

3 Refuge Resources and Description

The Sand Lake National Wildlife Refuge is located in Brown County, South Dakota, approximately 25 miles northeast of Aberdeen.

To get to the refuge, visitors must travel 5 miles east of Aberdeen on South Dakota Highway 12, and then 20 miles north on Brown County Highway 16.



Beth Ullenberg/USFWS

Wetlands fill the backdrop behind the Sand Lake National Wildlife Refuge's sign.

The refuge lies in north-central South Dakota and covers 21,498 acres (figure 4, next page). This area of South Dakota is in the heart of the prairie-pothole region of the northern Great Plains and plays a major role for migratory birds associated with the Central Flyway. Since the refuge is located near the 100th meridian, both eastern and western migratory bird species may be found.

This chapter describes the current physical and socioeconomic environment of the refuge:

- Geographic setting
- Special management areas
- Physical resources
- Biological resources
- Fire regime and fire history
- Natural resources
- Population and habitat monitoring
- Cultural resources
- Wilderness review
- Socioeconomic setting
- Public use
- Partnerships

GEOGRAPHIC SETTING

The Sand Lake National Wildlife Refuge is located in the upper James River basin (figure 1). The 21,116-square-mile area of the James River basin is divided between North Dakota (6,688 square miles) and South Dakota (14,428 square miles). The South Dakota portion of the basin is 350 miles long, with a maximum width of about 100 miles. The river begins west of Fessenden, North Dakota, flows east for a short distance, then follows a general southerly course through North Dakota and South Dakota to its confluence with the Missouri River east of Yankton, South Dakota.

The upper James River basin is a flat plain bounded by the Missouri River escarpment on the west and the Altamont, Antelope, and Gary moraines on the east. The basin contains extinct glacial lakes whose beds are distinguishable by the extremely flat topography. The basin slopes from an elevation of 1,630 feet above sea level in the headwaters, down to 1,300 feet above sea level at the North Dakota-South Dakota line, and to 1,170 feet above sea level at the mouth of the James River. The river follows 747 miles of winding channel across the 350-mile length of the basin (within South Dakota). This meandering stream lies in a shallow floodplain that varies from a few hundred feet to three miles in width.

The James River lowlands are bordered by the Missouri Coteau, which extends from the Missouri River on the west and the prairie coteau to the east. The major land features associated with this area of South Dakota are products of the Pleistocene glaciations that formed the Missouri River and the prairie potholes sometime between 12,000 and 40,000 years ago. This area of the prairie-pothole region provides important habitat for waterfowl production and other prairie birds (figure 3).



Figure 3. The prairie-pothole region

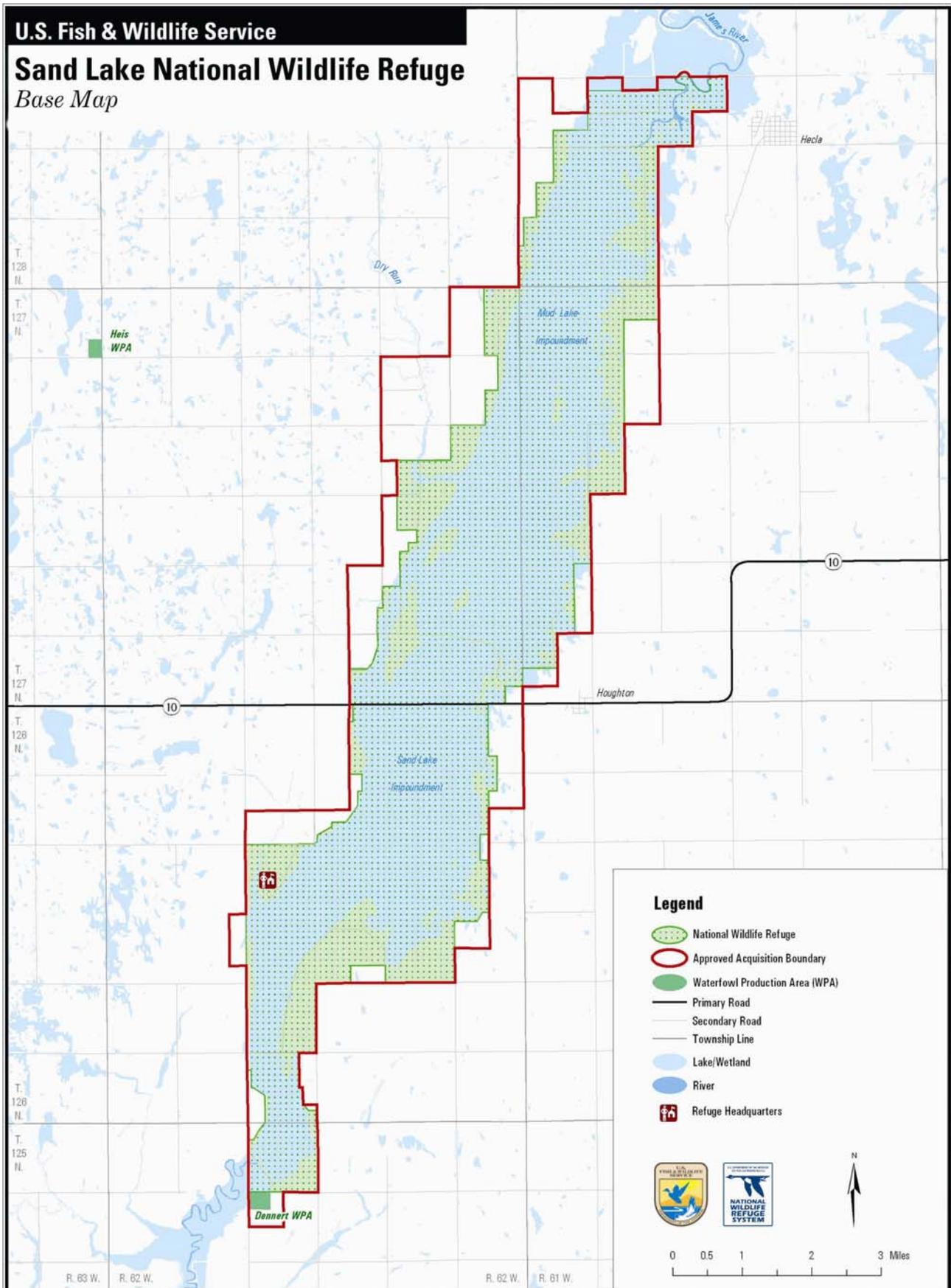


Figure 4. Base map for Sand Lake National Wildlife Refuge, South Dakota

The refuge is located in these rich lowlands along the James River. The James River bisects the refuge north and south and has the flattest gradient of any river its size in North America. From its source to its mouth, its average gradient is only 3 inches per mile. Through the refuge and most of Brown County, the river has a drop of only 1 inch per mile.

Two dams, with water-control structures, were built across the James River during the 1930s by the Civilian Conservation Corps (CCC). These structures impound and enhance two main pools, Mud Lake (containing 5,300 surface acres when full) and Sand Lake (containing 6,100 acres surface acres). Several other impoundments provide additional wetland habitat.

This region of South Dakota was once dominated by native prairie vegetation. The tall-grass prairie is located primarily east of the James River, and the mixed- and tall-grass transition dominates most of the James River basin physiographic region. Much of this zone has been farmed, but some prairie still exists, particularly in areas with numerous shallow wetlands or poor quality soils.

The Service has adopted watersheds as the basic building blocks for implementing ecosystem conservation. The Mainstem Missouri ecosystem includes portions of the Missouri River and Hudson Bay watersheds.

SPECIAL MANAGEMENT AREAS

In recognition of its value to the conservation of birds and their habitats, Sand Lake National Wildlife Refuge has been designated as both a Globally Important Bird Area (GIBA) by the American Bird Conservancy (March 17, 2001), and a Wetland of International Importance (WII) (Convention on Wetlands of International Importance 1971).

The refuge has supported the largest nesting colony of Franklin's gulls in the world, with up to 150,000 breeding individuals. At the time, this amounted to about 50 percent of the entire population of this at-risk species (National Audubon Society 2002). In addition, many thousands of Franklin's gulls gather on the refuge in the fall.

