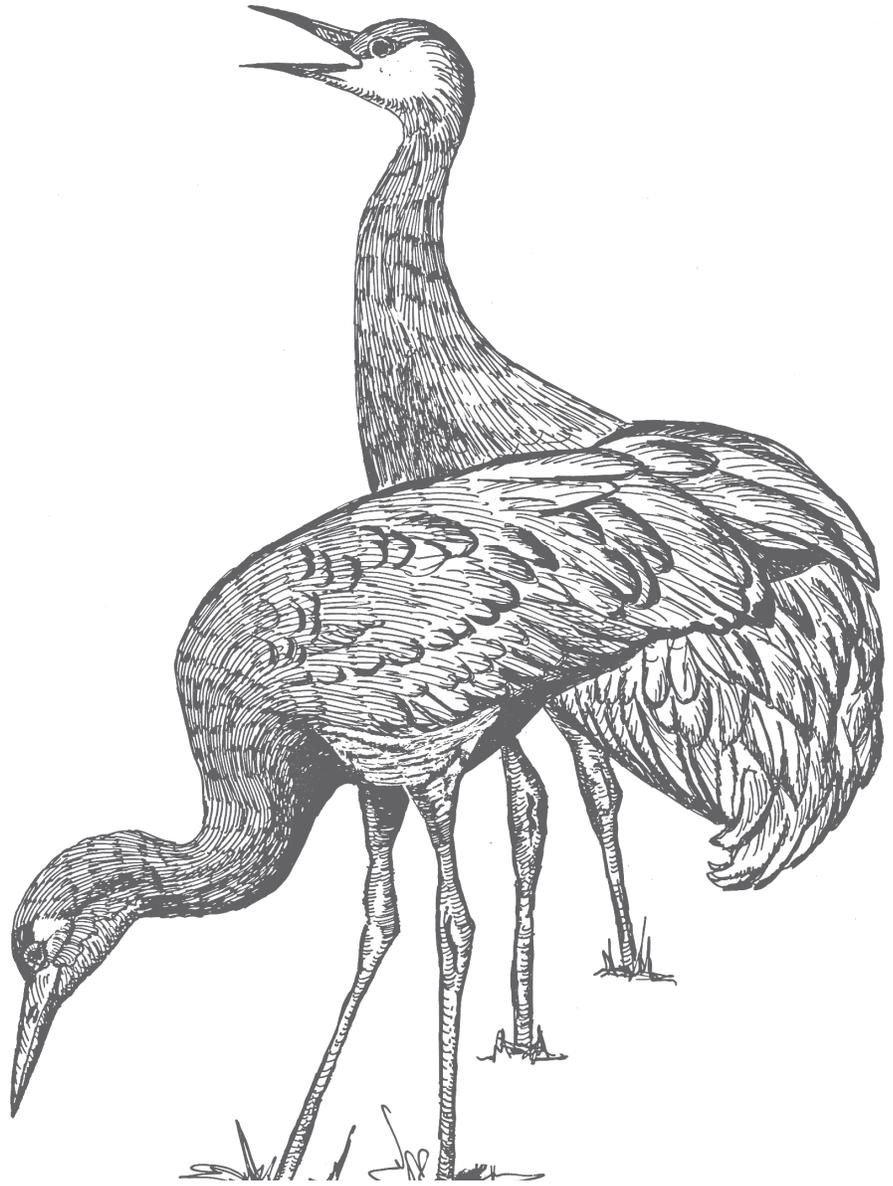


4 Affected Environment



4 Affected Environment

Lacreek NWR is located about 12 miles southeast of Martin in Bennett County in southwestern South Dakota. The refuge lies in the shallow Lake Creek Valley on the northern edge of the Nebraska Sandhills and includes native sandhills, sub-irrigated meadows, impounded fresh water marshes, and tall- and mixed-prairie uplands. The refuge occurs in a region characterized by the transition between eastern and western plant and animal species. Wildlife on the refuge includes aquatic and marsh dwelling species, as well as species typical of the prairie. This chapter describes the refuge's environmental resources that may be affected by the implementation of the CCP.

The refuge is in a semi-arid area characterized by cold winters and hot summers. Temperature fluctuates both seasonally and daily. Summer temperatures climb above 100°F, while winter temperatures may drop to -30°F with wind chills as low as -60°F. Annual rainfall is 17 inches, of which 80 percent occurs from April to September. Average snowfall is 32 inches.

