructure
This alternative maintains infrastructure at current levels. For complete list of assets see table 1.

Partnerships
Existing partnerships allow complex staff to accomplish much more than they could in the absence of partnerships. Partnerships enable complex staff improved capabilities with respect to: 1) land acquisition; 2) research, monitoring, and inventory efforts; 3) outreach and public use activities, and; 4) habitat management activities.

ALTERNATIVE B—Natural Processes Management

Wildlife and Habitat Management

Developed Wetlands
The water management actions of alternative B would potentially result in a reduction in the degree that Long Lake's hydrology is altered; This, in turn, should increase the overall longevity of the system with regard strengthening its ability to provide suitable habitat for a variety of wetland-dependent wildlife and also improve other crucial wetland functions (e.g., groundwater recharge, nutrient cycling). Measurable changes to the system should be seen in decreased salinity, sedimentation, and dissolved solid accrual. A reduced ability to support fish would benefit Long Lake with respect to the reduction or elimination of turbidity problems caused by exotic roughfish (i.e., common carp).

There are also potential negative impacts to developed wetlands. The lower water levels and lack of management capability that will result from the removal of WCSs on Long Lake would decrease the Service's ability to manage botulism outbreaks. The removal of WCS on Long Lake NWR and throughout the wetland management district would also reduce the Service's creative ability to managing the habitat for specific bird groups (e.g., shorebirds), as well as result in reduced acreage of managed semi-permanent wetlands. Another result of this management would be a reduced flood attenuation ability of the system.

Performing these actions would not only require an initial funding increase, but also may also require the acquisition of outlet and discharge permits. It is expected that the frequency with which Long Lake experiences drought conditions would increase, due to the Service's lack of ability to impound water. Lack of water storage capabilities would also impact what is currently a marginal fishery at Long Lake. A reduced ability to support fish would benefit Long Lake with respect to the reduction or elimination of turbidity problems caused by exotic roughfish (i.e., common carp). Finally, the lower mean water levels on Long Lake would result in an earlier mean freeze-up date, effectively changing Long Lake's capacity as a stopover and/or staging area for fall migrating waterfowl.

In addition to paralleling the activities outlined in alternative A, this alternative will explore the option of removing nonwetland substrate (via dredging) from wetlands that the Service determines to be heavily impacted by sedimentation.

Wetlands without Water Control Structures
Through these actions there is potential to increase wetland productivity (i.e., invertebrate and plant diversity), as well as improve overall wetland function (e.g., groundwater recharge, nutrient cycling, flood attenuation). Ultimately, these actions would help reverse or stall a trend of degradation and promote long-term system sustainability. Because of the increased wetland productivity that is possible through the implementation of these actions, it would be possible to support a greater diversity of wetland-dependent wildlife. Increased funding would be necessary to complete the dredging activities outlined in this alternative.

Native Upland Habitats (including woody species)
There is potential to increase acreage of native grasses and forbs, which would result in a corresponding decrease in acreage of nonnative grasses and forbs. The coverage of invasive native low shrubs (i.e., western snowberry, silverberry) would also be limited. Once some degree of success

is achieved, it is likely that, through continued management, the degree of future invasion would be minimized. A corresponding positive vegetative response would result in an improved breeding habitat condition for most native grassland-dependent species in the south-central portion of the State. This would increase nest densities and nest success for bird species. Potential would exist for less favorable breeding habitat conditions for certain species (e.g., clay-colored sparrow, exotic bird species). Because this alternative lacks structural criteria (e.g., height-density) for certain wildlife species or groups, its objectives (species composition-based) would likely be more achievable. Increased funding would be necessary to cover restoration and maintenance costs.

Disturbed Upland Habitats
There is potential to convert areas that are presently dominated by nonnative grasses and forbs to a native grass and forb-dominated vegetative community. Crop fields and DNC fields would be phased out and eventually eliminated from uplands within the complex. Once some degree of success is achieved it is likely that, through continued management, the degree of future invasion would be minimized. Additionally, habitat fragmentation would be reduced, as well at overall acreage of noxious weed species (e.g., leafy spurge, Canada thistle, absinth wormwood). Accomplishment of the above actions with a corresponding positive vegetative response would result in an improved breeding habitat condition for most native grassland-dependent species in the south-central part of the State. This would increase nest success and nest densities for bird species. Potential would exist for less favorable breeding habitat condition for certain species. Because this alternative lacks structural criteria (e.g., height-density) for certain wildlife species or groups, its objectives (species composition-based) are likely more achievable.

Nonnative Trees and Shrubs
The reduction of nonnative trees and shrubs would lead to a reduced invasion of nonnative flora. Breeding habitat would be improved for grassland-dependent bird species, including improved recruitment and overall abundance. Additionally, this management would promote more balanced predator/prey relationships through reduced predation rates (due to less fragmented habitats) and less favorable year-round habitat for certain problematic nest predators (e.g., skunk, raccoon). Negative effects would include degraded habitat conditions for arboreal bird species (e.g., yellow warbler, black-billed cuckoo, willow flycatcher), as well as for the winter habitat of resident-bird species (e.g., ring-necked pheasant, sharp-tailed grouse). Elimination of nonnative tree and shrub plantings would also reduce the edge habitat favored by parasitic brown-headed cowbirds.

With regard to public use, these management activities could cause reduced hunting opportunities for deer and pheasants due to the loss of tree/shrub habitat. Therefore, any activities that involve the removal of trees (native or nonnative) are often controversial. Additionally, increased funding would be necessary to conduct these intensive management activities.

Predator Management
The actions in this alternative would promote improved breeding habitat conditions for grassland-nesting bird species (e.g., Baird's sparrow, northern pintail, marbled godwit), including improved recruitment and increased abundance. Trapping would result in a decreased in nest predators (e.g., skunks, red fox, raccoon), but could also result in artificially high populations of small mammals (e.g., shrew, vole) due to the removal of mid-sized predators. Removal of trees would result in less favorable habitat conditions for certain wildlife species (i.e., breeding arboreal birds, wintering deer and resident bird species). Increased funding would be necessary to conduct trapping and habitat restoration activities.

Wildlife Disease
The actions in this alternative could potentially cause an increased severity, longevity, and frequency of various disease outbreaks, resulting in reduced net recruitment and population size of various waterbird species (e.g., northern pintail, Wilson's phalarope, Franklin's gull). Lack of an active disease response could also send a negative message to the public (e.g., a passerby who notices concentrations of dead waterfowl in a Service-owned wetland along a roadway for an extended period of time). Conversely, lack of disease response would reduce time constraints on complex staff, as well as reduce annual funding needs.