Other colonial-nesting birds on the refuge include white-faced ibis, black-crowned night-heron, eared and western grebes, and Forster's and black terns. One large, mixed-species, heron rookery hosts up to 6,000 pairs.

The marbled godwit and the willet nest on the refuge, as do the short-eared owl, the bobolink, the Nelson's sharp-tailed sparrow, and the clay-colored sparrow. When mud flats are exposed during spring and fall migration, the refuge hosts thousands of shorebirds.



© John Jave

A Franklin's gull lands on a refuge lake.

Fall migrations of snow geese may reach peaks of 250,000 individuals, whereas the spring migration has been documented at more than 1.2 million. Hundreds of thousands of ducks also stop over on migration. As many as 12,000 American white pelicans are found on the refuge seasonally.

PHYSICAL RESOURCES

Soil and water resources largely determine habitat communities, along with climatic factors. Mineral resources and air quality, other important resources, are also described in this section.

SOILS

The refuge is located along the James River within the Dakota Lake plain, a lowland physiographic division of South Dakota. The area is characterized by the sandy bottom of an ancient lake, glacial uplands, and alluvial floodplains. Soil composition is strikingly different on opposite sides of the refuge. To the east, the soils are characteristically sandy and loamy soils similar to the lake plain. To the west and beyond the refuge, the soil is characteristically silty and sodium-affected silty soils (USDA 1993).

WATER RESOURCES

The upper James River is a unique portion of the total James River ecosystem in South Dakota. At the refuge, the flow of the sluggish James River is interrupted by two natural pools (Mud and Sand lakes) that have been regulated by low, earthen dams and water control structures. Both lakes are shallow; Mud Lake averages about 1.5 feet in depth and Sand Lake averages about 2.75 feet in depth with current management. The maximum depths of the pools are approximately 6 feet. Margins and other shallow areas of both impoundments produce dense stands of emergent vegetation.

The principal water right at the refuge is withdrawal number U.S. 1-3 (October 16, 1934). The withdrawal

covers 61,062 acre-feet of water (27,021 acre-feet storage and 34,041 acre-feet seasonal use) from the James River. The water's principal use is for migratory waterfowl use, supplemental use, game and fish propagation, and public recreation.

The refuge also holds water license number 4225-3 (February 2, 1978) for 0.67 cubic feet per second (totaling 150 acre-feet annually) from a well at headquarters, with supplemental pumping to a marsh.



Cattail Wetland

Water license number 4258-3 (March 24, 1978) allows 63 acre-feet of water storage and sufficient water annually to maintain the water level at outlet elevation 1,291.0 feet mean sea level from Dry Run for waterfowl production.

Water permit number 5516-3 (March 8, 1991) allows for impoundment of 295 acre-feet with sufficient water annually to maintain water level to the outlet elevation of 1288.5 feet mean sea level in Columbia Marsh. This water is diverted from James River overflow during high, spring runoff events to provide habitat for fish and wildlife production.

The refuge also holds a vested right for an artesian well drilled in 1935 by the CCC. The well flows approximately 5 gallons per minute and the water is used for domestic purposes.

CLIMATIC CONDITIONS

Large seasonal fluctuations of climate in the region are the rule, rather than the exception. Extreme cold

in the winter, with mean minimum temperatures of -2.7°F in January, is normal. During the summer, mean maximum temperatures are commonly near 83.5°F in July. Precipitation averages 20.3 inches annually, but cycles of drought and heavy precipitation are evident (NOAA 2002).

MINERAL RESOURCES AND RESERVED RIGHTS

During the withdrawal of lands establishing the refuge in 1935, and as additional lands were acquired, there were no reservations of surface or subsurface mineral rights (to other than the federal government) on all the land owned fee-title by the federal government. Purchase of some land tracts were subject to existing rights-of-way at the time of acquisition. These rights-of-way include a buried telephone line, an electric distribution line, and three highway easements to the South Dakota Department of Highways.

AIR QUALITY

Visibility and clean air are primary resource values. The protection of these resources must be given full consideration in fire management planning and operations. Additionally, smoke can have serious health and safety effects that must be considered. The management of smoke will be incorporated into the planning of prescribed fires and, to the extent possible, in the suppression of wildfire. South Dakota does not have a permit system for air quality, but does have regulations concerning agricultural burning.

The Environmental Protection Agency's (EPA) air quality index rates air quality in Brown County, South Dakota as "good" (U.S. EPA 2004). In 2001, Brown County ranked among the best, i.e., cleanest, 20 percent of all counties in the U.S. in terms of total environmental releases.

Based on the EPA's most current data, Brown County ranked among the cleaner 40 percent of all counties in the U.S. in terms of an average individual's added cancer risk from hazardous air pollutants (Environmental Defense Network 2004). Conversely, Brown County ranked among the worst, i.e., dirtiest, 20 percent of all counties in the U.S. in terms of aerial emissions of fine particles (Environmental Defense Network 1999), 70 percent of which is a result of agricultural practices (EPA 1999).

BIOLOGICAL RESOURCES

This section describes the existing plant and animal communities on the refuge. Figure 5 shows existing habitat conditions.

HABITAT

The nutrient-laden waters contained in the 11,450 acres of marsh and open water form the heart of the 21,498-acre Sand Lake National Wildlife Refuge.

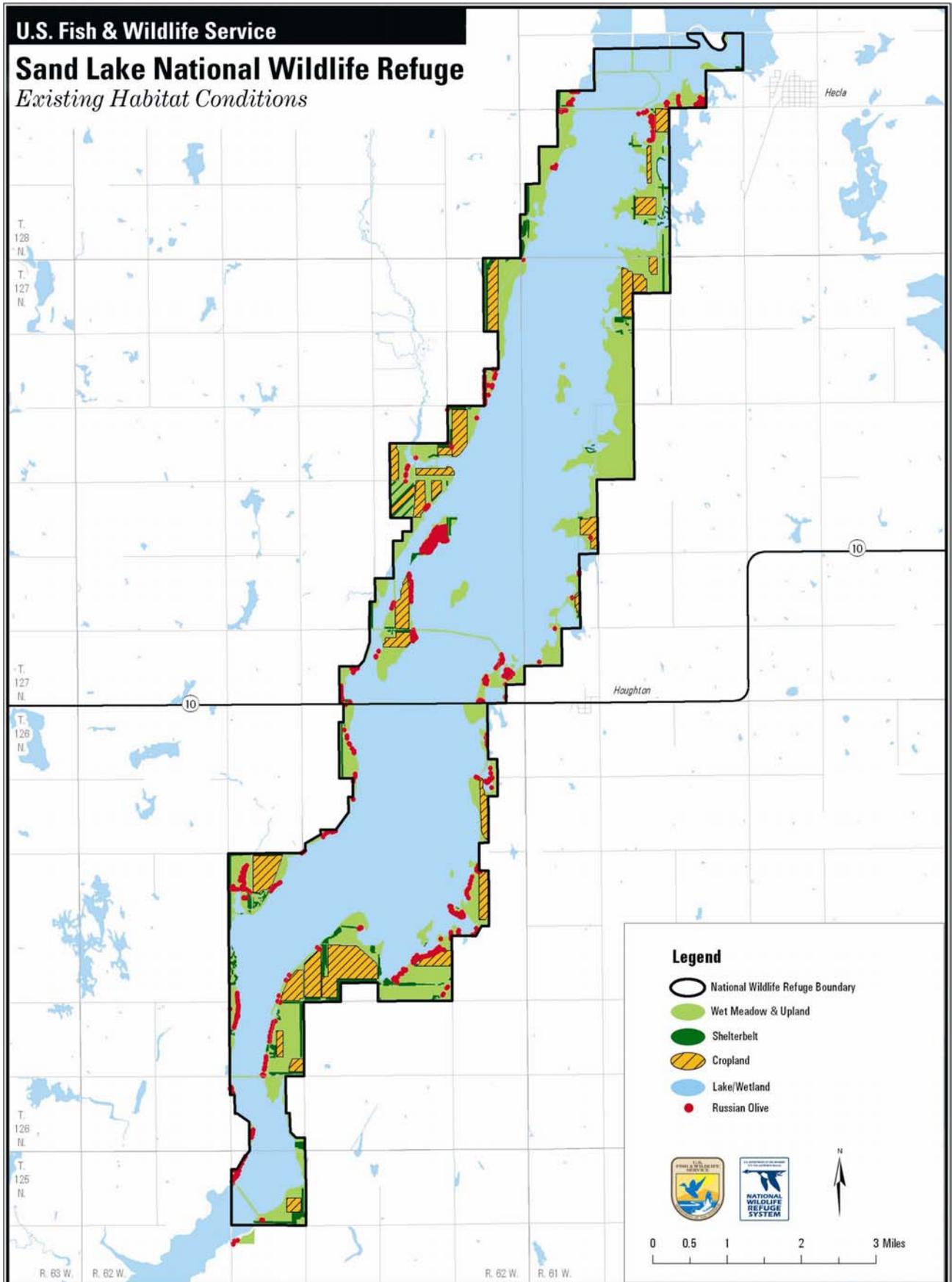


Figure 5. Existing habitat conditions at Sand Lake National Wildlife Refuge, South Dakota

The remaining 10,000 acres of uplands consist of 424 acres of shelterbelts; 1,217 acres of croplands; and more than 8,000 acres of grasslands.