4.1 Geology and Soils

The geologic materials underlying the refuge consist of clays and silts of the Chadron Formation and siltstones and sandstones of the Brule Formation, deposited during the Lower Tertiary

and overlain with materials of the Arikaree and Ogallala Formations deposited during the Upper Tertiary (Whitehead 1996). The materials of the Arikaree and Ogallala Formations were deposited primarily by streams, but the presence of volcanic ash indicates that some material was deposited as the result of wind (Perisho 1912).

The sandhills were of late Pleistocene age and were formed by wind-deposited sands. The surface on which the sand dunes were formed rises nearly 2,000 feet over the 250-mile east-west extension of the sandhills.

Three major soil associations are present on the refuge. The Valentine Association is an extension of the Nebraska Sandhills, and consists of hills with ridges ranging from 29 to 75 feet high. This association is made up of excessively drained, deep sandy soils. These soils are very permeable; a large percentage of runoff percolates into the groundwater. These soils also are very erosive, causing large "blowouts" to form when vegetation and its soil binding root systems are removed.

The Keith-Rosebud Association is an area of nearly level to gently sloping tablelands and consists of well drained, deep silty soils. These soils are suitable for farming, and the majority of these soils were farmed prior to establishment of the refuge.

The Mosher-Minature Loup Association is found on bottoms, terraces, upland valley bottoms, and basins that have a fluctuating water table. These



Soil erosion

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associations consist of nearly level, somewhat poorly drained, deep loamy soils and saline soils with a clay pan. The shallow water table supports vegetation more typical of tall-grass prairie. In areas of saline soils with a claypan, saltgrass and foxtail barley are the predominant vegetation.

4.2 Water Resources

Surface Water

Several spring-fed creeks emerge from the Nebraska Sandhills and provide a constant supply of clear water for the refuge. Lake Creek is the major spring-fed stream after which the refuge is named (see figure 8, habitat map). Average stream flows on Lake Creek range from a low of 9.2 cfs in 1981 to a high of 41.2 cfs in 1997. The long-term average is about 20 cfs. A series of dikes with control structures impound these waters and create 5,400 acres of wetlands in 13 water management units.

Groundwater

The majority of deep groundwater in Bennett County occurs in geologic materials of Oligocene, Miocene, and Holocene/Pleistocene age; however, some aquifers also exist at greater depths in Cretaceous and Paleozoic materials (Whitehead 1996). Some domestic wells exist in the deeper aquifers, but there has been little development of deep groundwater for irrigation in the vicinity of the refuge.

Groundwater is also present in the alluvial aquifer associated with Lake Creek, and in the sandhills to the south of the refuge. The sandhills act like a huge sponge, soaking up the limited amount of precipitation that falls and slowly releasing it back to surface water features. The sandhills are largely responsible for maintaining Lake Creek as a perennial stream. The alluvial aquifer is expressed by the springs, small wetlands, and wet meadows near Lake Creek and Cedar Creek. This aquifer is critical to the maintenance of subirrigation on the refuge and surrounding properties. This subirrigated area has historically been the most productive area for grass hay.

Wetlands

Wetlands on Lacreek NWR occur primarily within the floodplain of Lake Creek. Given that the majority of groundwater at Lacreek NWR in this area discharges by movement to lakes and streams, leakage to shallower aquifers, and to springs (Whitehead 1996), surface hydrology of wetlands on the NWR is influenced by a combination of surface water and groundwater inputs. Several small, spring-fed creeks and major creeks (i.e., Lake Creek, Cedar Creek, Elm Creek) contributing water to the NWR exhibit perennial flows even though evaporation far exceeds precipitation annually. Data from the USGS gauging station on Lake Creek above the refuge indicate daily flows exceeded 20 cfs and 10 cfs about 50 percent and 95 percent of days, respectively, during the periods 1963-1979 and 1997-2003. Further, groundwater discharge from aquifers has been documented as contributing more than 50 percent of flows in the Little White River and Minnechaduza Creek, which are in relatively close proximity to the refuge (Carter 1998). This suggests that the influence of groundwater on the surface hydrology of wetlands on the NWR may be substantial, particularly during the late spring and summer when evapotranspiration rates are greatest.

Water Rights

The following section is a summary of water rights associated with the refuge:

- U.S. Water Right 2-2, priority date October 16, 1934, for all unappropriated waters of Lacreek (Lake Creek) and tributaries in Bennett County to be used on the refuge by means of dams 7, 8, 9, and 10. A maximum amount of 23,710 acre-feet (11,008 acre-feet of storage and 12,702 acre-feet of seasonal use) of water use is permitted.