Priority Population Issues
The above actions will potentially result in improved habitat and protection conditions for these priority wildlife species. The re-directed survey effort for piping plovers will help us locate

Service wetlands that were previously unknown to harbor breeding piping plovers, with a limited amount of effort. Piping plover habitat enhancement and nest protection efforts will potentially increase overall piping plover recruitment on lands in the complex. The enhanced protection efforts for fall migrant whooping cranes that utilize Service lands will reduce overall disturbance and the likelihood of accidental shootings. Initiation of systematic Dakota skipper surveys on priority lands in the complex, as well as an assessment of habitat conditions with respect to Dakota skipper habitat requirements will give us a better indication of whether this candidate species does occur on Service lands within the complex. The implementation of management guidelines will ensure that our upland management activities are not negatively affecting Dakota skippers on lands we determine to have suitable habitat.

Public Use, Education and Interpretation

Hunting
The actions in this alternative would potentially decrease hunting opportunities for certain species (e.g., white-tailed deer), and potentially increase hunting opportunities for other species (e.g., ring-necked pheasant, gray partridge, coyote). Possible liberalized season frameworks for certain species (e.g., ring-necked pheasants) might conflict with other hunting seasons (e.g., archery deer), as well as other wildlife management objectives (e.g., sanctuary for staging waterfowl). Implementation of a predator hunting season could potentially improve recruitment rates for waterfowl and other breeding bird species, depending on predator harvest levels. However, a predator hunting season, as well as other expanded hunting seasons would necessitate an increased law enforcement presence. Reduced trail access could impede hunters with limited mobility, but would also result in an improved hunt quality for many hunters due to restricted motor vehicle use.

Fishing
The elimination of boating would result in reduced disturbance to waterbirds and other wetland-dependent wildlife. However, it would also reduce the opportunity to participate in one of the six priority public-use activities.

Environmental Education and Interpretation
This alternative would result in an improved public understanding of the south-central portion of the State's natural history, wildlife biology, the history and qualities of complex lands, and the mission of the Refuge System. This alternative would also provide a more natural experience for visitors. It would limit the amount of habitat impact caused by public-use activities and subsequently would avoid most compatibility concerns associated with facility and/or program development.

Wildlife Observation and Photography
Same as alternative A.

Trapping
Same as alternative A.

Research and Monitoring

Wildlife and Habitat
The Service would improve its understanding of upland management (e.g., burning, grazing, haying) effects on vegetative composition and structure throughout complex. It would also understand better how wetland management activities on Long Lake NWR affect the system's hydrology, water chemistry, and overall productivity.

Additionally, because this alternative would increase the extent of land being monitored for upland vegetation change (i.e., permanent belt transect establishment), it would result in an improved understanding of wildlife response to the Service's management activities. This, in turn, would correspond to better management decisions that target specific wildlife objectives. The end result would be improved habitat throughout the complex and a better ability to maintain and improve recruitment of various wildlife populations. Additionally, the Service would gain a better understanding of how human disturbance affects various wildlife groups. This would give the Service the opportunity to adjust public-use activities for the benefit of targeted wildlife species.

Socioeconomics
The availability and analysis of data on public uses and their wildlife-dependent recreational expenditures would allow complex staff to estimate the impact of its actions on local, municipal, and State economies and thus be able to garner support for the Refuge System. Furthermore, the data analysis would allow the Service to tailor public uses and facilities to meet the public's needs and expectations. This in turn could result in increased public participation in the complex and support for the mission of the Refuge System.

Cultural Resources

The Service would improve its knowledge of the locations and types of cultural resources on complex lands. This improved knowledge would give the Service the ability to preserve and restore various cultural resources. This alternative has the potential to improve certain aspects of the complex's habitat management, because areas of cultural concern will be identified. Additionally, this alternative increases the likelihood for more involved management schemes to protect cultural resources while accomplishing habitat management. A funding increase would accompany the actions in this alternative, to complete the inventory and cover excavation costs.

Refuge Operations

Staffing

Increased staffing would give the Service the ability to accomplish the goals and objectives of this alternative's management plans.

Operations and Maintenance

The increased resources that are requested in this alternative would allow the Service to accomplish the goals and objectives of this alternative. Increased funding for staffing, equipment, and supplies would be necessary under this alternative.

Infrastructure

The additional infrastructure that is requested in this alternative would allow the Service to accomplish the goals and objectives associated with other elements (e.g., wildlife and habitat management, public use, education and interpretation, research and monitoring) of this alternative. Increased funding for the construction of new infrastructure and the purchase of equipment and supplies would be necessary to meet the goals of this alternative.

Partnerships

Expanded partnerships would increase the Service's ability to restore altered ecosystems and habitats. It would also result in improved relationships with a greater number of private landowners, government agencies, and nongovernmental organizations. However, the increased partner load would create increased time constraints on complex staff. Additionally, the potential exists to alienate partners who have other ideas or motives that do not parallel the goals and objectives of this alternative.

Increased funding will be necessary in order to complete the new programs associated with the additional partnerships.

ALTERNATIVE C—Single Wildlife Group-level Intensive Management

Wildlife and Habitat Management

Developed Wetlands

Increased water management capabilities on Long Lake will improve the Service's ability to prevent and manage botulism outbreaks. It would also improve its ability to provide ideal habitat for a particular wildlife group (e.g., waterfowl). This includes the use of drawdowns to increase wetland productivity on portions of Long Lake and managed wetlands throughout the wetland management district. Additionally, Long Lake's flood attenuation capabilities have the potential to be enhanced through these actions. Performing these actions would not only require a long-term funding increase, but could also require the acquisition of permits related to water discharge and/or construction. These actions would likely give the Service tremendous flexibility with regard to dealing with periods of drought at Long Lake. Similarly, the Service would have a great deal of flexibility in managing Long Lake's fishery, including associated turbidity problems. Finally, the increased ability to maintain high water levels on Long Lake would result in flexibility related to fall freeze-up date, depending on the wildlife group that is steering water management.

Conversely, where intensive wetland management (i.e., impoundments) continues, or is further developed at Long Lake NWR, the Service expects continued and possibly accelerated alteration of the hydrology of Long Lake, which raises concerns about system sustainability.

Wetlands without Water Control Structures

There is potential to increase wetland productivity (i.e., invertebrate and plant diversity) through various management actions (i.e., drawdowns, dredging). Because of the increased wetland productivity and increased management flexibility that is possible through the implementation of these actions, it would be possible to provide ideal habitat for a specific wildlife group (e.g., shorebirds).

On wetlands that are managed via WCSs, however, there is potential for altered hydrology, which may lead to a reduction in system sustainability, in the

form of increased sedimentation, conductivity, and dissolved solids accrual. Conversely, on those wetlands selected for dredging, the Service could see a reversed trend of degradation, and improved wetland function and sustainability.
Increased funding would be necessary for dredging activities, construction of WCSs and associated infrastructure, as well as annual operation and periodic maintenance.

