

Chapter 3: Refuge Environment

Area Description

Ecological Context

Glaciers formed the major landscape features that we see today on the Refuges. Those features and climate are dominant determinants of the past vegetation of the area. In order to generalize and understand the fundamental aspects of the landscape, scientists have classified areas with similar geological, soil and climatic characteristics. In the Ecological Land Classification for Minnesota, the northwestern portion of Rice Lake NWR lies in the Tamarack Lowlands subsection, which is generally characterized by rolling to flat lake plains, beach ridges and ground moraines. The potential vegetation for this area is black spruce bog, white cedar-tamarack swamp, and aspen-birch forest. The rest of Rice Lake NWR lies in the St. Louis Moraines subsection, characterized by glacial moraines, rolling hills and small short rivers and large lakes. The potential vegetation for the area is aspen-birch forest, and Northern hardwood forest. Mille Lacs NWR and the Sandstone Unit lie in the Mille Lacs Uplands subsection, which is generally characterized by an ice-molded landscape with irregular ground moraines. The potential vegetation for the area is white pine-oak forest, white pine-red pine forest, and cedar-tamarack swamp.

Francis Marschner (1882-1966) mapped the pre-settlement vegetation of Minnesota based on Public Land Survey notes and landscape patterns. His maps provide a more detailed approximation of the vegetation in the area of Rice Lake NWR prior to European settlement. The reader should use caution in interpreting too much detail into the historic vegetation maps because of the scale and base data that Marschner used. Marschner's interpretation



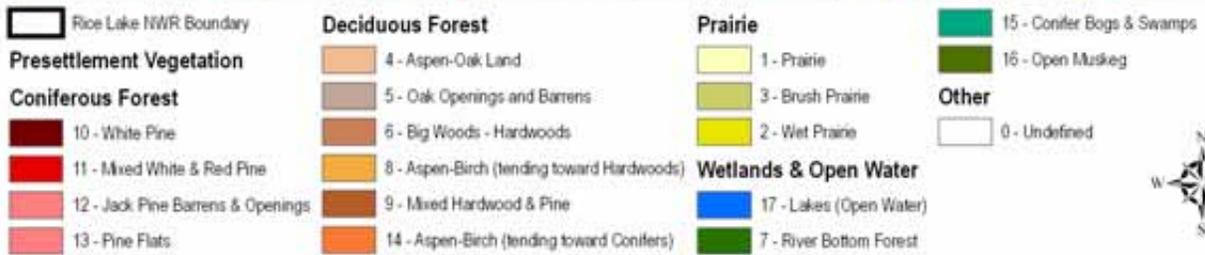
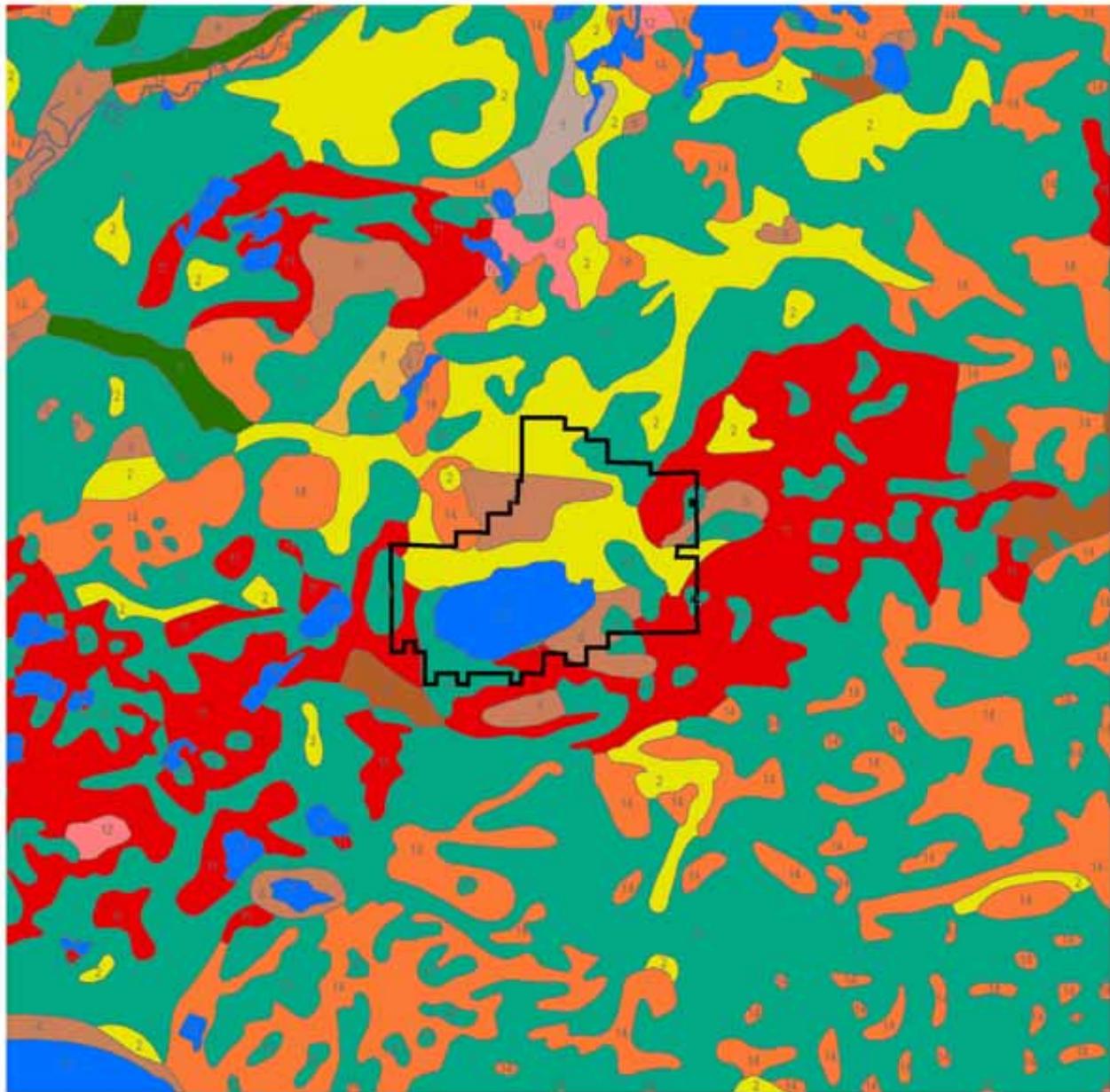
Twin Lakes, Rice Lake NWR

for the area that is now Rice Lake NWR included the following major habitat categories: aspen-birch, big woods, conifer bogs and swamps, lake, white and red pine and prairie. Maps showing the historic vegetation of Rice Lake NWR and the Sandstone Unit as interpreted from Marshner's map are displayed in Figure 4 and Figure 5.

Socioeconomic Context

The population of Aitkin County in 2000 was 15,301 people. The Minnesota state demographer projects that the county population will grow to 20,370 in 2015 and 22,160 in 2020. In 2000, approximately 2,800 residents were of school age (5 to 19 years). The estimate for school age residents for 2020 is about 3,300. The county is sparsely populated with 8.4 persons per square mile. The average for Minnesota is 61.8 persons per square mile. The ethnic mix for the county's population is 96.4 percent white, 0.2 percent black or African American, 2.3 percent American Indian, 0.6 percent Hispanic or Latino origin, and 0.2 percent Asian. The percent of persons age 5 years or older who speak a lan-

Figure 4: Historic Vegetation, Rice Lake NWR



Scale 1:250,000

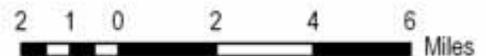
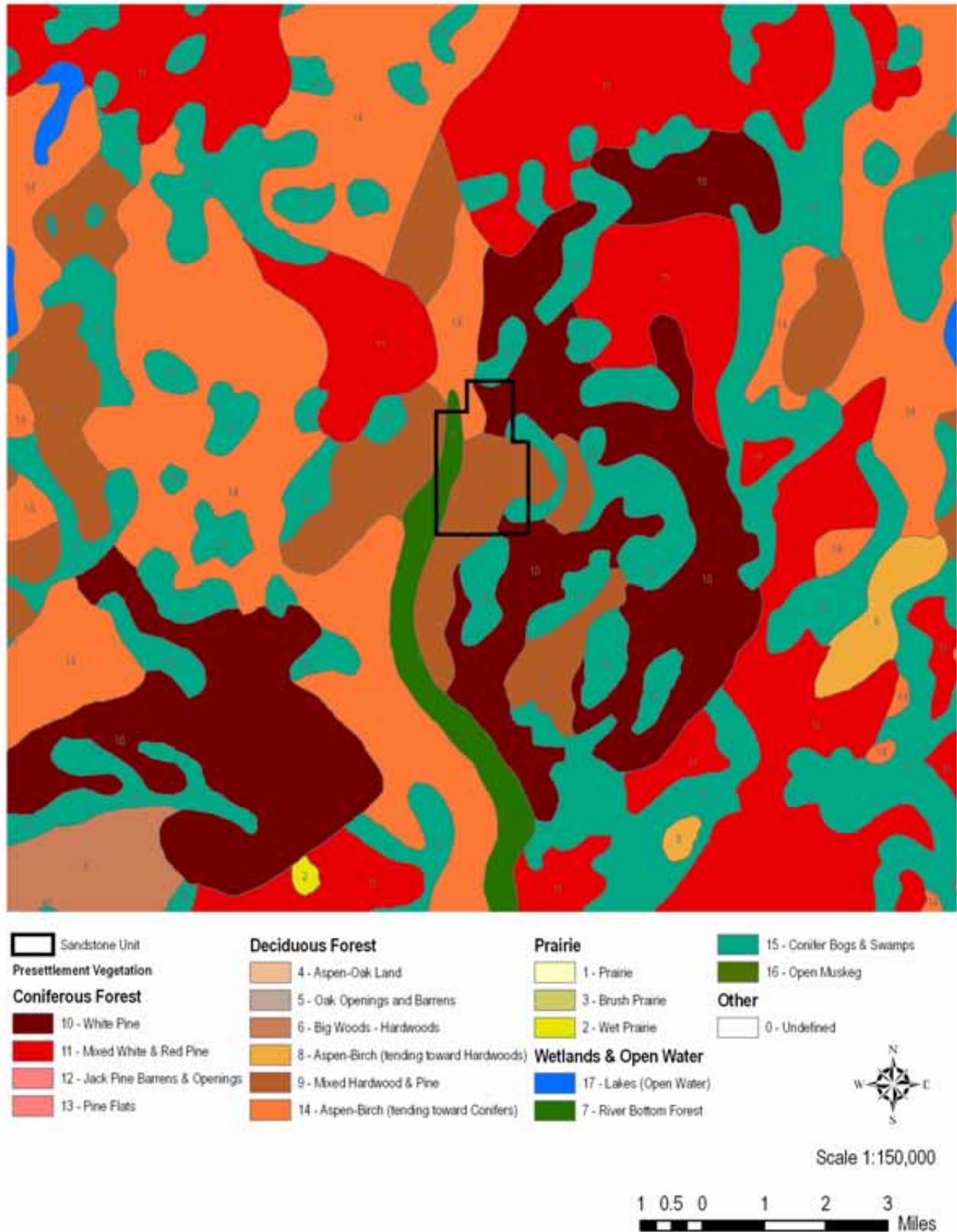


Figure 5: Historical Vegetation, Sandstone Unit of Rice Lake NWR





Bobcat, U.S. Fish & Wildlife Service

guage other than English in their home is 3.5 percent. Past population growth is attributed to the creation of new manufacturing jobs and immigration of retirees.

As reported in the 2000 County Business Patterns, Aitkin County had 3,192 employees. The largest employment sectors for the county were health care and social assistance (582), retail trade (569), accommodation and food services (511), manufacturing (479), construction (226), and wholesale trade (192).

“Northeastern Minnesota has traditionally lagged behind the state in terms of income and Aitkin County historically has the lowest income level within the region. Despite diversification of the regional and local economy this situation remains unchanged.” (Aitkin County Land Management Plan).

Personal income per capita in 2000 was \$20,242 for the county and \$31,935 for the state. The median household income was \$31,139 for the county and \$47,111 for the state. The average earnings per job was \$18,375 for the county and \$34,836 for the state. The percent of persons below poverty in 1999 was 11.6 percent for the county and 7.9 percent for the state.

Compared to the state, the residents of Aitkin County have less formal education. The percent of persons age 25 or greater who are high school graduates is 80.4 percent for the county and 87.9 percent for the state. The percent of persons age 25 or greater with a bachelor’s degree or higher is 11.3 percent for the county and 27.4 percent for the state.