- U.S. Water Right 3-2, priority date December 13, 1935, authorizes storage of water in the LWRRR reservoir and the diversion of water from the Little White River to Pools 9 and 10. U.S. 3-2 was supplemented with the purchase of water license 253-2, priority date May 27, 1940, for all of the unappropriated waters of the Little White River from its confluence with Lake Creek to the Town of White River. A maximum of 1,827 acre-feet of storage with 843 acre-feet of seasonal use is authorized for use in supplementing Pools 9 and 10.
- Water Right 2147-2 to appropriate and impound up to 167.5 acre-feet in the DU sub-impoundment in Pool 9 with a priority date of November 1, 1990.
- Water Right 2192-2, priority 1991, authorizes 1444.7 acre-feet with 4.44 cfs from six springs originating along the edge of the sandhills to create 235 acres of marshes, sloughs and wet meadows for waterfowl propagation and enhancement of wildlife habitat.
- Water Right 1921-2, priority May 20, 1933 for 4.45 cfs from Cedar Creek to be stored in a dam on Cedar Creek with a capacity of 30 acre-feet, and to irrigate 362 acres.
- South Dakota Reissued Water Permit 2300-2 authorizes construction and maintenance of a control structure to impound 0.75 acre-feet of water to prevent carp from traveling upstream of the structure, in order to protect the state-listed threatened pearl dace. This permit has a priority date of February 1, 1994.

4.3 Vegetation Communities

Wetlands and Associated Vegetative Communities

Wetlands on the refuge (see figure 8) are managed to provide both resting cover and food resources for migratory birds. Flows from springs through the winter months keep portions of some units open and provide resting and feeding sites for trumpeter swans, Canada geese, mallards, and a small number of other migratory bird species. Throughout the rest of the year, wetlands serve as production and maintenance habitat for waterfowl, other migratory birds, and resident wildlife.

Substantial emergent and submergent vegetation occurs in wetlands at the refuge. Sago pondweed, coontail, and duckweed occur in the deeper, more permanently flooded zones, while cattail, bulrush, wild rice, burreed, and arrowhead grow in more

shallowly flooded areas that may go dry due to a drawdown. The perimeter of these units may be dominated by smartweed, barnyard grass, Canada bluejoint, prairie cordgrass, sedges, rushes, wild mint, and dock that can tolerate shorter periods of surface flooding and saturated soils.

The management of wetlands on the refuge attempts to simulate historical wet/dry cycles by raising and lowering water levels to meet specific management objectives. Desirable emergent and submergent vegetation establishment and growth is encouraged, invertebrate substrate is increased, water clarity can be improved, accumulated nutrients in bottom sediments are broken down and cycled, and some measure of carp control is achieved. Extensive mudflats are created when wetlands are in the initial drawdown phase and create optimal feeding opportunities for migrating shorebirds, wading birds, and other neotropical species.

Wet Meadows and Associated Vegetative Communities

Wet, subirrigated meadows make up about 13 percent of the acres on the refuge and occur notably between the Nebraska Sandhills to the south and the drier, uplands to the north (see figure 8, habitat map). These meadows are nearly flat, have saturated soils near the surface for most of the growing season, and frequently pond water for short periods after rainfall events. Much of the western portion of the refuge falls into the wet-meadow category. These wet meadows contain a full complement of native grasses and forbs. Species found in this community include Nuttall's sunflower, blue vervain, goldenrod, wild licorice, swamp milkweed, wild mint, spotted joe-pye weed, and black-eyed susan.

