Chapter 3: The Refuge Environment

3.1 Geographic/Ecosystem Setting

3.1.1 The Lower Missouri River Ecosystem

The U.S. Fish and Wildlife Service has implemented an ecosystem approach to fish and wildlife conservation. The Service's goal with this approach is to integrate the expertise and resources of many Service divisions that will contribute to the effective conservation of natural biological diversity through perpetuation of dynamic, healthy ecosystems. There are eight ecosystems within Region 3 of the Fish and Wildlife Service.

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Squaw Creek NWR lies within the Lower Missouri River Ecosystem (Figure 3). The Refuge is located 5 miles northeast of the Missouri River and lies within the eastern border of the Missouri River floodplain. A portion of the Refuge in and around the headquarters site extends into the Loess Hills adjacent to the valley floor, but the main portion of the Refuge is on the broad plain that slopes gently to the Missouri River.

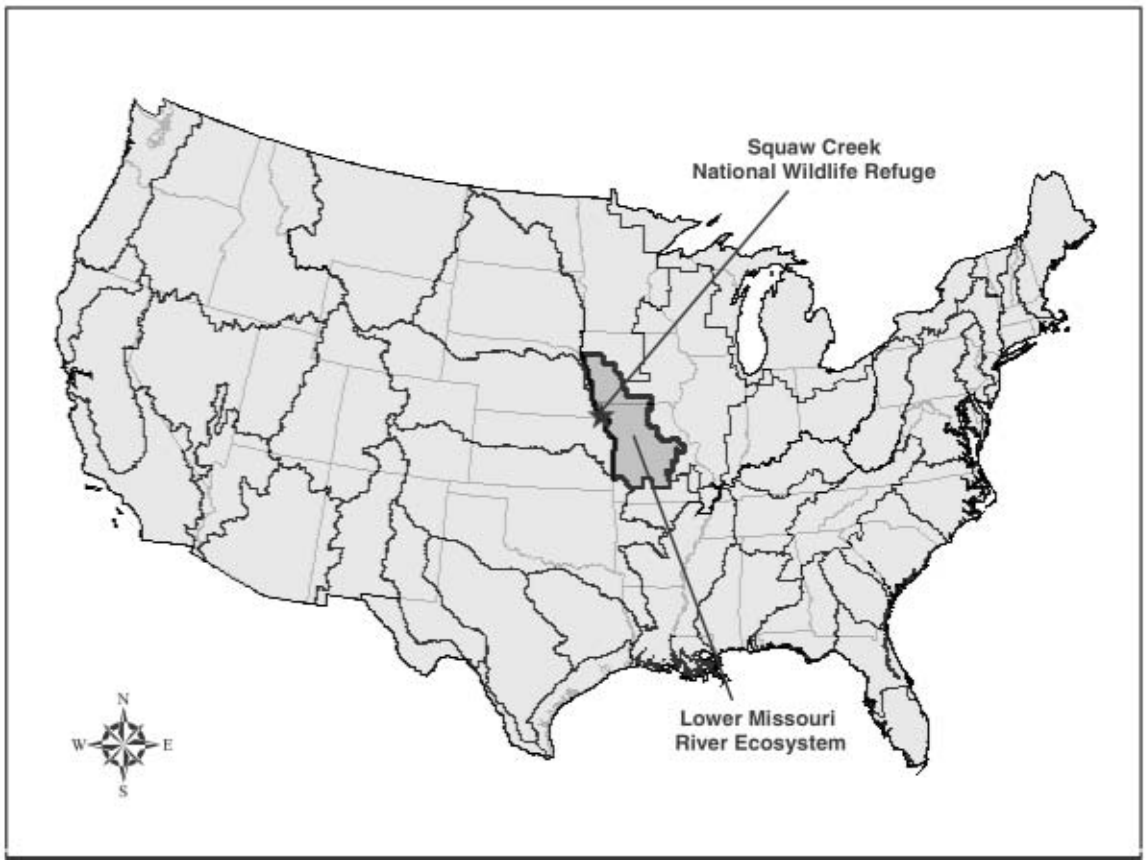
Most of the 7,415 acres comprising the Refuge are located along the eastern edge of the Missouri River floodplain in an historic wetland area. Habitat types include 1,000 acres of bottomland forest, 291 acres of bottomland mesic prairie, 1,077 acres of wet prairie, 378 acres of Loess Hills forest, 221 acres of Loess Hills prairie, 3,409 acres of managed wetland, and 176 acres of wetland. Developed land, which includes administrative areas, channelized ditches and roads, accounts for 251 acres on the Refuge.

The Refuge's 15 managed impoundments total approximately 3,400 acres. All are managed primarily for migrating waterfowl, but also provide benefits for numerous species of other wetland-associated fauna. Water sources include gravity flow from diversion of Squaw and Davis creeks, a well on Mallard Marsh and Rice Paddy moist-soil unit, and whatever rainfall is received.

Flows from the Missouri River have limited and indirect influences on the Refuge. This is particularly true during floods. As an example, during the 1993 flood, most of the damage the Refuge sustained was a result of runoff from the upstream watershed rather than the Missouri River. However, because the River was in flood stage, the Refuge was unable to discharge adequate amounts of water and runoff from the watershed backed up and flooded most the Refuge bottom land habitat.

Squaw Creek NWR is directly influenced by a 60,000-acre upstream watershed (Figure 4). The Refuge lies at the base of this highly erodible upland in the loess bluff hills with runoff coming primarily from Squaw and Davis creeks. Squaw Creek drains about 63 square miles (approximately

Figure 3: Squaw Creek NWR Relations to Watershed-based FWS-classified Ecosystems



45,000 acres) above Highway 59 and crosses under Interstate Highway 29. At this point, the creek enters the floodplain and is confined between levees extending to the north boundary of the Refuge.

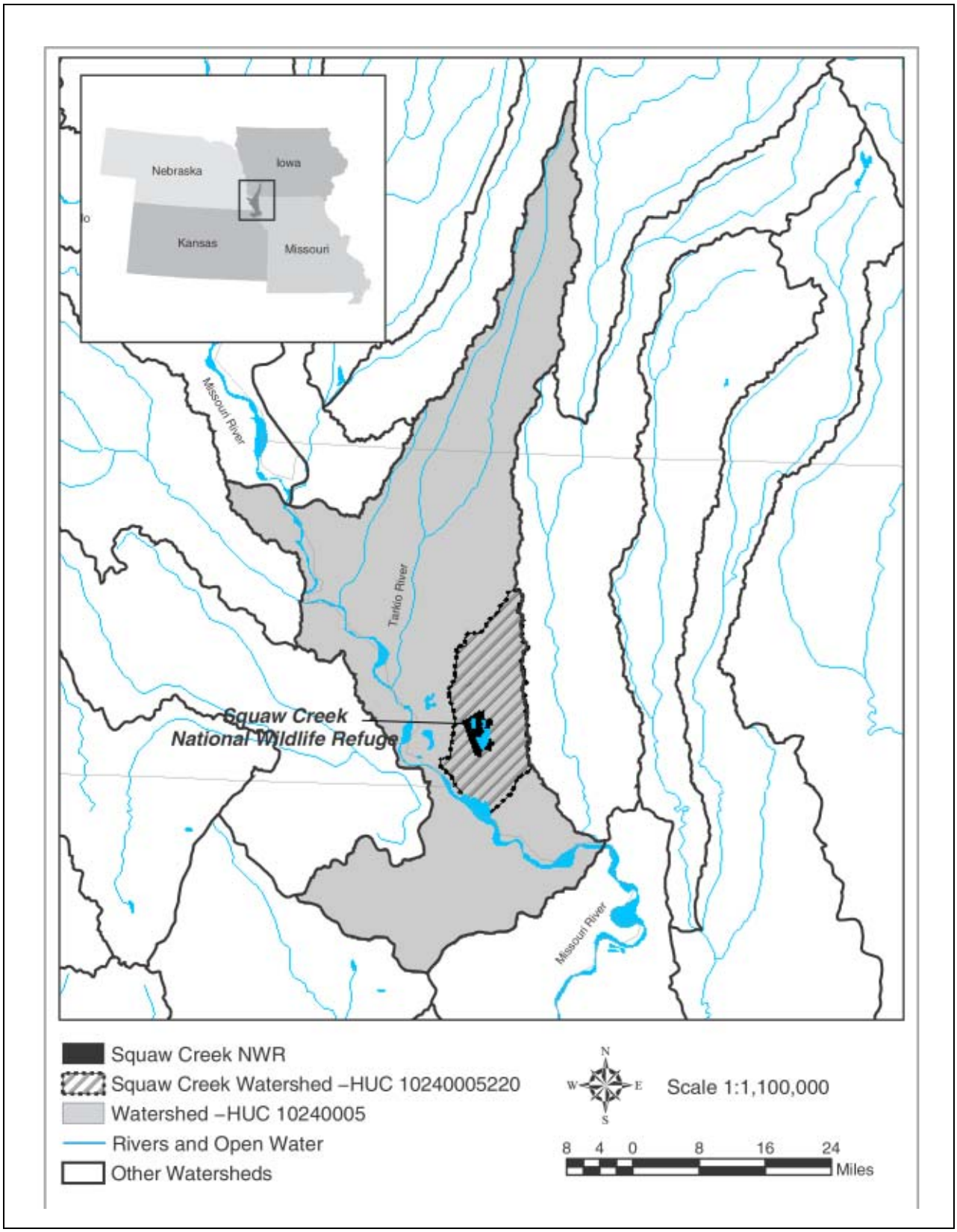
Davis Creek drains about 23 square miles (approximately 15,000 acres). The creek emerges from the hills at Mound City and directly enters the northeast corner of the Refuge after passing under Interstate Highway 29.

Three smaller creeks drain watersheds from the north and east that enter Squaw Creek NWR – Porter, Swope and Blair creeks. Though small, they add another 9 square miles of drainage and runoff to the Refuge, making the total upstream drainage area influencing the Refuge of approximately 95 square miles.

Because of its extreme topography, the total drainage area produces rapid runoff. Cultivation is practiced on lands within the basin where slopes permit. There was severe erosion on the disturbed agricultural areas in the years just after the Refuge was established, and runoff was heavily laden with silt. However, in recent years, soil conservation measures such as grassed waterways, terraces and water retention ponds have reduced silt loads and rapid rises in creek levels.