“Tourism is a growing sector of the local economy, and is reflected by the number of second homes located on Big Sandy and northern Mille Lacs Lakes. Snowmobiling and hunting opportunities also draw significant numbers of tourist dollars to the county. Tourism and population growth has implications for the Aitkin County land base, particularly for public lands.” “The in-migration of retirees, along with increasing numbers of second home developments, are leading to forestland fragmentation on private lands.” (SmartWood, 2004).

Historical Context

Pre-Historical

The earliest evidence of inhabitation by humans is dated to the Woodland Tradition (ca. 500 B.C. – A.D. 1650), which is characterized by the initial appearance of ceramic vessels and the construction of earthen mounds primarily by the Dakota (Sioux) people. In 1897, Jacob Brower and Edward Bromley first mapped the mounds present on what is now the Rice Lake NWR and labeled it the “Bromley Lake Mounds” (Brower 1910). Brower located and mapped 186 mounds in the area extending from the Civilian Conservation Corps (CCC) Camp east to the Indian Point. It is estimated that 114 (61 percent) of those mounds have been destroyed, while 72 (39 percent) remain intact or partially intact. (Johnson, 1990). A subset of the original “Bromley Lake Mounds,” presently known as the Mandy Lake Mound Group, contains burial mounds in three forms: 27 are linear, 22 are conical, and six are oval. The distribution or clustering of these varied forms is not random and it is probable that the total group represents mound construction by different socio/cultural groups over a considerable period of time. (Johnson 1990). The Mandy Lake Group is virtually intact and, when combined with the Indian Point mound group, they form one of the largest extant groups of mounds remaining in Minnesota, and certainly contain the largest number of linear mounds in one area. (Johnson 1990). It is believed that these people were nomadic and visited Rice Lake to collect maple syrup and harvest wild rice.

Historical

At the time of Brower and Bromley’s visit in 1897, Ojibwe (Chippewa) Indians were present on the landscape. An Ojibwe village and the East Lake Cemetery were located on Indian Point. Sam Yankee and John Aubit (Aubid) were the first Ojibwe to have a warranty of deed dated 1904 on the Indian

Point. By the 1920s, a village consisting of 20-25 Ojibwe families developed around Rice Lake (Ollendorf, 2000). These families lived year-round on the land, harvesting rice and maple syrup, planting gardens and raising some livestock. In the fall, Ojibwe from around the region would travel by foot and horse to gather on the shores of Rice Lake and set up temporary ricing camps. Rice Lake has the distinction of having had one of the last existing ricing camps in the state, if not in the whole wild rice belt. The convenience of the automobile and building of road accesses to chief ricing waters made it unnecessary to camp overnight at ricing sites. Indians at both Rice Lake and Kettle Lake cited the automobile as a cause for the disappearance of camps (Jarvenpa, 1971). Today, members of the Ojibwe people harvest rice in accordance with the Collier Agreement (Appendix G) signed in 1935. Each spring a no fee Special Use Permit (SUP) is issued that allows them to collect maple syrup. The SUP allows them to collect syrup in a limited manner and location as a means to provide traditional education/instruction to Ojibwe youth. They also use the Indian cemetery and hold drumming ceremonies on a sacred area of the Indian Point. No other tribal activities are regularly conducted as the Refuge lies within the Treaty of 1855, which does not reserve the right to hunt, fish or gather on the lands or waters that were ceded.

Besides the fur trade, the first large European influence on the landscape came with the logging industry, which was present around Rice Lake from the 1850s until 1911. Timber (initially white pine) was cut from around Rice Lake in the winter and the logs were skidded to the lake, tied into rafts and floated to the Mississippi River, 20 miles to the west, upon ice-out. In 1897, the American Grass and Twine Company purchased a block of land that is now the portion of Refuge north of the Rice River. They later became known as the Crex Carpet Company and harvested the marsh grass to manufacture carpets until they declared bankruptcy in 1936. In 1900, Davidson and McRae purchased several thousand acres around Rice Lake that they used for ranching until 1917. They were the first to attempt to drain Rice Lake with a hand-dug ditch, which failed to function. They then sold their interests to the St. Croix Land and Lumber Company of Stillwater, Minnesota, which built a sawmill on “Tom’s Island,” located near the junction of the Wildlife Drive and the South Trail (Johnson, 1945).

In 1910, a branch of the Soo Line Railroad known as the Cuyuna and Iron Range was completed and

forms much of what is now the Wildlife Drive. The branch was abandoned in the 1920s. The following years were a mixture of failed farming attempts, market hunting and “guided” duck hunts on the lake. The drought years of the early 1930s and the Great Depression left most of the inhabitants of the area without income and unable to pay their taxes. Much land went into tax-forfeiture and in 1935 was purchased by the U.S. Bureau of Biological Survey to create a migratory waterfowl refuge.

Civilian Conservation Corps (CCC) Camp BS-3, Company 2705, a 23-building camp, was erected on the Refuge and was active from 1939 until 1941. While no buildings remain, the site is clearly marked and identified with an onsite interpretative kiosk and as site number 10 in the Refuge’s auto tour brochure. The mission of Company 2705 was the initial development of this land as a federal migratory waterfowl refuge. One of the first projects was to remove rail and ties from the old railroad grade that is now the main refuge road to Highway 65.

Associated Plans and Initiatives

Bird Conservation Initiatives

Several migratory bird conservation plans have been published over the last decade that can be used to help guide management decisions for the Refuge. Bird conservation planning efforts have evolved from a largely local, site-based orientation to a more regional, even inter-continental, landscape-oriented perspective. Several transnational migratory bird conservation initiatives have emerged to help guide the planning and implementation process. The regional plans relevant to Rice Lake and Mille Lacs NWRs are:

- # The Upper Mississippi River/Great Lakes Joint Venture Implementation Plan of the North American Waterfowl Management Plan;
- # The Partners in Flight Boreal Hardwood Transition [land] Bird Conservation Plan;
- # The Upper Mississippi Valley/Great Lakes Regional Shorebird Conservation Plan; and
- # The Upper Mississippi Valley/Great Lakes Regional Waterbird Conservation Plan.

Each of the bird conservation initiatives has a process for designating priority species, modeled to a large extent on the Partners in Flight method of

computing scores based on independent assessments of global relative abundance, breeding and wintering distribution, vulnerability to threats, area importance, and population trend. These scores are often used by agencies in developing lists of priority bird species. The Service based its 2001 list of Non-game Birds of Conservation Concern primarily on the Partners in Flight, shorebird, and waterbird status assessment scores. Recently, the Minnesota Bird Conservation Initiative (MBCI) has been established by federal and state agencies and statewide conservation organizations. The MBCI will integrate all bird conservation plans and step them down to a local level. This will allow Rice Lake and Mille Lacs NWRs to better refine population and habitat objectives and determine the role it should play in regional bird conservation.

Minnesota Comprehensive Wildlife Conservation Strategy

In 2005, Minnesota completed the Comprehensive Wildlife Conservation Strategy (CWCS), a strategic plan to better manage populations of “species in greatest conservation need” in Minnesota. The plan was developed with the support of funding from the State Wildlife Grant Program created by Congress in 2001. The heart of the strategic plan is for a partnership of conservation organizations across Minnesota to work together to sustain the populations of the identified species. Members of the partnership include the Minnesota Department of Natural Resources, the U.S. Fish and Wildlife Service, The Nature Conservancy, Audubon Minnesota, and the University of Minnesota, as well as many other agencies and conservation organizations. The plan outlines priority conservation actions that might be undertaken by partners.

The organizational units of the CWCS are 25 ecological subsections within Minnesota. Rice Lake and Mille Lacs NWRs occur within the Tamarack Lowlands, St. Louis Moraines, and Mille Lacs Uplands subsections. (Figure 6) The information and strategies of the CWCS were used as a means to assist with development of Refuge objectives in the CCP. The townships that enclose Rice Lake NWR have been identified as containing the highest abundance of species of greatest conservation need within the St. Louis Moraines and Tamarack Lowlands subsections, which suggests that the Refuge plays a key role in the state’s conservation partnership. Appen-

dix C of Minnesota’s CWCS contains a summary of other conservation plans and efforts for each subsection.

Climate

The Refuge experiences long, cold winters and cool summers. The average annual rainfall, which mostly comes during the spring and fall, is about 27 inches. Snowfall averages about 60 inches per year. The temperature extremes for the year can range from minus-40 degrees Fahrenheit to 100 degrees Fahrenheit. Lakes typically freeze over in early-November and remain frozen until mid-to-late-April. The growing season, the time between the last frost in the spring and the first frost in the fall, is about 118 days.

Geology and Soils

The dominate Refuge surface features were formed by glaciers over 10,000 years ago. A system of moraines, or glacial ridges, in the shape of a huge horseshoe surrounds the area on three sides with the open end to the northeast. One set of ridges formed Rice Lake itself. Scattered islands and glacial ridges rise above the surrounding bog and are covered with timber and other upland plants. Glacial material consisting of rocks, gravel, sand, and clay covers the area’s bedrock in layers ranging from 50 to 300 feet thick.

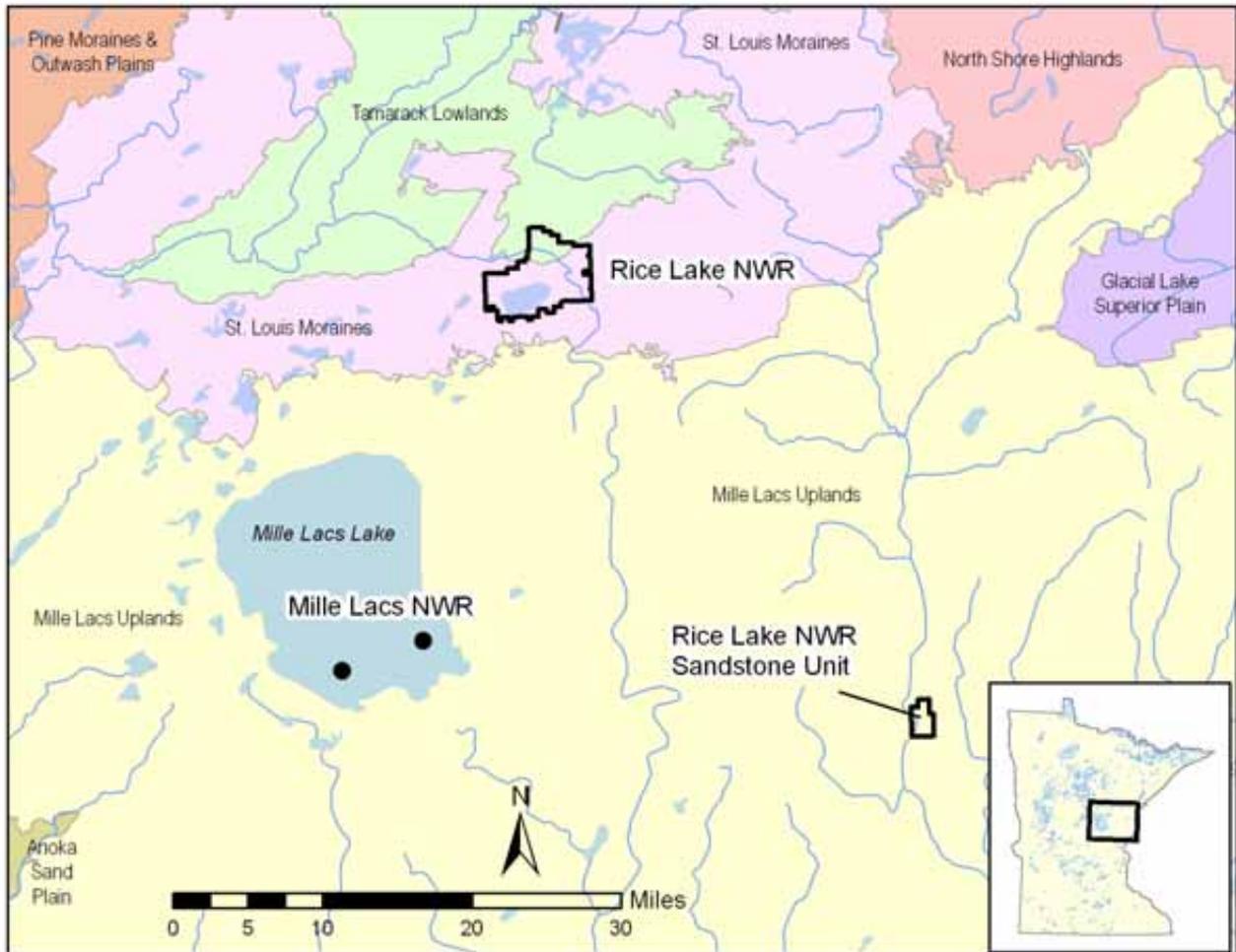
Water and Hydrology

Rice Lake NWR is bisected by the Rice River, which drains the Refuge, flowing from the southeast corner to the northwest, and empties into the Mississippi River 20 miles to the west. The land’s natural water drainage toward the south has been blocked by the moraines. This wet area is slowly filling in with sediment and vegetation, becoming a floating or muskeg-like bog.