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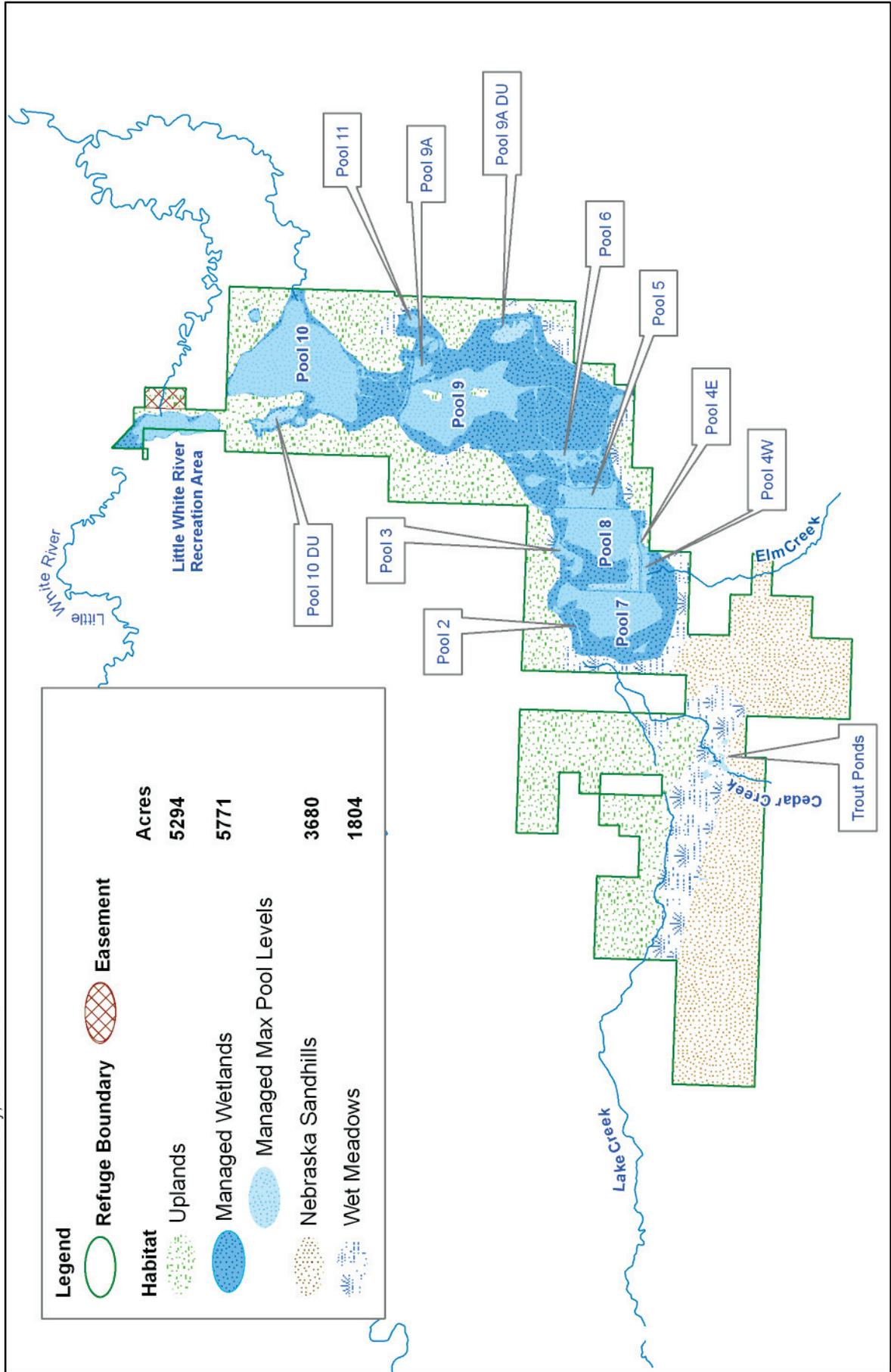


Figure 8. Habitat map

Uplands and Associated Vegetative Communities

There are 10,350 acres of grasslands at Lacreek that consist of sandhills, meadows, and uplands (see figure 8, habitat map). Approximately 4,900 acres of native grasses are within the refuge, of which 3,726 acres are in the Nebraska Sandhills. Big bluestem, little bluestem, sand bluestem, prairie sandreed, switchgrass, Indian grass, Canada wildrye, June grass, sand dropseed, needle-and-thread grass, western wheatgrass, and salt grass have all been noted on refuge grassland transects.

The sandhills portion of the refuge contains a diverse component of grass and forb species generally not found anywhere else on the refuge. Although not found on the refuge, today it is believed that blowout penstemon may have extended at one time to the edge of the sandhills, including the area of Lacreek NWR. Several small “blowouts” or areas of active sand movement can be found and may be suitable habitat.

During the 1930s, large fields formerly planted to crops were plowed to form ridges, and planted with non-native grasses including smooth brome, crested wheatgrass, and Kentucky bluegrass species to minimize soil erosion. Today, the refuge contains approximately 5,450 acres of uplands dominated by these non-native species. Extensive areas of crested wheatgrass and smooth brome remain on the refuge.