Since the 1993 Flood, Squaw Creek NWR has partnered with the Holt County Soil and Water Conservation District, the United States Geological Survey and the Natural Resource and Conservation Service by providing economic incentives to complete additional conservation measures

Figure 4: Squaw Creek NWR Watershed and Surrounding Watershed



in the Davis and Squaw Creek watersheds. The Soil and Water Conservation Service was awarded a $950,000 Agricultural Non-point Pollution grant in 2001 to work with private landowners in the Squaw Creek drainage during a 5-year period to reduce quantity and increase the quality of agricultural runoff from their croplands.

3.1.2 Migratory Bird Conservation Initiatives

3.1.2.1 Migratory Bird Conservation Initiatives

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There are several ongoing migratory bird conservation initiatives that refuges should participate in to the extent applicable and practical. The North American Waterfowl Management Plan (NAWMP) is a partnership effort to restore waterfowl populations to historic levels. It was developed in 1986, with objectives and strategies evolving through NAWMP Updates (the latest produced in 1998). Refuges found within NAWMP Joint Ventures should strive to achieve waterfowl objectives outlined in pertinent Joint Venture Implementation Plans (see http://northamerican.fws.gov/NAWMP/nawmphp.htm). Squaw Creek NWR is covered by the Upper Mississippi River/ Great Lakes Region Joint Venture.

Several nongame bird initiatives have been developed in recent years. Partners In Flight (PIF) deals primarily with landbirds and has developed Bird Conservation Plans for numerous physiographic areas across the U.S. (see http://www.partnersinflight.org). These plans include priority species lists, associated habitats, and management strategies. Squaw Creek NWR should strive to implement the conservation strategies outlined in these plans to the extent possible. Squaw Creek NWR lies within PIF Physiographic Area No. 32, the Dissected Till Plains (Figure 5).

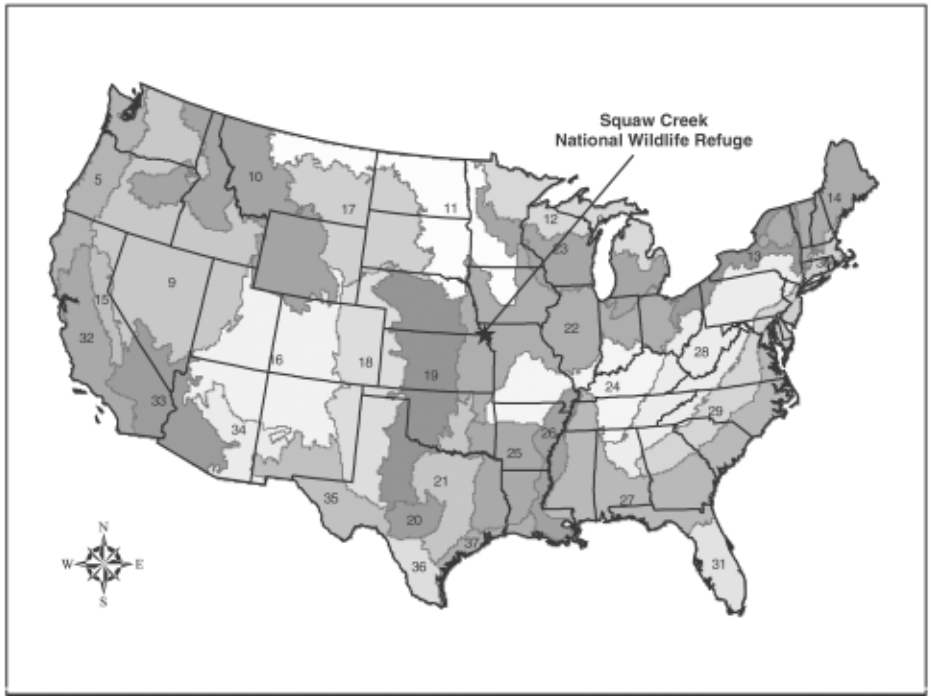
The U.S. Shorebird Conservation Plan) and the North American Waterbird Conservation Plan (see http://www.nacwcp.org) have regional components that identify priority species and conservation strategies, mostly focused around habitat, that will address the needs of these groups of birds. Squaw Creek NWR is included in the Upper Mississippi Valley / Great Lakes Regional Shorebird Conservation Plan. The refuge will soon be nominated for inclusion as a site in the Western Hemisphere Shorebird Reserve Network.

All migratory bird conservation programs will be integrated under the umbrella of the North American Bird Conservation Initiative (NABCI). This is a continental effort to have all bird initiatives operate under common Bird Conservation Regions and to consider the conservation objectives of all birds together to optimize the effectiveness of management strategies (see http://www.dodpif.org/nabci/index.htm). The goal of NABCI is to facilitate delivery of the full spectrum of bird conservation through regionally-based, biologically-driven, landscape-oriented partnerships. Squaw Creek NWR is located in Bird Conservation Region 22, the Eastern Tallgrass Prairie. As part of a national American Bird Conservancy program, Squaw Creek was designated an Important Bird Area.

3.1.2.2 Region 3 Fish and Wildlife Resource Conservation Priorities

The Resource Conservation Priorities list is a subset of all species that occur in the Region and was derived from an objective synthesis of information on their status. The list includes all federally listed threatened and endangered species and proposed and candidate species that occur in the Region; migratory bird species derived from Service wide and international conservation planning efforts; and

Figure 5: Bird Conservation Region



rare and declining terrestrial and aquatic plants and animals that represent an abbreviation of the Endangered Species program's preliminary draft “Species of Concern” list for the Region.

Although many species are not included in the priority list, this does not mean that we consider them unimportant. The list includes 60 species or populations for the Service's Lower Missouri River Ecosystem (see Appendix I, page 187).

3.1.2.3 Biological Needs Assessment

The National Wildlife Refuge System Biological Needs Assessment (U.S. Fish & Wildlife Service, 1998) resulted from a self analysis of biology within the System. The Assessment addressed issues related to the biological aspect of Refuge management and proposed six goals for their resolution along with actions and strategies for achieving those goals.

The goals are:

Goal 1: Address inadequate and inconsistent biological program staffing.
Goal 2: Focus biological program activities through goals and objectives.
Goal 3: Integrate evaluation and oversight into the biological program.
Goal 4: Increase the amount and accountability of funding for the biological program.
Goal 5: Provide for career and professional needs of biological program staff.
Goal 6: Meet information needs of the biological program.

The Biological Needs Assessment provides a benchmark in measuring progress toward meeting the biological mandates of the National Wildlife Refuge System Improvement Act of 1997.

3.1.2.4 Arctic Goose Management Initiative

Lesser Snow Geese and Ross' Geese in the mid-continent region are causing widespread damage to Arctic habitats used by these geese and other wildlife. The Snow Goose population has been expanding at an average rate of about 5 percent per year. The major reason for this population growth has been improved winter survival and recruitment brought about by a virtually unlimited food supply due to the expansion and productivity of modern agriculture in the Midwest and the availability of sanctuaries and refuges. Snow Geese and Ross' Geese now exceed the carrying capacity of habitats on several breeding colony sites in northern Canada.

Over-grazing and grubbing of the tundra vegetation has been degrading and destroying the native plant community. The over-exploitation has lead to increases in soil salinity, which has impeded recovery of formerly dominant plant species and has caused the growth of less desirable plants.

In 1997, the Arctic Goose Habitat Working Group recommended that the mid-continent Snow Goose and Ross' Goose population be reduced by 50 percent, primarily through more liberal hunting regulations, unplugged shotguns, no limits, and electronic calls.

In February 1999, the Service implemented the above recommendations and published new regulations to authorize new methods of take (unplugged shotguns, electronic calls) during the regular season when other waterfowl and crane hunting seasons are closed. In addition, the Service created a conservation order, which allowed take of geese beyond March 10, removed bag limits, allowed new methods of take, and also allowed shooting hours to one-half hour after sunset.

3.1.3 Squaw Creek Wildlife Management District

The Squaw Creek Wildlife Management District is comprised of lands that were involved in Farm Service Agency (formerly the Farmer and Home Administration) loan foreclosures in the 1970s and 1980s. While these lands are privately owned, the owners have agreed to carry out habitat restoration and preservation practices prescribed in perpetual management agreements with the Service. These agreements also define the negotiated costs and labor responsibilities of each party.

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The Squaw Creek Management District encompasses 15 counties in northwest Missouri (see Figure 2 on page 3). Currently 34 easements covering 1,553 acres are recorded on deed and three fee-title tracts totaling 911.5 acres are located in 11 of the district counties.

The majority of District lands are associated with riparian corridors. Considerable acreage was previously cropland and, as such, Refuge management emphasis has been on establishing permanent cover on those acres. Fencing of riparian areas to exclude livestock has also been a priority.

3.1.4 Region 3 Fish and Wildlife Conservation Priorities

The Government Performance and Results Act (GPRA) required the Service to identify its most important functions and to direct its limited fiscal resources toward those functions. A group worked from 1997 to 1999 to evaluate how best to identify the Service's most important functions in Region 3. The group recognized that the Service has a complex array of responsibilities specified by treaties, laws, executive orders and judicial opinions, and these responsibilities dwarf the agency's budget.

The group recognized that at least two approaches are possible in identifying conservation priorities - habitats and species. The group chose to focus on species because (1) species represent biological and genetic resources that cannot be replaced; (2) a focus on species conservation requires a concurrent focus on habitat; and (3) by focusing on species assemblages and identifying areas where ecological needs come together, the Service can select the few key places where limited efforts will have the greatest impact. Representatives of the migratory bird, endangered species, and fisheries programs in Region 3 identified the species that require the utmost attention given our current level of knowledge. Representatives prioritized the species based on biological status (endangered or threatened, for example), rare or declining levels, recreational or economic value, or "nuisance" level. The group pointed out that species not on the prioritized list are important too, but when faced with the needs of several species, the Service should emphasize the species on the priority list. Figure 6 identifies the states within Region 3. Appendix I lists the resource conservation priority species that occur at the Refuge.

We have considered the ecosystem context, the over arching conservation programs, state listed species, and the regional resource conservation priorities as we wrote this comprehensive conservation plan.

