

III. Refuge and Resource Descriptions

Socio-economic Environment

Crescent Lake Refuge is located in Garden County on the eastern edge of the Nebraska Panhandle, an 11-county, 14,000-square-mile region with a population of about 90,000 people. Basic economic activities in Garden County include irrigated and dryland farming, cattle feeding, and ranching.

According to the Nebraska Panhandle Economic Development Report (Panhandle Area Dev. Dist., undated ca. 1998), the population of Garden County decreased from 2,460 in 1990 to 2,224 in 1997, a decrease of about 10 percent. The population in the year 2010 is projected at 1,707, a decrease of more than 20 percent from 1997; similar trends are projected for much of the surrounding rural area. Only the major population centers, such as Scottsbluff/Gering (100 miles to the west), project growth of any significance.

Geographic / Ecosystem Setting

Crescent Lake Refuge lies on the southwestern edge of the 19,300 square mile Nebraska Sandhills, the largest sand dune area in the Western Hemisphere and one of the largest grass-stabilized regions in the world. The Sandhills are characterized by rolling, vegetated hills and inter-dunal valleys which are oriented in a northwest to southeast direction. Many shallow lakes and marshes are interspersed in the lower valleys. Native grasses predominate. Wildlife diversity, except large ungulates and their predators, is relatively unchanged since early settlement.

About 177,000 acres of open water lakes, shallow marshes and fens, and nearly 1,130,000 acres of wet meadows remain in the Sandhills. Most wetlands are freshwater; about 10 percent are alkaline. They range in size from 1 to 2,300 acres, but 80 percent are less than 10 acres (LaGrange 1997). Many wetlands have been drained in attempts to increase hay production. Estimates of the amount drained range from 15 percent (McMurtrey and Craig 1969) to 46 percent (USFWS 1986). Wetland drainage continues to this day (Bleed and Flowerday 1989).

The Fish and Wildlife Service operates under an “ecosystem approach to resource management” and, for organizational purposes, has identified watershed-based ecosystems. The Crescent Lake Refuge is within the Platte-Kansas Rivers Ecosystem (Map 3).

Climate

Climate of the Sandhills is characteristic of the central Great Plains - cold winters, hot summers, and frequent thunderstorms from spring to late summer. Annual precipitation ranges from 17 to 23 inches (Wilhite and Hubbard 1989), and is coupled with high evapo-transpiration rates. The Refuge has operated an official weather station since 1935. Precipitation on the Refuge averages 16.8 inches and temperatures have ranged from minus 46 to 109 degrees Fahrenheit. Since 1976, relatively high precipitation has resulted in positive net moisture balances (annual precipitation minus open pan evaporation) in most years.

Soils

Most soils are wind-laden sands that have not been held in place long by vegetation. They are light colored and have little organic matter. Soils in basins, valleys, and wet meadows have thicker and darker surface layers and more organic matter than soils found in the hills. The main soil types are dune sand, Valentine sands, Valentine-loamy sands, and Gannett loamy sands. Rainfall is quickly absorbed and causes little erosion; soil evaporation rates are low. Native grasses grow well under these conditions, but soil exposed by overgrazing or plowing is subject to wind erosion (Layton, et al 1956).

Geology

During the Cretaceous period of the Mesozoic era, a shallow sea covered the area of the Sandhills. When the sea receded, large valleys were formed which today are covered with sand. The geological processes are not well understood because of that sand cover. The exact time is debated, but somewhere between 4,000 and 8,000 years ago, water deposited sand which later began shifting as a result of climatic changes. This blowing sorted the alluvial deposits; fine material was carried out of the area and coarse material was left behind, resulting in the uniform particle size typical of wind deposited dunes (Bleed and Flowerday 1989).