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 smooth brome 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 noxious weeds. The refuge plans to restore these grasslands, along with the crested wheat grass fields, to native grasses and forbs. The native grass restoration process generally involves cropping the field for 3 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 seed. Since 1997, the refuge has restored or is in the process of restoring approximately 670 acres to native grasses. Approximately 350 acres were planted to native grasses in 2000 and 2001 alone. Starting in 2004, refuge staff began to harvest seed from the refuge and other local sites. Over 120 species of native grass, forb, sedge, and rush species have been harvested to be used for restoration. Future plantings will utilize over 100 species of locally collected seed.

Upland vegetation is maintained to provide nesting habitat for migratory and resident bird species. Upland habitats also provide necessary habitat

requirements for resident wildlife throughout the year. A variety of management techniques have been implemented to maintain and enhance upland habitat conditions on the refuge including the use of prescribed fire, grazing, haying, native prairie restoration, and invasive species management.

Shrub and Tree Plantings (Shelterbelts)

The refuge has less than 70 acres of shrubs and trees. Some refuge dikes are lined with American plum, chokecherry, peachleaf willow, sandbar willow, and eastern cottonwood. In order to maintain dikes, and provide secure fire lines for prescribed burning, most of the peachleaf willows will be removed from the dikes. American plum, chokecherry, and sandbar willow provide habitat for species such as Bell’s vireos and willow flycatchers. Large mature cottonwoods will be maintained to provide perch sites for bald eagles and other raptors. The refuge has several shelterbelts composed of green ash, American elm, honey locust, hackberry, ponderosa pine, eastern redcedar, and Russian olive. Many of the shelterbelts are near refuge housing, headquarters, and other buildings and provide protection from the wind.

4.4 Wildlife

Mammals

A total of 39 species of mammals have been recorded on the refuge. Representative species include coyote, cottontail rabbit, deer mice, shrew, meadow vole, weasel, ground squirrel, prairie dog, badger, mink, beaver, muskrat, skunk, raccoon, white-tailed deer, mule deer, and pronghorn.

Black-tailed Prairie Dogs

It is unknown to what extent prairie dogs historically occurred on the refuge. Prairie dog control programs were enacted prior to refuge establishment and during the early years of the refuge. It is likely, however, that prairie dogs were present north of the sandhills and Lake Creek. Most of these soils were farmed prior to refuge establishment and were seeded to crested wheatgrass and smooth brome. These shallow-rooted introduced grasses are more prone to drought stress than native mixed-grass prairie. The resulting short vegetation allows for rapid expansion of black-tailed prairie dogs during droughts.

Eleven prairie dog towns totaling 502 acres are currently located within the refuge and are found primarily in the uplands north of Lake Creek (see the Draft Black-tailed Prairie Dog Management Plan in appendix E).

Reptiles and Amphibians

Formal and informal surveys and observations on the refuge have noted tiger salamanders, Woodhouse's toad, western chorus frog, leopard frog, bullfrog, and plains spadefoot toad. Turtles include common snapping turtle, western painted turtle, and box turtle. Four species of lizard have been observed: northern earless lizard, northern prairie lizard, many-lined skink, and the prairie racerunner. Snakes include the eastern yellow-bellied racer, western hognose snake, bull snake, plains garter snake, red-sided garter snake, and prairie rattlesnake.

Birds

Over 281 species of birds have been recorded at Lacreek NWR since 1959. The majority of passerines and other birds common to the plains states are found on the refuge at some time during the year. Twenty-four species of waterfowl are commonly observed. During spring and fall migrations, waterfowl numbers have peaked at 29,000 ducks and 37,000 geese in recent years. Refuge files indicate that as many as 80,000 ducks have staged on the refuge during migration. Approximately 150 to 200 trumpeter swans typically winter at Lacreek. The largest nesting colony of American white pelicans in South Dakota is found on the refuge. Nine species of cormorant, herons, egrets, bittern, and ibis use the refuge for migration and/or nesting. Secretive species such as American bitterns are commonly observed. Golden eagles, bald eagles, red-tailed hawks, Swainson's hawks, northern harrier, American kestrel, great-horned owls, burrowing owls, and short-eared owls are some of the more common species of raptors seen on the refuge. Twenty-one species of shorebirds use the refuge from spring through fall, some staying to nest. Regionally rare species such as long-billed curlews and marbled godwits are commonly observed. A number of songbirds migrate through or nest on the refuge. Declining species, such as grasshopper sparrows, bobolinks, eastern meadowlarks, and dickcissels, are commonly observed in refuge grasslands.