Native Upland Habitats (including woody species)
The actions in this alternative would target improved breeding conditions for a specific wildlife group (e.g., grassland passerines). Through these actions there is potential to increase acreage of native grasses and forbs, which would result in a corresponding decrease in acreage of nonnative grasses and forbs. However, there is also potential to promote any productive habitat type if it benefits the target wildlife group. Therefore, if the target wildlife group's most suitable habitat consists of nonnative vegetation, little would be done to preserve native tracts. Potential exists for less favorable breeding-habitat condition for certain species that are not a part of the target wildlife group. Under this alternative, vegetative structure (i.e., height-density, litter depth) would be taken into consideration, in addition to species composition, when setting objectives for a particular wildlife group.

Increased funding would be necessary to cover the costs of intensive habitat management.

Disturbed Upland Habitats
This alternative's actions would target improved breeding conditions for a specific wildlife group (e.g., waterfowl). Through these actions there is potential to increase acreage of native grasses and forbs, or conversely increase the acreage of nonnative cover types (e.g., cropland, DNC) depending on the target-species group. Potential exists for less favorable breeding habitat conditions for certain species that are not a part of the target wildlife group. Consequences include possible increased fragmentation, noxious weed acreage, and invisibility of lands managed by the complex. Additionally, certain management practices may not maximize the land to its fullest wildlife potential. Under this alternative, vegetative structure (i.e., height-density, litter depth) would be taken into consideration, in addition to species composition, when setting objectives for a particular wildlife group. Increased funding would be necessary to cover restoration and maintenance costs.

Nonnative Trees and Shrubs
Habitat changes could occur in two completely different directions depending on the target wildlife group (e.g., waterfowl). If nonnative trees and shrubs are removed the amount of contiguous grassland habitat would be increased, and the reduction of nonnative microclimates would lead to less overall invasion of nonnative flora. Breeding habitat would be improved for grassland-dependent bird species, including improved recruitment and overall abundance. Habitat conditions for arboreal bird species (e.g., yellow warbler, black-billed cuckoo, willow flycatcher) would be degraded, as well as winter habitat for resident bird species (e.g., ring-necked pheasant, sharp-tailed grouse). Elimination of nonnative tree and shrub plantings would also reduce the edge habitat favored by parasitic brown-headed cowbirds. Additionally, this management would promote more balanced predator/prey relationships through reduced predation rates (due to less fragmented habitats) and less favorable year-round habitat for certain problematic nest predators (e.g., skunk, raccoon).

With regard to public use, these management activities could cause reduced hunting opportunities for deer and pheasants due to the loss of tree/shrub habitat. Therefore, any activities that involve the removal of trees (native or nonnative) are often controversial.

Additionally, increased funding would be necessary to conduct these intensive management activities.

Conversely, if the habitat needs of the focus wildlife group warrant that existing trees and shrubs are left intact and possible additions of more trees and shrubs would be beneficial, then an entirely different suite of habitat, wildlife, and public-use impacts would prevail. Through additional shrub plantings, suitable habitat areas would be increased for breeding arboreal birds, as well as several resident wildlife species (e.g., white-tailed deer, ring-necked pheasants) during the winter. Additional plantings of nonnative trees and shrubs would reduce the acreage of native flora, as well as increase the degree site fragmentation and invisibility adjacent to new plantings. Amount of edge habitat would be increased, promoting the occurrence of parasitic brown-headed cowbirds. Additionally, the number and overall acreage of microclimates suitable for problem nest predators

would be increased, further exacerbating the problem of high nest predation rates. Breeding habitat conditions would be degraded for several bird groups (e.g., grassland passerines, upland nesting shorebirds, waterfowl).

With regard to public use, these management activities provide additional hunting areas for deer and pheasants due to the increase of tree/shrub habitat. Conversely, the birding community would likely see a loss in bird species diversity and diminished birdwatching experience.

Additionally, increased funding would be necessary to conduct tree and shrub planting.

Predator Management
The actions in this alternative would promote improved breeding habitat conditions for a particular group of ground and over-water nesting birds, including improved recruitment and increased abundance. Trapping would result in a decreased abundance of nest predators (e.g., skunks, red fox, raccoon), but may also result in artificially high populations of small mammals (e.g., shrew, vole) due to the removal of mid-sized predators. Removal of trees would result in less favorable habitat conditions for certain wildlife species (i.e., breeding arboreal birds, wintering deer and resident bird species). Additionally, the "large-block" trapping component of this alternative would include partner (e.g., Delta Waterfowl Foundation) and private landowner involvement and would hold the potential for improved Service/private landowner relations throughout portions of the complex. Increased funding would be necessary to conduct "large-block" intensive trapping and habitat management activities.

Wildlife Disease
With respect to botulism, the actions in this alternative could potentially reduce the severity, longevity, and frequency of outbreaks, resulting in an increased net recruitment and population size of various waterbird species (e.g., northern pintail, Wilson's phalarope, Franklin's gull) as compared to the no- action alternative.

The complex staff's present disease response plan would be evaluated and, if necessary, improved. Increased funding to conduct research would initially be necessary, with the possibility of a long-term reduction in complex staff time and funding needs, depending on research results and management implications. Also, if research conclusions recommend a "no action" response to botulism outbreaks, a negative message might indirectly be sent to the public (e.g., a passerby who notices concentrations of dead waterfowl in a Service-owned wetland for an extended period of time). Research conclusions would also likely result in improved use of staff time and funding.

Priority Population Issues
Same as alternative B.

Public Use, Education, and Interpretation

Hunting
The expanded hunting opportunities would potentially conflict with other recreational uses (e.g., birdwatching, photography) and/or wildlife management objectives. Additionally, the increased vehicle access proposed in this alternative would potentially reduce the quality of the experience for other hunters. Certain complex visitors might feel that the presence of hunting structures (i.e., blinds, stands) detracts from the naturalness of complex lands. The expansion of hunting areas and season would require an increased law enforcement presence. Increased funding would be necessary to pay for the increase law enforcement, to conduct special hunting programs (e.g., physically challenged hunts), improve existing and/or develop new roads/trails and hunting structure construction.

Fishing
Increased boat traffic would lead to greater disturbance to waterbirds and other wetland-dependent wildlife. The increase in fishing activity throughout the complex would also result in potential habitat degradation (e.g., littering, injection of motor fuels into water) and a need for increased law enforcement. Stocking of fish would create potential competition for the invertebrate resource between stocked fish and waterbirds. Conversely, this alternative would result in an increased opportunity to participate in one of the six priority public uses. A substantial increase in funding would be necessary for construction of boat ramps and access routes, docks, interpretive signage and materials, and an increased law enforcement presence.

Environmental Education and Interpretation
The public would gain an improved understanding of this area's (south-central North Dakota) natural history, wildlife biology, the history and qualities of

complex lands, and the mission of the Refuge System. The Service would have the ability to host larger, more diverse groups of visitors due to new facilities. Wildlife observation opportunities would be improved at Long Lake NWR through an auto tour route, observation deck, and new and improved educational/interpretive materials. These changes would give the complex the potential to generate greater support for future complex and Refuge System programs.