Refuge Resources

Water and Wetlands

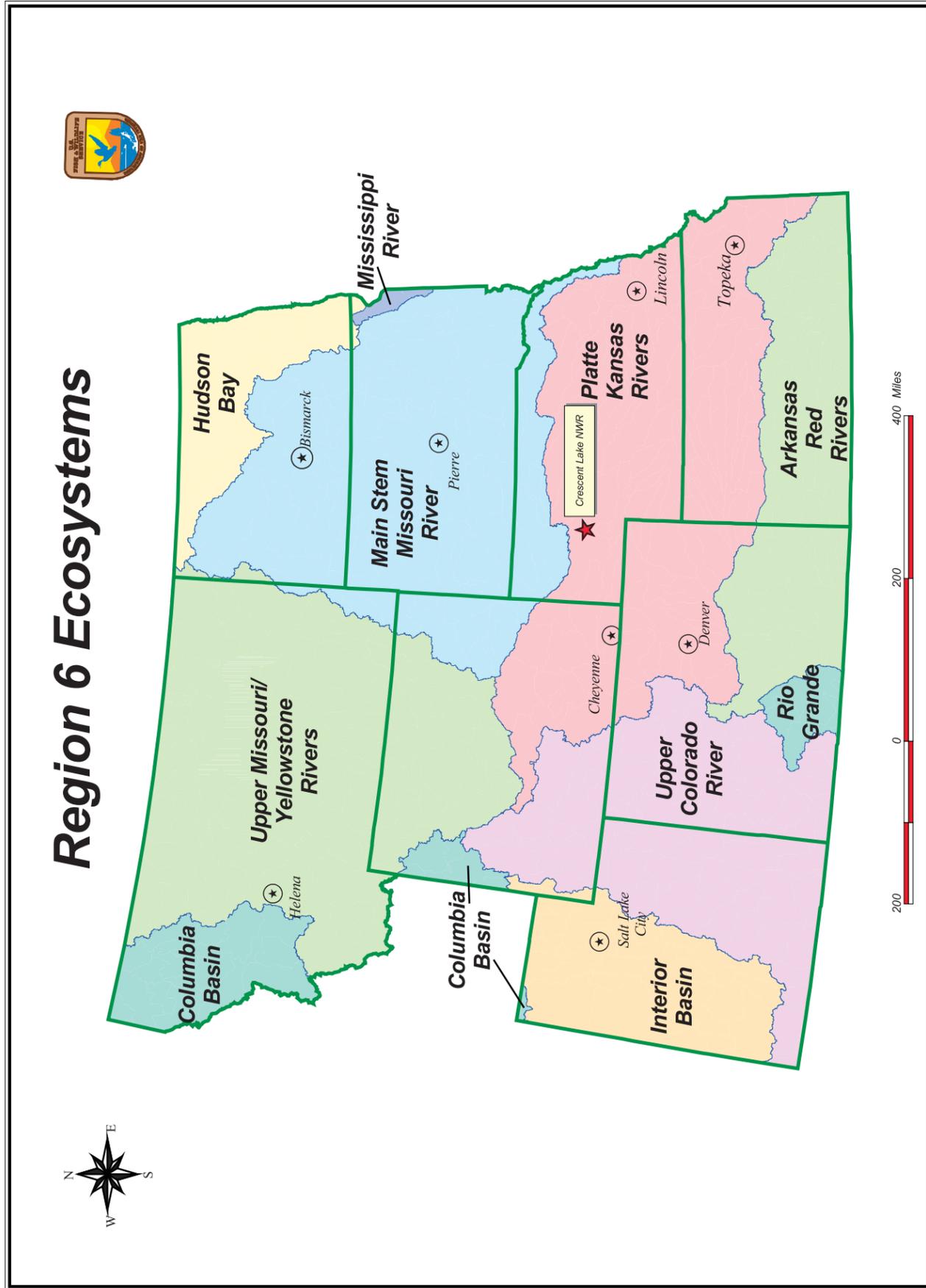
The Nebraska Sandhills overlay the High Plains Aquifer, commonly referred to as the Ogallala Aquifer. This groundwater is the source of wetlands in low areas and valleys and is the driving force supporting the ecological diversity and integrity of the Sandhills.

There are 21 wetland complexes on the Refuge totaling approximately 8,251 acres or about 18 percent of the total area (Map 4). These wetlands are a mixture of shallow lakes, marshes, seasonal wetlands, wet meadows and a small stream resulting from Refuge management activities. They were classified as follows by the Fish and Wildlife Service (USFWS, Sandhills Wetlands 1986):

Type II, Fresh Meadows	4,755 acres
Type III, Shallow Fresh Marshes	1,154 acres
Type IV, Fresh Marshes	309 acres
Type V, Open Fresh Water	2,033 acres

A few, small alkaline wetlands also exist. These were not specifically identified as such by the inventory and total about 413 acres. Submergent and emergent wetland vegetation ranges from sparse to dense depending on soils and alkalinity. Emergent vegetation includes cattail, bulrush, and phragmites. Vegetation bordering wetlands is primarily grasses and sedges. A few lakes have associated groves of cottonwood and willow trees, usually on the north shores.