3.1.5 Other Conservation and Recreation Lands in the Area

The Missouri Department of Conservation manages several conservation areas throughout Holt County (Figure 6). The 227-acre Jameson C. McCormack Conservation Area is located adjacent to the Refuge. Mostly forest, the conservation area also includes 30 acres of grassland, 25 acres of savanna and 38 acres of cropland and old field. Hunting and primitive camping are permitted.

The Bob Brown Conservation Area (3,302 acres) is located within a few miles of the Refuge near Forest City. Hunting, fishing, camping, birding, canoeing and hiking are allowed, although some areas are closed to hiking during waterfowl season. The area is managed primarily to provide wetland habitat and it provides excellent opportunities for observing Bald Eagles, shorebirds and waterfowl.

Other areas in Holt County that are managed by the Missouri Department of Conservation include: H.F. Thurnau Conservation Area (366 acres); Little Tarkio Prairie Conservation Area (129 acres); Riverbreaks Conservation Area (2,307 acres); Monkey Mountain Conservation Area (787 acres); Nodaway Valley Conservation Area (3,813 acres); Maitalnd Access and Payne Landing Access.

The Missouri Department of Natural Resources manages the 435-acre Big Lake State Park 11 miles southwest of Mound City. The park offers camping, cabins, a swimming pool, and recreational activities include fishing and picnicking.

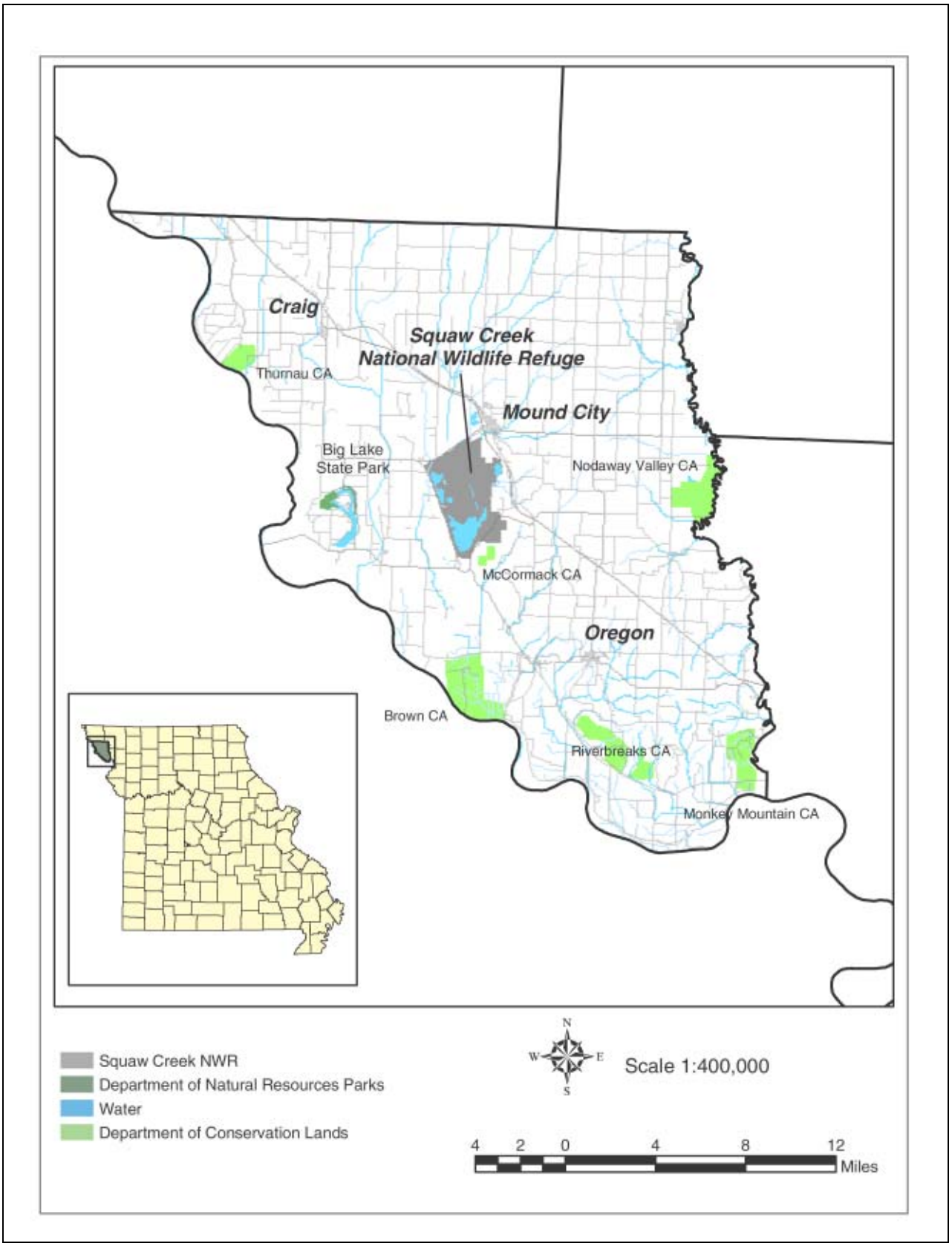
3.2 Refuge Resources, Cultural Values and Uses

3.2.1 Climate

The Refuge is located in an area characterized by a continental climate, experiencing a wide range of temperatures throughout the seasons. The coldest average minimum temperature in St. Joseph, Missouri, about 30 miles from Squaw Creek NWR, is 15.9 degrees Fahrenheit and occurs in January. The highest average high temperature is 89.9 degrees F. and occurs in July.

The area in which the Refuge is located receives an average of 35.24 inches of precipitation annually.

Figure 6: Other Conservation Areas in the Area of Squaw Creek NWR



3.2.2 Geology and Soils

The formation and even the productivity of the land we know today is the work of many glaciers. Called the "Pleistocene Epoch," glaciers that moved through northern Missouri 650,000 years ago gouged out river beds, deposited sheared off trees that decayed and eventually became the blowing dust that formed the Loess Hills, and so thoroughly mixed the earth that eroded soils were replaced with richer, more productive soil (Figure 7). Melting glaciers sent huge volumes of water down what is today the Missouri River, preventing vegetation from taking hold in cycles of flooding and freezing.

The Refuge is part of the Glaciated Plains area of Missouri, which was formed by the last glacier to enter the area about 200,000 years ago. The glaciers left the land relatively flat, but large boulders called "erratics" were deposited throughout northern Missouri. The size and weight of erratics – some are estimated at 384 tons – testify to the force behind the glaciers (Missouri Department of Conservation website).

Glaciers even changed the direction of water flow in Missouri (Nagel 2001). Ancient rivers and streams in northwest Missouri once drained east-west. These valleys were filled in by glacier till, and the Missouri River did not attain its present course until the Kansan and Nebraskan glaciers retreated.

The Missouri Department of Natural Resources Geological Survey places Holt County within the Dissected Till Plains of the state. The Refuge is located on soil that is mostly gumbo overlaid with rich silt (Figure 8).

3.2.2.1 Water and Hydrology

Holt County is located in two Missouri groundwater production areas and aquifers: the western one-third of the county are within the Missouri and Mississippi River Alluvium; the eastern two-thirds of the County are within the Glacial Drift and Alluvium (Missouri Department of Natural Resources).

Located in the relatively flat floodplain of the Missouri River, water resources include gravity flow from Squaw Creek, gravity flow from Davis Creek, a well and pump in Mallard Marsh and on the Rice Paddy moist-soil unit.

The quality of Squaw Creek Refuge wetland habitat is constantly influenced by the heavy silt loads from the 60,000-acre Loess Hills watershed being carried into the Refuge by five creeks that converge to become Squaw Creek and Davis Creek. Silt is a primary concern for the Refuge.

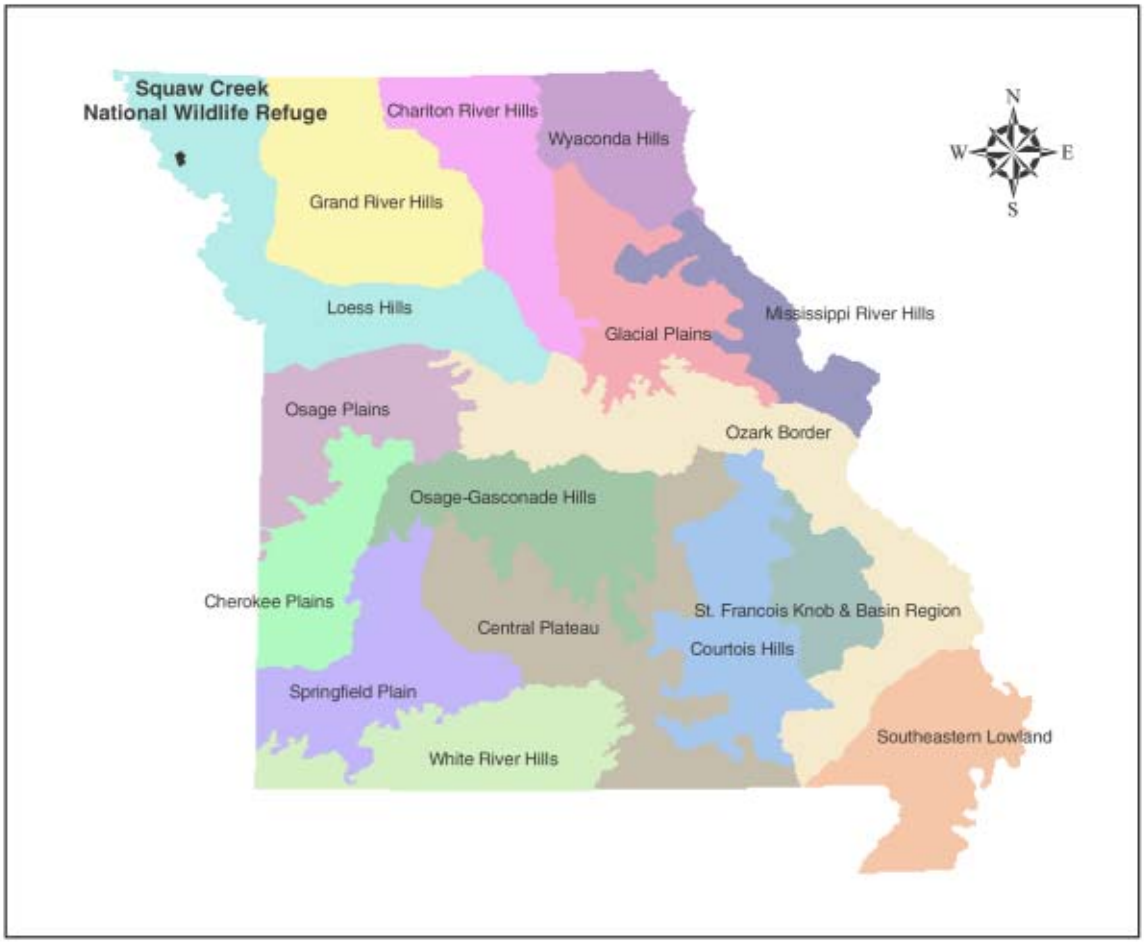
Background

> "When Missouri was admitted to statehood in 1821, the northwestern part of the state was Indian territory. In 1836, William Clark of the Lewis and Clark Expedition, acting as agent for the Sac-and-Fox and Ioway Indian tribes, accepted $7,500 and 400 sections of land in Kansas in what was referred to as the Platte Purchase. Holt County was organized out of the Platte Purchase in 1841." (NRCS, 1997)

The above cited publication indicates that the first settlers arrived in Holt County in 1838. The Soil Survey also states that "...artificial drainage of the Missouri River flood plains began in 1872, and in 1944 the Congressional Flood Act authorized the building of a system of levees along the river."