The Sandstone Unit is crossed by several small streams, flowing east to west to join the Kettle River. The Kettle River, which flows through the western portion of the Unit, has cut a steep sided canyon approximately 100 feet deep and 3,000 to 4,000 feet wide. This portion of the Kettle River is a part of the State of Minnesota Wild and Scenic River System.

Mille Lacs NWR is located approximately 1 mile from any shoreline of Mille Lacs Lake. The water

Figure 6: Minnesota Comprehensive Wildlife Conservation Strategy Units, Rice Lake NWR

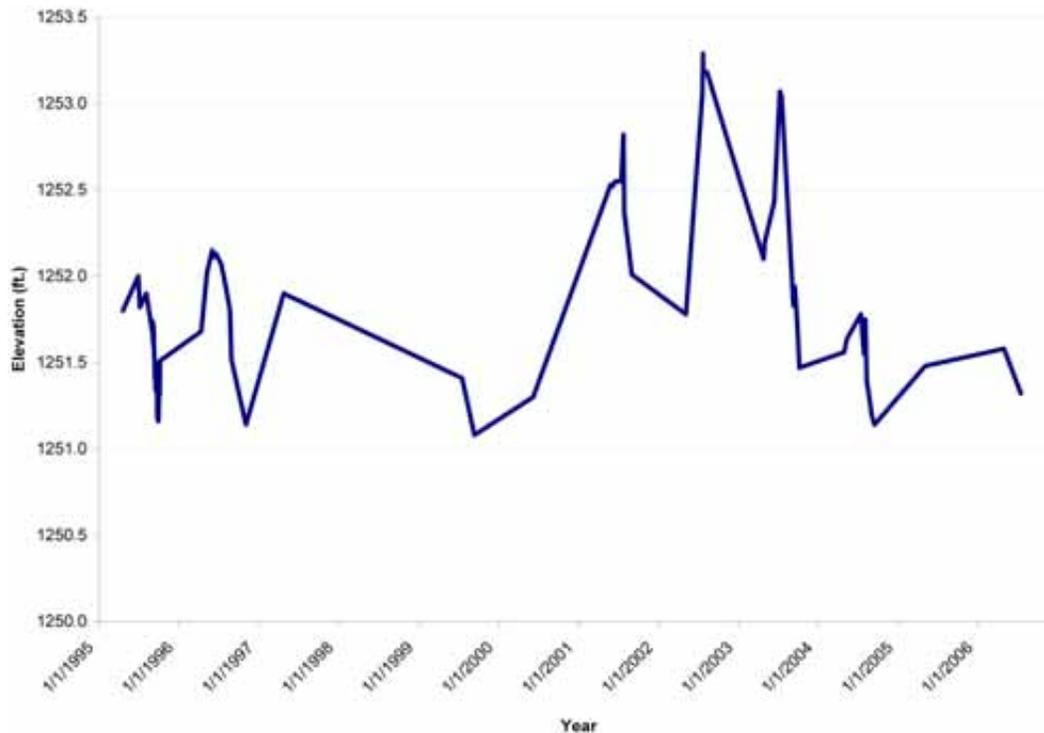


level in Mille Lacs Lake affects the size of the islands and their vulnerability to erosion by wave action. Seiches occur on the lake and account for brief, but record changes in water levels. A seiche can be described as a large wave or storm surge that is created by dramatic changes in atmospheric pressure coupled with high winds. The effects of a seiche to nesting Common Terns on this low lying island can be devastating. The more persistent changes in water level are influenced by broader weather patterns. Over the last 10 years the water level has had a range of about 3 feet. Figure 7 displays the water level data for Mille Lacs Lake for the last 10 years (Minnesota Department of Natural Resources).

Refuge Resources

The wild rice wetlands on Rice Lake NWR and the relationship between wild rice and Ring-necked Ducks are of vital importance and need to be highlighted. Typically during the second and third weeks of October, over 100,000 Ring-necked Ducks will be feeding and resting on the wild rice beds in Rice Lake. A noteworthy exception occurred during the second week of October 1994, when more than 1 million ducks were observed, of which 60 percent were Ring-necked Ducks and 40 percent were Mallards, a Minnesota record for the most waterfowl observed in one location at one time (Lapp 1995).

Wild rice is high in protein and vitamins and helps waterfowl recover quickly from the demands of migration. Ten to 15 percent of a duck's body weight is lost during a day dominated by flight. If

Figure 7: Lake Mille Lacs Water Levels, 1995-2005

those birds have adequate habitat, good food resources and little disturbance they can rebound in just 1 to 3 days (Norrgard 2005). A suite of wetland birds also nest and feed in Refuge wild rice beds during the summer. Examples of rare and declining species, and/or the Services' Region 3 Resource Conservation Priority Species that use wild rice habitat include:

- # Common Loon
- # American Bittern
- # Trumpeter Swan
- # Bald Eagle
- # Northern Harrier
- # Yellow Rail
- # Greater Yellowlegs
- # Marbled Godwit
- # Stilt Sandpiper
- # Black Tern

Common Loons and American Bitterns nest along the undisturbed shores. Trumpeter Swans are once again nesting and raising broods in lakes where they have been absent for many years. Bald Eagles nest in the nearby forest and feed on the fish and waterfowl that are associated with wild rice

lakes. Northern Harriers nest and hunt in the marsh edge. Yellow Rails nest in the lake's emergent plant zones. Greater Yellow-legs, Marbled Godwit, Stilt Sandpiper, and other shorebird species feed on invertebrates in the wild rice straw mats and in the mudflats during their spring and fall migration. Black Terns use the wild rice straw mats as nesting platforms. Other wildlife species that commonly feed on wild rice include ducks, geese Sora, American Coot, blackbirds, deer beaver, and muskrats. Blackbirds and warblers are drawn to the invertebrate prey found in wild rice habitat while marshbirds feed on the small vertebrate species found there.

American Indian cultures throughout the northern Midwest and northeast have traditionally harvested wild rice. Such activities are supported by the Refuge System and allow American Indians contact with their culture as well as providing a source of income.

The range of wild rice has contracted greatly since European settlement. The boom and bust ecology of wild rice creates highly fluctuating annual production cycles. Some of the causal factors of this oscillation are the buildup of rice straw from the previous year's growth, sediment nutrient levels

and water depth. By preserving/restoring healthy wild rice beds we are preserving healthy wetland habitat for the benefit of many species, including our own.

Plant Communities

Forest

Rice Lake NWR lies within the transition zone between the coniferous forests of Northern Minnesota and the deciduous hardwood forests typical of the southern portion of the state. Historically, white pine was very abundant in the pre-settlement mixed forests of the region, but logging in the late 1800s resulted in replacement of pine with quaking aspen, red and sugar maples, paper birch, basswood, and red oak. Today there are approximately 4,222 acres of upland forest on the Refuge (lowland or submontane cold-deciduous forest per the National Vegetation Classification System, NVCS). Lowland forest stands are characterized by tamarack, black spruce, black ash, balsam fir, and white cedar. There are approximately 3,259 acres of lowland forest on the Refuge (temporarily flooded cold-deciduous forest and saturated cold-deciduous forest, NVCS). See Figure 8.

Brushland is a difficult habitat type to classify. Brushland typically occurs in areas that were once farmed, grazed or hayed and have been left undisturbed for years, allowing brush to invade the grassland. In some systems, the bog areas are classified as brushland due to the expanses of invading brush species found dominating the native sedge species. In the case of the Refuge, brush is considered an undesirable condition, hence, brush-dominated areas will be discussed as acreages in their desired condition of forest, bog or grassland.

Rice Lake NWR also includes a Research Natural Area that consists of 100 acres of tamarack located between Rice Lake and the Rice River.

The Sandstone Unit consists of approximately 1,315 acres of upland forest (Figure 9). The terrain is gently rolling to nearly flat. The presettlement vegetation was primarily pine, maple, oak and tamarack. Bearing trees listed in 1849 and 1851 Government Land Office surveys show primarily white pine and tamarack with a few aspen, red oak, maple, jack pine, and spruce. Francis Marschner's map of the Original Vegetation of Minnesota shows vegetation cover in the vicinity of the Sandstone Unit as being white pine groves, mixed hardwood and pine, and conifer bog and swamp. However, like most of the surrounding area, the virgin pine forests were

extensively exploited by white settlers. Few examples of this original vegetation are now found anywhere in the county.

Most of the wooded uplands of the Sandstone Unit are now occupied by a relatively even aged (40-60 years) aspen/birch timber type that includes a mature red pine component. Some areas of this aspen/birch type are beginning to succeed to maple/basswood. There is also a 116-acre timber type that is dominated by red pine with an intermediate association of aspen, maple, oak and birch. The understory of the red pine type is hazel brush of medium density. Regeneration is slight to non-existent in part due to deer browsing and lack of disturbance such as fire. This pine type is probably close to what represents the dominant presettlement vegetation for the Unit. The large pines on the Unit apparently became established immediately following the "Great Hinckley Fire" of 1894.

Bog

Rice Lake NWR bog lands are classified as saturated temperate or subpolar grasslands in the NVCS. There are approximately 5,791 acres of this habitat type on the Refuge. The bogs are flat expanses of poorly drained organic soils known as peat. They support a dense, spongy mixture of flowering plants, grasses, low shrubs, and small stands of black spruce, balsam fir and tamarack. Shallow lakes with marshy shorelines dot this landscape. Peat is formed from successive layers of partly decomposed vegetable matter, mostly sphagnum moss. The peat makes the bog soil acidic and tints bog waters a clear amber color. A muskeg or floating bog is created in a poorly drained lake that is slowly filling-in with vegetation. Dense collections of floating plants at the lake's margin offer a seedbed for more vegetation. Soon a floating mat forms that builds sediment on the lake bottom, paving the way for other water-tolerant plants and shrubs. A floating bog mat will eventually cover the water's surface and, over a long period of time, turn what was once a lake into a lowland forest.

The greatest expanse of bog on the Refuge is located on the north side of the Refuge. This area surrounds the Rice River and is over 3,000 acres in size. Some classification systems describe this area as a "brushland" though by description it has only achieved an overgrowth of brush due to the lack of a disturbance factor, such as wildfire, over the past 70 years. The native vegetation within the bog would have consisted of sedge species with sporadic areas