Downstream from the refuge, the meandering, wooded channel provides a scenic contrast to the surrounding agricultural landscape. Terrestrial habitat associated with the upper James River channel is generally characterized by a hardwood corridor, interspersed with thickly vegetated marshes and brushy fields. The existing natural woodland and forest habitat consists primarily of mature, mixed stands of American elm, green ash, boxelder, and willow. This habitat offers scenic beauty and provides the diverse habitat necessary for wildlife to reproduce and survive in the typical prairie environment that surrounds it.

Grasslands

Grassland vegetation makes up 8,600 of the 21,498-acre refuge. These grassland acres are primarily composed of reseeded exotic grass and forb species, mainly smooth brome and alfalfa with some fields of intermediate wheatgrass and sweetclover.

Grasslands are managed with emphasis on providing optimum nesting cover for upland-nesting waterfowl.

Approximately 8,000 acres of tame grass and legumes (DNC) and restored native grass plantings are on the refuge. Most DNC fields have degraded to smooth brome. These fields have not been recently restored by farming and reseeding to maintain stand vigor. Because Canada thistle tends to invade new grass-seeded areas, the breakup of DNC fields slowed. Instead, management actions such as grazing or haying, followed by a disking, were used to improve the existing stands by encouraging the forb component.

Nearly 500 acres of cropland has been removed from production and planted to restored native grass. These native sites generally consist of six or seven grass species, which may include big and little bluestem, green needlegrass, western wheatgrass,



Indiangrass, sideoats grama, and switchgrass. The seeding of forbs in the restoration process has been limited due to high seed costs, difficulty in acquiring seed, and problems associated with the control of Canada thistle in the plantings.

Grasslands are managed using grazing, haying, and prescribed burning. The management tool selected is dependent on the availability of water, fences, livestock, ease of firebreak construction, and suitability for haying. Management is focused on obtaining the maximum height and density of grasslands with some type of management action occurring every 4–5 years.

The refuge has been divided into management zones; individual units are selected each year within a zone depending on the monitoring results. Grazing is used most commonly to reduce litter, stimulate forb species, and promote active healthy growth of the grasslands. Grazing is also used help control invasive species. Permittees for all grassland management actions are selected by the bid process and only farmers and ranchers who operate on land within 2 miles of the refuge boundary are eligible to bid.

Wetlands

The wetland component is comprised of two main bodies of water, Mud and Sand lakes. The construction of the two low-lying dams changed the habitat conditions of these historical marshes.

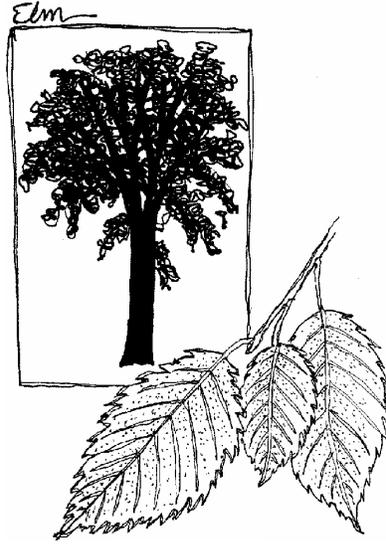
Wetland habitat on the marsh is characterized by open water, submergent vegetation (e.g., sago pondweed and coon's tail), emergent vegetation (e.g., cattail and common reed), and temporary and seasonal vegetation (e.g., rush, sedge, and prairie cordgrass).

Water management on the refuge is greatly dependent on flows in the James River, largely due to the low gradient. Spring flows are generally allowed to fill Mud and Sand lakes to full-pool level by early May. The pools are held near full-pool level through mid-August. Water levels are dropped 1 foot below full-pool level prior to freeze-up to protect the water control structures and dikes from ice damage. Summer drawdowns are scheduled when needed to reestablish emergent vegetation within the pools.

In addition to the two main impoundments, there are five subimpoundments and many smaller, natural wetlands scattered throughout the uplands. Management of the subimpoundments is opportunistic, being dependent on water levels in the James River or local runoff. Efforts are made to draw down the subimpoundments when wetlands surrounding the refuge are full. The subimpoundments are reflooded during periods of drought to provide quality habitat when it is most beneficial to wetland-dependent wildlife.

Woodlands

Most of the estimated 424 acres of woodlands are in shelterbelts planted by the CCC in 1937–38 to control wind erosion and provide wildlife habitat. The shelterbelts have been deteriorating and no active management has been done to restore them. Most of these plantings consist of American and Chinese elms and green ash. Dutch elm disease has been gradually killing the American elms in these plantings (figure 6, next page).



© Cindie Brunner

Historically, woody vegetation occurred along riparian corridors and around some wetlands. Native cottonwood seedlings have colonized naturally into many of the marsh edges due to flood conditions on the James River during much of the 1990s. These isolated, scattered trees, with an understory of cattail and Canada thistle, have been allowed to grow naturally in the floodplain, except where controlled by upland management activity.

Management of native woodland vegetation has not been emphasized in previous habitat management efforts.

Croplands

The uplands have a long history of agricultural crop production and virtually all native prairie on the refuge has been lost to the plow. Approximately 3,146 acres of cropland was farmed on the refuge in 1952. In response to a variety of factors, including complaints of short-stopping geese from the southern states, management emphasis for uplands has shifted from providing food for migrating snow geese to waterfowl production. Much of the cropland was replanted with DNC.

Beginning in the late 1990s, additional cropland was replanted to grassland because of the lack of use by the snow geese, and because the midcontinent population of lesser snow geese were well above objectives set for the species. The planting of agricultural crops was not needed for the management of migratory birds.

A total of 1,217 acres of cropland is currently farmed by 8 cooperators on the refuge. Farming is conducted to restore native grass on deteriorating tame

grasslands, to reduce use of nonselective broadleaf herbicides, to control invasive plants and to provide, indirectly, food for white-tailed deer.

Fields are typically rotated between corn and spring wheat or soybeans. Refuge cooperators maintain the food plots on a 25:75 sharecrop basis. The kinds of herbicides permitted are limited and no insecticides are allowed. The refuge's share is taken in corn, which is left standing to provide food for wintering white-tailed deer.

INVASIVE PLANTS

Canada thistle, leafy spurge, Russian olive, and wormwood sage are the primary invasive species in the grasslands on the refuge. At least 3,000 acres of uplands and wetlands are heavily infested with Canada thistle. Most control efforts are directed at Canada thistle using grazing, haying, mowing, and biological methods. This species is a pervasive pest, partly because control measures are limited and generally require repeated application.

Canada thistle has infested almost all wetland margins in northeastern South Dakota, providing an endless seed source. The James River just ended an unprecedented, extended period of flooding during the 1990s. During this period, above-normal precipitation provided ideal germination and growing conditions for this species.

On the refuge, Canada thistle colonizes the wetland margins, spreading from there into the grasslands. Areas identified for treatment have generally been grazed, mowed, or burned prior to chemical application. To keep infestations in check, an average of 800 acres has been chemically treated annually. The uplands are often reinfested within 4–5 years.

While efforts are made to limit the amount of herbicide used on the refuge, control efforts are never complete because of the tolerance of Canada thistle to control efforts. In addition, an endless seed source from public and private lands makes reinfestation highly likely.