A 1934 report entitled "*The Squaw Creek Bottoms*" prepared by the Bureau of Biological Survey, which was later reorganized as the Bureau of Sport Fisheries and Wildlife and ultimately evolved into the U.S. Fish and Wildlife Service, notes that: "Apart from intermittent use for agriculture purposes

Figure 7: Landforms of Missouri



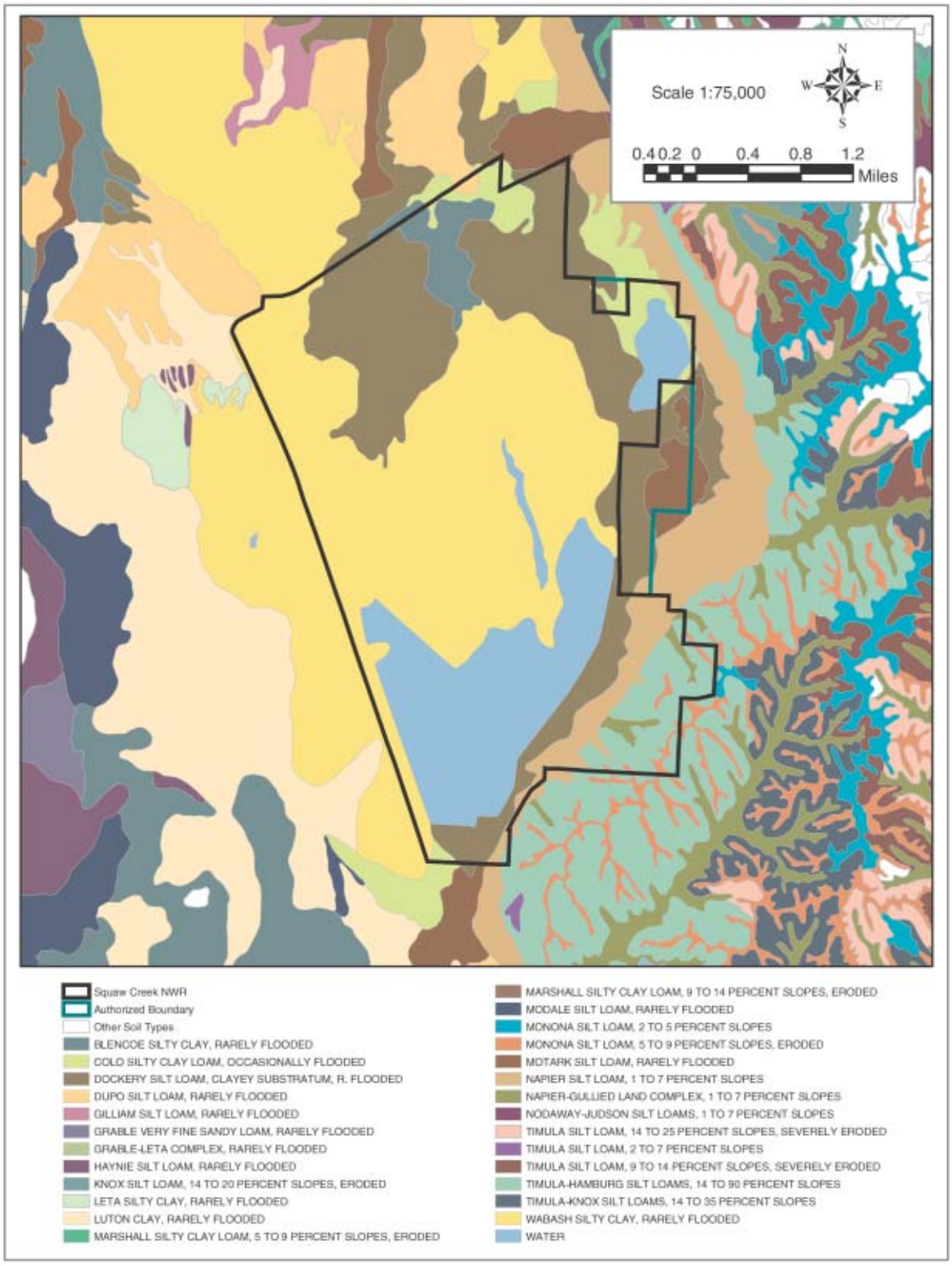
(depending upon seasonal moisture conditions) of some of the higher lands, 40 to 160 acre parcels are being rented for waterfowl shooting purposes to individuals and clubs. Some of the latter own their shooting grounds."

By the time the above report was prepared, Squaw Creek was recognized as the most important source of surface water into what is now the Refuge and it had already been modified into "...a straight, improved, channel bordered by dikes that confine, above the level of adjacent corn fields, flood waters." Similar modifications are described on Davis Creek.

Channelization of the Missouri River, wetland drainage, and conversion of land to extensive agricultural use reduced wildlife habitat to a remnant of its former size. Creation of the Refuge has protected a small portion of the floodplain from drainage and provided a haven for waterfowl, other migrant birds, and resident wildlife. The major thrust of management has been to restore wetland habitat by constructing a dam and several cross dikes resulting in a series of artificial impoundments.

The major thrust of management has been to restore wetland habitat by constructing a dam and several cross dikes resulting in a series of artificial impoundments.

Figure 8: Soils of Squaw Creek NWR



3.2.3 Fish and Wildlife and Plant Resources

3.2.3.1 Vegetation

Plant diversity on Squaw Creek NWR reflects the dominance of wetlands and prairie. Plants found on the Refuge include:

smooth sumac	coralberry	false indigo
swamp milkweed	blue wild indigo	swamp buttercup
monkeyflower	blue lobelia	downy painted cup (Indian paint brush)
prairie larkspur	dotted blazing star	soaptree yucca
hoary puccoon	goldenrods	prairie ragwort
bush-clover		sunflowers
asters		

In addition to these plants, there are numerous grasses, including big and little bluestems, prairie cordgrass, Eastern grama grass, switchgrass, Indian grass, side oats garama, and hairy grama.

The Refuge also features "Wildflower Gardens at Squaw Creek," plantings around the Visitor Center of native tallgrass-prairie and woodland wildflowers, grasses, and other plants. Among these species are:

Dutchman's breeches	wild columbine	prairie smoke
blue-eyed grass	showy evening primrose	wild sweet-William (Phlox)
Solomon's-seal	mayapple	Jack-in-the-pulpit
beardtongue	butterflyweed	lead plant
rose verbena	spiderwort	black-eyed Susan
coneflowers	wild petunia	queen-of-the-prairie
shrubby St. John's -wort	rattlesnake master	white snakeroot

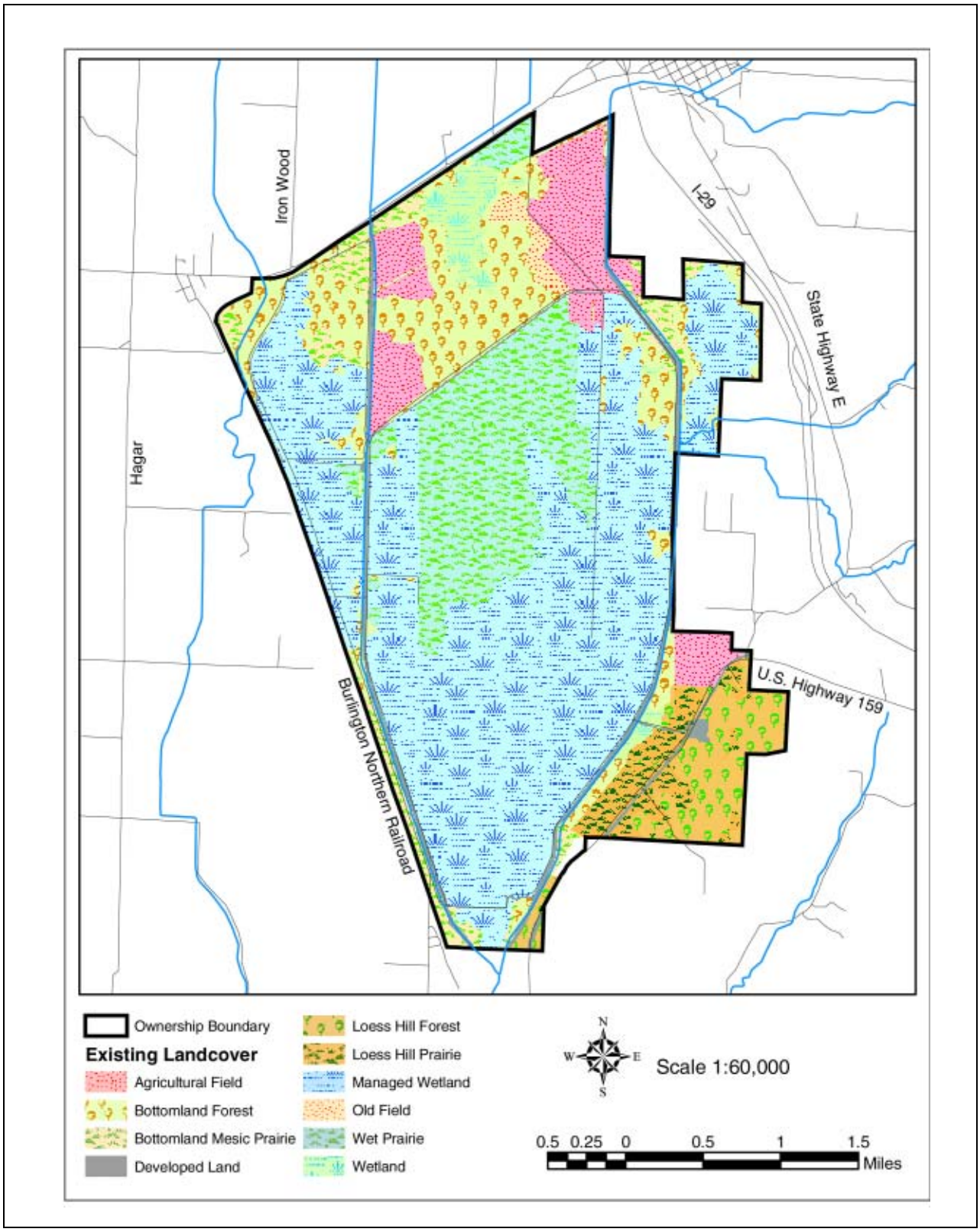
The Refuge has 1,378 acres of forests; common trees include Eastern cottonwood, black willow, and silver maple, oak, hickory, green ash, honey locust, dogwood, and redbud.