Actions outlined in this alternative would increase the potential for conflicts and disturbance to wildlife, due to increased human activity and facilities at Long Lake NWR, Slade NWR, and Small WPA. Increased funding would be needed for facility and program development, as well as possible increased operations and staffing costs.

Wildlife Observation and Photography
The improved wildlife observation opportunities at Long Lake NWR would increase the potential for conflicts and disturbance to wildlife, due to increased human activity and facilities at Long Lake NWR. Increased funding would be needed for construction of new facilities, maintenance of these facilities, and possible staff increased necessary for maintenance of these facilities and operation of the increased wildlife viewing program at Long Lake NWR.

Trapping
Same as alternative A.

Research and Monitoring

Wildlife and Habitat
The complex staff will improve its understanding of upland management's (e.g., burning, grazing, haying) effects on vegetative composition and structure throughout the complex. They will also understand better how wetland management activities on Long Lake NWR affect the system's hydrology, water chemistry, and overall productivity.

Additionally, this alternative would increase the extent of land in the complex that is being monitored for upland vegetation change (i.e., permanent belt transect establishment). Ultimately, this alternative would result in an improved understanding of wildlife responses to management activities, would allow for better management decisions that target specific wildlife objectives. The result would be improved habitat throughout the complex and a better ability for staff to maintain and improve recruitment of various wildlife populations.

With this alternative increased funding would be necessary to support research costs and additional staff.

Socioeconomics
Same as alternative B.

Cultural Resources
The actions in this alternative would improve complex staff's knowledge of the locations and types of cultural resources on complex lands. This improved knowledge would give the Service the ability to preserve and restore various cultural resources. This alternative has the potential to improve certain aspects of the Service's habitat management because areas of cultural concern would be identified. Additionally, this alternative increases the likelihood for more involved management schemes to protect cultural resources while accomplishing habitat management. A funding increase would accompany the actions in this alternative, in order to complete the inventory and cover testy excavation costs.

Refuge Operations

Staffing
The increased staffing that is requested in this alternative would provide the Service with the ability to accomplish the goals and objectives associated with other elements (e.g., wildlife and habitat management, public use, education, and interpretation, research and monitoring) of this alternative. Increased operational and maintenance funding would be necessary under this alternative.

Operations and Maintenance
The increased resources that are requested in this alternative would provide the Service with the ability to accomplish the goals and objectives associated with other elements (e.g., wildlife and habitat management, public use, education, and interpretation, research and monitoring) of this alternative. Increased funding for staffing, equipment, supplies (e.g., fuel, native grass seed) would be necessary under this alternative.

Infrastructure
The additional infrastructure that is requested in this alternative would provide staff the ability to accomplish the goals and objectives associated with

other elements (e.g., wildlife and habitat management, public use, education, and interpretation, research and monitoring) of this alternative. Increased funding for the construction of new infrastructure, including equipment, supplies, and additional staff, would be necessary.

Partnerships

Expanded partnerships would increase the Service's ability to provide quality habitat for a specific wildlife group (e.g., shorebirds), improve public-use opportunities within the complex, and promote additional compatible activities. It would also result in improved relationships with a greater number of private landowners, government agencies, and nongovernmental organizations. However, the increased partner load would create increased time constraints on complex staff. Because of its single-wildlife species group focus, this alternative would potentially "split" partners, possibly alienating those who have other ideas or motives that do not parallel the goals and objectives of this alternative.

Conversely, the approach of this alternative holds increased potential to attract partners that are interested in a single wildlife group (e.g., Delta Waterfowl, Pheasants Forever). Increased funding would be necessary in order to complete the new programs associated with the additional partnerships. Furthermore, because of this alternative's strong public use interest, there is potential to involve the public in refuge operations through the utilization of a friends' group.

ALTERNATIVE D—Target Species Group-level Modified Management (Proposed Action)

Wildlife and Habitat Management

Developed Wetlands

Where intensive wetland management (i.e., WCSs) continues or is further developed at Long Lake NWR, the Service expects continued and possibly accelerated alteration of the hydrology of these wetlands, which raises issues about system sustainability. Conversely, where WCSs are removed, the Service expects some level of reduction in hydrologic alteration. Through increased development of our water management capabilities on Long Lake the Service expects to be able to better manage against botulism outbreaks, as well as have a better ability to provide ideal habitat for multiple wildlife groups (e.g., waterfowl, shorebird, colonial waterbirds). This includes the use of drawdowns to increase wetland productivity on portions of Long Lake and managed wetlands throughout the wetland management district. Additionally, Long Lake's flood attenuation capabilities have the potential to be enhanced through this alternative's actions. Performing the actions outlined in this alternative would not only require an long-term funding increase, but may also require the acquisition of permits related to water discharge and/or construction. The actions in this alternative would likely give complex staff tremendous flexibility with regard to dealing with periods of drought at Long Lake. Similarly, staff will have a great deal of flexibility in managing Long Lake's fishery, including associated turbidity problems. Finally, the increased ability to maintain high water levels on Long Lake would result in flexibility related to fall freeze-up date, depending on the wildlife group that is steering the Service's water management.

Wetlands without Water Control Structures

Where intensive wetland management (i.e., WCSs) continues or is further developed at Long Lake NWR, the Service expects continued and possibly accelerated alteration of the hydrology of these wetlands, which raises issues about system sustainability. Conversely, where WCSs are removed, the Service expects some level of reduction in hydrologic alteration. Through increased development water management capabilities on Long Lake, the Service expects to be able to better manage against botulism outbreaks, as well as have a better ability to provide ideal habitat for multiple wildlife groups (e.g., waterfowl, shorebird, colonial waterbirds). This includes the use of drawdowns to increase wetland productivity on portions of Long Lake and managed wetlands throughout the district. Additionally, Long Lake's flood attenuation capabilities have the potential to be enhanced through this alternative's actions. Performing the actions outlined in this alternative would not only require a long-term funding increase, but may also require the acquisition of permits related to water discharge and/or construction. The actions in this alternative would likely give complex staff tremendous flexibility with regard to dealing with periods of drought at Long Lake. Similarly, staff would have a great deal of flexibility in managing Long Lake's fishery, including associated turbidity problems. Finally, the increased ability to maintain high water levels on Long Lake would result in flexibility related to fall freeze-up date, depending on the wildlife group that is steering the Service's water management.

Through these actions, there is potential to increase wetland productivity (i.e., invertebrate and plant diversity) through various management actions (i.e., drawdowns, dredging). Because of the increased wetland productivity and increased management flexibility that is possible through the implementation of these actions, it would be possible to provide ideal habitat for multiple wildlife groups (e.g., shorebirds, wading birds, waterfowl). However, on wetlands that the Service selects to be managed via WCSs, there is potential for altered hydrology, which may lead to a reduction in system sustainability, in the form of increased sedimentation, conductivity, and dissolved solids accrual. Conversely, on those wetlands selected for dredging, the Service may see a reversed trend of degradation, and improved wetland function and sustainability. Increased funding would be necessary for dredging activities, construction of WCSs and associated infrastructure, as well as annual operation and periodic maintenance costs.