Trumpeter Swans

Trumpeter swans were introduced on the refuge from Red Rock Lakes NWR between 1960 to 1962. These original birds established the High Plains Flock, which now nest primarily on sandhill lakes

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to the south of the refuge. An estimated 400 birds make up this flock, with as many as 268 returning to Lacreek NWR during the fall and winter. The trumpeter swans also rely heavily on spring-fed creeks in the sandhills for winter habitat. A portion of this flock migrates north to Greenwater Lake Provincial Park in Saskatchewan, Canada to nest and returns to Lacreek NWR to winter.

Lacreek NWR has not had a successful nesting attempt for over 5 years. Habitat has decreased, but with wetland management efforts, habitat is increased and there may be nesting in the future.

American White Pelicans

American white pelicans began nesting on two islands in Pool 9 shortly after construction. This nesting colony has become one of the largest in South Dakota. A nesting site relatively free from predators, little human disturbance, and abundant food resources both on the refuge and lakes and ponds within flying distance are believed to make this site attractive to nesting pelicans. Although nesting requirements were met previously, predators have become a problem in recent years

USFWS, Laura Williams

USFWS, Laura Williams

Fish

Fish species including northern pike, saugeye, large-mouth bass, black crappie, perch, bluegill, pumpkinseed, bullhead, carp and a variety of minnows including the state threatened pearl dace and red-belly dace are all found in refuge waters. Rainbow trout are stocked in spring-fed ponds in the sandhills portion of the refuge. Great blue herons, American white pelicans, double-crested cormorants, American bitterns, and western, pied billed, eared, and horned grebes forage for fish in the refuge waters. Selected pools (Pools 3, 4, 7, 10, the trout ponds, and the LWRRA) are open to public fishing.

Threatened and Endangered Species

Table 2 from the South Dakota Natural Heritage Program documents federal and state listed endangered and threatened species found at Lacreek NWR.

4.5 Cultural Resources

Prehistoric Resources

Although the number of cultural resources investigations in and around Lacreek NWR have

been few, a major discovery was made in 2000 of a large bison bone and stone artifact site located in Pool 8. The site was called the Sierra-Kai site. Mapped and recorded by FWS archaeologists in August 2000 during a drawdown of the reservoir, over 1500 bison bones and numerous stone artifacts were documented. It appears that the site may have been used to process bison carcasses. A Late Plains period (1500 A.D. to 1800 A.D.) projectile point was recovered with other stone tools. The site covered nearly 20 acres and extended to the northeast. Other indications of prehistoric Native American activity within the boundaries of Lacreek NWR include stone artifact finds near Pool 9 by an FWS archaeologist. These sites indicate the potential for other prehistoric sites, usually covered by the waters and vegetation of the reservoirs, to exist along the old creek bed and floodplain dammed in the 1930s to create the reservoirs. It is now known that the Sand Hills and the Badlands areas of Nebraska and South Dakota have evidence of various periods of Native American occupation, possibly going back several thousand years. It is also known from historic records, that the Lacreek NWR area was frequently visited by various tribes during the 18th and 19th centuries; including the Lakota, Cheyenne, Arapahoe and Pawnee, to name a few. Although no prehistoric sites have been determined eligible for nomination to the National Register of Historic Places, future discoveries may change that situation.

Table 2. Endangered and threatened species found at Lacreek NWR

<i>Common Name</i>	<i>Scientific Name</i>	<i>Federal Status</i>	<i>State Status</i>	<i>Occurrence</i>
Fish				
Northern redbelly dace	<i>Phoxinus eos</i>	None	State Threatened	Resident, found in Lake Creek
Pearl dace	<i>Margariscus margarita</i>	None	State Threatened	Resident, found in Lake Creek
Birds				
Bald eagle	<i>Haliaeetus leucocephalus</i>	Federal Threatened	State Threatened	Regular spring/fall migrant, regular winter resident
Interior least tern	<i>Sterna antillarum athalassos</i>	Federal Endangered	State Endangered	Rare migrant
Osprey	<i>Pandion haliaetus</i>	None	State Threatened	Rare migrant
Peregrine falcon	<i>Falco peregrinus</i>	None	State Endangered	Regular spring/fall migrant
Piping plover	<i>Charadrius melodus</i>	Federal Threatened	State Threatened	Rare spring fall migrant
Whooping crane	<i>Grus americana</i>	Federal Endangered	State Endangered	Occasional spring/fall migrant
Mammals				
Swift fox	<i>Vulpes velox</i>	none	State Threatened	Rare area resident

Source: Bryce et al. 1998.