Prescribed fire is an important tool for grassland management; however, Canada thistle usually responds well to fire. Application of herbicides following prescribed burns is essential. There are 2,900 acres of wet meadows. While such areas often have the most severe infestations, these areas are extremely difficult to burn effectively.

Herbicides used to control invasive plants have a disastrous impact on the forb/legume component of a plant community. Chemical control is driving vegetative "succession" toward a chemical-tolerant grass community. The high water table on the refuge is problematic for herbicide application, particularly in the lower wet areas where infestations are the most severe.

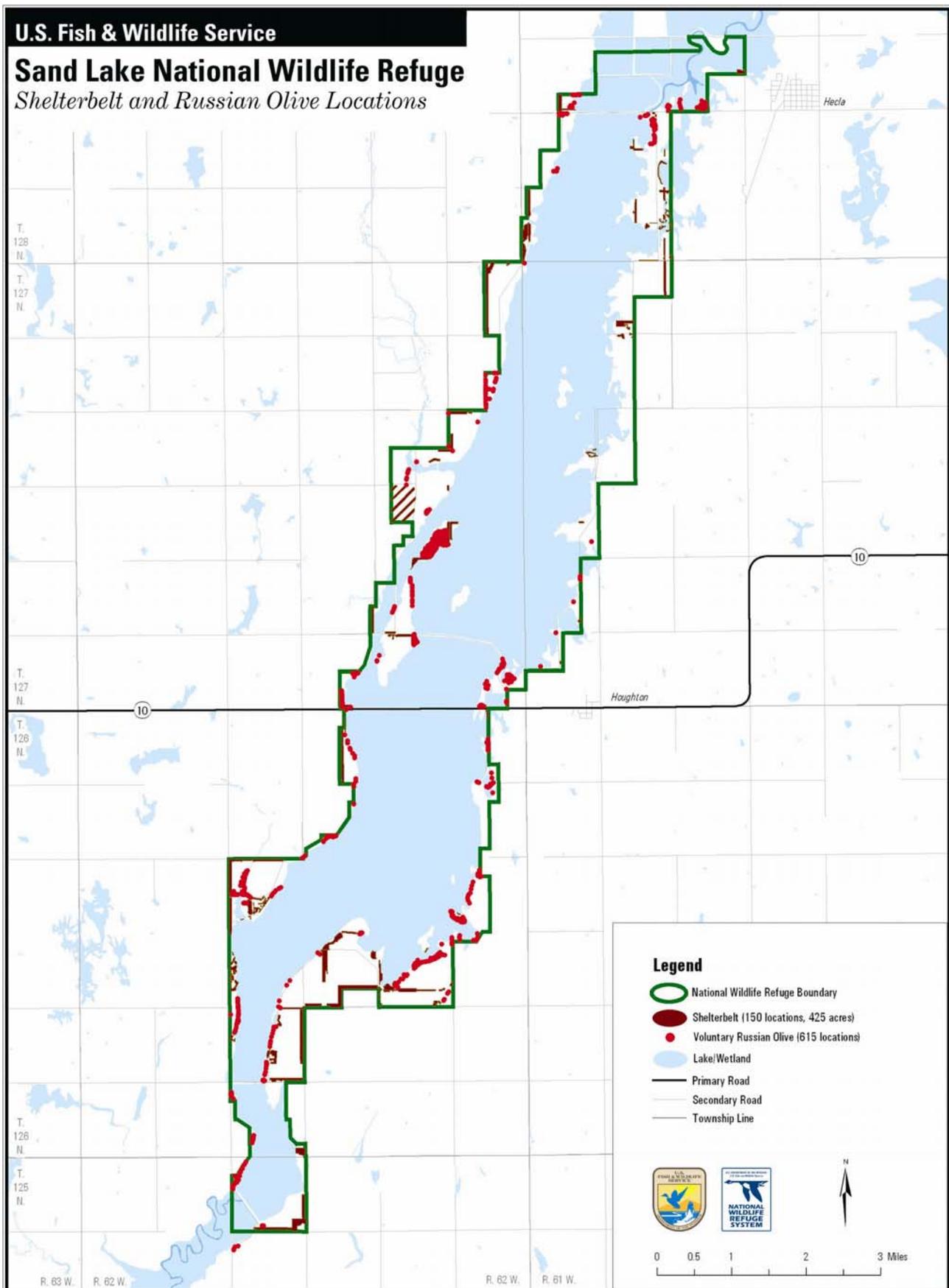


Figure 6. Shelterbelt and Russian olive locations at Sand Lake National Wildlife Refuge, South Dakota

Four species of insects were introduced on the refuge for biological control of Canada thistle, two of which have been found to overwinter. However, no reduction in thistle stands has yet been observed. Flea beetles have been introduced to control leafy spurge, with mixed results.

Russian olives have invaded many wetland margins and lowland areas. While annual herbicide treatments control new seedling growth, scattered mature trees continue to serve as seed sources.

Mowing prevents seed germination and dispersal. In addition, mowing prepares areas for subsequent herbicide application if needed. Hundreds of acres are mowed every year.

Grazing is used on a limited scale as part of the integrated approach to invasive plant control; however, the availability of interested cooperators is limited. Grazing serves as a site preparation prior to herbicide applications.

FIRE REGIME AND FIRE HISTORY

Wildfire is one of the primary natural disturbances of native prairie. Historical records describe huge prairie fires started by lightning or humans. Fires burned millions of acres, as there were few natural fuel breaks and no suppression. Wright (1980) and others believe that fire frequency in the prairie grasslands is 5–10 years. Other studies indicate that a longer frequency of 10–20 years may be more accurate (Jave 1999).

Prior to the 20th century, the role of fire in the northern plains had been one of continued perpetuation of the prairie ecosystem. Fire restored vigor to plant growth, increased seed production, released nutrients, and reduced accumulations of litter (Higgins 1986a, b). This included the area now designated as the Sand Lake National Wildlife Refuge.

Since the early 20th century and the establishment of the refuge, nearly all fires within the boundaries have been suppressed and adjacent habitat has been fragmented by agricultural practices. These activities have significantly reduced the role fire plays as a vital element of the prairie ecosystem in north-central South Dakota. In addition, grassland composition and structure have changed (i.e., exotics). This has influenced fuel type, extent, and micro-environmental factors (moisture). Recently, there has been an accumulation of knowledge, now being translated into management practices, that recognizes fire as an essential process of the mixed-grass prairie.

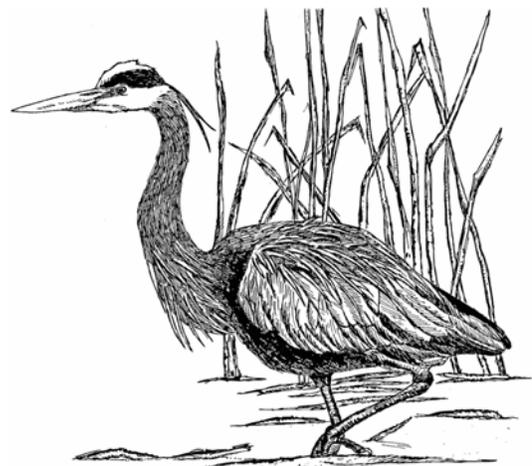
Over a 20-year period (1977–97), only 16 wildland fires, burning a total of 517 acres of Service and non-Service lands, have been reported. This limited

acreage burned is partly attributed to barriers such as roads, plowed fields, lakes, ponds, or rivers that serve as breaks. Remaining areas within the refuge had been mostly hayed or grazed, making them less fire prone.

NATURAL RESOURCES

The upper James River provides aquatic habitat for a wide range of plants and animals that have persisted through the years, despite multiple human alterations and fluctuating conditions. The James River basin is one of few major north–south migration corridors in the northern Great Plains with relatively intact riparian vegetation. This draws large numbers of migratory birds to move through the Dakotas in spring and fall.

The James River, running more than 600 miles through North Dakota and South Dakota, forms a natural flight path for migrating birds—one of the most heavily used in the Central Flyway. The upper James River is an important migration route for many species of songbirds, marsh birds, and other nongame birds.