Figure 8: Current Landcover, Rice Lake NWR

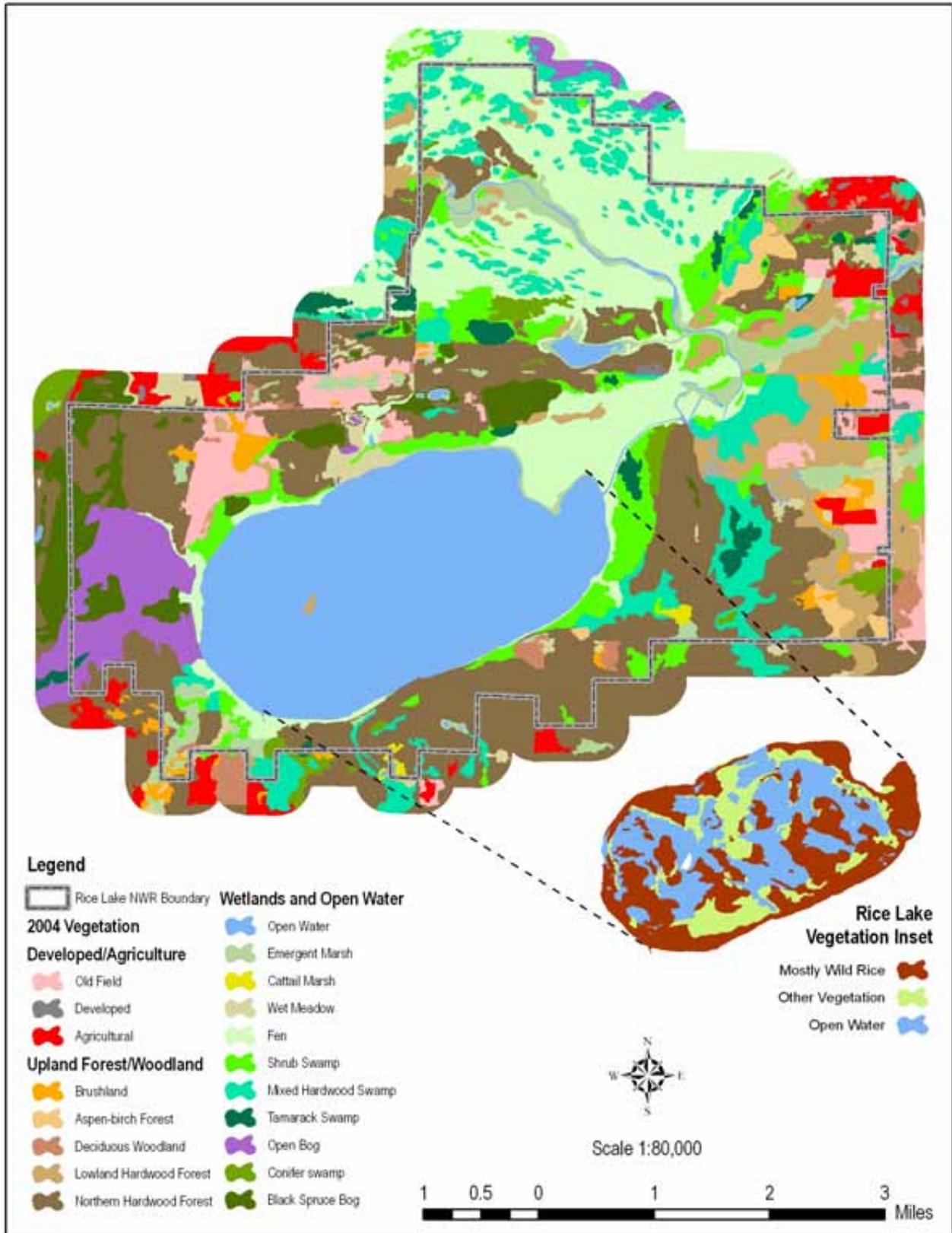
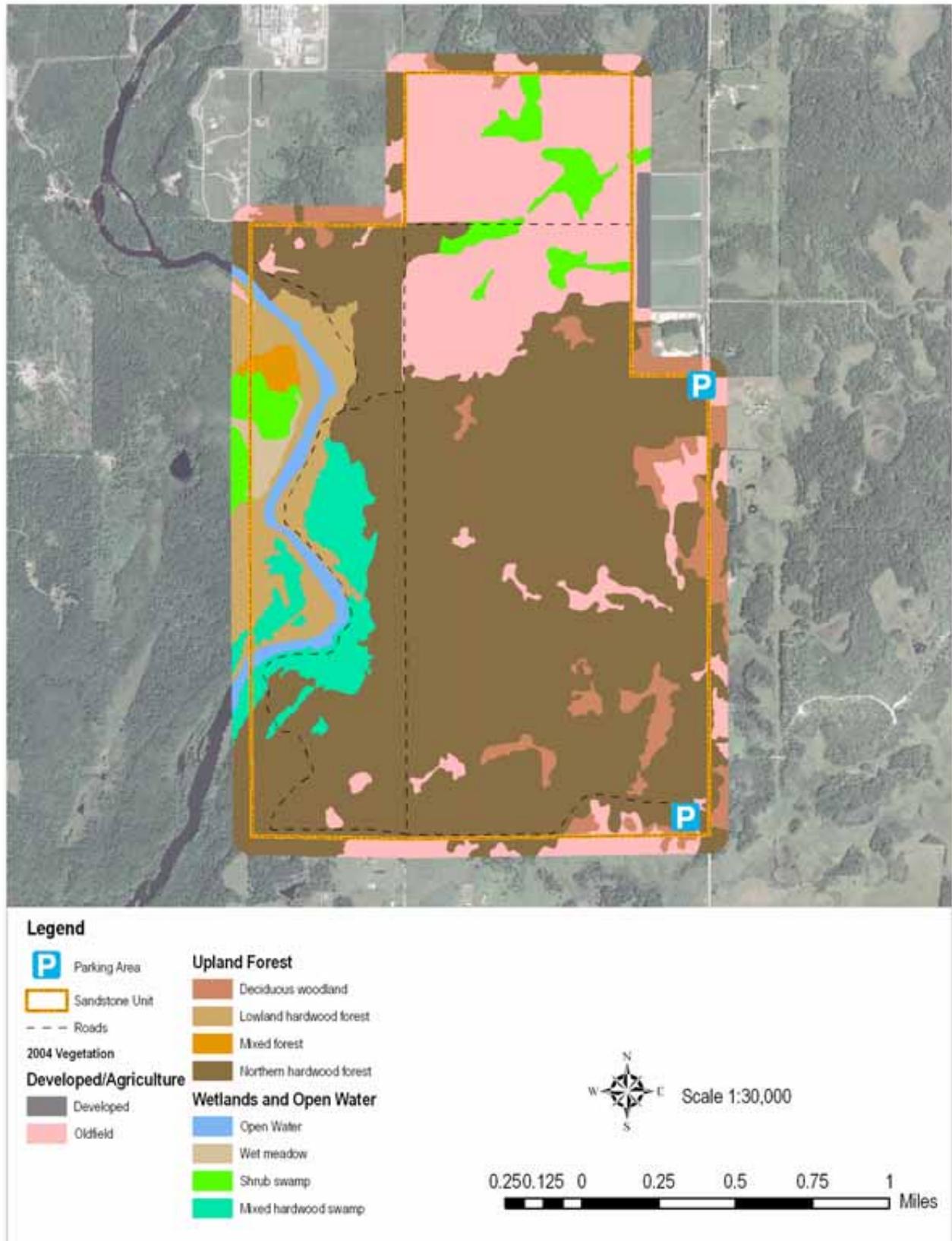


Figure 9: Current Landcover, Sandstone Unit of Rice Lake NWR



of brush, like willow and dogwood. Prescribed fire has been the management tool used to decrease and inhibit further brush invasion into this bog.

Grassland

Rice Lake NWR maintains approximately 678 acres of grassland (medium-tall sod temperate or subpolar grassland, NVCS), which were created through the clearing of timber and brush by former landowners and planted to species suitable for hay cutting and grazing. Since 2003, these open areas have been maintained through the use of prescribed burning. The majority of these fields contain non-indigenous species (smooth brome and timothy), although a couple of small fields were planted to tall-grass prairie cultivars (big blue stem, Indian grass) by Refuge staff in the late 1980s. The largest grassland block is 148 acres. It occurs on the west end of the Refuge in the former crop-fields area.

The Sandstone Unit has approximately 406 acres of grass/brushland that exist primarily as a result of previous land clearing activities by the Federal Correctional Institution. The open area on the north end of the Unit was cleared of trees for agricultural development. This area was kept open through hay-ing under a permit system until 2001.

Aquatic

The main body of water on Rice Lake NWR is Rice Lake, which is approximately 3,600 acres, or



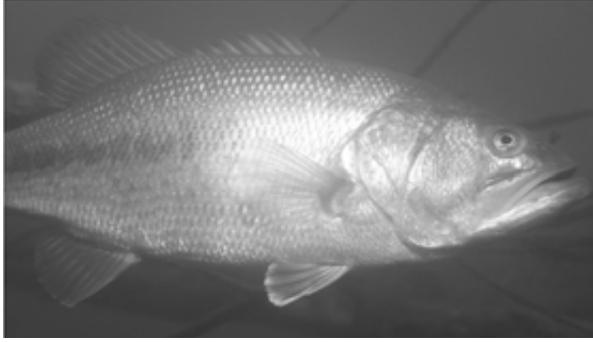
Herring Gull on a nest, U.S. Fish & Wildlife Service

nearly one-quarter of the Refuge, and has 9.5 miles of shoreline. Rice Lake is a shallow, natural wild rice producing wetland. Average water depth is 2 feet and the bottom is a composition of mud and silt. Vegetation in the lake is dominated by wild rice and pickerelweed. Although pickerelweed is a native species, it is acting as an invasive in the lake. This dominance has been accentuated by the stable water levels needed to produce wild rice. Other vegetation present in the lake include: bulrush, cattail, wild celery, and a variety of pondweeds. The lake is known as a bigmouth buffalo and northern pike spawning and rearing area. A ditch and water control structure were built on the inlet/outlet to the lake in the early 1950s. A larger capacity structure was completed in 1979.

Other major water bodies on the Refuge include Mandy Lake, Twin Lakes and the Rice River. Mandy Lake is an open body lake with beds of wild rice, cattail, and common reed around the perimeter. The lake is 101 acres and has approximately 2.1 miles of shoreline with a maximum depth of 16 feet. Mandy Lake is connected to the Rice River via a floating bog. During times of high water, it is possible for fish to move under the bog.

Twin Lakes is a classic example of a developing bog. The two lakes have a combined surface area of 16 acres with a maximum depth of 50 feet and 0.6 mile of shoreline. The shoreline is filling-in with peat and vegetation and provides an excellent example of bog succession and contains species like lady-slipper and pitcher plant.

The Rice River traverses the Refuge from the southeast corner to the northwest corner. The river originates in the Solana State Forest, 7 miles south of the Refuge. The river is fed by Porcupine Lake and numerous small tributaries as it flows northward into the Refuge. The Refuge receives drainage from approximately 155 square miles of the Rice River watershed. The river averages 70 feet wide and 2.5 feet deep. The river serves as both the inlet and outlet to Rice Lake depending on the flow and water level in the lake. A water control structure (Radial Gates) located on the North Bog Road was installed in 1952 to form the Rice River Pool. During high water times, the Pool will cover 2,500 acres. Sedge mats that support heavy growths of common reed, wild rice, cattail, and willow dominate the pool. Even when the pool is completely flooded, little increase in open water is achieved



Largemouth Bass, U.S. Fish & Wildlife Service

because of a propensity for the mat to float. The open water area of Rice River Pool seldom exceeds 300 acres.

Fish and Wildlife Communities

Birds

A total of 242 species of birds has been confirmed on Rice Lake NWR (Appendix D). Waterfowl, raptors, and songbirds are commonly observed on the Refuge. Rice Lake NWR has been designated a Globally Important Bird Area by the American Bird Conservancy. This designation was granted due to the importance of the lake and its naturally producing wild rice as a food source to migrating waterfowl, especially Ring-necked Ducks. More than 100,000 Ring-necked Ducks are typically found in the wild rice beds on Rice Lake during the second and third weeks of October. In 1994, Ring-necked Ducks numbered 600,000 during a single survey period. The Refuge has also been designated as a State Important Bird Area, as part of the larger McGregor Important Bird Area, by the National Audubon Society.

The two islands that comprise Mille Lacs NWR serve as nesting sites for colonial waterbirds. Hennepin Island is the site of one of four Common Tern breeding colonies in Minnesota. The Common Tern is a Minnesota State Threatened species. Spirit Island has nesting Ring-billed and Herring Gulls, and Double-crested Cormorants. Many species of waterbird, shorebird and waterfowl have also been observed on the islands, including American White Pelicans, Caspian Terns, Dunlin, Red Knots, Ruddy Turnstones, Common and Red-breasted Mergansers and Mallards.

Mammals

Forty-three species of mammals have been confirmed on Rice Lake NWR. (Appendix D). White-

tailed deer, black bear, porcupine, snow-shoe hare, bobcat, beaver, coyote and red fox are commonly observed species on the Refuge. The Refuge is home to at least one pack of gray wolves and Canada lynx have been observed. Though a rare occurrence, moose have also been seen on the Refuge.

Amphibians and Reptiles

Three species of reptiles have been confirmed on Rice Lake NWR. Literature searches indicate that four species could be found on the Refuge. Eight species of amphibians have been documented on the Refuge. Literature searches indicate that 12 species could be present. (Appendix D).

Fish

Fish surveys are conducted by the Minnesota DNR and the Service's Ashland, Wisconsin, Fishery Resource Office (FRO) on a sporadic basis. Sampling by various methods has located 21 species including northern pike, yellow perch, bluegill, black and brown bullheads, bigmouth buffalo, white suckers, bowfin, golden shiner and walleye (Appendix D). The Refuge is best known for spring and fall runs of northern pike in and out of Rice Lake via the Rice River. The Minnesota DNR conducts a "fish rescue" each fall when the dissolved oxygen level falls to a certain level, forcing the northern pike to leave the lake. Fish traps are then placed in the water control structure at Rice Lake to capture the departing northern pike. The pike are transported to lakes primarily around the Twin City metro area. While trapping northern pike may once have been commonplace in Minnesota, DNR officials have said that the trapping effort at Rice Lake NWR is the last such place in the state. The average catch is around 4,000 pounds per year.

Mussels and Clams

A literature search indicates that 13 species of mussels have ranges that include Rice Lake NWR. Surveys have found and identified five species and one unknown species. The surveys were conducted by FRO divers in July 2004. The most common species found during the surveys were the fat mucket (*Lampsilis siliquioda*); paper pondshell (*Utterbackia imbecillis*); eastern floater (*Pyganodon cataracta* sp.) (pending verification); giant floater (*Pyganodon grandis*); and the strange floater, *Strophitus undulatus*. Fingernail clams (*Sphaeridae* sp.), were also found throughout the Refuge. No mussels were found in Mandy Lake during the survey, possibly because aquatic plant growth was very heavy throughout the shoreline. Four of the five

freshwater mussels and clam are common species and found throughout the Midwest. The fifth species, the eastern floater (*Pyganodon cataracta* sp.), a freshwater mussel looking very similar to the giant floater (*Pyganodon grandis*), is not currently listed as being found in Minnesota. Malacologists with the Minnesota DNR are reviewing these two mussels. Funding was secured by the Refuge in early 2006 for comparative DNA analysis to verify the species identity (Appendix D).