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Historic Resources

The refuge's early twentieth century history is closely tied to the Civilian Conservation Corps (CCC) and Works Progress Administration (WPA). Young men enrolled in the CCC in the mid- to late 1930s completed much of the dike-construction and infrastructure work at the refuge. CCC Company #4723 started work at the refuge in spring 1937 and completed its work in fall 1939. The WPA worked at the refuge from 1937 to 1941. Young men working under the WPA planted thousands of trees and shrubs on the refuge. Both the CCC and WPA were involved in building trails, dikes and landscaping.

The refuge buildings were constructed in 1936 and included a service garage and office, small cabin residence, equipment shed, lookout tower, and barn. All these buildings are still present at the refuge except for the equipment shed. The service garage, barn, and lookout tower were determined to be eligible for the National Register of Historic Places (Register) in 1999, but none of these structures has been formally listed on the Register.

The WPA constructed a picnic shelter at LWRRA in 1940-1941. The original fabric of the picnic shelter has been rebuilt over the years and it was determined to be ineligible for the Register in 2000.

4.6 Special Management Areas

Wilderness Review

Lacreek NWR meets the size, scenic, and ecological value criteria for wilderness; however, the refuge has been modified by roads, fences, grazing, agriculture, and wetland drainage. These alternations prevent designation as a wilderness area. To be designated a wilderness area; lands

must meet certain criteria as outlined in the Wilderness Act of 1964:

- Generally appears to have been affected primarily by the forces of nature, with the imprint of human work substantially unnoticeable;
- Has at least 5,000 acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and
- May also contain ecological, geological, or other features of scientific, educational, scenic or historical value.

Little White River Recreation Area

The LWRRA is a special management area on the refuge. The land was accepted as a donation in fee title under the Refuge Recreation Act. Historically, it has been a place that surrounding community members have used for recreational purposes. Within the deed, there are provisions for activities not normally found on a wildlife refuge. In this area of the refuge there are opportunities for recreational hunting, fishing, swimming, boating, and camping.

4.7 Visitor Services

The refuge offers a variety of recreational opportunities to local residents and other visitors centered on the wildlife resources. Opportunities on the refuge include wildlife-dependent and wildlife compatible uses legislated by Congress and outlined in the National Wildlife Refuge System Improvement Act of 1997. These uses include hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation.

The refuge is open to hunting for white-tailed and mule deer, ring-necked pheasant, and sharp-tailed grouse. A number of select pools are open for fishing throughout the year. The refuge is a popular destination for viewing migrations of waterfowl, shorebirds, and neotropical birds. Popular wildlife watching opportunities on the refuge include trumpeter swans, American white pelicans, burrowing owls, and black-tailed prairie dogs. Interpretive displays and brochures are available at refuge headquarters. An auto tour route and nature trails provide opportunities for viewing and photographing wildlife. The LWRRA has facilities for boating, fishing, swimming, and camping.

Fishing

Fishing is permitted year-round on Pools 3, 4, 7, 10, trout ponds, and the LWRRA. Warm water species such as northern pike, channel catfish, and large mouth bass are the species most desired by anglers on the LWRRA. The trout ponds are spring-fed and remain cold enough to support rainbow trout. The refuge coordinates with the South Dakota Department of Game, Fish and Parks to manage the recreational fishery; the state stocks game fish.

Hunting

A portion of the refuge is open to pheasant and sharp-tailed grouse hunting. The refuge also provides bow and muzzle loading hunting for deer. Special regulations apply to all hunting activities.

Environmental Education and Interpretation

Refuge staff provides educational talks and tours for schools and other groups upon request. Exhibits, educational videos, and informational brochures are available in the visitor center. Informational brochures and refuge maps are also available at two information kiosks located on the refuge.

Wildlife Observation

The refuge provides outstanding opportunities for viewing wildlife. The abundance and variety of wildlife species combined with relatively low visitation provides many opportunities to view wildlife close up. The refuge offers a 4-mile, self-guided auto tour loop, starting at the refuge headquarters and winding around several large wetlands. Waterfowl, shorebirds, wading birds, and raptors are common along the auto tour loop, as are deer, muskrats, and snapping and painted turtles. Trumpeter swans and large concentrations of ducks and geese begin to arrive in October. Numbers generally peak in November. From November through March, trumpeter swans are easily spotted from the auto tour route. Auto tour guides are available at the visitor center and provide interpretive information along the route.