Great Blue Heron
Tom Kelley/USFWS

As part of the only continuous north–south corridor of woodland habitat in South Dakota, at least 161 species of birds have been identified in this area during migration periods, many of which remain there to nest. Schneider (1978) identified 138 species on his census routes, including 103 in woodlands, 71 in savannahs, 67 in marshes, and 62 in grasslands. In addition, a minimum of 48 species of mammals have been identified. The bird and mammal diversity demonstrate the importance of the river system (including the refuge) to both nongame and game species.

Mud and Sand lakes are managed for intensive use by waterfowl and other migratory birds during the

spring, summer, and fall and for rough fish control during the winter. Production of sago pondweed and other submergents that are important food resources for birds are encouraged.

WATERFOWL

The prairie-pothole region is the primary breeding grounds for waterfowl in the United States. Mallards, wood ducks, and blue-winged teal are the most common breeding ducks (Schneider 1978). Populations are variable, peaking in high-water years.



Dave Menke/USFWS

Snow Geese

Studies conducted by the Service found concentrations as high as 15 breeding pairs per square mile. Wood duck densities of two breeding pairs per square mile use the refuge woodlands. Breeding densities on the river were the highest in Brown County, primarily at the Stratford Slough area.

Large concentrations of migrating waterfowl use the floodplain and temporary and seasonal wetlands in the area for resting and feeding. On the refuge, waterfowl populations have averaged approximately 184,000 ducks and 216,000 geese annually.

COLONIAL BIRDS

Colonial-nesting grebes, gulls, ibises, terns, and herons are found on the refuge. Fall concentrations of Franklin's gulls and ring-billed gulls have peaked at 150,000 and 5,000, respectively.

Information gathered by the Service (USFWS 1985) indicates that use of the James River by colonial-nesting species, including the great blue heron and double-crested cormorant, may be greater than previously realized. The preliminary list includes 24 rookery sites below the refuge, 9 of which are in Brown County. These birds depend on trees for nesting and on aquatic habitats for food, mostly fish.

SHOREBIRDS

Shorebird surveys have been conducted annually since 2000. Refuge data contributes to Manomet's

International Shorebird Survey and the U.S. Geological Survey (USGS) prairie-potholes shorebird survey. Analyses of shorebird numbers in conjunction with records of water levels in Mud and Sand lakes may be helpful in making future decisions regarding management of impoundments for shorebirds.

FISH

The upper James River, from the North Dakota border to near Redfield, South Dakota (including the refuge), is an important fish production area for the James River.

Currently, 60 species of fish have been identified as occurring in the James River and at least 22 in the upper reaches in South Dakota. Owen and others (1981) collected 41 species in the river. Primary game fish species are black bullhead, walleye, northern pike, yellow perch, channel catfish, and crappie. The majority of fish biomass in the river is made up of nongame species such as carp, buffalo, and freshwater drum.

The upper James River, which includes the refuge, provides excellent spawning habitat and has highly productive rearing areas during spring floods. Occasional test-netting by SDGFP showed an annual influx of fish during the spawning season.

There is important reproductive and rearing habitat for the northern pike, which is probably the only game fish that occurs on the refuge.

Fish greatly influence relationships of species in aquatic systems. In the upper James River, fish are an important food source for birds such as cormorants and herons and mammals such as mink and raccoon. In turn, fish depend on a rich supply of



Northern Pike
Tom Kelley/USFWS

aquatic insects, crustaceans, and other organisms for food. Collectively, these organisms are dependent on the diverse environment of pools, riffles, brush piles, and overhanging vegetation that the upper James River provides.

The quality of the aquatic habitat is directly related to stream flow characteristics. The James River is a typical prairie stream, subject to heavy organic and sediment loads, low oxygen levels, and wide fluctuations in stream flow. Historical flows range from zero in dry years to several hundred-thousand acre-feet.

Generally, stream flow is at a minimum in winter and reaches maximum in the spring (March-June). Dissolved oxygen levels sometimes reach zero in stretches of the river, usually during periods of low

flow, resulting in fish kills. Despite frequent occurrence of these adverse conditions, the upper James River maintains a substantial fish population with its diversity of habitat types—deepwater pools (protective areas) and spawning sites (reproductive areas)—and the migration of fish from other areas.

DEER

The white-tailed deer population in Brown and Spink counties largely depends on the James River for production and survival.

Data gathered on the Oahe Irrigation Project (Solomon 1982) showed that deer sightings ranged from 0.117 to 0.431 adults per mile in the irrigation areas and from 0.477 to 1.555 adults per mile on the James River. In this study, 91.2 percent of the sightings were along the river's floodplain.

A standardized spotlight survey was developed to obtain total deer counts and doe/fawn ratios for the pre-hunting population of deer on the refuge in 1990.

A postseason spotlight survey was standardized to provide comparative data. This data was collected by Bill Antonides of the SDGFP, with annual assistance from refuge staff. The data provides an index of the total deer population used by SDGFP and refuge staff to set hunting licenses for population control.



Doe with Fawn

© John Jave

OTHER WILDLIFE

The upper James River's marsh habitat (Brown and Spink counties) is important to the pheasant population as protection from winter storms. Winter concentrations of more than 1,000 birds have been reported in this area (SDGFP 1976). In addition, the brushy, wooded cover provides roosting and loafing areas.

Furbearing mammals are closely tied to the river ecosystem, depending on both the terrestrial and aquatic habitat. Mink, raccoon, and beaver thrive and fox and badger make use of available cover.

The importance of the natural river habitat for wildlife is also indicated by the diversity of species found there. In addition to game species, many nongame species including the belted kingfisher, red-headed woodpecker, white-breasted nuthatch, and bank swallow are found in this area. These species, although not important from a harvest perspective, are a vital part of the total ecosystem. Their presence indicates the unique nature of the upper James River.

Trapping for Management Purposes

The refuge has had a furbearer trapping program for both recreation and management purposes throughout most of its history. Interest in trapping has decreased in recent years partially because of a decrease in fur prices. Consequently, the knowledge and skills are being passed on to fewer young people.

Most interest is in trapping muskrats after freeze-up. Trapping success is based on the muskrat population, which fluctuates depending on hydrologic conditions of the James River. Wetter conditions following a period of drought provide resources such as flooded stands of cattails and adequate water depths for lodges that allow muskrat populations to flourish. Fall trapping can be used to remove muskrats causing damage to dikes and roads.

The Service discourages fall trapping of furbearers for recreation on national wildlife refuges. Trapping was not included in the wildlife-compatible uses legislated by Congress and outlined in the National Wildlife Refuge System Improvement Act of 1997. The fall trapping of fox, raccoon, and skunk does not increase the spring nesting success of upland-nesting species of waterfowl.

A 90-acre predator enclosure was constructed near the refuge headquarters as a Ducks Unlimited project in 1990. Waterfowl nest depredation is reduced by trapping predators inside the enclosure and along the perimeter. These species include red fox, raccoon, striped skunk, mink, and Franklin's ground squirrel. Nest success is 60–80 percent, with a record number of 220 nests recorded in 2000. As a result, a spring trapping program was initiated on Mud Lake Island during periods of high water in the James River.

POPULATION AND HABITAT MONITORING

Population monitoring of migratory and breeding birds occurs annually. Nest dragging is conducted to determine preferred habitat use by upland-nesting waterfowl and to determine waterfowl production in the predator enclosure. Other on-going monitoring is achieved through the cooperation of various agencies, volunteers, and individuals.

Sand Lake National Wildlife Refuge is an official banding station as part of the North American Duck Banding Program. More than 51,000 ducks were banded on the refuge from 1982 through 2004.



Bill Schultze/USFWS

Refuge staff doing early-morning duck banding.

Nesting activity of various bird species is monitored. Waterfowl-nesting success is monitored within the 90-acre predator exclosure. Refuge staff monitors the use of wood duck boxes, bluebird boxes, goose tubs, and mallard baskets, and checks for signs of bald eagle-nesting activity.

Until recently, habitat monitoring has not received the primary emphasis or the attention as population monitoring. A grassland-monitoring plan was developed in 2003–4 and a program of formal habitat monitoring was begun. Upland grassland habitats were classified and are monitored annually by refuge staff. The results are used to make future management decisions and to evaluate past techniques.