Native Upland Habitats (including woody species)
Through these actions there is potential to increase acreage of native grasses and forbs, which would result in a corresponding decrease in acreage of nonnative grasses and forbs. This alternative would also limit the coverage of invasive native low shrubs (i.e., western snowberry, silverberry). Once some degree of success is achieved regarding the above impacts, it is likely that, through continued management, the degree of future invasion would be minimized to a certain degree. Accomplishment of the above actions with a corresponding positive vegetative response would result in an improved breeding habitat condition for the wildlife groups represented by our selected indicator species. This relates ultimately to increased nest success and nest densities for these wildlife groups. Potential does exist for less favorable breeding habitat condition for certain species (e.g., clay-colored sparrow, exotic bird species). These actions would provide somewhat of a structural mosaic on the landscape.

Disturbed Upland Habitats
Through these actions there is potential to increase acreage of native grasses and forbs, which would result in a corresponding decrease in acreage of nonnative grasses and forbs. Once some degree of success is achieved regarding the above impacts, it is likely that, through continued management, the degree of future invasion would be minimized to a certain extent. Additionally, habitat fragmentation and noxious weed acreage would both be reduced. Accomplishment of the above actions with a corresponding positive vegetative response would result in an improved breeding habitat condition for wildlife groups represented by our selected indicator species. Ultimately, this relates to increased nest success and nest densities for the various bird groups. These actions would provide somewhat of a structural mosaic on the landscape and ultimately allow for more efficient management.

Nonnative Trees and Shrubs
Habitat changes incurred through the implementation of the actions outlined in this alternative could go in two completely different directions depending on the target wildlife group (e.g., waterfowl).

If nonnative trees and shrubs are removed the amount of contiguous grassland habitat would be increased, and the reduction of nonnative microclimates would lead to less overall invasion of nonnative flora. Breeding habitat would be improved for grassland-dependant bird species, including improved recruitment and overall abundance. Habitat conditions for arboreal bird species (e.g., yellow warbler, black-billed cuckoo, willow flycatcher) would be degraded, as well as winter habitat for resident bird species (e.g., ring-necked pheasant, sharp-tailed grouse). Elimination of nonnative tree and shrub plantings would also reduce the edge habitat favored by parasitic brown-headed cowbirds. Additionally, this management would promote more balanced predator/prey relationships through reduced predation rates (due to less fragmented habitats) and less favorable year-round habitat for certain problematic nest predators (e.g., skunk, raccoon).

With regard to public use, these management activities could cause reduced hunting opportunities for deer and pheasants due to the loss of tree/shrub habitat. Therefore, any activities that involve the removal of trees (native or nonnative) are often controversial. Additionally, increased funding would be necessary to conduct these intensive management activities.

Conversely, if the habitat needs of the focus wildlife group warrants that existing trees/shrubs are left intact and possible additions of more trees/shrubs would be beneficial, then an entirely different sweet of habitat, wildlife, and public use impacts would prevail, as compared to those listed above. Through

additional shrub plantings, suitable habitat areas would be increased for breeding arboreal birds, as well as several resident wildlife species (e.g., white-tailed deer, ring-necked pheasants) during the winter. Additional plantings of nonnative trees and shrubs would reduce the acreage of native flora, as well as increase the degree of site fragmentation and invisibility adjacent to new plantings. Amount of edge habitat would be increased, promoting the occurrence of parasitic brown-headed cowbirds. Additionally, the number and overall acreage of microclimates suitable for problem nest predators would be increased, further exacerbating the problem of high nest predation rates. Breeding habitat conditions would be degraded for several bird groups (e.g., grassland passerines, upland nesting shorebirds and waterfowl). With regard to public use, these management activities provide increased additional hunting areas for deer and pheasants due to the increase of tree/shrub habitat. Conversely, the birding community would likely see a loss in bird species diversity and diminished birdwatching experience. Additionally, increased funding would be necessary to conduct tree and shrub planting.

Predator Management
The actions in this alternative would promote improved breeding habitat conditions for a suite of indicator species that represent multiple groups of ground/overwater nesting birds, including improved recruitment and increased abundance. Trapping would result in a decreased abundance of nest predators (e.g., skunks, red fox, raccoon), but may also result in artificially high populations of small mammals (e.g., shrew, vole) due to the removal of mid-sized predators. Removal of trees would result in less favorable habitat conditions for certain wildlife species (i.e., breeding arboreal birds, wintering deer and resident bird species). Landscape fragmentation would be reduced through the replanting of grass cover in areas where trees were previously removed, as well as acquisition of additional lands. Additionally, the "large-block" trapping component of this alternative would include partner (e.g., Delta Waterfowl Foundation) and private landowner involvement and would hold the potential for improved Service/private landowner relations throughout portions of complex. Increased funding would be necessary to conduct "large-block" intensive trapping and habitat restoration activities.

Wildlife Disease
Same as alternative C.

Priority Population Issues
Same as alternative B.

Public Use, Education and Interpretation

Hunting
There is potential to increase recreational opportunities through new hunting areas and seasons. There is also potential, after critical evaluation, to adjust certain hunting season dates and open/closed areas on refuges. This would be done to alleviate unacceptable human disturbance levels to migratory waterfowl using refuges and/or redistribute hunters in high hunter-use areas. Additionally, local breeding-bird recruitment rates could potentially be improved depending on harvest levels during predator hunting seasons. However, increased law enforcement would need to accompany any increase in hunting opportunity. So, increased funds would be needed for increased law enforcement officer support, as well as improved signage and interpretive materials.

Fishing
Implementing this alternative would result in increased disturbance to waterbirds and other wetland-dependant wildlife due a potential increase in boat traffic. The increase in fishing activity throughout complex would also result in potential habitat degradation (e.g., littering, injection of motor fuels into water) and a need for increased law enforcement. The fishery resource inventory would provide us with an improved understanding of current fisheries on Service-owned lands within complex, as well as our ability to sustain them. This alternative would result in increased opportunity to participate in one of the six priority public use activities. A substantial increase in funding would be necessary for completion of the fishery inventory, construction of boat ramps and access routes, docks, interpretive signage and materials, and an increased law enforcement presence.

Environmental Education and Interpretation
Same as alternative C.

Wildlife Observation and Photography
Same as alternative C.

Trapping
Same as alternative A.

Research and Monitoring

Wildlife and Habitat
Same as alternative B.

Socioeconomics:
Same as alternatives B and C.

Cultural Resources
Same as alternative B.

Refuge Operations

Staffing
The increased staffing that is requested in this alternative would give complex staff the ability to accomplish the goals and objectives associated with other elements (e.g., wildlife and habitat management, public use, education, and interpretation, research and monitoring) of this alternative. Increased operational and maintenance funding would be necessary under this alternative.