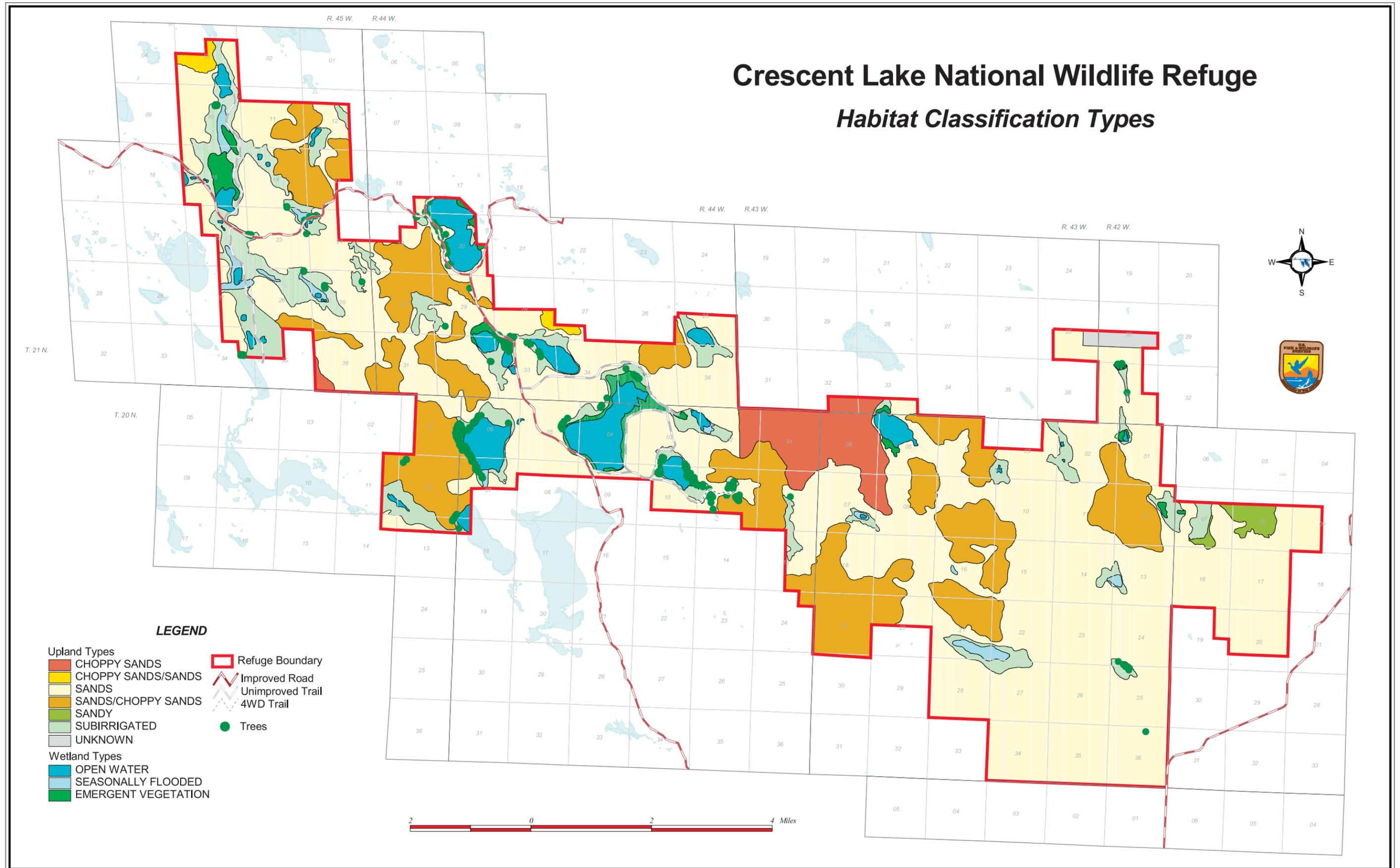
Most Refuge wetlands rise and fall with precipitation and groundwater levels. Since 1981, precipitation has been above average resulting in record water levels. Control structures and elevation gauges have been installed on nine lakes, but water levels can be increased significantly on only five that are connected to a ditch which drains a private marsh north of the Refuge. Gauges on Island Lake record natural fluctuations. The U.S. Geological Survey has many groundwater survey wells on the Refuge which are used to study the complex groundwater hydrology of the area; the Refuge staff monitors about 25 of these.