Monitoring of wildlife diseases is limited primarily to detection of waterfowl botulism outbreaks in wetlands. Other diseases of recent concern include West Nile virus, avian chlamydiosis, and chronic-wasting disease.

CULTURAL RESOURCES

Documented occupation in the vicinity of Sand Lake National Wildlife Refuge spans a 10,000-year period, thus there is potential for presence of archeological resources on the refuge. There are no known cultural resources on the refuge; however, a comprehensive cultural resource inventory has not been conducted. Individual sites that may be affected by management activities are surveyed for cultural resources prior to disturbance.

As indicated on a plaque, the Columbia Day Use Area is the location of the first Catholic mass in South Dakota in 1845.

The refuge contains clear ties to the Depression-era period, based on the original landscape design and presence of all but one of the original buildings. An evaluation of the historical context of structures

built during the Depression-era identified one historical site; however, the buildings have been altered.

The eight-stall vehicle building is probably the most intact and unique. In addition, the entrance sign represents the standard sign originally designed for refuges.

In South Dakota, most refuges were established in the 1930s, during the Depression. The CCC, formed during the Depression years, performed early construction activities on Sand Lake National Wildlife Refuge. Projects focused on holding water, linking channels, and creating habitat islands for migratory birds.

The CCC Camp BF-2, for Company #2749 was opened in June 1935 and closed in July 1939. Various works were accomplished, as described in the following excerpt from a report (CCC 1939).

“Forty miles of very satisfactory refuge trails provide travel facilities to almost any part of the area. Seventy miles of fence surround the refuge.

More than one-half million new trees are now thriving on the area and enhancing its appearance.

Two major and seven minor dams have been constructed or reconstructed.

Where 17 sets of farm buildings once existed, a portion of three now remain.

More than 200 miles of undesirable and run down farm fences have been removed.

Nesting and resting islands, a network of low water system channels and a complete set of water controls now are in evidence on the large marsh area that used to be marked only by hay stacks.

The foundations of two public picnic grounds have been laid.

New buildings have been constructed on the headquarters and secondary residence sites.

Large signs are located in strategic locations near the refuge, proclaiming the purpose and sponsor of the refuge.

Many upland game shelters are observed as one tours the refuge.

Large areas have been seeded to aquatic plants and an abundance of natural cover growth is present.

As a result of the display pool dam, the first CCC project, a small lake with pinioned geese and many broods of wild ducks swimming around on it is the first picture seen when entering.”



The 108-foot observation tower at refuge headquarters in the 1930s.

USFWS



Looming over a small wetland, the tower continues to be a favorite with visitors.

Beth Ullenberg/USFWS

WILDERNESS REVIEW

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 outstanding opportunities for solitude or a primitive and unconfined type of recreation.
- 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.

- May also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.

The Sand Lake National Wildlife Refuge meets the size and scientific, scenic, and ecological value criteria for wilderness. However, roads, fences, grazing, agriculture, and wetland drainage have modified the refuge. These alterations prevent designation as a wilderness area.

SOCIOECONOMIC SETTING

This section is a summary of the socioeconomic setting. The complete economic analysis is in appendix I.

The refuge is located in Brown County, South Dakota. The county is part of the glacial lakes and prairies region of South Dakota and is sometimes called the heart of the prairie-pothole region of North America. Brown County has a total area of 1,713 square miles (1,096,320 acres).

Brown County offers such attractions as the Dacotah Prairie Museum, the Centennial Village, pari-mutuel horse racing, the Brown County Fair, and the Richmond Lake Youth Camp (Brown County 2004).

Aberdeen, the third largest city in South Dakota, is the county seat and the center of commerce for the region. Aberdeen was nicknamed the "Hub City" because it served as an important intersection for many busy railroad lines. Today's "Hub City" has grown into a diverse, regional trade center with service and manufacturing industries, attractive retail shopping opportunities, convention facilities, a private college, a state university, and two large medical centers (Aberdeen Area Chamber of Commerce 2004).

POPULATION, EMPLOYMENT, AND INCOME

The 2000 census estimated Brown County's population at 35,460 persons (U.S. Census Bureau 2002). Approximately 70 percent of the county's residents reside in Aberdeen (Discover Aberdeen 2004).

While South Dakota experienced a 7.8 percent population increase from 1990 to 2000, Brown County's population decreased 0.4 percent over the same time frame (U.S. Census Bureau 2002). In 2000, Brown County averaged 21 persons per square mile; the state average was 10 persons per square mile.

The 2000 census reported the following for the county's population:

- 95.1 percent are white persons not of Hispanic/Latino origin

- 2.7 percent are American Indian and Alaska Native persons
- 0.7 percent are persons of Hispanic or Latino origin
- 0.4 percent are Asian persons
- 0.3 percent are Black or African American persons

Approximately, 86 percent of the county population 25 years and older were high-school graduates and 24 percent were college graduates (U.S. Census Bureau 2002). There are two colleges in Aberdeen—Northern State University and Presentation College.

South Dakota's major exports include computers and electronic production, machinery manufactures, processed foods, and crop production (U.S. Department of Commerce 2002).

In 2000, 83.5 percent of county jobs were in private wage and salary employment (people who work for someone else) as compared to 79.2 percent for South Dakota. According to the Discover Aberdeen website, the major employers in Aberdeen are health services, education, manufacturing, hotel reservations, agriculture, higher education, the call center, and support services.

RECREATIONAL ACTIVITIES

The refuge offers a wide variety of year-round accessible recreational opportunities that are wildlife dependent. Hunting, fishing, wildlife observation (e.g., bird watching), wildlife photography, and education are all popular activities.

The refuge is a nationally recognized wildlife sanctuary and offers opportunities for big game, upland game, and waterfowl hunters. Pheasant hunting draws outdoorsmen and women from across the country each fall. Fishing is allowed year-round at five locations on the refuge.

Major visitor expenditure categories include lodging, food, and supplies. Current visitors to the refuge spend about \$655,500 annually in the Brown County economy. The current level of visitor spending directly generates more than \$152,000 in personal income and 9.4 jobs for local businesses accommodating visitors including hotels, restaurants, supply stores, and gas stations. The associated indirect and induced effects generate an additional 4.3 jobs and more than \$102,000 in personal income throughout the Brown County economy. This has a total economic impact of 13.7 jobs and more than \$254,000 in personal income associated with the current level of refuge visitation.

REFUGE STAFFING AND BUDGETING

Current refuge staffing and budgeting generates 13 permanent and 4 temporary and seasonal employees.

The current staff accounted for an annual payroll, including salaries and benefits, of \$910,600 in 2003.

In addition to providing salaries and benefits, the refuge purchased goods and services totaling \$165,200 in 2003, approximately 65 percent of which was spent locally in the Brown County economy.



Beth Ullenberg/USFWS

Students look in wonderment at items on the "discovery table" in the visitor center.

PUBLIC USE

In addition to the various fish and wildlife habitats, the James River provides a scenic contrast to the agriculturally dominated prairie. An appreciation of this value was shown with the nomination of the upper James River as a Scenic and Recreational River by the SDGFP (1976).

Studies have documented the recreational value of the river. Hanson (1981) surveyed recreational and other uses of the river from 1975 to 1979. He divided the river into three segments beginning at Sand Lake National Wildlife Refuge. The upper section, just south of the refuge, included the river from Columbia to Fisher Grove State Park. In 1 year, this upper section had an estimated 357,590 hours of recreation, including 27 different activities. Camping and fishing were the highest uses. In Hanson's discussion, he stated:

"The number and variety of uses observed are proof that the James River is truly a multi-use resource. Uses such as sightseeing, that do not directly consume a product of the river, were consistently important to the total recreational value. Impacts upon this total recreational value, rather than a single use or value, must be considered in any management plans for the river."

The refuge offers a variety of public use activities (figure 7, next page). Approximately 50,000 people visit annually to participate in some form of recreation. Activities include hunting, fishing, wildlife observation, wildlife photography, environmental education, interpretation, and hiking.

Interpretive displays, a book sales outlet, various brochures, and accessible rest rooms are located at refuge headquarters; the visitor area and main office are open year-round.

A small room adjacent to the lobby serves as space for educational activities and as a small visitor area housing exhibits, displays, wildlife mounts, and audio equipment. This space also holds two employee offices. Maximum capacity is 20–25 elementary students and 20 or fewer junior and high school students. Classes of more than 25 students find it difficult to use the facility because of the limited size; it also has no classroom or laboratory-type space.