Operations and Maintenance
The increased resources that are requested in this alternative would give complex staff the ability to accomplish the goals and objectives associated with other elements (e.g., wildlife and habitat management, public use, education, and interpretation, research and monitoring) of this alternative. Increased funding for staffing, equipment, supplies (e.g., fuel, native grass seed) would be necessary under this alternative.

Infrastructure
Same as alternative C

Partnerships
The expanded partnerships would increase the Service's ability to provide quality habitats for multiple wildlife groups and improve public-use opportunities. It would also result in improved relationships with a greater number of private landowners, government agencies, and nongovernmental organizations. Because of its multiple-wildlife group approach, this alternative holds potential to group partners with a wide variety of interests, leading to increased funds and an increased likelihood that the goals and objectives of this alternative are achieved.

CUMULATIVE IMPACTS

Cumulative impacts result from incremental effects of the proposed action when these are added to the actions of the past, present and future. These cumulative impacts can be the result of individually minor impacts, which can become significant when added over time.

The implementation of the proposed action (Alternative 4) would reduce the likelihood for cumulative impacts because of the incremental approach in which habitat and wildlife management and other programs would be carried out.

The new approach of the proposed action would emphasize a more ecologically-oriented, habitat-based management. This approach would alleviate some of the possible impacts that might have been caused by target-species management.

NEPA requires mitigation measures when the environmental analysis process detects possible significant impacts to habitat, wildlife, or the human environment.

All the activities proposed under alternative D are not expected, nor intended, to produce significant levels of environmental impacts that would require mitigation measures. Nevertheless, the CCP contains the following measures to preclude significant environmental impacts from occurring:

- Federally listed species will be protected from intentional or unintended impacts by having activities banned where these species occur.
- Hunting safety regulations will be closely coordinated with, and enforced by, personnel from the complex and NDGF personnel.
- All proposed activities will be regulated to lessen potential impacts to wildlife and plant species, especially during the sensitive reproductive cycles.
- Protocols will be established to help in determining goal achievement levels, possible unforeseen resource impacts, and adaptive management actions to ensure wildlife and habitat resources, as well as the human environment, are preserved.

The CCP can be revised and amended 5 years after implementation, using adaptive management techniques, to correct unforeseen impacts.

Table 6. Summary of impacts by alternatives on wildlife and habitat management

	Alternative A *(Current Management - no action)*	Alternative B (Natural Processes Management)	Alternative C (Single Wildlife Group-level Intensive Management)	Alternative D *(*Target Species Group-level Modified Management - *proposed action)*
Wetlands With Water Control Structures (WCS)				
Hydrology Impacts	The hydrology of Long Lake has been altered due to water impoundment by WCSs, resulting in increases in sedimentation, conductivity, and salinification, as well as in accrual of dissolved solids in the waters of the lake. This will continue to affect the long-term sustainability of the wetland system, yielding a gradual reduction in resource support capabilities.	Reduction in the degree that Long Lake's hydrology is altered. Driving force to address potential system sustain ability issues with assumption that natural hydrology over long term will provide appropriate habitats in natural condition.	Further alteration of hydrology combined with potential to address current hydrological issues. Driving force to target habitat needs of specific species or narrow group of birds within a classification (i.e. waterfowl, shorebirds, or marsh birds).	Further alteration of hydrology combined with potential to address current hydrological issues. Driving force to target habitat needs of a guild of species representing a broad spectrum native to the area (i.e. pintail, sharp-tailed sparrow, Wilson's phalarope, sharp-tailed grouse, and ferruginous hawk).
Botulism Impacts	General ability to manage most of the time.	Potential decreased ability to manage.	Potential increased ability to manage.	Increased ability to manage.
Wildlife Output	Outputs undermined by management to address botulism driven water management practices.	Outputs undermined by management to address potential system sustain ability issues.	Increased capability to provide ideal habitats for specific bird specie(s) or birds within a narrow group (i.e. waterfowl, etc.).	Increased capability to provide habitats which provide the needs of multiple groups or guild(s).
Funding Impacts	Neither increased or Decreased need.	Initial increased funding need, thereafter, potentially less funding needed to manage.	Increased funding need (cost of construction, annual recurring management costs).	Increased funding need (cost of construction, annual recurring management costs).
Flood Attenuatio	Ability to buffer flooding during moderate runoff.	Loss of flood attenuation capability.	Flexibility to manage portions for flood attenuation depending upon the prescribed management needs of targeted specie(s).	Flexibility to manage portions for flood attenuation depending upon the prescribed management needs of guild(s) targeted.
Water Permits / Rights	Perfected water rights for water stored and used.	Potential to lose water rights. May require discharge permits/construction permits. Potential humps below in drainage which would limit release of water.	May require discharge permits/construction permits depending upon the development prescribed.	May require discharge permits/construction permits depending upon the development prescribed.

Table 6. Summary of impacts by alternatives on wildlife and habitat management

	Alternative A *(Current Management - no action)*	Alternative B (Natural Processes Management)	Alternative C (Single Wildlife Group-level Intensive Management)	Alternative D *(*Target Species Group-level Modified Management - *proposed action)*
Timing of Freeze Up for	Seasonal timing in tune with migration needs of trust species 80-90% of years.	Reduced water levels would result in dry or earlier freeze up, resulting in reduction in Refuge benefit for migration habitat	Flexibility retained to manage for deeper water with later freeze up and/or shallow water for earlier freeze up depending on the target specie(s) driving water management.	Flexibility retained to manage for deeper water with later freeze up and/or shallow water for earlier freeze up depending on the selected guild(s) driving water management.
Fish	There is a possibility to sustain a sport fishery at Long Lake during the moderate to high water levels portions of the hydrological cycles. This possibility is diminished by carp-induced water turbidity problems at Long Lake.	Would essentially eliminate fishery and rough fish related turbidity problems.	Flexibility to retain or manage against fish depending on the unit and target specie(s) managed for; address turbidity problems.	Flexibility to retain or manage against fish depending on the unit and target guild(s) managed for; address turbidity problems.
Drought Attenuation	Some ability to capture and store water to attenuate drought conditions - delays natural cycling while maintaining wetlands during drought.	Compromised - no drought attenuation capability.	Flexibility to manage for drought attenuation depending upon the target specie(s) driving water management.	Flexibility to manage for drought attenuation depending upon the target guild(s) driving water management.
Wetlands Without WCS				
Productivity Impacts	Retains the current productivity, characterized by a gradual long-term reduction in productivity due to siltation and reduction of water quality.	Potential to improve the productivity (e.g. invertebrates and plant diversity of palustrine wetlands).	Improved wetland productivity through the use of draw downs on portions of wetlands in the WMD.	improved wetland productivity through the use of draw downs on portions of wetlands in the WMD.
Function/Hydrology/ Sustainability Impacts	Currently wetlands aging at a natural rate, experiencing gradual siltation, eutrophication and water quality deterioration.	Improved overall wetland function (e.g. groundwater recharge, flood attenuation, nutrient cycling). Potential to reverse degradation trend and restore wetland to earlier stage/age condition and lengthen the sustainability of the natural wetlands.	Altered hydrology and possible negative associated effects (e.g. increased sedimentation, conductivity, dissolved solids accrual) of natural wetlands in the WMD, including possible reduced overall sustainability of these wetlands (potentially address the sustainability issue with periodic dredging).	Altered hydrology and possible negative associated effects (e.g. increased sedimentation, conductivity, dissolved solids accrual) of natural wetlands in the WMD, including possible reduced overall sustainability of these wetlands (potentially address the sustainability issue with periodic dredging).
Wildlife Impacts	Maintains current support capability with a gradual decline over time due to aging and deterioration of the wetland condition.	Potential to improve the support capability for a wider diversity of wetland-dependent wildlife.	Potential to provide ideal habitats for specific specie(s) or narrow group of birds within a classification.	Potential to provide ideal habitats for multiple bird groups across a spectrum native to the area (i.e. guilds).