Map 3 - Ecosystem Map

Crescent Lake National Wildlife Refuge

Habitat Classification Types



LEGEND

- Upland Types**
- CHOPPY SANDS
- CHOPPY SANDS/SANDS
- SANDS
- SANDS/CHOPPY SANDS
- SANDY
- SUBIRRIGATED
- UNKNOWN
- Wetland Types**
- OPEN WATER
- SEASONALLY FLOODED
- EMERGENT VEGETATION
- Refuge Boundary
- Improved Road
- Unimproved Trail
- 4WD Trail
- Trees

Map 4 - Habitat Classification Types

Vegetation

The Sandhills are within a wide transitional zone called the Mixed Grass Prairie which lies between Tallgrass Prairie to the east and Short Grass Prairie to the west. Although precipitation is typical of the semi-arid Mixed Grass Prairie, the Sandhills are characterized by post-climax, tallgrass species typical of a greater moisture regime (Oosting 1948; Keeler, et al 1980). This is due primarily to the moisture penetration and holding capacities of the soil, root structures, and photosynthetic strategies of cool and warm season plants (Tolstead 1942; Barnes 1984).

The Refuge plant herbarium contains 223 species; however, the collection is incomplete (Appendix F).

Vegetative Types

Four basic vegetative types or range sites are on the Refuge (NRCS 1995). (see Map 4)

Wetland Range Sites. These low meadow sites make up only 1 percent of the Refuge and are dominated by species that thrive in a moisture-saturated soil profile, such as prairie cordgrass, blue-joint reed grass, sedge species, and non-grass species such as golden rod, dock, and willows.

Sub-irrigated Range Sites. These are meadows close to the groundwater level where soil moisture can support deep-rooted, warm season native grasses even during drought. They make up about 9 percent of the Refuge and are dominated by tallgrass species such as switchgrass and sand bluestem. They are also prone to invasion by exotic species, such as Kentucky bluegrass and smooth brome, and noxious weeds, such as Canada thistle.

Sand Range Sites. These include the dry meadows (the edge between wet meadows and the sandhills) and the gently undulating sandhills. They make up about 76 percent of the Refuge. Predominate grasses include both cool season species such as needle-and-thread and western wheatgrass, and warm season species such as prairie sandreed, sand bluestem, sand love grass, and sand dropseed. Common non-grass species include prairie sunflower, yucca, lead plant, and prairie rose. Exotic species, such as cheatgrass, will invade these sites.

Choppy Sand Range Sites. These are the characteristic dunes for which the Nebraska Sandhills are named and make up about 11 percent of the Refuge. They support a wide variety of vegetation but also contain many, relatively small, unvegetated areas, commonly called "blowouts," that are subject to wind erosion. The number of blowouts vary with terrain but, overall, these open sand areas make up about 3 percent of the choppy sand range sites. Blowout penstemon (*Penstemon haydenii*), a federally-listed endangered species, is endemic to the Sandhills and its characteristic habitat includes the blowouts and open sand areas. Predominate grasses include blue grama, sand bluestem, sand dropseed, blowout grass, sand love grass, little bluestem, and sandhills muhly. Non-grass species include yucca, sand cherry, prairie rose, and prairie sunflower.

Perennial and annual flowering forbs are an important component of true native prairie and are more abundant on the Refuge than on the surrounding private lands which are managed for livestock production. Although formal surveys are not conducted, refuge managers have observed an increase in non-grass species since grazing was reduced starting in 1993.

There are about 45 species of native and introduced trees and shrubs in the Sandhills, 30 of which occur on the Refuge. Some, such as sand sage, choke cherry, sandbar willow, and cottonwood, are characteristic of native prairie. Many are not. The Civilian Conservation Corps planted native and nonnative trees and shrubs during the 1930s, most of which have disappeared. Mature trees succumb to prairie fires and porcupines, and seedlings rarely survive deer and rodent browsing. The only tree species that has become successfully established without human assistance is the green ash which reproduces well but only in the shade canopy of mature willows or cottonwoods. There are about 80 acres of trees on the Refuge.

Endangered Plants

Hayden's, or blowout, penstemon is Nebraska's rarest plant (Farrar 1990) and the only endangered plant on the Refuge. It was placed on the Federal list of endangered species in 1987. This plant is somewhat unique in that it depends on non-vegetated sand surfaces, or blowouts, for its existence (Fritz, et al 1992). Good management of private grazing lands has reduced the amount of blowouts in the Sandhills; only in the drier western fringes are blowouts still common. In 1984, The Nature Conservancy purchased an 840-acre area adjacent to the Refuge specifically for perpetuation of blowout penstemon.