There is increasing demand for on-site educational and interpretive programs. Educational programs are limited to videos or floor activities. The current facility can accommodate only one school group at a time and, during peak use, groups have to be turned away. This space is used for special refuge events, which are also limited due to the facility's small size.

The Columbia Day Use Area is often used for birding and it provides accessible restrooms and parking, a hiking trail, tables, and a sun shelter.

Public access to the interior of the refuge is limited during hunting seasons from mid-October to February 1. During this time, gates and roads are closed and access is limited only to hunters to avoid user conflicts and ensure safety.

Wildlife observation, wildlife photography, environmental education, interpretation, and hiking are best from April 1 through mid-October when wildlife is more prevalent and roads and gates are open.

Areas open to visitors include the 15-mile “wildlife drive” auto tour route, the 20-mile North Loop Road, and the Columbia and Hecla day use areas.

HUNTING

The refuge has long been famous for waterfowl hunting and huge fall concentrations of snow geese. In fiscal year 2004, there were approximately 1,100 waterfowl-hunting visits.

Pass shooting for waterfowl is offered from approximately 200 waterfowl blinds placed around the refuge perimeter (figure 8). This program was set up in response to the article, “Carnage at Sand Lake,” published in the National Audubon Society magazine (1970), documenting excessive crippling of waterfowl.

In 1970, in cooperation with the state of South Dakota, certain road rights-of-way were closed to hunting to reduce waterfowl crippling, reduce road congestion, and space hunters in blinds for a higher quality hunt. In recent years, the hunting from these blinds has been less productive. Many blinds on the northern portion of the refuge receive very little use because of changed use-patterns of snow geese. It is anticipated that the number and locations of these blinds may change in the future, if the lack of use continues.

The refuge is a popular area for white-tailed deer hunters, with archery, muzzleloader, and rifle seasons occurring in November and December. In fiscal year 2004, there were approximately 2,200 deer-hunting visits.

The local agri-business community is appreciative of the refuge's efforts to provide for additional deer harvest, in addition to what is available in Brown County surrounding the refuge. Cooperative plans and strategies have been ongoing for years with SDGFP to address the dynamics of the regional deer herd.

Upland game birds include ring-necked pheasant, sharp-tailed grouse, and gray partridge. A December season for upland birds, primarily ring-necked pheasant, is offered each year at the close of the rifle seasons. In fiscal year 2004, there were approximately 900 upland game-hunting visits.



Ring-necked Pheasant

© John Jave

FISHING

The angling pressure on the upper and middle sections of the James River is significant, comparing favorably to the better lakes in northeastern South Dakota.

Fishery resources on the James River in the vicinity of Jamestown Reservoir and isolated reaches upstream are also important fishery resource areas.