Invertebrates

No formalized invertebrate sampling has been conducted on the Refuge. A literature search indicates that 103 species of butterflies and moths and 95 species of dragonfly/damselflies could exist on the Refuge. Freshwater invertebrate samples have been taken for environmental education purposes but not documented (Appendix D).

Threatened and Endangered Species

Federally-listed threatened animal species that have been confirmed on the Refuge include the Bald Eagle and the Canada lynx. State-listed endangered or threatened bird species include the Trumpeter Swan and Henslow's Sparrow. One state-listed bird species, the Common Tern, nests on Mille Lacs NWR. The state-listed plant, triangle moonwort, is found on Rice Lake NWR.

Wildlife Species of Concern

Nearly everyone recognizes that all species are important to a healthy ecosystem. However, over the last few years, members of the conservation community have realized that with limited fiscal resources it is necessary to identify which species should be prioritized. The federal and state lists of threatened and endangered species identify one set of priority species. In the Fish and Wildlife Service's Region 3, representatives of the migratory bird, endangered species, and fisheries programs identified species that require the most attention given our current level of knowledge. Migratory bird conservation initiatives also contribute to setting priorities. The base for Minnesota's Comprehensive Wildlife Conservation Strategy was the identification of the "species of greatest conservation need." The several efforts to identify priority species are highly inter-related with cross-references and the same experts contributing to multiple projects. In general, the species priority reflects population levels that are rare or declining and below levels that

ensure their long-term stability. Region 3 priorities also included species with recreational or economic value and species with a "nuisance" level.

Table 1 summarizes information on wildlife habitat and species relationships for species of management concern for Rice Lake and Mille Lacs National Wildlife Refuges. The species were chosen from the FWS Region 3 January 2002 list of Fish & Wildlife Resource Conservation Priorities. The relationship table is adapted from the "Aitkin County Forest Management Plan," which was based on the Wildlife Habitat Association Database developed for and used on the Chippewa National Forest.

Appendix C compiles the FWS Region 3 Resource Conservation Priorities and the Minnesota list of species of greatest conservation need applicable for Rice Lake and Mille Lacs National Wildlife Refuges.

Threats to Resources

Invasive Species

Rice Lake NWR

Invasive species are considered one of the greatest threats to the National Wildlife Refuge System and Rice Lake NWR. The list of presently known invasive plant species includes common reed, reed canary grass, purple loosestrife, leafy spurge, and European buckthorn. It is probably only a matter of time before such species as Gypsy moth (100 miles distant), emerald ash borer, zebra mussel (40 miles distant), Asian carp, and the New Zealand mud snail (50 miles distant) also appear.

Mille Lacs NWR

Zebra mussels are present in Mille Lacs Lake but are not expected to directly impact Mille Lacs NWR. The potential impacts to the food chain for the avian species that use Mille Lacs NWR, especially the Common Tern population, are of greater concern.

Contaminants

Mercury is a pervasive contaminant across Minnesota, necessitating a statewide Fish Consumption Advisory from the Minnesota Department of Health. Air pollution is the major source of mercury contamination to Minnesota's lakes and rivers. About 70 percent of the mercury in the air is the result of emissions from coal combustion, mining, and the incineration of mercury-containing prod-

Table 1: Wildlife Habitat and Species Relationship for Species of Management Concern, Rice Lake NWR (including the Sandstone Unit) and Mille Lacs NWR

Species	Open Water / River / Wetland							Opening		Forest Habitats															
	Lake	Pond	Stream-River	Emergent Non-Perm Wetland	Emergent Permanent Wetland	Sedge Meadow Wetland	Shrub Sapling Wetland	Open Heath Bog	Permanent Forest Opening	Shrub Sapling Opening	Semi-Open Lowland Conifer	Closed Canopy Lowland	Young Deciduous Upland	Mature Deciduous Upland	Old Deciduous Upland	Young Coniferous Upland	Mature Coniferous Upland	Old Coniferous Upland	Young Mixed Upland	Mature Mixed Upland	Old Mixed upland	Young Lowland Deciduous	Mature Lowland Deciduous	Old Lowland Deciduous	
Gray Wolf					f	f	f		x	x		f	x	x	x	x	x	x	x	x	x	x	x	x	x
American Bittern				f	x	x	f																		
American Woodcock							f		x	x	x		x						x						
Bald Eagle	f		f											b	b		b	b		b	b				
Black Tern	f	f	f	x	x																				
Black-billed Cuckoo							x				x	x	x	x					x	x					
Black-crowned Night Heron	f		f	f	f																				
Blue-winged Teal	f	f	f	f	f	x	f				b														
Bobolink						x		x			x														
Buff-breasted Sandpiper	f				f		f																		
Canada Goose	x	x	x	x	f						f														
Canada Warbler							x	f	x			x	x	x					x	x		x	x		
Canvasback	f			f	f																				
Common Loon	f	f	f	f	x																				
Common Tern	x	f	f																						
Connecticut Warbler								x	x	x															
Dickcissel											x														
Double-crested Cormorant*	f	f	f																						
Eastern Meadowlark											x														
Field Sparrow						x		x			x														
Forster's Tern	f																								
Golden-winged Warbler											x	x	f	f											
Grasshopper Sparrow						x		x			x														
Greater Yellowlegs	f	f	f	f	f	f																			

Table 1: Wildlife Habitat and Species Relationship for Species of Management Concern, Rice Lake NWR (including the Sandstone Unit) and Mille Lacs NWR

Species	Open Water / River / Wetland							Opening		Forest Habitats															
	Lake	Pond	Stream-River	Emergent Non-Perm Wetland	Emergent Permanent Wetland	Sedge Meadow Wetland	Shrub Sapling Wetland	Open Heath Bog	Permanent Forest Opening	Shrub Sapling Opening	Semi-Open Lowland Conifer	Closed Canopy Lowland	Young Deciduous Upland	Mature Deciduous Upland	Old Deciduous Upland	Young Coniferous Upland	Mature Coniferous Upland	Old Coniferous Upland	Young Mixed Upland	Mature Mixed Upland	Old Mixed upland	Young Lowland Deciduous	Mature Lowland Deciduous	Old Lowland Deciduous	
Henslow's Sparrow						x		x			x														
Hudsonian Godwit	f	f		f	f																				
Least Bittern				f	x	x	f																		
LeConte's Sparrow					f	x		x			x														
Lesser Scaup	f	f		f	f																				
Long-eared Owl						f	f	f	f	f	f	f	f		f	b	b	f	b	b					
Mallard	x	x	f	f	f	b	b				b	b	b	b	b	b	b	b	b	b	b				
Marbled Godwit	f	f			f																				
Nelson's Sharp-tailed Sparrow				f	f	x					f														
Northern Flicker											x	x	x	b	b		b	b		b	b				
Northern Goshawk									x		f	f		x	x		x	x		x	x				
Northern Harrier				f	f	x		x			x														
Northern Pintail	f	f		f	f																				
Olive-sided Flycatcher	f	f					f	f	f	f	f						f	f				x	x	x	
Orchard Oriole													f	f	f	f	f	f	f	f	f				
Peregrine Falcon	f		f		f						f														
Red-headed Woodpecker							f		f		x	x	x	x	x								f	x	
Red-shouldered Hawk						f	f	f						b	b					x			x	x	
Sedge Wren				x	x	x	x																		
Short-billed Dowitcher	f	f	f	f	f																				
Short-eared Owl								f			x														
Snow Goose	f										f														
Stilt Sandpiper	f	f	f	f	f																				
Trumpeter Swan	x	x	f																						

Table 1: Wildlife Habitat and Species Relationship for Species of Management Concern, Rice Lake NWR (including the Sandstone Unit) and Mille Lacs NWR

Species	Open Water / River / Wetland							Opening		Forest Habitats															
	Lake	Pond	Stream-River	Emergent Non-Perm Wetland	Emergent Permanent Wetland	Sedge Meadow Wetland	Shrub Sapling Wetland	Open Heath Bog	Permanent Forest Opening	Shrub Sapling Opening	Semi-Open Lowland Conifer	Closed Canopy Lowland	Young Deciduous Upland	Mature Deciduous Upland	Old Deciduous Upland	Young Coniferous Upland	Mature Coniferous Upland	Old Coniferous Upland	Young Mixed Upland	Mature Mixed Upland	Old Mixed upland	Young Lowland Deciduous	Mature Lowland Deciduous	Old Lowland Deciduous	
Upland Sandpiper										f															
Western Meadowlark										f															
Whimbrel	f	f		f	f			f		f															
Whip-poor-will										f		b	b	b					b	b				f	f
Wilson's Phalarope	f	f		f	f																				
Wood Duck	f	f	f	f	f	f	f							x	x					x			x	x	
Wood Thrush														x	x					x	x		x	x	
Yellow Rail					x	x																			
Brook Trout – Inland population			x																						
Lake Sturgeon – Inland population			x																						
American Burying Beetle							x			x		x	x		x	x		x	x			x	x		
Black Sandshell			x																						
Elktoe			x																						
Round Pigtoe			x																						
Snail spp.												x							x			x			
Threeridge			x																						
Zebra Mussel *	x		x		x																				
Rusty Crayfish *	x		x		x																				

b = uses habitat for breeding; f = uses habitat for feeding; x = uses habitat for both breeding and feeding; *"Nuisance" species



Twin Lakes, Rice Lake NWR

ucts, the remaining 30 percent is derived from natural emissions. Only about 10 percent of Minnesota's mercury contamination originates from Minnesota emissions, however 90 percent of Minnesota's emissions are deposited in other states and countries. (Minnesota Pollution Control Agency, 2005). The Kettle River, which flows through the Sandstone Unit, is on the Minnesota Impaired Water list with mercury as the pollutant and includes a specific Fish Consumption Advisory. No other contaminants are known to exist on Rice Lake NWR.

Climate Change Impacts

The U.S. Department of the Interior issued an order in January 2001 requiring federal agencies, under its direction, that have land management responsibilities to consider potential climate change impacts as part of long range planning endeavors.

The increase of carbon dioxide (CO₂) within the earth's atmosphere has been linked to the gradual rise in surface temperature commonly referred to as global warming. In relation to comprehensive conservation planning for national wildlife refuges, carbon sequestration constitutes the primary climate-related impact that refuges can affect in a small way. The U.S. Department of Energy's "*Carbon Sequestration Research and Development*" defines carbon sequestration as "...the capture and secure storage of carbon that would otherwise be emitted to or remain in the atmosphere."

Vegetated land is a tremendous factor in carbon sequestration. Terrestrial biomes of all sorts – grasslands, forests, wetlands, tundra, and desert – are effective both in preventing carbon emission and acting as a biological "scrubber" of atmospheric

CO₂. The Department of Energy report's conclusions noted that ecosystem protection is important to carbon sequestration and may reduce or prevent loss of carbon currently stored in the terrestrial biosphere.

Conserving natural habitat for wildlife is the heart of any long-range plan for national wildlife refuges. The actions proposed in this CCP would conserve or restore land and habitat, and would thus retain existing carbon sequestration on the Refuge. This in turn contributes positively to efforts to mitigate human-induced global climate change.

One Service activity in particular – prescribed burning – releases CO₂ directly to the atmosphere from the biomass consumed during combustion. However, there is actually no net loss of carbon, since new vegetation quickly germinates and sprouts to replace the burned-up biomass and sequesters or assimilates an approximately equal amount of carbon as was lost to the air (Boutton et al. 2006). Overall, there should be little or no net change in the amount of carbon sequestered at Rice Lake NWR from any of the proposed management alternatives.

Several impacts of climate change have been identified that may need to be considered and addressed in the future:

- # Habitat available for cold water fish such as trout and salmon in lakes and streams could be reduced.
- # Forests may change, with some species shifting their range northward or dying out, and other trees moving in to take their place.
- # Ducks and other waterfowl could lose breeding habitat due to stronger and more frequent droughts.
- # Changes in the timing of migration and nesting could put some birds out of sync with the life cycles of their prey species.
- # Animal and insect species historically found farther south may colonize new areas to the north as winter climatic conditions moderate

Managers and resource specialists on the Refuge need to be aware of the possibility of change due to global warming. When feasible, documenting long-term vegetation, species, and hydrologic changes should become a part of research and monitoring programs on the Refuge. Adjustments in refuge management direction may be necessary over the course of time to adapt to a changing climate.