The principle Refuge habitats include agricultural fields, bottomland forest, bottomland mesic prairie, loess hill forest, loess hill prairie, managed wetlands, old fields, wet prairie, wetland and developed land (Figure 9). The acreages of these habitats can be found in the Environmental Assessment, Appendix A.

3.2.3.2 Birds

Waterfowl are a year-round presence on the Refuge, sometimes in awesome numbers. Squaw Creek NWR is a mecca for large concentrations of migratory birds during the spring and fall because of the diversity and interspersion of habitats as well as the Refuge's location between two major migratory bird corridors, the Central Flyway and the Mississippi Flyway.

Figure 9: Current Landcover (2003), Squaw Creek NWR



Shallow, backwater wetlands such as those provided by Squaw Creek NWR offer critical habitat for dabbling ducks, geese, herons, egrets, bitterns and rails. Mallard, Gadwall, American Wigeon, Northern Shoveler, Green-winged Teal, Blue-winged Teal, Northern Pintail and American Coot are the dominant species seen on the Refuge during both spring and fall migration. In the spring, large numbers of Scaup and Ring-necked Ducks are common.

Average peak populations of Lesser Snow Geese are 259,000 to 350,000.

During the fall migration, the Pectoral Sandpiper, Killdeer, Stilt Sandpiper, Lesser Yellowlegs and Least Sandpiper are among the shorebird species using the Refuge. In the spring, Greater Yellowlegs, White-rumped Sandpiper and Semipalmated Sandpiper pass through. A total of 38 species of shorebirds have been recorded on the Refuge.

Marsh birds and other water birds, including grebes, pelicans, cormorants, bitterns, herons, egrets, ibis, and rails, are typically counted during the shore bird surveys.

Raptors using the Refuge include the Bald Eagle (see Section 3.2.3.7, Threatened and Endangered Species) and a variety of hawks. In 2001, a local college professor counted 214 Broad-winged Hawks on a hawk count day.

Several bird species that are on the Missouri endangered species list are known to occur on the Refuge, including: Bald Eagle, American Bittern, Northern Harrier, Snowy Egret, Peregrine Falcon, Least Tern and Barn Owl.

Just a mile north of the Refuge, a Loess Hills bluff on the MoDOT right-of-way on Highway 159 provides outstanding Bank Swallow nesting habitat. The Missouri Department of Transportation (MoDOT) recently set aside the area for that purpose. The department built a pull-off parking area with barriers and installed a wood split rail fence. The Service prepared an information sign interpreting bank swallow history and habits. The Refuge installed “do not disturb” signs intended to prevent harassment of the swallows.

Other birds commonly found on the Refuge include the Red-winged Blackbird, Common Grackle, Tree Swallow, Barn Swallow, Great Blue Heron, Yellow-billed Cuckoo, Red-headed Woodpecker, Red-bellied Woodpecker, Common Yellowthroat, Northern Cardinal, House Wren, Song Sparrow, European Starling, Yellow Warbler and Gray Catbird.

3.2.3.3 Mammals

Approximately 33 species of mammals use the Refuge. Annual deer counts indicate that the Refuge has about three times as many deer as desired to maintain healthy browse and to avoid negative impacts to understory vegetation. Even though the Refuge has an annual muzzle loader antler-less deer hunt, which typically removes 100-140 deer from the area, the Refuge continues to harbor deer densities well above carrying capacity, suggesting that the Refuge is probably a concentration area for deer. Future efforts to expand the refuge hunting program are planned in an attempt to reduce the local deer population.

A number of carnivorous mammals are seen on the Refuge, including gray fox, red fox, coyote, mink, raccoons, striped skunk, bobcat, longtail weasels, badgers and river otters. Other mammals on the Refuge include rabbits and several species of bats, rodents and shrews.

3.2.3.4 Amphibians and Reptiles

Two species of salamander, four toad species and five species of frogs are found on the Refuge. The Refuge has participated in deformed frog surveys and the number of deformed frogs found on Squaw Creek NWR is well within the bounds of what is considered to be normal deformity rates. The Refuge has also conducted annual frog and toad calling surveys.

Five species of turtles, including the state listed endangered Blandings turtle, are found on the Refuge. Reptiles include two lizard species and 15 snakes, including the Eastern Massassauga rattlesnake, a species that is a candidate for federal listing as threatened or endangered and is a state-listed endangered species.

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3.2.3.5 Fish

Fish resources are limited. The lack of deep water and the fluctuation in water levels in the managed wetlands effectively limit the species found on the Refuge. Game species are not typically found on the Refuge. Fish such as carp, buffalo, gar, and a variety of others are present, and when water levels are sufficient and state law permits, snagging and fishing are permitted.

3.2.3.6 Invertebrates

Invertebrate diversity, while extensive, is little documented. The only insect on the Regional Conservation Priority list that falls within the Lower Missouri Ecosystem is the American burying beetle (Nicrophorus americanus). This species is not known to occur on the Refuge. It uses many types of habitat, with a slight preference for grasslands and open understory oak hickory forests. However, the beetles need carrion the size of a dove or a chipmunk to reproduce. Carrion availability may be the greatest factor determining where the species can survive. Its range includes Michigan and Ohio. Dragon and damselfly surveys are conducted on the Refuge biannually.

3.2.3.7 Plants

A full inventory and quantification of plant species has never been undertaken on the Refuge and presents opportunities for expanded work. The Refuge Biologist is currently inventorying plants and has created an herbarium for reference.

3.2.3.8 Threatened and Endangered Species

One federally-listed endangered bird and two threatened birds occur on the Refuge. Three state-listed threatened reptiles (Eastern massassauga rattlesnake, Western fox snake and Blandings turtle) are also found on the Refuge. The federally listed species include:

Bald Eagle (*Haliaeetus leucocephalus*): Bald Eagles have increased in abundance and distribution across the United States, including Missouri, and have been reclassified from endangered to threatened. They are commonly seen on the Refuge; in fact, 476 Bald Eagles were counted on December 27, 2001. Bald Eagles became endangered because of habitat loss, but especially because of DDT use following World War II. Today, the DDT threat is largely gone. Now the challenge is to prevent contamination and loss of sites that eagles depend on for nesting, feeding, migration, and wintering.

Piping Plover *(Chadarius melodus) (Great Plains Population)*: Piping Plovers are rarely seen on Squaw Creek NWR during migration. Piping Plovers nest in coastal areas, but they are also prairie birds, nesting across the Great Plains of the United States and Canada, and specifically to the north on the Missouri River sandbars in western Iowa. They are nesting in perilously low numbers, however, and the Great Plains population is listed as threatened. The loss of prairie wetland areas contributes to their decline. Like many shorebirds, Piping Plovers feed on immature and adult insects and other invertebrates at the water's edge. They winter primarily along beaches, sandflats, and algal flats on the Gulf of Mexico.

Least Tern *(Sterna antillarum)* (Interior Population): Listed as endangered, the Least Tern nests along large rivers of the Colorado, Red, Mississippi, and Missouri River systems. Least Terns are considered a transient bird on Squaw Creek NWR, however the species does nest on the Missouri River to the north on sandbars in western Iowa. It nests on sand and gravel bars and protected beach areas of large rivers and winters in coastal Central and South America. The species is endangered because human disturbance and alteration of river systems has rendered much of its nesting habitat unusable. Pesticides may reduce food available to the tern by reducing the numbers of small fish in their feeding areas.

3.2.3.9 Cooperative Farming

Three cooperative farmers currently (2001) have agreements to farm 473 acres of the 579 total acres of cropland on the Refuge. Currently 34 of those acres are in clover. Actual crops in 2001 included 171 acres of corn and 268 acres of soybeans. One-third of the corn produced was left standing in the field for wildlife food and cover.

3.2.3.10 Land Use

The area within the authorized boundary of Squaw Creek NWR includes 7,815 acres. The Refuge manages the Squaw Creek Wildlife Management Area, which consists of small parcels of land within a 15-county area. Agriculture is the predominant land use in the area immediately surrounding the Refuge.

The nearest community is Mound City, which has a population of 1,273 and is located approximately 5 miles from Refuge headquarters. The community's population has remained relatively stable and at the time of this writing did not present urban development issues that seriously threatened Refuge resources. The nearest big city is St. Joseph, Missouri, which has a population of 71,711 in 1995. Some development has occurred on the outskirts of the city, however St. Joseph is located approximately 30 miles from the Refuge and sprawl is not expected to affect Refuge resources.

3.2.3.11 Threats to Resources

Siltation: The Refuge is a sump-like area that lies between the Missouri River on the west and the Loess Bluffs on the east. The steep slopes on the river side of the bluffs, along with intensive agriculture, result in heavy silt loads in Squaw Creek and Davis Creek that pass through the Refuge on their way to the Missouri River. While these creeks are the primary water source for the Refuge, they also dump considerable amounts of silt in the managed marsh units of the Refuge, making them steadily more shallow. These marsh areas could eventually fill completely and disappear.