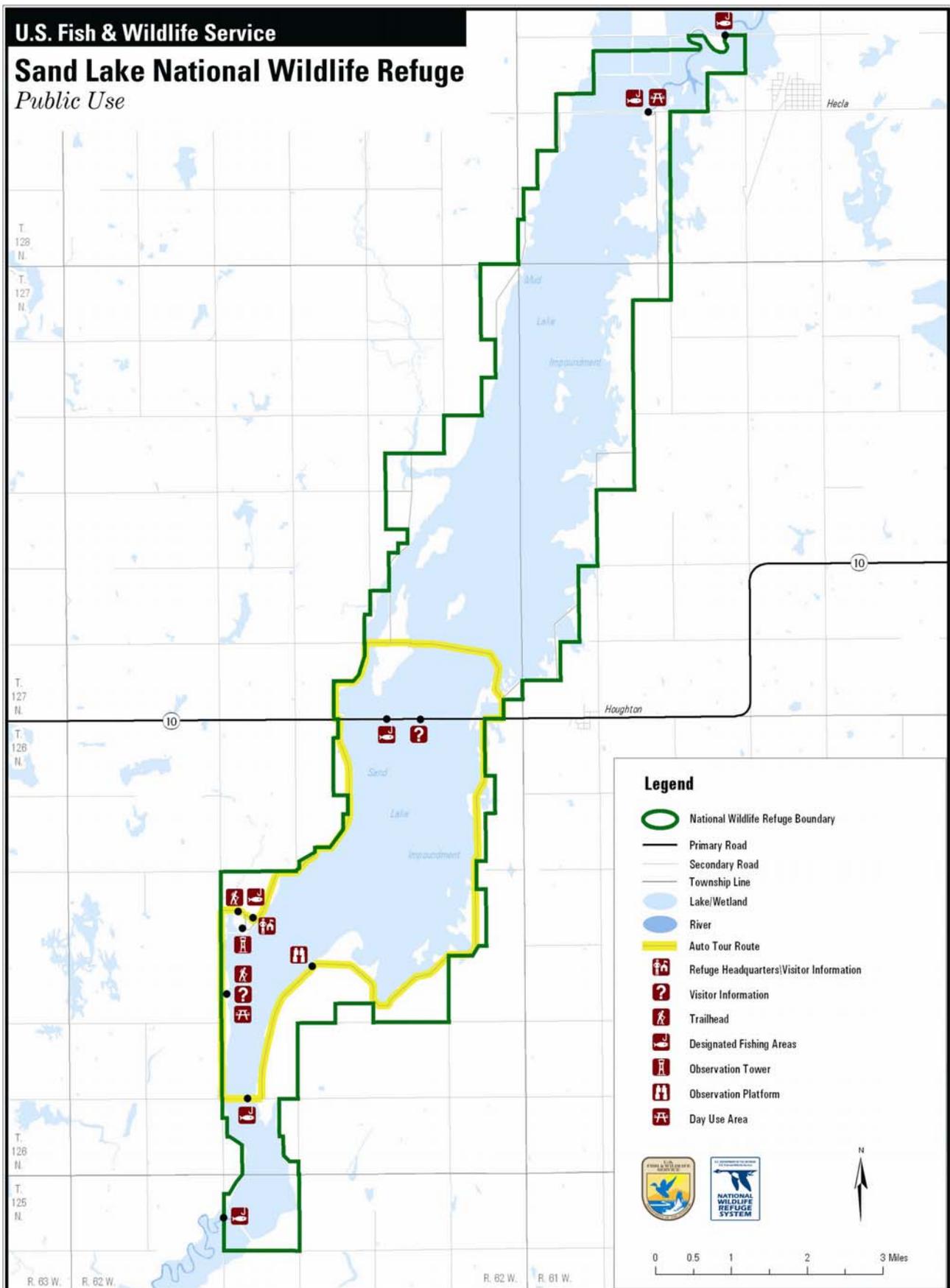


Figure 7. Public use at Sand Lake National Wildlife Refuge, South Dakota

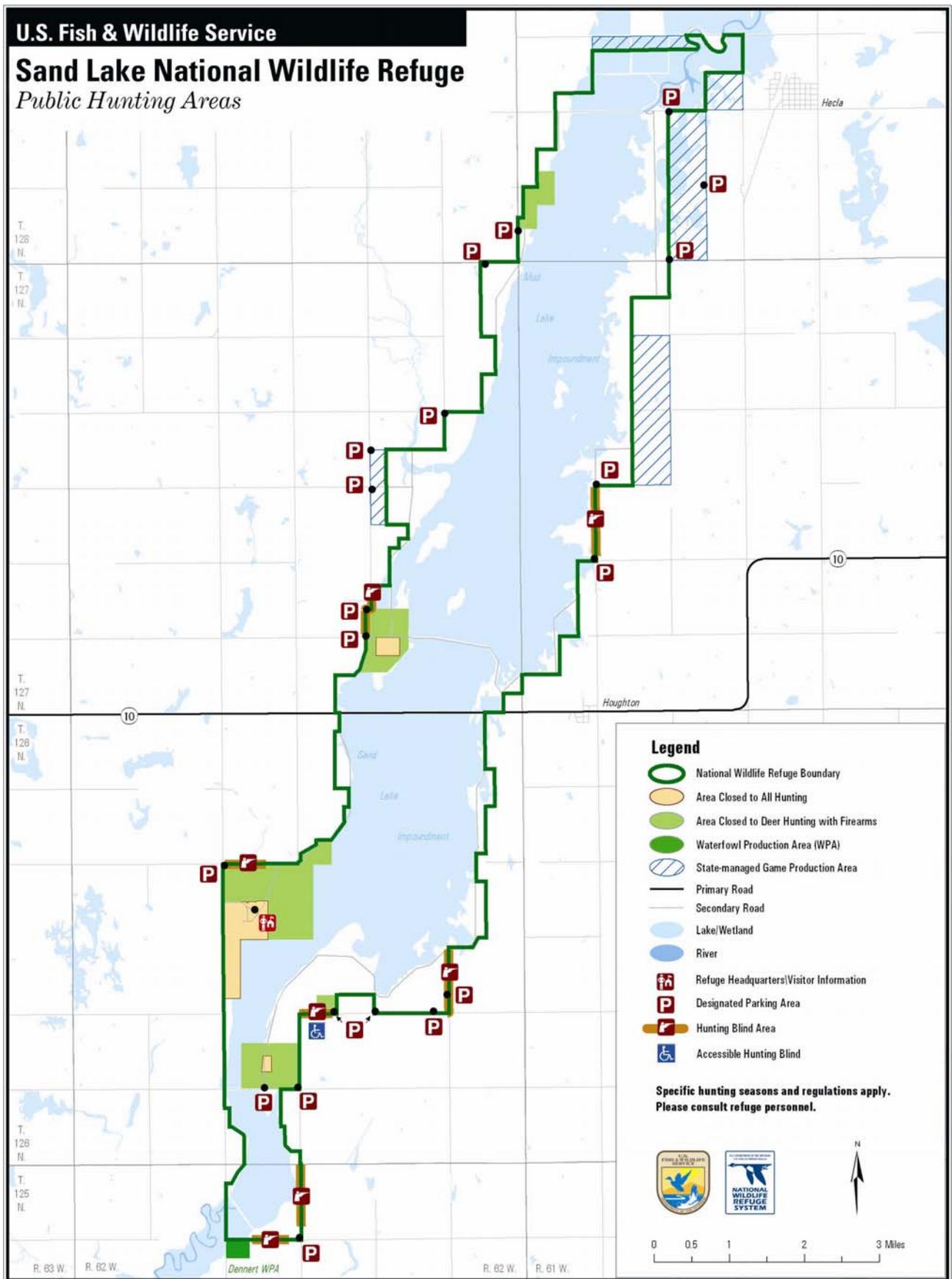


Figure 8. Public hunting areas at Sand Lake National Wildlife Refuge, South Dakota

Fishing on the refuge is offered year-round at five locations, where road rights-of-way cross the James River. Motorized and nonmotorized boating is not allowed and no facilities for fishing exist. Angler preferences include walleye, northern pike, yellow perch, and rough fish. In fiscal year 2004, there were approximately 1,200 angler visits.

The fisheries are not actively managed and fishing is opportunistic. Fish populations flourish during wet cycles and decline (winterkill) during periods of low flow or when lower water levels occur in Mud and Sand lakes. Sand Lake is generally too shallow to support a viable game fishery. Water depths at full-pool level pool are less than 6 feet, which is not enough to overwinter game fish. However, during years of high flow, the James River may provide winter fish habitat.

Anglers are limited to ice fishing within a close proximity of the designated fishing areas. Ice shacks are allowed, but must be removed daily. Vehicles are not allowed on the ice.

WILDLIFE OBSERVATION AND WILDLIFE PHOTOGRAPHY

Several state and county highways traverse the refuge and offer excellent viewing opportunities. Most activity is in spring and fall, when thousands of people visit to see large concentrations of birds when migrations are at their peak.

ENVIRONMENTAL EDUCATION

The Sand Lake National Wildlife Refuge has an active on- and off-site environmental education program. Special events include several water festivals, Scout camps, 4-H camps, local fairs, and a free fishing day.



Eagle Day visitors learn about birds of prey at a live bird exhibit.

USFWS

Each year, more than 600 students visit the refuge on school field trips. This use is dropping due to budget constraints within local school districts,

which includes the elimination of busing for nonessential activities and decreased funding for field trips and outdoor education. Refuge staffs are exploring creative ways to assist schools with busing issues to help bring field trips to the refuge.

Due to constraints on school budgets, off-site environmental education programs have flourished. More than 3,000 students are reached through staff- and educator-led programs and special events each year. Classroom programs use The Prairie Learning Trunk, The Shorebird Trunk, and other teaching kits.

INTERPRETATION

Refuge facilities for public use are somewhat limited. Interpretive kiosks on Highway 10, at the refuge headquarters, and in the Columbia Day Use Area provide visitors with information about wildlife and the Sand Lake National Wildlife Refuge.

A small visitor area, located within the headquarters building, provides information and exhibits. The building is open during regular work hours (Monday–Friday, 8:00 am–4:30 pm). During the spring waterfowl migration, volunteers staff the visitor area on weekends. A 100-foot observation tower that is open for public use in the headquarters area provides panoramic views of the refuge and the surrounding area.

A self-guided auto tour route, known as the “wildlife drive,” is available for the public to learn about the refuge and its wildlife. The route has 12 numbered stations and is open, when conditions permit, from April through mid-October. A viewing platform along the route overlooks Sand Lake.

A 0.75-mile-long, self-guided hiking trail with interpretive signs is located in the Columbia Day Use Area. A second nature trail is planned for the headquarters display pool area along with a shelter to be used for environmental education.

No photography blinds are maintained for the public. However, special-use permits are issued to professional photographers who are working on specific photographic projects.

PARTNERSHIPS

The refuge has a long history of fostering partnerships to help accomplish its mission and goals. These partners include city, county, state, and federal agencies; nongovernmental organizations; conservation groups; and private citizens.

The refuge’s partners have assisted in wildlife and habitat management, public use and recreational activities, and community outreach. Many of these relationships have developed into formalized partnerships that have written agreements or

understandings, while others remain more informal. Existing and potential partners are listed below.

ORGANIZATIONS

- 4-H Clubs of Brown County
- Aberdeen Bird Club
- American Bird Conservancy
- Aberdeen Chamber of Commerce
- Aberdeen Convention and Visitors Bureau
- American Rivers
- Booth Society
- Boy Scouts–Sioux Council
- Dacotah Prairie Museum
- Ducks Unlimited
- Girl Scouts–Nyoda Council
- Glacial Lakes and Prairies Tourism
- Hecla Sportsmen’s Club
- Manomet Center for Conservation Sciences
- National Audubon Society
- National Wildlife Refuge Association
- Pheasants Forever
- South Dakota Ornithologists’ Union
- South Dakota Wildlife Federation
- Sportsmen’s Club of Brown County
- The Nature Conservancy–Ordway Prairie
- The Wildlife Society–South Dakota Chapter
- Whitetail Bowmen
- Whitetails Unlimited

EDUCATIONAL INSTITUTIONS

- Northern State University
- South Dakota State University

GOVERNMENTAL GROUPS

- Aberdeen Parks, Recreation and Forestry
- Brookings Wildlife Habitat Office
- Brown County Commission

- Brown County Emergency Manager
- Brown County Extension Service
- Brown County Farm Service Agency
- Brown County Highway Department
- Brown County Natural Resources Conservation Service
- Brown/Marshall Conservation District
- Bureau of Reclamation–Dakotas Area Office
- Convention on Wetlands of International Importance
- Garrison Diversion Conservancy District
- Local and Regional School Districts
- Lower Crow Creek Watershed District
- National Weather Service
- Northern Prairie Wildlife Research Center
- Patuxent Wildlife Research Center
- South Dakota Department of Agriculture
- South Dakota Department of Environment and Natural Resources
- South Dakota Department of Game, Fish and Parks
- South Dakota Water Rights Program
- South Dakota Division of Forestry
- South Dakota State Historic Preservation Officer
- U.S. Army Corps of Engineers–Omaha District
- U.S. Fish and Wildlife Service (international conservation, ecological services)
- USGS (water resources)

POTENTIAL PARTNERS

A “friends group” within the community could be established and other potential partners include:

- American Fisheries Society–Dakota Chapter
- Wildlife Management Institute
- Northeast South Dakota Walleye Club
- Izaak Walton League