The Bird Walk Trail (0.2 mile) originates at refuge headquarters and takes visitors around a wooded thicket. The Pelican Islands Trail (0.2 mile) provides visitors with a rare opportunity to view American white pelicans nesting on two islands. During late April and early May, visitors can see up to 1,500 pelican, double-crested cormorant, black crowned night herons, and great blue heron nests located on these islands. Black-tailed prairie

dogs, and, at times, burrowing owls, are easily viewed in the large prairie dog towns north of the refuge.

4.8 Fire and Grazing History

Historically, grasslands in the northern Great Plains co-evolved with various disturbance regimes such as fire and large-scale grazing. Whether lightning induced or deliberately set by Native Americans, fire has influenced the composition of the plant community at the refuge. A handful of fire-tolerant shrubs such as chokecherry, American plum, and leadplant were present, while other woody species killed by fire were restricted to areas that were protected from fire. The plant community was dominated by a number of species of grasses with many species of forbs dotting the landscape.

It is believed that the historical fire frequency for the mixed grass prairie was 5 to 7 years. Little information is available on the occurrence of wildfire during the early years of the refuge. More recently, the refuge has had up to three wildfires a year. 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 refuge policy to control all wildfires occurring on the refuge.

Refuge staff now uses prescribed fire to simulate the historical influence wildfire had on the plant communities (see appendix F). Most prescribed fires are generally ignited during late winter through greenup in spring. This time of year presents opportunities to complete prescribed burns when temperatures are lower, humidity is higher, and the fire may be more easily controlled. This timeframe also coincides with other refuge activities such as wetland management. Wetlands can be drawn down in late winter and prescribed burned, and then be re-flooded to provide spring



Mule Deer

USFWS, Tom Koerner

migratory habitat. Historically, wildfires likely also would have occurred during the summer and fall. Prescribed fire was infrequently used as a management tool for most of the refuge's history. During the last 10 years, prescribed fire has been increasingly used, and refuge staff now completes five to ten prescribed burns each year, covering 1,500 to 3,000 acres.

Similar to fire, grazing 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 landscape at multiple scales.

Most plant species have developed 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, and some species have spines to cause injury to grazing animal's mouths.

Historically, Lake Creek and other springs on the refuge were some of the only local water sources available. It is likely that herds of bison spent a considerable amount of time here. Their grazing, trampling, trailing, and related activities likely had a significant impact on the development and maintenance of the plant communities.

Bison and elk are no longer present on the refuge. Instead, refuge staff works with local ranchers to mimic natural disturbances due to 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 warm season grasses and forbs. Wetland and wet meadow grazing may occur for much of the growing season to stress and physically injure aggressive wetland species such as cattails and favor species that provide more seed production, open habitats, and competition to Canada thistle.

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. Refuge staff has found that cattle will actively graze Canada thistle early in the growing season. Follow-up treatments also tend to be easier to complete and more effective after grazing.

4.9 Socioeconomics

Population and Demographics

The population in Bennett County grew 11.5 percent from 1990 to 2000. The population estimate for the county in 2004 was 3,522, a 1.5 percent decline from 2000 (U.S. Census Bureau 2005). Martin, the county seat, had a population of 1,106 in 2000.

Farming and livestock ranching are the main agricultural enterprises. About 96 percent of the county land is in farms or ranches. Major crops are winter wheat, alfalfa, hay, proso, sorghum millet, and sunflowers. During wet years, some dry land corn and soybeans are also planted. Movement of grain, livestock, and freight is by truck lines and farm-owned trucks; there is no rail line in the county.

The racial makeup of the county is 40.91 percent White, 0.28 percent African American; 52.07 percent Native American, 0.06 percent Asian, 0.14 percent Pacific Islander, 0.17 percent from other races and 6.38 percent from two or more races (www.en.wikipedia.org/southdakota)

Employment and Income

In 2001, Bennett county had 71 private non-farm employment establishments with paid employees, compared to a total of 24,032 in the State of South Dakota overall. Agriculture is the major employer in the county. A variety of businesses exist in Martin, including health services, education, retail sales, and support services. The median per capita income is \$10,106 (1999) compared with the state which was \$17,562. 39.2 percent of the population was living below the poverty line, compared with the state at 13.2 percent (U.S. Census Bureau QuickFacts 2002).



USFWS, Tom Koerner

Cottontail rabbit

4.10 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 tiny liquid or solid particles in the air that is respirable in the lungs.

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