Invasive Plant Species: Squaw Creek NWR has numerous herbaceous pest problems. Some of the dominant pests include reed canaryrass, garlic mustard, johnsongrass, musk thistle and marijuana.

For the past several years, garlic mustard has been taking hold in floodplain forested areas of the Refuge. Johnsongrass has become more prevalent since the Missouri River flooded in 1993

The Refuge has an Integrapted Pest Management program that uses current best management practices. The Refuge will also partner with other interested parties such as local organizations, colleges, government agencies, and corporations to find better methods of controlling invasive plants. The Refuge will use a full host of chemical, biological and mechanical methods. Chemicals are used within label restrictions or under a research program. Treatment methods arereveiwed annually for sucess and cost effectiveness. The most practical, cost-effective management methods will be used.

Once a cash crop and even part of the seed mix used in Missouri Department of Conservation food plots, marijuana remains a pervasive volunteer plant. In 1992, Refuge staff destroyed 250,000 plants; in 2001, approximately 6,700 marijuana plants were hand cut.

Contaminants: Runoff of agricultural chemicals from farm fields into water is a well-known nonpoint source pollution of water from large geographic areas. Although agricultural runoff of fertilizers and pesticides has been documented in many areas and is suspected to affect the Refuge, the type and amount of pollution from Squaw Creek and Davis Creek have not been specifically documented.

3.2.3.12 Administrative Facilities

Refuge facilities include the headquarters building, which was expanded in 2003 with the addition of an auditorium for public presentations. A new vehicle storage building was completed in 2003. Existing facilities are depicted in Figure 10.

Despite the new construction, we face a serious shortage of garage space for vehicles and equipment and office space for Refuge employees. Building codes prohibit us from locating offices in the headquarters basement. Existing offices have been divided numerous times, and we simply do not have a place to house any staff beyond existing positions. We are currently using recreational trailers to house interns.

The Mallard Marsh pump was installed in 1991 as part of an extensive habitat restoration project. Four hundred acres of Mallard Marsh were restored after nearly filling in with siltation. The pump serves to flood the north unit during fall migration. An additional pump is used for the Rice Paddy moist-soil units.

Gravel roads: The auto tour route is a 10-mile circuit road with a gravel surface as well as a 2-mile road that goes around Mallard Marsh, exiting on to Highway 118 in the northwest corner of the Refuge. Both roads require annual spot maintenance to keep the driving surface up to Service standards. However, there have not been any funds specifically designated for road maintenance. The last time the entire 12 miles of gravel road was resurfaced was in 1999, when TEA 21 transportation funds were allocated. There are three bridges, on Squaw and Davis creeks and across the outlet at the south end of the Refuge. The Squaw Creek bridge is concrete and incorporates a water control structure. The Davis Creek and Eagle Pool outlet bridges are wooden structures that were built in the mid 1990s. All of the bridges are structurally sound and critical to the maintenance operations and the auto tour route.

Dikes and Levees: The Refuge maintains more than 14 miles (74,900 linear feet) of dikes and levees that parallel the ditches and surround all of the pool, marshes and moist soil units. All dike and levee surfaces must be mowed throughout the growing season to prevent brush invasion, to control noxious weeds and to provide safe access to Refuge vehicles for biological and habitat management purposes.

Ditches: The Refuge contains more than 11 miles (59,330 linear feet) of ditches that require occasional maintenance such as removal of silt deposition and bank erosion. Maintenance of the ditches is critical for effective and efficient water management.

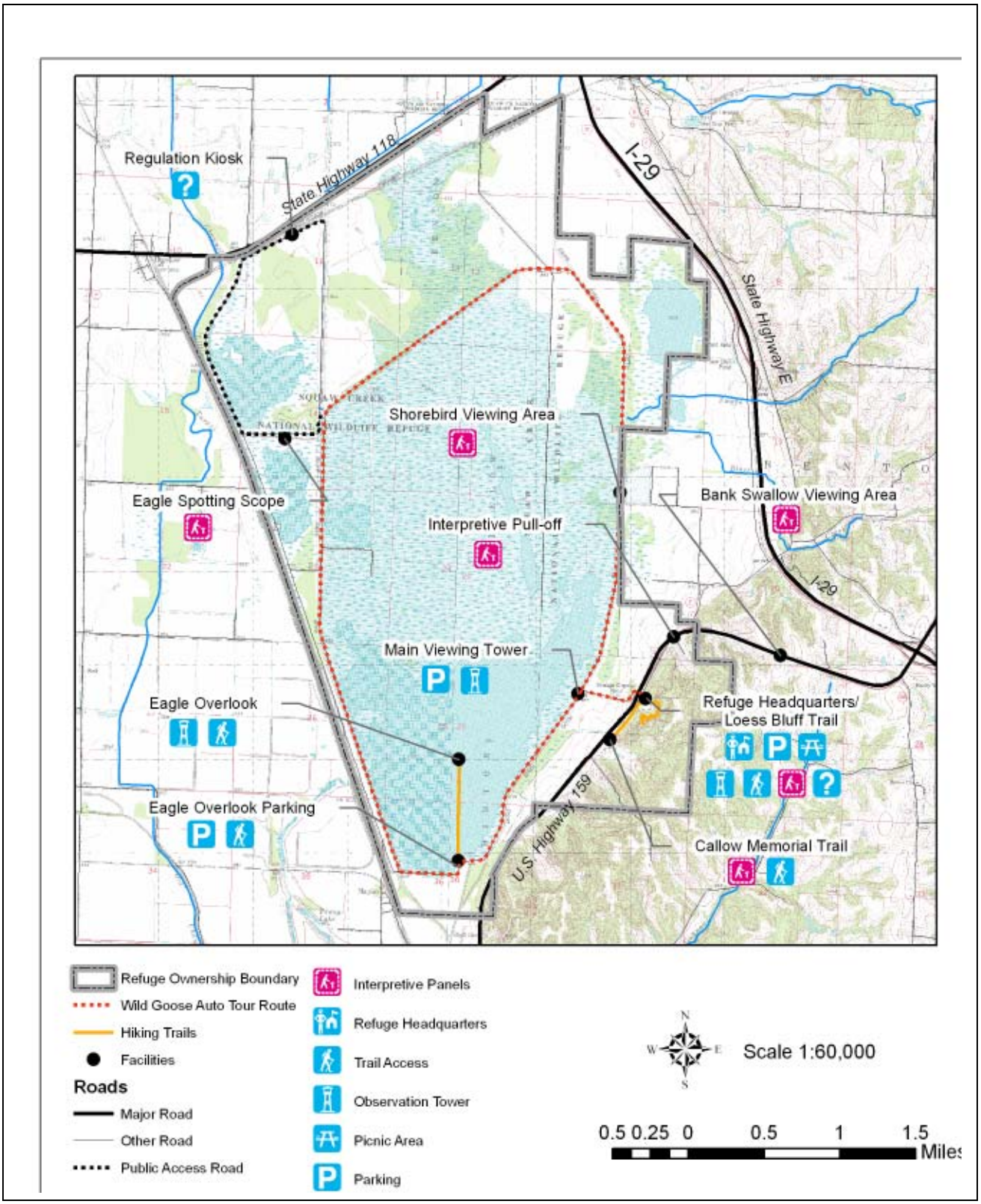
3.2.4 Socioeconomic Setting

Squaw Creek National Wildlife Refuge is located in Holt County, Missouri. The Refuge makes up approximately 2.5 percent of the County land area. Compared to the entire state, Holt County is more rural and less racially diverse. Its population is less dense and has a lower average income and education level. The County population is declining and the state population is increasing.

3.2.4.1 Population

The population of Holt County was 5,351 in 2000. The entire population of the County is classified as rural. In Missouri, 30.6 percent of the population is classified as rural. The county population declined 12.3 percent during the 1980s and 11.3 percent during the 1990s while the State's population increased. The County's population is projected to continue to decline to 4,974 in 2015. The number of children of school age is expected to decline and reflect the decline in population. In 2000, persons age

Figure 10: Squaw Creek NWR Administrative Facilities, 2003



5-17 years was 1,019; in 2015 the number is projected to be 785. In 2000, Holt County's population density was 11.6 persons per square mile; Missouri's was 81.2 persons per square mile. The County population was 98.5 percent white in 2000; the State population was 84.5 percent white.

3.2.4.2 Employment

In 2000 there were a total of 2,752 full- and part-time jobs in the County. The industries that accounted for the largest proportion of jobs in 2000 were agriculture (22.20 percent), services (16.39 percent), retail trade (15.30 percent), and government and government enterprise (14.83 percent). The industries of construction, manufacturing, transportation and public utilities, wholesale trade, and finance, insurance and real estate each contributed 5ñ1 percent of the jobs in the County.

From 1997 to 2001, the County unemployment rate averaged 3.68 percent. This compares to a state unemployment average of 4 percent for the same period.

3.2.4.3 Income and Education

Average per-capita income in Holt County was $15,876 in 2000; in Missouri it was $19,936. The median household income in the County was $29,461; in the State it was $37,934.

In Holt County, 35.6 percent of persons over 25 years of age have had some college or hold a college or advanced degree. The comparable figure in the State is 56.2 percent.

3.2.5 Archeological and Cultural Values

Northwest Missouri, where the Refuge and its management district are located, contains archeological evidence from the earliest suspected human presence in the Americas, the Early Man cultural period prior to 12,000 B.C.; and extending through the Paleo Indian, Archaic, Woodland, Mississippian, and historic Western cultures including the New Deal period. But just 12 sites, including the Refuge headquarters complex, have been identified on the Refuge and none on the management district lands. If the Derr tract is typical, many prehistoric and historic sites are likely located on uplands around the pools. As of April 2003, no properties on the National Register of Historic Places are located on Refuge and district lands.

Seven Indian tribes have been identified as possibly being associated with the Refuge and district lands and could have concerns about traditional cultural properties, sacred sites, areas of cultural activities, human remains, and items of cultural patrimony.

The Refuge has one museum collection at the University of Missouri. There is also a small natural history collection at the Refuge headquarters.