The following paragraphs are excerpts from the 2000 report, *Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change*, produced by the National Assessment Synthesis Team, an advisory committee chartered under the Federal Advisory Committee Act to help the US Global Change Research Program fulfill its mandate under the Global Change Research Act of 1990. These excerpts are from the section of the report focused upon the eight-state Midwest region.

Observed Climate Trends

Over the 20th century, the northern portion of the Midwest, including the upper Great Lakes, has warmed by almost 4 degree F (2 degrees C), while the southern portion, along the Ohio River valley, has cooled by about 1 degree F (0.5 degrees C). Annual precipitation has increased, with many of the changes quite substantial, including as much as 10 to 20 percent increases over the 20th century. Much of the precipitation has resulted from an increased rise in the number of days with heavy and very heavy precipitation events. There have been moderate to very large increases in the number of days with excessive moisture in the eastern portion of the basin.

Scenarios of Future Climate

During the 21st century, models project that temperatures will increase throughout the Midwest, and at a greater rate than has been observed in the 20th century. Even over the northern portion of the region, where warming has been the largest, an accelerated warming trend is projected for the 21st century, with temperatures increasing by 5 to 10°F (3 to 6°C). The average minimum temperature is likely to increase as much as 1 to 2°F (0.5 to 1°C) more than the maximum temperature. Precipitation is likely to continue its upward trend, at a slightly accelerated rate; 10 to 30% increases are projected across much of the region. Despite the increases in precipitation, increases in temperature and other meteorological factors are likely to lead to a substantial increase in evaporation, causing a soil moisture deficit, reduction in lake and river levels, and more drought-like conditions in much of the region. In addition, increases in the proportion of precipitation coming from heavy and extreme precipitation are very likely.

Midwest Key Issues

Reduction in Lake and River Levels

Water levels, supply, quality, and water-based transportation and recreation are all climate-sensitive issues affecting the region. Despite the projected increase in precipitation, increased evaporation due to higher summer air temperatures is likely to lead to reduced levels in the Great Lakes. Of 12 models used to assess this question, 11 suggest significant decreases in lake levels while one suggests a small increase. The total range of the 11 models' projections is less than a one-foot increase to more than a five-foot decrease. A five-foot (1.5-meter) reduction would lead to a 20 to 40% reduction in outflow to the St. Lawrence Seaway. Lower lake levels cause reduced hydropower generation downstream, with reductions of up to 15% by 2050. An increase in demand for water across the region at the same time as net flows decrease is of particular concern. There is a possibility of increased national and international tension related to increased pressure for water diversions from the Lakes as demands for water increase. For smaller lakes and rivers, reduced flows are likely to cause water quality issues to become more acute. In addition, the projected increase in very heavy precipitation events will likely lead to increased flash flooding and worsen agricultural and other non-point source pollution as more frequent heavy rains wash pollutants into rivers and lakes. Lower water levels are likely to make water-based transportation more difficult with increases in the costs of navigation of 5 to 40 percent. Some of this increase will likely be offset as reduced ice cover extends the navigation season. Shoreline damage due to high lake levels is likely to decrease 40 to 80 percent due to reduced water levels.

Adaptations: A reduction in lake and river levels would require adaptations such as re-engineering of ship docks and locks for transportation and recreation. If flows decrease while demand increases, international commissions focusing on Great Lakes water issues are likely to become even more important in the future. Improved forecasts and warnings of extreme precipitation events could help reduce some related impacts.

Agricultural Shifts

Agriculture is of vital importance to this region, the nation, and the world. It has exhibited a capacity to adapt to moderate differences in growing season climate, and it is likely that agriculture would be

able to continue to adapt. With an increase in the length of the growing season, double cropping, the practice of planting a second crop after the first is harvested, is likely to become more prevalent. The CO₂ fertilization effect is likely to enhance plant growth and contribute to generally higher yields. The largest increases are projected to occur in the northern areas of the region, where crop yields are currently temperature limited. However, yields are not likely to increase in all parts of the region. For example, in the southern portions of Indiana and Illinois, corn yields are likely to decline, with 10-20% decreases projected in some locations. Consumers are likely to pay lower prices due to generally increased yields, while most producers are likely to suffer reduced profits due to declining prices. Increased use of pesticides and herbicides are very likely to be required and to present new challenges.

Adaptations: Plant breeding programs can use skilled climate predictions to aid in breeding new varieties for the new growing conditions. Farmers can then choose varieties that are better attuned to the expected climate. It is likely that plant breeders will need to use all the tools of plant breeding, including genetic engineering, in adapting to climate change. Changing planting and harvest dates and planting densities, and using integrated pest management, conservation tillage, and new farm technologies are additional options. There is also the potential for shifting or expanding the area where certain crops are grown if climate conditions become more favorable. Weather conditions during the growing season are the primary factor in year-to-year differences in corn and soybean yields. Droughts and floods result in large yield reductions; severe droughts, like the drought of 1988, cause yield reductions of over 30%. Reliable seasonal forecasts are likely to help farmers adjust their practices from year to year to respond to such events.

Changes in Semi-natural and Natural Ecosystems

The upper Midwest has a unique combination of soil and climate that allows for abundant coniferous tree growth. Higher temperatures and increased evaporation will likely reduce boreal forest acreage, and make current forestlands more susceptible to pests and diseases. It is likely that the southern transition zone of the boreal forest will be susceptible to expansion of temperate forests, which in turn will have to compete with other land use pressures. However, warmer weather (coupled with beneficial effects of increased CO₂), are likely to lead to an increase in tree growth rates on marginal forest-

lands that are currently temperature-limited. Most climate models indicate that higher air temperatures will cause greater evaporation and hence reduced soil moisture, a situation conducive to forest fires. As the 21st century progresses, there will be an increased likelihood of greater environmental stress on both deciduous and coniferous trees, making them susceptible to disease and pest infestation, likely resulting in increased tree mortality.

As water temperatures in lakes increase, major changes in freshwater ecosystems will very likely occur, such as a shift from cold water fish species, such as trout, to warmer water species, such as bass and catfish. Warmer water is also likely to create an environment more susceptible to invasions by non-native species. Runoff of excess nutrients (such as nitrogen and phosphorus from fertilizer) into lakes and rivers is likely to increase due to the increase in heavy precipitation events. This, coupled with warmer lake temperatures, is likely to stimulate the growth of algae, depleting the water of oxygen to the detriment of other living things. Declining lake levels are likely to cause large impacts to the current distribution of wetlands. There is some chance that some wetlands could gradually migrate, but in areas where their migration is limited by the topography, they would disappear. Changes in bird populations and other native wildlife have already been linked to increasing temperatures and more changes are likely in the future. Wildlife populations are particularly susceptible to climate extremes due to the effects of drought on their food sources.

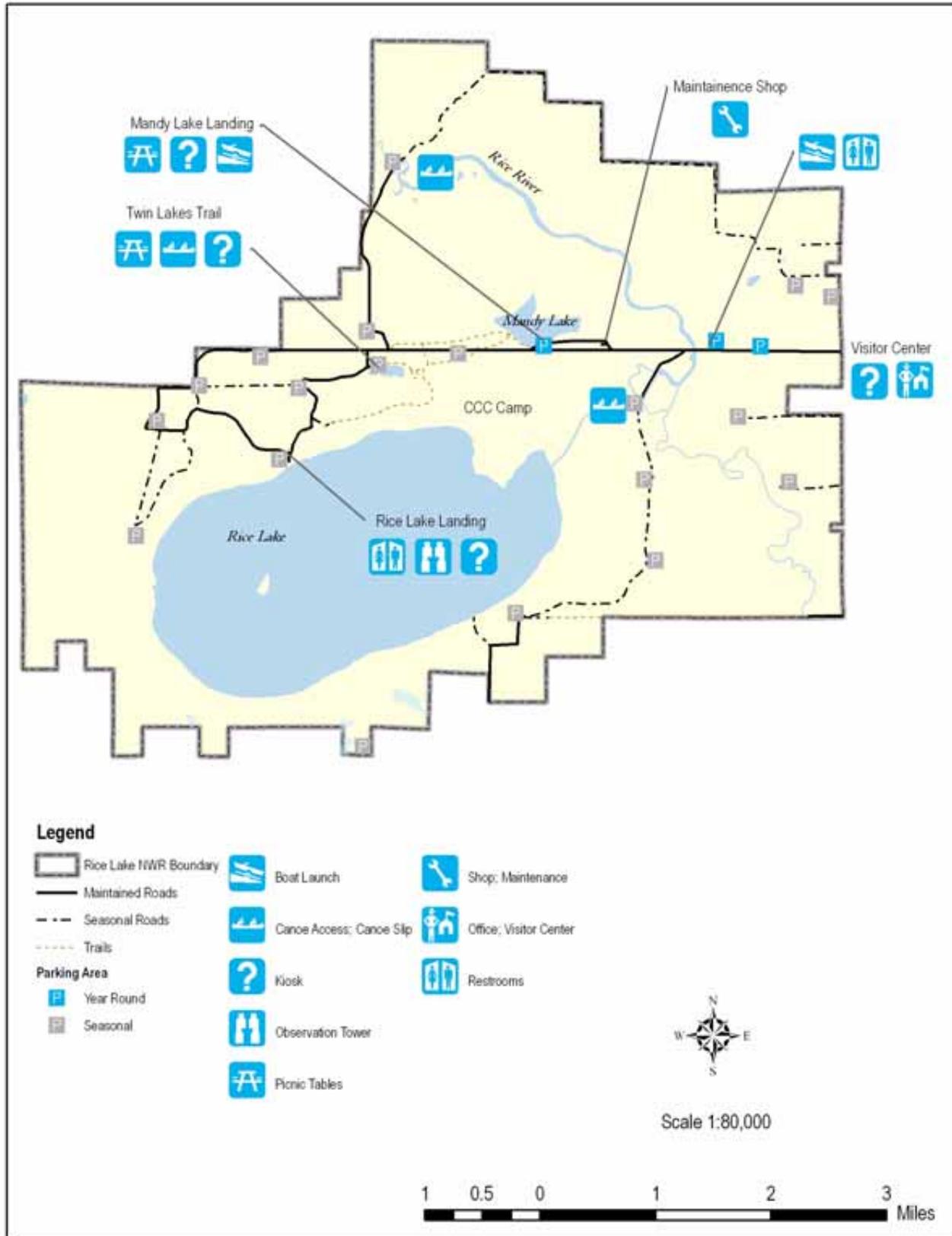
Administrative Facilities

The major buildings on Rice Lake NWR include the Refuge headquarters/visitor contact station, two residences, a maintenance shop, and five buildings for vehicle and equipment storage (Figure 10). There are no facilities associated with the Sandstone Unit or Mille Lacs NWR.

Archeological and Cultural Values

A limited description of cultural values can be found in Historical Context, page 15. The most recent cultural resources overview of the Refuge is "A Cultural Resources Reconnaissance of Rice Lake National Wildlife Refuge, Aitkin County, Minnesota," by Oothoudt and Watson, 1978. While the Service recognizes the need for a current cultural

Figure 10: Facilities, Rice Lake NWR



resources overview and management direction study to meet the requirement in the National Wildlife Refuge System Improvement Act of 1997 that comprehensive conservation plans include “the archaeological and cultural values of the planning unit,” no such study has been completed for the entire Refuge. In partial fulfillment, the Service contracted for and obtained the “Cultural Resources Management Plan for Indian Point at Rice Lake National Wildlife Refuge” by Ollendorf, 2002.

Limited archeological investigations centered on Indian Point villages and extensive related mound groups have identified evidence of the Middle Woodland Malmo (200 B.C.-A.D. 200), Saint Croix (A.D. 300-800), and Arvilla (A.D. 600-900); Late Woodland Sandy Lake (A.D. 1000-1750); and Chippewa (late 19th century-1939). Western (e.g. Euro-American) culture is also represented on the Refuge. Documents refer to sites associated with lumbering, farmsteads and fields, a Civilian Conservation Corps camp (as well as facilities on the Refuge constructed by the CCC), hunters’ graves, cabins, and railroad in addition to Refuge facilities. The Refuge contains the historic Chippewa Cemetery, which continues to be used by the East Lake Band. The Refuge also has museum property and Indian interview descriptions of traditional cultural properties.

Cultural resources are important parts of the Nation’s heritage. The Service is committed to protecting valuable evidence of human interactions with each other and the landscape. Protection is accomplished in conjunction with the Service’s mandate to protect fish, wildlife, and plant resources.