Blowout penstemon surveys began on the Refuge in 1987 when 2,058 plants were found. In 1998, only 415 remained (see Figure 1). Although shrinking habitat is part of the problem, plant populations are declining even in areas with what appears to be good habitat. So, other factors are at work. Perhaps genetic viability is failing as plants become increasingly isolated from each other. Since 1997, the University of Nebraska has supplied seedlings grown at a facility in Lincoln. About 9,500 plants have been planted on the Refuge through 2000; about 15 percent of the 1997 planting and 20 percent of the 1998 planting survived.

Figure 1. Penstemon Populations

Year	Native	Surviving Transplants	Total
1987	2,058	--	2,058
1988	1,652	--	1,652
1989	1,264	--	1,264
1990	1,545	--	1,545
1991	765	--	765
1992	1,055	--	1,055
1993	985	--	985
1994	956	--	956
1995	624	--	624
1996	608	--	608
1997	533	332	865
1998	415	831*	1,246
1999	407	777**	1,184
2000	486	546***	1,032

* Includes 1998 transplants
 ** Does not include the 1999 transplants
 *** Does not include the 2000 transplants

Plant Species of Management Concern

Plant Species of Management Concern listed by the U.S. Fish & Wildlife Service or the State of Nebraska are presented in Appendix H. In addition, there are several other plant species which will receive special management emphasis on Crescent Lake Refuge for the reasons listed below:

Canada thistle	Widespread noxious weed
Cheatgrass brome	Exotic, expanding range
Common reed	Exotic, expanding range
Eastern cottonwood	High wildlife values, native plant, decreasing range
Blowout penstemon	Federally-listed endangered species, decreasing range

Wildlife

The Nebraska Sandhills are one of the few large native prairie areas in the United States that have not been substantially converted to farmland or otherwise modified. Thus, most of the plant and animal species present when settlement began are still present today.

Surveys and census activities are limited by staffing and funding. Most are broad-scale sampling, which works well for large numbers of highly visible species but yields erratic and questionable results for species which are less visible or occur in smaller numbers. Some intensive, more sophisticated surveys have been discontinued because of insufficient staff and questionable data. As a result, high quality, refuge-specific information is not available for many species.

Endangered and Threatened Species

There are no federally-listed endangered wildlife which depend on the Refuge in any significant way. Prairie falcons, least terns, and piping plovers are occasionally seen during migrations but are considered casual visitors. The ferruginous hawk is considered a sensitive species but is an uncommon migrant. Black terns and loggerhead shrikes are also sensitive species which nest on the Refuge. Recent informal surveys revealed about 100 tern nests and 20 shrike nests.

The swift fox, an infrequent visitor, is a State-listed species for which little information is available. One sighting was made on the Refuge in 2000 and an increasing number of sightings are occurring north of the Refuge, but no official data is available.

The yellow mud turtle is another Refuge species of special interest and will be treated as a listed species for planning purposes. The Refuge population is centered at Gimlet Lake and is estimated at 4,000 to 5,000. A study by Earlham College, which includes the Refuge, provides good information on the biology of the turtle (Iverson, Annual Study Reports).

Birds

Nebraska includes 413 species on its official bird list, 279 of which occur on Crescent Lake Refuge (Appendix F).

Species of Special Interest. For the purposes of this plan, Wildlife Species of Management Concern are those listed by the U.S. Fish & Wildlife Service, the State of Nebraska, or Partners in Flight as declining and in need of special attention. Comparing these lists with the Refuge bird list indicates 25 such species occur on the Refuge sometime during the year (Appendix H). Little is known about the status and trends of most of these birds or how they are affected, positively or negatively, by present habitat management.

Waterfowl. Thirty-two species use the Refuge during some portion of the year and 15 species nest on the Refuge. Peak numbers during the fall migration occur in October and averaged 13,100 over the last 10 years. Peak numbers during the spring migration occur in April and averaged 12,600 over the same period. Table 1 shows average peak numbers by species.