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

3.2.6 Public Use

The visitor center/headquarters at the Refuge has approximately 875 square feet of exhibit space. It is open to visitors Monday through Friday all year around and every day from mid-March to early May, and again from mid-October to early December. Exhibits include dioramas and mounted wildlife specimens. An addition to the visitor center includes an auditorium that seats 100 people. Outside the visitor center there is an overlook with interpretive signs and an information kiosk.

A major visitor attraction is the arrival of thousands of Snow Geese on their fall and spring migration routes. A 10-mile auto tour route, a hiking trail, interpretive panels, and two observation platforms facilitate the viewing of the flocks.

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There are two hiking trails near the visitor center. The Mike Callow Memorial Trail (0.25 mile) is accessible to visitors with disabilities. The Loess Bluff Trail (0.25 mile) climbs from the visitor center to the top of the loess bluffs, providing a panoramic view of the Refuge.

In fiscal year 2001, Squaw Creek NWR's visitation totaled 134,245 visits with Visitor Contact Station visits totaling 41,683. A significant number of groups visit from local area Missouri school districts representing Holt County, St. Joseph City Schools, and Kansas City Metropolitan Schools. Out-of-state school districts from Kansas and Nebraska and two local college departments have also utilized Refuge resources.

In fiscal year 2001, visitors participating in interpretation and nature observation totaled 177,742 on-site visits. A total of 290 talks, tours, and demonstrations were conducted that year. Interpretive foot trail uses totaled 13,650 visits and the auto tour had 134,245 visits. The visitor trail uses of the observation platform, Eagle Pool tower, and Callow Memorial Trail totaled 32,512 visits in 2001.

3.2.6.1 Potential Refuge Visitors

In order to estimate the potential market for visitors to the Refuge, we looked at 1998 consumer behavior data for an area within an approximate 60-mile radius. We used a 60-mile radius because this was an approximation of a reasonable drive to the Refuge for an outing. The area included the Missouri counties Atchison, Nodaway, Worth, Gentry, Holt, Andrew, De Kalb, Buchanan, Clinton, Platte; the Nebraska counties Otoe, Johnson, Nemaha, Pawnee, Richardson; the Kansas counties of Nemaha, Brown, Doniphan, Jackson, Atchison; and the Iowa counties Fremont, Page, Taylor.

The consumer behavior data that we used in the analysis is derived from Mediamark Research Inc. data. The company collects and analyzes data on consumer demographics, product and brand usage, and exposure to all forms of advertising media. The consumer behavior data were projected by Tetrad Computer Applications Inc. to new populations using Mosaic data. Mosaic is a methodology that classifies neighborhoods into segments based on their demographic and socioeconomic composition. The basic assumption in the analysis is that people in demographically similar neighborhoods will tend to have similar consumption, ownership, and lifestyle preferences. Because of the assumptions made in the analysis, the data should be considered as relative indicators of potential, not actual participation.

We looked at potential participants in birdwatching, photography, freshwater fishing, hunting, and hiking. In order to estimate the general environmental orientation of the population we also looked at the number of people who potentially might hold a membership in an environmental organization.

The consumer behavior data apply to persons greater than 18 years old. For the counties that we included in our analysis, the population of persons greater than 18 years old was 283,024. The estimated maximum participants in the 60-mile radius for each activity are: freshwater fishing (42,953), photography (31,399), hiking (27,237), hunting (24,921), and bird watching (22,992). The number of persons who might hold a membership in an environmental organization is 6,697. The projections represent the core audience for repeated trips to the Refuge. On days with major attractions such as Eagle Days and when large numbers of birds are at the Refuge, visitors can be expected to travel longer distances.

3.3 Current Management

3.3.1 Habitat Management

Management of Refuge habitats involves a variety of techniques to control and enhance habitat conditions. Our primary objective is to provide waterfowl and other wildlife with diverse habitats to meet myriad resting, feeding and nesting needs.

3.3.1.1 Wetland Management

Wetland habitats on Squaw Creek NWR include approximately 3,452 acres of managed wetlands, with 15 independently managed marshes in 10 designated pools (Figure 11). Pools include:

Mallard Marsh North (400 acres	Mallard Marsh South (190 acres)
Pintail Pool (200 acres)	South Pintail Pool (25 acres)
North Pool (200 acres	Snow Goose A: (71 acres)
Snow Goose B: (39 acres)	Snow Goose C: (80 acres)
Snow Goose D: (40 acres)	Snow Goose E: (50 acres)
Pelican Pool (600 acres)	Long Slough (60 acres)
Cattail Pool (130 acres)	Eagle Pool (900 acres)
Bluff Pool (200 acres)	

Refuge staff manipulate water levels in the wetlands to affect habitat structure and waterfowl use. The level of the Missouri River can affect the staff's ability to manipulate water levels in Refuge wetlands during flood stages on the river.

3.3.1.2 Moist Soil Units

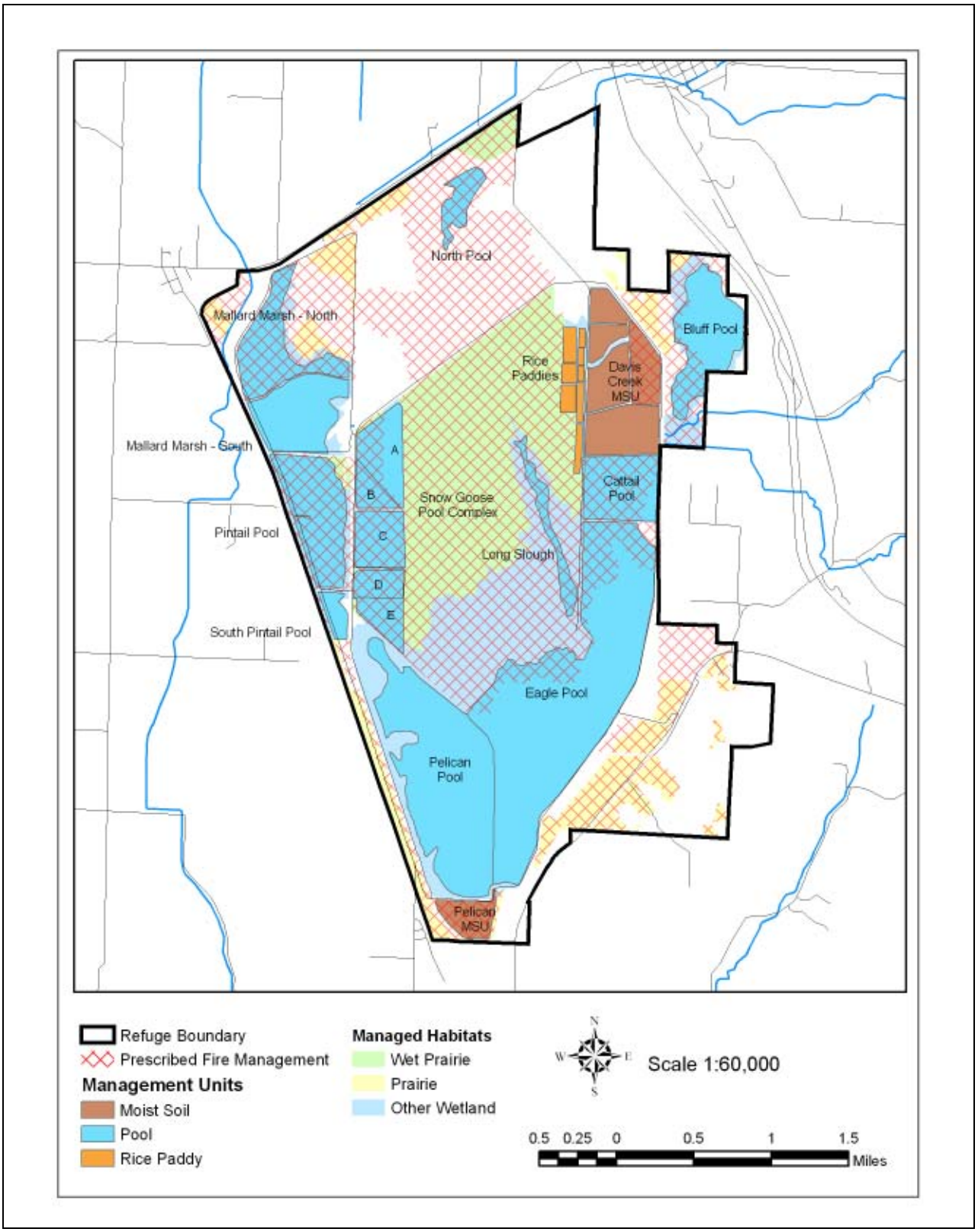
In a normal year, the water level is lowered during the summer to establish moist-soil vegetation. After plants are established in the summer, the units are gradually reflooded in the fall to optimize use of the seed resources. During the spring the water level will gradually be lowered for use by migrating waterfowl, shorebirds and waders. The Refuge manages 15 independently managed lowlands in three designated moist soil units totaling 350 acres. They include:

Rice Paddies: This 60-acre area includes a group of eight small moist soil units separated by low level dikes that were built in the early 1960s. In 1991, the ditch and dike system was rehabilitated. Today the Rice Paddies are managed for to benefit shorebirds and dabbling ducks during the spring and fall migration.

Davis Creek: The Davis Creek moist soil units total approximately 250 acres in five units. They are located adjacent to the Rice Paddies on the west and Davis Creek on the east. Prior to development they were comprised of three crop fields, a damp savannah field of reed canarygrass and willow, and a lowland softwood forest. Construction of the Davis Creek water control structure in 1989 enabled the Refuge to convert the area from cropland to moist soil units.

Pelican MSU: This 40-acre unit was abandoned cropland and had reverted to reed canarygrass and brush. In 1991, an inlet water control structure was installed under the auto tour route to take water from Pelican Pool, the cross dike was rehabilitated and a new outlet water control was installed to release water into Davis Creek. This work permitted this 40-acre unit to be managed as a moist-soil unit.

Figure 11: Habitat Management, Squaw Creek NWR



3.3.1.3 Grasslands

Refuge grasslands, including bottomland mesic prairie, Loess Hills prairie, old fields and wet prairie, are used in the spring and fall by migrating grassland birds. A few ducks also nest in the grassland. The primary management concern related to grasslands is battling invasive species, shrubs and trees. Prescribed fire is the primary tool we use in maintaining grasslands. There are 1,248 acres of grassland on the Refuge.