Table 6. Summary of impacts by alternatives on wildlife and habitat management

	Alternative A *(Current Management - no action)*	Alternative B (Natural Processes Management)	Alternative C (Single Wildlife Group-level Intensive Management)	Alternative D (Target Species Group-level Modified Management - *proposed action)*
Funding Impacts	Generally requires similar funding to present levels adjusted for economics annually.	Requires increased funding (dredging).	Increased funding needs (e.g. cost of initial construction, annual operation, periodic maintenance costs).	Increased funding needs (e.g. cost of initial construction, annual operation, periodic maintenance costs).
Native Upland Habitats (including woody species)				
Management direction	Current management includes grazing, prescribed burning, spraying, clipping, re-seeding natives, and biological agents to manage native (unbroken) grasslands and tamegrass fields, and restoring and managing native grass seedings in optimum condition for nesting waterfowl and other migratory birds. Balance of native uplands and tame uplands.	Management would be driven by natural processes theme where management of native (unbroken) grasslands would target invigorating native plants (composition and diversity), management of all nonnative uplands would target native plant re-establishment and/or restoration. Future management would target maintaining native and restored habitats in as "natural" or native condition as possible.	Management would be driven by identifying the specific habitat requirements of a specific specie(s) or narrow group of birds within a specific classification (i.e. waterfowl, or shorebirds, or marshbirds) and targeting blocks of land to restore and manage for the specific habitat necessary to address those requirements.	Management would be driven by identifying the broad habitat requirements of a guild of species representing a broad spectrum native to the area (e.g. Pintail, sharp-tailed sparrow, Wilson's phalarope, sharp-tailed grouse, and ferruginous hawk) and targeting restoration and management of all lands to provide habitat necessary to address the requirements representing indicator species across the guild.
Invasives Impacts	Invasives are treated with a variety of management practices.	Targets decrease in the acreage of nonnative, invasive low shrubs. Targets decrease of invasives and invading exotic grasses and forbs, potential for removing source of re-invasion and associated problems. Minimize degree of future degradation of native prairie sites.	Targets decrease of invasives and invading exotic grasses and forbs, potential for removing source of re-invasion and associated problems. Minimize degree of future degradation of native prairie sites.	Targets decrease in the acreage of nonnative, invasive low shrubs. Targets decrease of invasives and invading exotic grasses and forbs, potential for removing source of re-invasion and associated problems. Minimize degree of future degradation of native prairie sites.
Habitat Impacts	Habitat management targets native plant restoration through various management practices.	Increase in the acreage of native grasses and forbs. Decrease in the acreage of nonnative grasses and forbs.	Potential to target any productive habitat including nonnative low shrubs if they serve a targeted specie(s) group.	Increased acreage of native grasses and forbs. Decreased acreage of nonnative grasses and forbs and invasive nonnative low shrubs.

Table 6. Summary of impacts by alternatives on wildlife and habitat management

	Alternative A *(Current Management - no action)*	Alternative B (Natural Processes Management)	Alternative C (Single Wildlife Group-level Intensive Management)	Alternative D *(*Target Species Group-level Modified Management - *proposed action)*
Wildlife Impacts	Habitat remains in current condition.	Improved breeding habitat condition for most grassland-dependent breeding bird species found in south-central North Dakota. Potential for increased nest success and nest densities of those species. Potential for less favorable breeding habitat condition for a few specific species (i.e. gadwall, clay-colored sparrow, and exotic species).	Improved breeding habitat conditions for a specific specie(s) or wildlife group (e.g. grassland passerines) including improved recruitment and increased abundance. Potential for less favorable breeding habitat condition for other "nonselected" wildlife groups (e.g. waterfowl, shorebirds, native gallinaceous birds).	Improved breeding habitat conditions for a guild of multiple wildlife species representing a broad spectrum native to the area (e.g. Pintail, sharp-tailed sparrow, Wilson's phalarope, sharp-tailed grouse, and ferruginous hawk) including improved recruitment and increased abundance. Less favorable breeding habitat condition for a few specific species (e.g. clay-colored sparrow, gadwall).
Funding Impacts	Generally requires similar funding to present levels adjusted for economics annually.	Increased funding need (costs of additional management needs for restoration and maintenance of habitats).	Increased funding need (costs of additional management needs for restoration and maintenance of habitats).	Increased funding need (costs of additional management needs for restoration and maintenance of habitats).
Management Implications /	Continue to manage with current tracking methods.	Less difficult to meet objectives because this alternative lacks a structural criterion for individual wildlife species or groups —it does not target a wildlife output.	More limited structural composition; restricted to what is needed for one wildlife group. Better tracking of progress toward wildlife outputs.	provides more of a structural mosaic and broad habitat spatially, structurally, and temporally addressing overall needs of wildlife characteristic to the area. Better tracking of progress towards wildlife outputs
Disturbed Upland Habitats				
Management direction	Current management targets converting disturbed uplands to native grass (6-8 species of grasses native to the area with varieties suited to the latitude). Approximately 250-300 acres per year are targeted for restoration. Eventual restoration of forbs into these fields is planned.	Management would focus on conversion of disturbed uplands to a diverse native grass forb mixture representative of the historical vegetation composition on a given site.	Management of disturbed uplands would focus on the habitat requirements of a specific specie(s) or narrow group of birds within a specific classification (i.e. waterfowl, shorebirds, passerines). Uplands could potentially remain cropland, tame-grass, or be restored to native grass.	Management of disturbed uplands would focus on the habitat requirements of a guild of species representing a broad spectrum native to the area (i.e. pintail, sharp-tailed sparrow, Wilson's phalarope, sharp-tailed grouse, ferruginous hawk). Uplands would focus on ongoing efforts to restore native grass/forbs with a diversity of height, density and structure.