Visitor Services

About 35,000 total visits were made to Rice Lake NWR and the Sandstone Unit in 2006. Visitation on the Refuge has been slowly increasing over the past several years. Visitors participate in wildlife observation, photography, interpretation, hunting, fishing, and environmental education. Most Refuge visitors are engaged in wildlife observation and benefit from interpretive displays located at the Visitor Contact Station and kiosks. It is estimated that fewer than 1,000 hunting visits and nearly 10,000 fishing visits occur per year. About 200 students each year experience programs on and off the Refuge. Through outreach efforts that include group presentations and exhibits, the Refuge reaches more than 5,000 people each year.

Little is known about the characteristics of Refuge visitors. The residential status of visitors was compiled using a “sign-in” book at the headquarters building for the years 2000-2004. The assumption is that repeat visitors and visitors from nearby are less likely to register in our book. However, registrants likely reflect the general origin of visitors apart from the local community. Of the visitors who signed the book, about 40 percent were from within 50 miles of the Refuge, 20 percent were from within 50-100 miles, 34 percent were from within 100-150 miles (this distance includes much of the Twin Cities metropolitan area), and 6 percent were from over 150 miles from the Refuge. Based on staff conversations with them, it is clear that visitors from more distant places are often serious bird watchers who have sought out the Refuge.

The Minnesota Department of Transportation estimated that the average daily traffic volume past the Refuge office on State Highway 65 in 2004 was 3,100 vehicles per day.

Mille Lacs NWR is closed to the public to protect the birds that use the islands from disturbance.

Current Management

Habitat Management

Current management is based on the 1997 Landscape Plan. This plan marked a change in Refuge management from the early wildlife management practice of encouraging small patchwork blocks of habitat favoring “edge” species to managing larger landscape blocks, reducing habitat fragmentation and favoring species of concern that use large blocks of unbroken habitat. The 1997 Landscape Plan also emphasized management of landscapes across Refuge boundaries by way of cooperative management agreements with other agencies and through the Private Lands program.

Wetland Management

The two major Refuge water impoundments, Rice Lake and the Rice River Pool, are managed to provide favorable food and habitat conditions for waterfowl and other wetland wildlife. Rice Lake, a large, shallow natural lake, is managed primarily for the production of wild rice. Wild rice production requires stable water levels throughout the growing season (early May to late September). Sufficient water depth is also required in Rice Lake to allow access for American Indians to harvest wild rice. The Rice River Pool is part of the Rice River and is



David Aubid ricing on Rice Lake NWR.

regulated to provide favorable conditions for growth and availability of moist soil plants, nesting waterfowl, and fall migration habitat within the pool.

Refuge (Rice Lake and Sandstone) wetland restoration projects have been completed in locations where farming once occurred and affected or eliminated naturally-occurring wetlands. During the 1950s, small water control structures called screw gates were placed on ditches in the Refuge to control water in man-made goose ponds. These gates have since been left open and the ponds have been allowed to fluctuate seasonally. Beavers have also produced some high-quality wetlands throughout the Refuge that provide nesting and migration habitat for waterbirds.

Bog Management

The Refuge has approximately 3,000 acres of bog adjacent to the Kimberly Marsh Wildlife Management Area that contains an additional 5,000 acres of bog habitat. The Refuge and the Minnesota DNR have conducted joint prescribed burn operations on this expansive bog to maximize restoration efforts in setting back the encroaching brush like willow and dogwood. These bogs, when burned periodically,

have resulted in lower brush densities that provide a more suitable habitat for Sharptail Grouse as well as for waterbird species like Yellow Rail and American Bittern for both migration and nesting purposes, and also neo-tropical migrants like the LeConte's Sparrow.

Forest Management

A vegetation inventory has been completed for Rice Lake NWR that includes a strong forest inventory component. The inventory has been started for the Sandstone Unit. Adjoining state and county lands in Aitkin County have also been inventoried and provide a good overview of the forest on a landscape level. The inventory includes eight forest types. The largest types located on Rice Lake NWR are northern hardwood forest (3,903 acres), mixed hardwood swamp (1,247 acres), and lowland hardwood forest (1,008 acres). The last permit issued to remove trees was in 1982, when approximately 6,500 board feet were cut to open up the forest canopy and to improve conditions for deer and Ruffed Grouse. Large sections of forest are managed for "old growth" and have been allowed to mature undisturbed. Logging road remnants have been sheared and mowed to facilitate access. This practice also encourages young aspen growth for Woodcock and early-successional species like Golden-winged Warblers.

Fish and Wildlife Monitoring

The monitoring surveys that are conducted on Rice Lake NWR and Mille Lacs NWR are provided in Appendix E. Birds, mammals, amphibians, fish and habitat are surveyed and monitored on regular schedules. The surveys are conducted by Refuge staff, volunteers, or in partnership with the Minnesota DNR. The purpose of monitoring is, in general, to estimate the presence/absence and numbers of fish and wildlife present and to aid in making management decisions. Analysis of the data is limited to tabulation with little statistical analysis.

Visitor Services

Mille Lacs NWR is closed to public use. Rice Lake NWR and the Sandstone Unit provide opportunities for wildlife-dependent recreation.

Law Enforcement

Protecting the visiting public, visitor use areas, cultural areas, administrative areas, residential areas, wildlife habitat, and the wildlife resources from criminal or negligent actions, as well as from

acts of nature, requires that certain safeguards be in place. The Refuge maintains an automatic gate at the main entrance that closes at dusk and reopens at dawn. The gate, coupled with periodic law enforcement patrols, nearly eliminates after-hours unauthorized entries and the late night illegal activities. Law enforcement is provided by Conservation Officers from the Minnesota DNR, and Refuge law enforcement officers from other stations are also brought in to assist as needed.

Hunting

Approximately 10,000 acres of Rice Lake NWR are open to public hunting of small game and deer by archery. The areas of the Refuge near the wildlife drive and hiking trails (approximately 3,500 acres) are closed to hunting. However, during a special 9-day Refuge firearm season for deer, all of the Refuge, with the exception of a small area around the Headquarters building and the maintenance area, are open to hunting. Approximately 1,340 acres of the Sandstone Unit are open to public hunting. Approximately 705 acres on the north side of the Unit are closed to hunting and firearms due to the proximity to the federal penitentiary.

Fishing

Fishing is permitted in Twin Lakes, Mandy Lake and the Rice River during regular State seasons. Rice Lake is closed to fishing. Visitors may use motorless boats or boats with electric motors on all fishing areas. Ice fishing is permitted on Mandy Lake. However, the use of gas-powered ice augers is not allowed. Ice fishing shelters must be removed from the ice at the end of each day. Fish that are commonly caught include northern pike, yellow perch, bullhead, bigmouth buffalo, and bluegill.

Interpretation, Wildlife Observation, and Photography

The observation tower at Rice Lake provides a vista of the 18,200-acre Refuge (not including the 2,045-acre Sandstone Unit), including the 3,600-acre lake. A self-guided 9.5-mile auto tour is open to the public from dawn to dusk. Brochures are located at the Refuge Headquarters and at kiosks along the tour route. Visitors also experience the Refuge by way of hiking and cross-country skiing trails, canoeing/kayaking, snowshoeing, and biking. All trails pass through a mixture of upland and lowland hardwood forest, small grasslands and marsh. The



Environmental education at Rice Lake NWR, U.S. Fish & Wildlife Service

slope for most trails ranges from level to gently sloping.

Environmental Education

The Refuge hosts classes of elementary and high school students from local schools when teachers request visits, as well as hosting visits by home-school programs. There is no formal curriculum for Refuge programs. Programs are presented in nearby schools and the Refuge participates in educational programs like the Envirothon and Big Sandy Water Institute.

Harvesting Wild Rice

American Indians harvest a portion of the wild rice crop from the Refuge each year under a Cooperative Agreement signed in 1935.

Predator, Pest, and Invasive Species Management

Animal Species

Rice Lake NWR has a trapping program as was approved by the 2000 Furbearer Management Plan and is reviewed annually by way of the Annual Trapping Proposal. The primary purpose for a trapping program is to control the population of predators (mink, skunk, and raccoon) on ground-nesting birds and also to control nuisance muskrat and beaver, which cause damage to Refuge dikes, roads, and water control structures.

The Refuge is divided into five trapping units and special use permits are issued to trappers through a

Table 2: Trapping Statistics, Rice Lake NWR

Species	10-Year Average 1996/97 Season Through 2005/06
Beaver	33
Muskrat	44
Mink	1
Raccoon	5
Skunk	0

lottery system. Low fur prices in recent years have diminished interest in trapping on the Refuge and as a result some units are not trapped each year. The average number of trappers per season for the past 10 years is 2.7. The Refuge has adopted all State trapping regulations except where Refuge regulations are more restrictive. Trapping statistics for the past 10 years are shown in Table 2.

Plant Species

Herbicides are used to control unwanted plants in public parking areas. Mowing is used to maintain trails, secondary use roads, seasonal parking lots and road sides. The Mille Lacs Electric Company uses mowing and herbicides to maintain its right-of-way along the east edge of the Refuge and along the main Refuge road between the Headquarters and Maintenance areas. A long-term invasive weed mapping/monitoring program using GPS technology was initiated in 2006.

Archaeological and Cultural Values

The protection of cultural resources is important to the American public and essential to American Indian heritage. The Service is committed to protecting valuable evidence of human interactions with each other and the landscape. Protection is accomplished in conjunction with the Service's mandate to protect fish, wildlife, and plant resources.

Responsibilities for cultural resources management in the Service are shared between the refuge and regional office. The Regional Director has responsibility (1) for the National Historic Preservation Act Section 106 process when historic properties could be affected by Service activities, (2) issuing archeological permits, and (3) Indian tribal involvement. The Regional Historic Preservation Officer (RHPO) is responsible for advising the Regional Director about procedures, compliance, and implementation of the several cultural resources laws. The refuge manager's responsibilities include: early interaction with the RHPO about

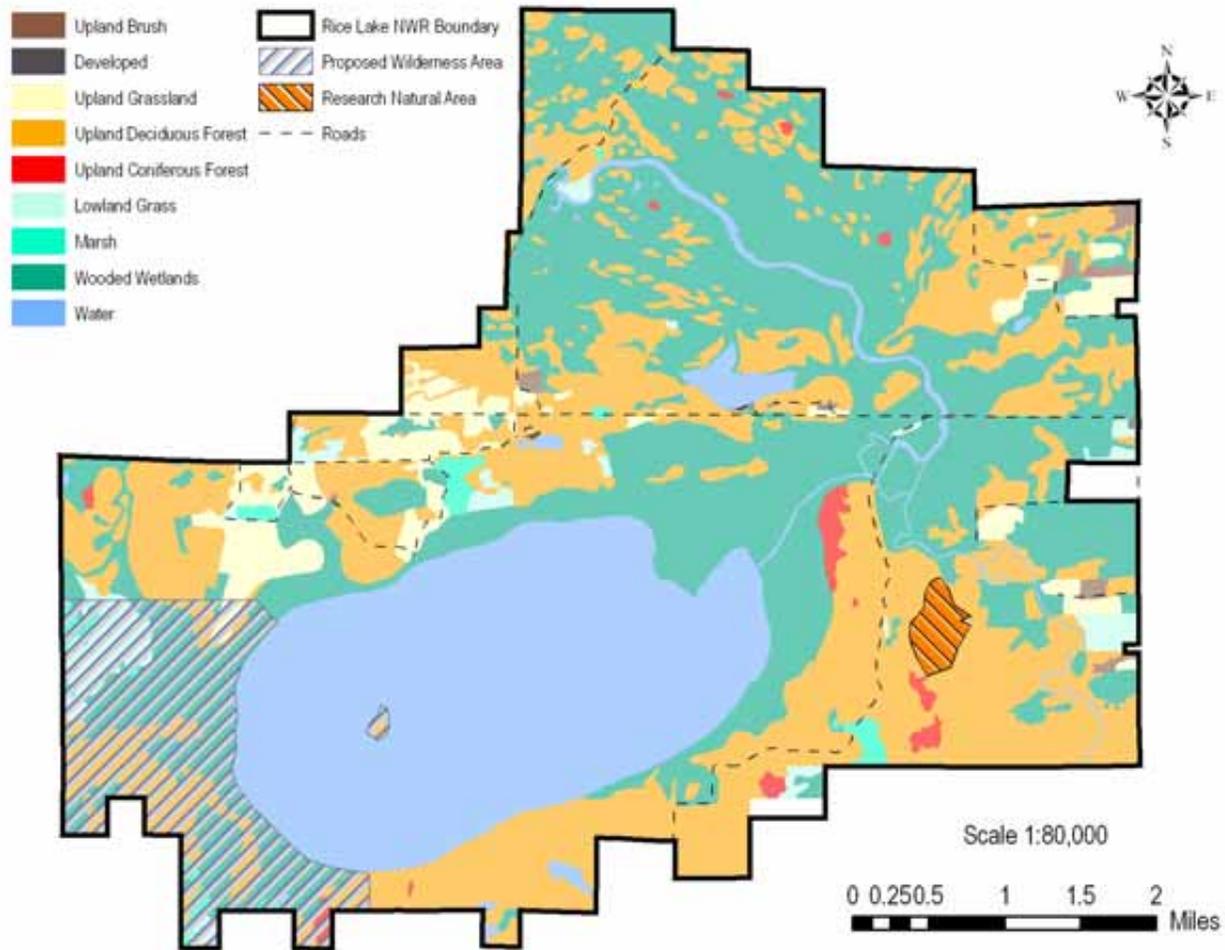
activities that might affect cultural resources; protecting archeological sites and historic properties; monitoring archeological investigations by contractors and permittees; and reporting violations.