With the help of volunteers, Refuge staff are working to restore the Loess Hill Prairies. Restoration is manually intensive and involves cutting and piling brush on steep bluffs. In 2001, approximately 4 acres were cleared by volunteers and staff.

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3.3.1.4 Forests

Forests on the Refuge are used by deer, squirrels, raccoons, hawks, owls and a variety of birds. Heavy browsing by deer and reed canary grass invasion has affected forest land, particularly in terms of regeneration. We have conducted studies on the effects of browsing on sapling in an effort to improve the success rate of tree plantings. There are 1,378 acres of forest on the Refuge.

3.3.1.5 Cropland

The Refuge currently has 579 acres of cropland, but we are working with cooperative farmers to reduce that acreage. The reduced cropland will benefit our goal of maintaining a diversity of habitats on the Refuge, contribute to reducing the use of the Refuge by Snow Geese, provide additional grassland bird habitat, and provide additional habitat for massasauga rattlesnake. Three cooperative farmers currently have agreements to farm 473 acres on the refuge. Currently 34 of those acres are in clover. Actual crops in 2001 included 171 acres of corn and 268 acres of soybeans. One-third of the corn produced was left standing in the field for wildlife food and cover.

3.3.2 Fish and Wildlife Monitoring

Bald Eagles

Bald Eagle populations are monitored to determine total numbers using the Refuge as well as monthly use days and peak numbers. In 2001, the peak number of eagles (219) was up 7 percent from the 10-year average peak of 204 and total use days were 25 percent less than the 10-year average of 7,147.

Waterfowl

Waterfowl are monitored weekly in the spring and fall. The total number of waterfowl use days for Squaw Creek NWR in fiscal year 2001 was 8,352,088.

Shorebirds

Spring and fall shorebird surveys are conducted by Refuge staff.

Marsh Birds and Other Water Birds

Marsh birds and other water birds, including grebes, pelicans, cormorants, bitterns, herons, egrets, ibis, and rails, are typically counted during the shore bird surveys. Although there is much variation and many missing species in these counts, due to the secretive nature of many of these birds, documentation of species occurrence is still considered important.

Intensive searches for nesting marsh and water birds via airboat has been conducted since 1991 in all Refuge wetlands. The most common bird species nesting include the Pied-billed Grebe, Least Bittern and Common Moorhen while the American Coot is periodically found. The Refuge contains the largest known number of nests of these species documented in the State of Missouri.

Breeding Bird Mini-route

This survey, which follows Breeding Bird Atlas Mini-route protocol, has been conducted annually since 1989, with the exception of 1990 and 2000. To date 100 species have been identified on these routes. In 2001, 54 species were identified on the 2001 Breeding Bird Mini Route.

Bottomland Forest Point Counts

Squaw Creek NWR harbors the largest wet prairie (approximately 1,000 acres) in Missouri and probably the Midwest. In an effort to begin documenting breeding bird use of this habitat type, preliminary point count surveys were undertaken in June 2001. This survey will be continued.

White-tailed Deer

Annual deer counts, comprised mainly of spotlight surveys, have been conducted on Squaw Creek since 1988. Although no trends can readily be ascertained from past counts, due to limited sample size and variability of sample techniques, data from these counts does demonstrate that high deer densities exist on the refuge. In an effort to use current scientific methodology to obtain accurate deer densities and to standardize survey efforts the refuge began using spotlight distance sampling techniques in FY 2000. Results from FY 2000 indicated that distance sampling could be a useful method for determining deer density so this techniques was used again in FY 2001.

Other Mammals

A muskrat house and beaver house census is completed annually.

Christmas Bird Count

A Christmas Bird Count is completed annually.

Mid-winter Waterfowl Count

Squaw Creek NWR participates in the National Mid-Winter Waterfowl Survey.

Sedge Inventory

During the summer field season, several sedge inventories were conducted on the Refuge. Species located included three Missouri Species of Special Concern: tussocks sedge (*Carex stricta*), Sartwell's sedge (*Carex sartwellii*) – only three locations in the state, and wolf spike rush (*Eleocharis wolfii*). Also located is the largest known population of Missouri Sedge (*Carex missouriensis*) in the state.

Amphibians

Squaw Creek has been conducting amphibian deformity surveys since 1997 and has completed frog and toad calling surveys since 2001. Collection of this data is important as it provides both a baseline for future amphibian monitoring on refuges and wetland management districts, and additional data for identifying the extent of the problem on a national basis. All of the data collected is submitted to the USGS North American Reporting Center for Amphibian Malformations. To date, 724 frogs representing four species have been captured and examined for deformities on Squaw Creek NWR. Species examined include plains leopard frog, bullfrog, cricket frog and western chorus frog. Deformity rates have ranged from 0 - 4.2 percent and appear to fall within the bounds of what are considered to be normal deformity rates of 1-3 percent.

Invertebrates

In a cooperative effort to begin documenting dragonfly and damselfly species occurrence on the Refuge and in northwestern Missouri, the Refuge biologist teamed up with an entomologist with the Missouri Department of Conservation to conduct odonate surveys on the Refuge. A total of 23 species were identified during three survey periods in 2001, two in July and one in September.

3.3.3 Public Use

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An estimated 130,000 people visit Squaw Creek NWR every year; Visitor Contact Station visits totaled 41,683 visits in 2001. With the construction of a new auditorium completed in 2003, we are better positioned to inspire visitors to care about the Refuge, the National Wildlife Refuge System and conservation in the future.

Most people experience the Refuge by driving our 10-mile auto tour route, which provides excellent opportunities for people to observe waterfowl and Bald Eagles. The Refuge also offers an observation platform at Davis Creek, an observation platform at the terminus of the Eagle Overlook hiking trail between Pelican Pool and Eagle Pool, the Loess Bluff hiking trail, which climbs a steep bluff to provide an outstanding view of the Refuge, and the Callow Memorial trail, which is accessible to visitors with disabilities, and terminates at the base of the loess bluffs.

Deer Hunting: The Refuge manages a firearm (muzzle-loading only) hunt for antlerless deer each year to reduce an over abundant population of white-tailed deer. Deer hunting procedures follow state laws and hunters who apply are randomly selected by the Missouri Department of Conservation. Refuge staff operate a check station where all hunters must enter and exit the Refuge and harvested deer are tagged and biological information is collected.

Fishing: Because of the varying water levels, the fishery resource is limited to rough fish. Fishing is permitted from the pool edges and stream banks in accordance to Missouri State fishing regulations. Snagging of non-game fish is also permitted at the Eagle Pool water control outlet structure during years when the pool levels exceed planned water elevations and excess water is released.

Wildlife Observation and Photography: Year-round, the Refuge provides a beautiful landscape and diverse wildlife viewing opportunities. In December, Eagle Days draws several thousand people to the Refuge to drive the auto-tour and attend an eagle show. Wildlife observation is enhanced by Refuge facilities including an auto tour route, hiking trails, observation decks, and scopes.

Environmental Education/Interpretation: Refuge staff offer interpretive programs, tours and demonstrations. Many groups visit from local Missouri school districts representing Holt County, St. Joseph City Schools, and Kansas City metropolitan schools. School districts from Kansas and Nebraska also use Refuge resources, and a number of college and university classes use the Refuge for field trips during the year. Interpretation is facilitated with an orientation video and information on signs in the field and in the visitor center.

3.3.4 Species Management

Integrated management of invasive or pest plants, animals and insects is a program on the Refuge in support of quality habitats and human health. Our primary goals is to provide complex habitat structures to meet the nesting, feeding, and resting requirements of migratory birds and other wildlife.

We use a variety of techniques in the integrated management of invasive plants. These techniques include monitoring the invasive species, manual and mechanical manipulations, timing of activities, chemical and biological control techniques, and introduction of competing species.

3.3.4.1 Animal Species

High densities of species like white-tailed deer, beaver and raccoons can severely affect habitat quality or other species. We are seeking to maintain acceptable densities of these species. We continue to monitor deer herds and attempt to manage density through a public hunt. Beaver are trapped when a management problem is identified.

3.3.4.2 Plant Species

Invasive or pest plants can affect many habitat types found at the Refuge. Reed canary grass and American lotus can invade wetlands; Illinois garlic mustard and marijuana can invade Loess Hill areas; black locust, honey locust, and johnsongrass can invade grasslands. To reduce encroachment by these species, we use several management techniques, such as hand pulling individual plants, mowing, burning, water level manipulation, plowing and chemical applications. The technique we select is influenced by management objectives, intensity of encroachment, best land use practices, cost, and timing of application.

3.3.5 Archaeological and Cultural Resources

Undertakings accomplished on the Refuge and the management district have the potential to impact cultural resources and are subject to Section 106 of the National Historic Preservation Act and sometimes other laws.

Thus the Refuge Manager, during early planning, provides the Regional Historic Preservation Officer (RHPO) a description and location of all projects, activities, routine maintenance and operations that affect ground and structures, requests for permitted uses, and of alternatives being considered. The RHPO analyzes these undertakings for potential to affect historic properties and enters into consultation with the State Historic Preservation Officer and other parties as appropriate. The Refuge Manager notifies the public and local government officials to identify concerns about impacts by the undertaking. The notification is at least equal to, and preferably with, public notification accomplished for NEPA and compatibility.

3.3.6 Special Management Areas

3.3.6.1 Farm Services Administration Conservation Easements

Squaw Creek NWR is responsible for managing conservation easements within the Squaw Creek Wildlife Management District, a 15-county area in northwest Missouri. The Conservation easements were obtained through the procedures of the Farm Services Administration (FSA), formerly Farmers Home Administration, or FmHA. When the FSA acquires property through a default of loans, it is required to protect wetland and floodplain resources on the property prior to resale to the public. The authority and direction for the FSA actions comes from the consolidated Farm and Rural Development Act (7 U.S.C. 1981, 1985); Executive Order 11990 providing for the protection of wetlands; and Executive Order 11988 providing for the management of floodplain resources.

The U.S. Fish and Wildlife 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 assigns the management responsibility to the Service. The easement areas become part of the national Wildlife Refuge System.

Currently 34 easements covering 1,553 acres are recorded on deed and three fee-title tracts totaling 911.5 acres are located in 11 of the District counties.