Figure 2. Average Peak Waterfowl Populations by Species During Fall Migration, 1985-95 (*Nests on the Refuge)

Species	Average Peak No.
* Trumpeter swan	29
* Canada goose	1,050
* Mallard	4,860
* Gadwall	4,960
* Pintail	1,370
* Green-winged teal	1,400
* Blue-winged teal	730
* Cinnamon teal	30
* Wigeon	3,075
* Shoveler	4,140
* Redhead	4,232
Ring-necked duck	4,950
* Canvasback	3,660
* Lesser Scaup	3,840
Common goldeneye	3,000
* Bufflehead	5,520
* Ruddy duck	3,420
Common merganser	600

Although the Sandhills, as a whole, are the most important waterfowl production area in the State, Crescent Lake is not considered a waterfowl production refuge per se. Duck breeding pairs ranged from 548 to 1,450 since 1987, a period which included very dry and very wet years on both the Refuge and on portions of the major breeding grounds to the north. The number of ducklings hatched ranged from 1,000 to 3,500. Among dabbling ducks, blue-winged teal are the most common nesters (62 percent), followed by mallards (33 percent), gadwalls (3 percent), pintails (1 percent), and shovelers (1 percent). For diving ducks, ruddy ducks are the most common nesters (48 percent), followed by redheads (43 percent) and canvasbacks (9 percent).

Predation on duck nests is a limiting factor. Bullsnares, weasels, raccoons, and skunks are the major predators. Without predator control, nest success rates hover around 16 percent, the bottom end of the rate needed for population maintenance. An intensive bullsnake removal program during the 1980s resulted in nest success rates up to 50 percent on a small sample area. However, because nest densities are relatively low, the resulting small increase in numbers of ducks produced to flight stage could not be justified, and the program was discontinued in 1994. Extensive predator control has not occurred on the Refuge since then.

There are 98 Canada goose nesting tubs on the Refuge, about 60 percent of which are used annually. Hatching success is around 80 percent and between 200 and 250 goslings are raised to flight stage. Few geese nest off the artificial structures.

Marsh and Water Birds. Eared grebes nest on Goose and Deer Lakes. Numbers vary considerably from year-to-year, and during the last 10 years ranged from 446 adults and 290 nests to 1,194 adults and 656 nests.

There is a long-standing double-crested cormorant rookery on Goose Lake, and cormorants pioneered onto Crane Lake in 1997. The number of nests over the last 10 years averaged about 60.

Great blue herons nest in the Crane Lake rookery. The number of nests in the last 4 years ranged from 43 to 127; production estimates range from 94 to 125 young hatched.

Black-crowned night-herons have traditionally nested at Smith Lake but, for unknown reasons, the colony moved to Goose Lake in 1997. The number of nests in the last 10 years ranged from 3 to 11.

American bitterns were first surveyed in 1996 (a breeding male song survey on Smith, Goose, Gimlet and Island Lakes). From 1996 to 1999, the number of males ranged from 24 to 35.

A rail call survey was initiated in 1997 and yields only trend information. Virginia rail calls went from 36 to 20 and sora rail calls from 6 to zero in the period 1997 to 1999.

Shorebirds, Gulls, Terns, and Allied Species. Thirty-one shorebird species, 7 gull species, and 5 tern species occur on the Refuge. Of these, 11 species nest on the Refuge (Appendix F). No formal surveys are conducted. Peak numbers of all species seldom exceed 2,500 in spring and 1,000 in fall.

Raptors. The open grasslands of the Sandhills, interspersed with small areas of trees, provide excellent habitat and food sources for raptors. Twenty-seven species have been recorded on the Refuge. Figure 3 presents 1997 breeding survey results, an average year.

Figure 3. 1997-1999 Raptor Breeding Survey Results

Species	Average Breeding Pairs	Average No. Young
Red-tailed hawk	2	4 (est.)
Swainson's hawk	5	8
Bald eagle	1	2
Great horned owl	2	3
Northern harrier	8	Unknown
American kestrel	4	15
Barn owl (in nest structures)	8	24

Non-migratory Birds. Prairie grouse, a significant component of the Nebraska Sandhills, are declining throughout their range (Proceedings Prairie Grouse Technical Conference 1998). Crescent Lake Refuge is also seeing declines. Sharp-tailed grouse lek surveys from 1986 to 1997 show active dancing grounds decreasing from 45 to 15 and dancing males decreasing from 413 to 109. Refuge populations seemed to rebound in 1998 and 1999 when the number of dancing grounds averaged 32 and the number of dancing males averaged 226. The causes for the decline and the significance of the recent increases are not clear.

The Refuge is on the western edge of the range of the greater prairie chicken. This species has not been present with regularity since the 1950s, and then numbers seldom exceeded 100. Reintroduction projects in the 1970s and 1980s were unsuccessful. A single male was seen on the Refuge in the spring of 2000, and five were heard during the lek counts.

Ring-necked pheasants, exotic but popular game birds, occur in relatively small numbers. The average breeding population from 1987 to 1999 was 361.