Table 6. Summary of impacts by alternatives on wildlife and habitat management

	Alternative A *(Current Management - no action)*	Alternative B (Natural Processes Management)	Alternative C (Single Wildlife Group-level Intensive Management)	Alternative D *(*Target Species Group-level Modified Management - *proposed action)*
Habitat Composition Impacts	Gradual increase in acreage of native grass/forb seedings. Gradual reduction in cropland and tame-grass. Gradual reduction in fragmentation.	Increased acreage of native grass/forb seedings. Reduced/elimination of cropland, DNC, tame-grass fields. Less fragmentation Reduced invisibility, less noxious weeds.	Potential for increased native grass and forbs depending on what wildlife group we are managing for. Potential for increased acreage of cropland, trees and shrubs, or nonnative grasses depending on what wildlife group we are managing for ncreased invisibility, more noxious weeds. Potential for increased fragmentation. Not maximizing land to fullest wildlife potential.	Increased acreage of native grass/forb seedings. Reduced/elimination of cropland, DNC, tame-grass fields. Less fragmentation. Reduced invisibility, less noxious weeds. Potential to manage land more efficiently.
Wildlife Impacts	Gradual improvement in breeding habitat for grassland-dependent birds. Less favorable habitat conditions for a few specific species.	Improved breeding habitat conditions for most grassland dependent breeding bird species (i.e. increased nest success rates, increased nest density). Less favorable breeding habitat conditions for a few specific species (i.e. clay-colored sparrow, gadwall). Reduced degree of invisibility, potential effects on territories and ranges of specific bird species. Provides habitat for a declining species group (native grassland dependent birds). Less pheasants, less deer	Improved breeding habitat condition for a specific wildlife group (i.e. grassland passerines) including improved recruitment and increased abundance. Potential for less favorable breeding habitat condition for other nonselected wildlife groups (i.e. waterfowl, shorebirds, native gallinaceous birds). If we elect to leave nonnative cover or cropland, increased degree of invisibility, potential effects on territories and ranges of specific bird species, increase noxious weeds.	Improved breeding habitat conditions for a guild of species representing a broad spectrum native to the area (i.e. pintail, sharp-tailed sparrow, Wilson's phalarope, sharp-tailed grouse, ferruginous hawk) including increased nest success rates, increased nest density Less favorable breeding habitat conditions for a few specific species (i.e. clay-colored sparrow, gadwall) Reduced degree of invisibility, potential effects on territories and ranges of specific bird species.
Funding Impacts	Generally requires similar funding to present levels adjusted for economics annually.	Increased funding need (cost of additional management activities). Cost:benefit ratio—is it even possible to accomplish due to changes in soil structure, range site alteration?	Increased funding need (cost of additional management activities).	Increased funding need (cost of additional management activities).

Nonnative Trees and Shrubs				
Management direction	Current management is conducted on an "as needed" basis - management includes removal of volunteer trees and shrubs from grasslands, additionally, sentinel tress that serve as raptor perches are removed from grassland nesting habitat.	This alternative would remove all nonnative trees and shrubs on all lands in the complex.	This alternative would manage nonnative trees and shrubs on a tract by tract basis allowing management actions that provide benefit for a specific wildlife species or narrow group of birds within a classification (waterfowl, shorebirds, upland birds, game mammals, etc) This would allow maintaining existing, augmenting and/or removal.	This alternative would manage nonnative trees and shrubs in a manner which provides the greatest overall benefit to the guild or select group of indicator species (i.e. Pintail, sharp-tailed sparrow, Wilson's phalarope, sharp-tailed grouse, ferruginous hawk).
Habitat Impacts	Management would continue as described above.	Decreased acreage of nonnative flora. Reduced areas for nonnatural microclimate relates to less invasive and noxious invasion.	<u>if removed:</u> Reduced winter habitat for some resident species (exotic gallinaceous birds, deer). Increased grassland habitat. Less fragmentation and micro-climate for invading exotics and noxious plants <u>if planting and no removal:</u> Decreased native flora and increased potential for nonnative species invasion into grassland areas. More fragmentation and micro-climate for invading exotics and noxious plants	<u>if removed:</u> Reduced winter habitat for some resident species (exotic gallinaceous birds, deer). Increased grassland habitat. Decreased nonnative flora. Less fragmentation and micro-climate for invading exotics and noxious plants. <u>if planting and no removal:</u> Decreased native flora and increased potential for nonnative species invasion into grassland areas. More fragmentation and micro-climate for invading exotics and noxious plants.

Wildlife Impacts	Continued at present levels	Improved breeding habitat conditions for grassland-dependent bird species; including improved recruitment and increased abundance. Less favorable breeding habitat conditions for arboreal bird species (i.e. yellow warbler, black-billed cuckoo, willow flycatcher). Less favorable winter habitat for some resident species. More balanced predator/prey relationships. Reduced population of parasitic birds (i.e. cowbirds). Restoration for native assemblages.	<u>if removed:</u> Improved breeding habitat condition for a specific wildlife species or narrow group of birds within a classification. Less favorable breeding habitat condition for other wildlife groups (i.e. arboreal birds). <u>if planting and no removal:</u> Increased winter habitat for some resident species (exotic gallinaceous birds, deer) Additional breeding habitat condition for specific wildlife groups (i.e. arboreal birds). Less favorable breeding habitat conditions for certain wildlife groups (e.g. grassland-dependent passerines, shorebirds, waterfowl_ including increased predation rates and lower abundance.	<u>if removed:</u> Improved breeding habitat condition for a variety of grassland-dependent birds (i.e. Baird's sparrow, pintail, marbled godwit) including improved recruitment and increased abundance. Less favorable breeding habitat condition for arboreal birds species (i.e. yellow warbler, black-billed cuckoo, willow flycatcher). <u>if planting and no removal:</u> Increased winter habitat for some resident species (exotic gallinaceous birds, deer). Additional breeding habitat condition for a variety of arboreal bird species (i.e. yellow warbler, black-billed cuckoo, willow flycatcher). Less favorable breeding habitat conditions for grassland-dependent birds including increased predation rates and lower abundance.
Public Use Impacts	Continues opportunities at or near existing levels.	Reduced hunting opportunities (deer, pheasant due to loss of tree/shrub habitat). Controversial due to cutting down of trees.	More/less hunting opportunity for deer pheasants depending on if removed or planting. Potentially more/less abundance of native birds for observation less diversity because of exclusion/reduction of exotics and non traditional species.	More/less hunting opportunity for deer pheasants depending on if removed or planting. Potentially more/less abundance of native birds for observation less diversity because of exclusion/reduction of exotics and non traditional species.
Funding Impacts	Generally requires similar funding to present levels adjusted for economics annually.	Increased funding needs to accomplish management activities.	Increased funding needs to accomplish management activities.	Increased funding needs to accomplish management activities.