If a Refuge activity might have a cultural resources component, the refuge manager, early in the planning of activity, asks the RHPO to begin the Section 106 process. Then, either as part of general NEPA compliance and compatibility determinations or, if only cultural resources are involved, the refuge manager informs the public and local officials of the proposed activity and requests comments through presentations, meetings, and media notices. The manager informs the RHPO about any comments received and appropriate modifications and next steps are then specified.

Only qualified archeologists, or persons recommended by the Governor, are allowed to conduct archeological investigations and collecting on the Refuge. And, the Regional Director issues an Archaeological Resources Protection Act permit only when the investigations and collecting are in the public interest. Archeological investigations have been deemed compatible when carried out under the stipulations of the compatibility determination, which includes the issuance of a special use permit. Refuge personnel act to prevent unauthorized collecting by the public, contractors, and refuge personnel. If violations are detected, violators are cited and reported to the RHPO.



Mandy Lake overlook, Rice Lake NWR

Figure 11: Special Management Areas, Rice Lake NWR

Special Management Areas

Research Natural Area

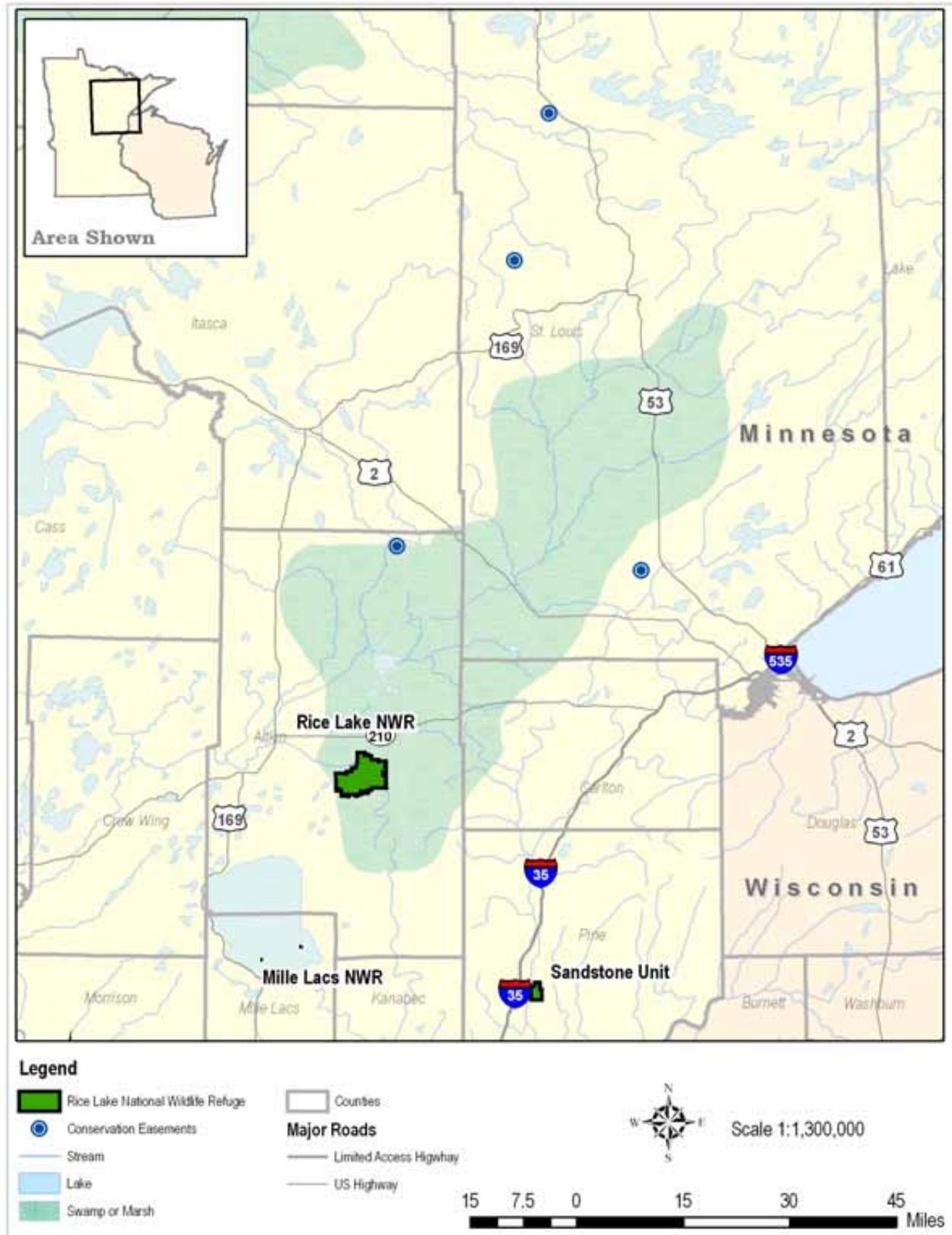
The Refuge includes one Research Natural Area (RNA) (Rice Lake-Tamarack, SAF-38) that is about 100 acres in size (Figure 11). This administratively designated area is a part of a national network of reserved areas under various ownerships. The RNAs are intended to assist in the preservation of examples of all significant natural ecosystems for comparison with those influenced by man, to provide educational and research areas for scientists to study the ecology, successional trends, and other aspects of the natural environment, and to serve as gene pools and preserves for rare and endangered species of plants and animals. In RNAs, natural processes are allowed to predominate without human

intervention. Under certain circumstances, deliberate manipulation may be used to maintain the unique features for which the RNA was established. Activities such as wildlife-dependent recreation are permissible, but not mandated, in RNAs.

Wilderness Area

In 1973, as part of a review of all lands within the National Wildlife Refuge System, the Bureau of Sport Fisheries and Wildlife studied the potential for designation of lands within Rice Lake NWR and Mille Lacs NWR as Wilderness (USDI, Bureau of Sport Fisheries & Wildlife, 1973). As a result of the study, a 1,400-acre unit and the 6.27-acre island in Rice Lake within Rice Lake NWR (Figure 11) and the two islands of Mille Lacs NWR were recommended for further consideration by the Secretary of Interior for Wilderness designation. The study

Figure 12: Conservation Easement Areas, Rice Lake NWR





Forest in winter, Rice Lake NWR

excluded most of the Refuge from consideration because facilities or intensive management for wildlife purposes were incompatible with Wilderness designation. The Mille Lacs NWR islands have been removed from further consideration due to management actions taken for the benefit of nesting Common Terns, which altered the wilderness character of the islands. The Rice Lake NWR areas recommended for further consideration did not have roads or active manipulation of the habitat and have been managed as de facto wilderness since the study. Since the study 34 years ago, no action has been taken by the Service or Department on the findings of the Wilderness Study.

Conservation Easements

When the Farm Services Agency (FSA), formerly the Farmers Home Administration (FmHA), acquires property through default of loans, it is required to protect wetland and floodplain resources on the property prior to resale to the public. The Service assists the FSA in identifying important wetland and floodplain resources on the property. Once those resources have been identified, FSA protects the areas through a perpetual conservation easement and transfers management responsibility to the Service. The authority and direction comes from the Consolidated Farm and Rural Development Act (7 U.S.C. 1981 and 1985, as amended); Executive Order 11990 providing for the protection of wetlands; and Executive Order 11988 providing for the management of floodplain resources. The Service administers the easements as part of the National Wildlife Refuge System.

The Refuge manages four conservation easement areas totaling 362 acres located within a six-county area in northeastern Minnesota (see Figure 12). Inadequate staffing levels have impeded proper

management of the widely dispersed easements. Some of the easements have not been surveyed or marked on the ground. The easements should be inspected regularly, but some have not been inspected in over 10 years. Without appropriate monitoring the easements and their resources can not be protected from the myriad forms of encroachment.

Private Lands

Refuge biologists participate in conservation activities on private lands within the six-county area. Activities include classifying wetlands and providing technical advice on habitat restoration and management. The biologists serve as agents in promoting the programs of others with the common goal of restoring and protecting additional wildlife habitats on private lands.

Current Staff and Budget

Staff

The Refuge's staffing as of June 2006 is illustrated in Figure 13.

Budget

A 5-year history of the operating and maintenance budget for the Refuge is displayed in Table 3. The FY 2001 funding included the study of relationships between multi-scale habitat features and forest bird productivity at Rice Lake NWR. The FY 2005 funding included \$90,108 for the purchase of a new dump truck.

Volunteers

Volunteers contribute valuable time and talent to all aspects of Refuge operations. They help with maintenance, construction, wildlife and resource monitoring, interpretation, and public contact. Over the 5 years from 2000 to 2004, the number of hours volunteers contributed to the Refuge ranged from 587 to 2,060 per year. Some volunteers live in nearby communities with one-way travel times of one hour; others travel from as far away as New Mexico and Indiana and stay in their personally owned RVs.

Figure 13: Staffing Chart, Rice Lake NWR

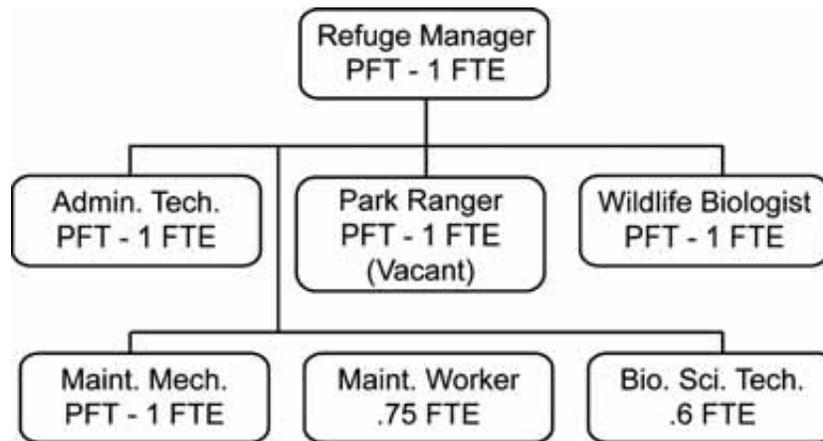


Table 3: 5-Year Annual Operating and Maintenance Funding

Funding	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005
Private Lands	\$7,000	\$10,021	\$0	\$0	\$0
Non-game and Engineering	\$10,000	\$1,500	\$0	\$400	\$3,000
Salaries and Operation	\$409,184	\$370,649	\$454,483	\$407,123	\$509,500
Maintenance	\$71,000	\$214,000	\$180,916	\$82,401	\$132,700
Fire	\$35,918	\$30,406	\$55,866	\$66,789	\$45,200

Partnerships

The Refuge has many partnerships that foster community relations and enhance Refuge habitats and wildlife populations. Recent partners include:

- # Minnesota Department of Natural Resources (Divisions of Ecological Services, Wildlife, Parks, Fisheries, Forestry, Enforcement, and the Aitkin Area Ecosystem Team)
- # U.S. Department of Agriculture (NRCS, FSA)
- # Aitkin County Soil and Water Conservation District
- # Big Sandy Area Watershed Task Force
- # Aitkin County Forest Advisory Committee
- # Long Lake Conservation Center
- # Aitkin County Water Planning Task Force
- # Aitkin County Land Department
- # Aitkin County Sheriff
- # Palisade Volunteer Fire Department
- # Mille Lacs Band of Ojibwe (DNR, Police)
- # University of Minnesota
- # Central Lakes College

- # McGregor Area Planning Committee
- # Rivers and Lakes Fair Planning Committee
- # McGregor Chamber of Commerce
- # Wetland Conservation Act Advisory Committee
- # Big Sandy Water Institute
- # Minnesota Audubon
- # Bee Nay She Birding Council
- # Minnesota Historical Society, for curation and storage of four archeological collections totaling 1,257 artifacts from the Refuge.

A special partnership exists with the non-profit group, Friends of Rice Lake Refuge, which formed in October 2002. The Friends have approximately 100 members. The Friends support and enhance the public's role in fish and wildlife habitat protection. Their goal is to promote public use along with educating visitors on the natural and cultural resources of the area. The group has sponsored events and built facilities on the Refuge and represented the Refuge at community and county gatherings. The Friends operate the sales area in the visitor contact station.