Mammals

The Sandhills provide habitat for a variety mammals (Appendix F). Pre-settlement mammalian fauna included 59 species. Ten carnivores and ungulates were probably extirpated by 1900, including the bison, elk, and bighorn sheep. Ten mammals have been introduced or their natural ranges extended, including the fox squirrel, black-tailed jackrabbit, and raccoon (Jones 1964).

White-tailed deer and mule deer are both present. The best populations estimates are from the period 1979 to 1991 when aerial surveys were conducted. Estimated average populations during that period were 110 mule deer and 152 white-tailed deer. Populations have not significantly changed since that period, although aerial surveys are cost-prohibitive and were replaced with less accurate ground surveys. The largest harvests since the hunter check station was initiated in 1981 occurred in 1998 and 1999 when 66 and 47 deer were checked respectively. The average harvest since 1981 is 32.

Because of their economic importance and because they can alter wetland habitat, muskrats have been surveyed by counting houses in the winter since the Refuge was established. Population peaks occurred in 1950 (934 houses), 1989 (1,929 houses), and 1996 (742 houses). During the last peak, considerable opening of cattail marshes was noted.

Coyote scat counts were initiated in 1997 and supply population trends which have been stable during the survey period. Estimates of population numbers are not available.

There is no data for population trends of other mammal species.

Amphibians and Reptiles

The most common reptiles and amphibians are tiger salamander, northern prairie lizard, bullsnake, garter snake, and box turtle (Appendix F). The yellow mud turtle is considered a Refuge species of special interest and is discussed under endangered species.

Fish

Fisheries have been managed by the NGPC under an agreement with the Refuge since 1991, when FWS fisheries capabilities were reduced. Island Lake has been open to sport fishing since 1931. Carp were eliminated in 1978, and the lake now supports warm water species including largemouth bass, bluegill, crappie, yellow perch, walleye, and sauger. However, a few carp of even-age class were discovered in the spring of 2000 and the problem may reemerge.

Carp were reduced, but not eliminated, in Smith Lake in 1996. That lake now supports a perch/panfish fishery but may develop a serious carp problem in the future. Crane Lake is the only other lake with sport fishery potential and was stocked with yellow perch in 2000. The fathead minnow, the only other fish species on the Refuge, was introduced into several lakes in the late 1970s. The minnow provides a food source for a variety of birds but also creates turbid water, an undesirable result.

Cultural Resources

Little formal archaeological work has been conducted within the Nebraska Sandhills. Collections by avocational archaeologists indicate the area has a long prehistoric record and that artifacts are widely distributed; however, because of the unique nature of the Sandhills, settlement and subsistence patterns are difficult to predict (Burgett and Nickel 1999). No systematic surveys have been conducted on the Refuge, and no known Native American sites exist.

Historic use of the Sandhills is better documented. Only a few fur trade and ranching operations existed prior to the Federal government's decision to survey the region and make it available for homesteading in 1904. Nearly all early attempts at farming failed and homesteads were aggregated into efficient and successful ranching operations. No farm or ranch buildings remain on the Refuge but old dump sites are still scattered across the area. Two Refuge buildings and two fire towers built by the CCC and WPA in the 1930s are subject to conditions of Federal laws protecting historic resources.

Public Use

Crescent Lake offers a variety of public use opportunities including hunting, fishing, wildlife viewing, photography, hiking, and environmental education (Map 5). Public trapping has been allowed on a permit basis. About 7,000 to 9,000 people visited Crescent Lake in recent years, a drop of over 30 percent from the 13,000 recorded in 1987. Counting methods varied somewhat throughout the period and may be the reason for this drop.

Most visitors engage in more than one activity but the primary reason for visits in recent years can be categorized as follows:

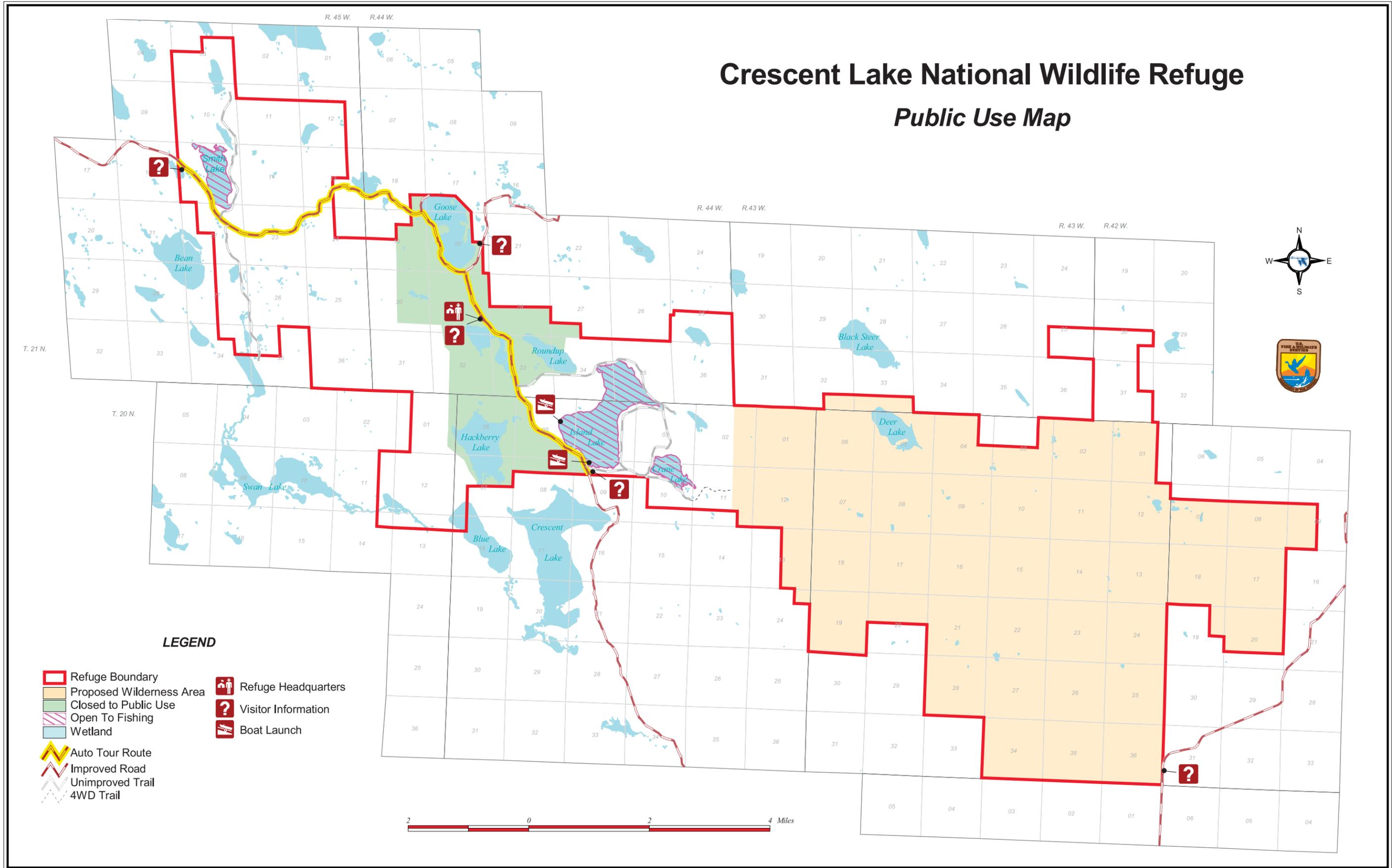
Hunting	3%
Fishing	67%
Wildlife viewing and photography	28%
Education/Interpretation	2%

The Refuge is open to hunting for mule and white-tailed deer, prairie grouse, and ring-necked pheasants. It is not open for waterfowl, other migratory birds, or predators, such as coyotes. The 5-year average for deer hunting is 200 visits; the average for upland game is 300 visits. Some hunters hunt for both deer and upland game during the same visit.

Fishing on Island and Smith Lakes is the most popular use of the Refuge. In recent years, fishing visits averaged about 5,000, of which 20 percent occurred during winter months. Supporting facilities are limited to two graveled boat ramps and two fishing piers on Island Lake. Boats are only allowed on Island Lake and gas powered engines are prohibited. Formal education/interpretation facilities are limited to one auto tour route along the County road and modest information kiosks and displays at the headquarters. The Refuge is available as an outdoor classroom; however, the isolated location, sparse local population, and distances to schools limits use to about 200 students per year.

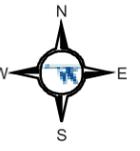
Crescent Lake National Wildlife Refuge

Public Use Map



LEGEND

-  Refuge Boundary
-  Proposed Wilderness Area
-  Closed to Public Use
-  Open To Fishing
-  Wetland
-  Auto Tour Route
-  Improved Road
-  Unimproved Trail
-  4WD Trail
-  Refuge Headquarters
-  Visitor Information
-  Boat Launch



Map 5 - Public Use Map

