Squaw Creek

National Wildlife Refuge

Comprehensive Conservation Plan Approval

Submitted by:

Ronald L. Bell 6/8/05

Ron Bell — Date
Refuge Manager

Concur:

Jon Kauffeld 7/8/05

Jon Kauffeld — Date
Refuge Supervisor, Area 2

Nita M. Fuller 7.18.2005

Nita M. Fuller — Date
Regional Chief, National Wildlife Refuge System

Approve:

Charles M. Wooley
Acting Regional Director

Charles Wooley 7/19/05

Robyn Thorson — Date
Regional Director

Squaw Creek

National Wildlife Refuge

Comprehensive Conservation Plan

Table of Contents

Squaw Creek

National Wildlife Refuge

Comprehensive Conservation Plan

List of Figures and Tables

Chapter 1: Introduction and Background

1.1 Introduction

Squaw Creek National Wildlife Refuge (Refuge), is located in Holt County in northwest Missouri, approximately midway between Kansas City, Missouri and Omaha, Nebraska, 2.5 miles off Interstate Highway 29 (Figure 1). This 7,415-acre refuge includes approximately 6,700 acres of floodplain that is managed as wetland, grassland and riparian habitats that attract up to 475 Bald Eagles, 300,000 Snow Geese, and 200,000 ducks during fall and winter seasons.

Frank Durbian

The Refuge also manages 34 easements obtained from the Farm Service Agency, previously known as the Farmers Home Administration, or FmHA. These easements lie in 11 of the 15 counties that make up the Squaw Creek Wildlife Management District (Figure 2).

The Refuge gets its name from Squaw Creek, a major stream that drains the Loess Hills on the east and flows through the Missouri River floodplain lands of the Refuge via a man-made ditch, and then empties into the Missouri River approximately 8 miles south of the Refuge. Davis Creek, which has also been ditched, flows along the eastern Refuge boundary and joins Squaw Creek just after leaving the Refuge. The Refuge's west boundary is about 5 miles from the closest bank of the Missouri River. The Santa Fe-Burlington Northern railroad embankment runs along the west Refuge boundary. Its embankment provides some protection from Missouri River overflows.

Refuge lowlands were once a part of a large natural marsh in the Missouri River floodplain. Historically, this area was heavily used by waterfowl and other migratory birds during their spring and fall migrations.

The almost 700 acres of Refuge upland include a segment of the 200-mile long band of hills known as the Loess Hills. The Loess Hills, formed by wind-deposited, silt-sized soil particles, are a geologic phenomenon unique to the Missouri River Valley. While loess deposits do exist elsewhere in North America and the world, only in the Missouri River Valley are the deposits deep enough to create such an extensive land form. The Loess Hills support rare remnants of native prairie and prairie associated wildlife.

Figure 1: Location of Squaw Creek NWR

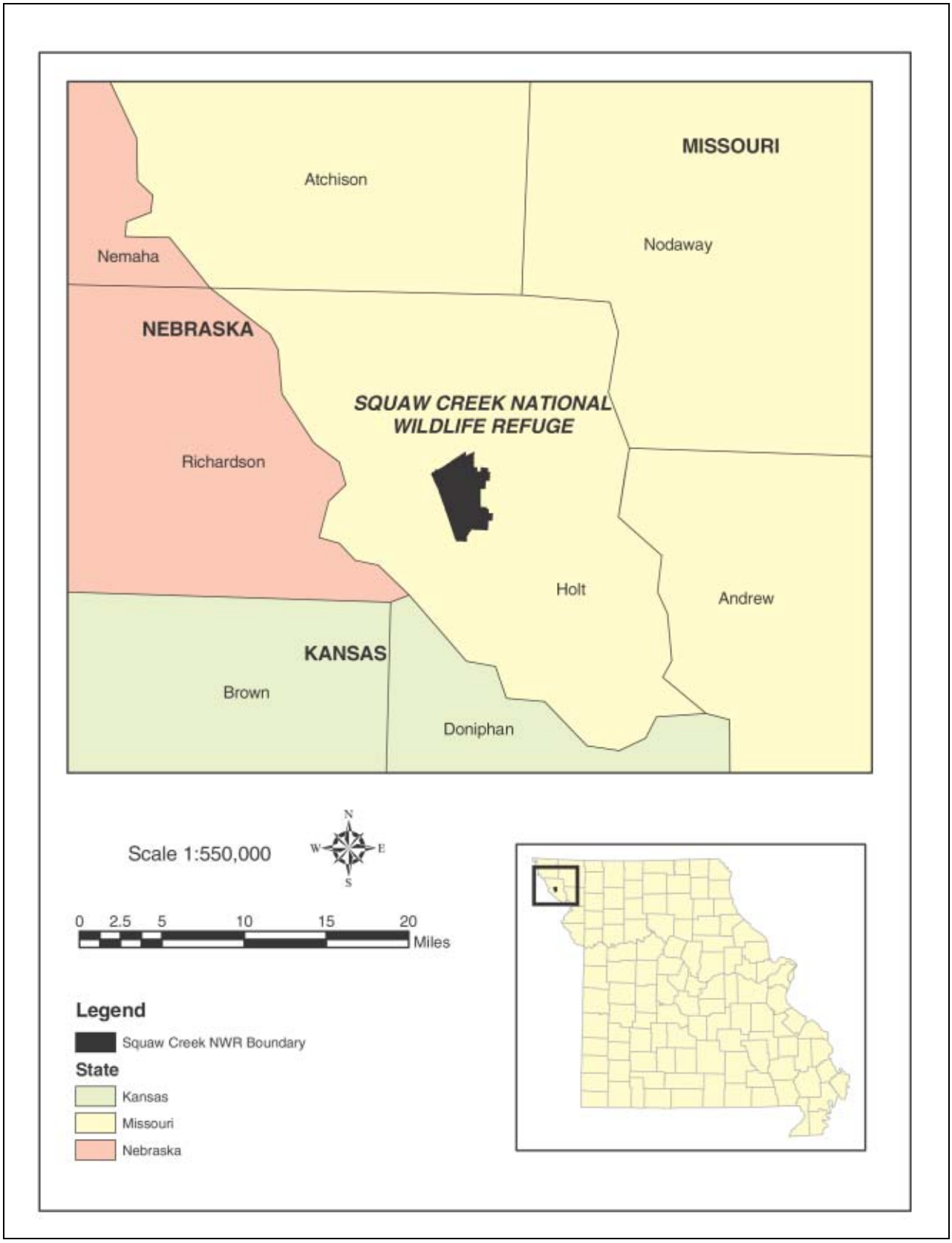


Figure 2: Squaw Creek Wildlife Management Area

The Refuge hosts 310 species of birds, 33 mammals, and 35 reptiles and amphibians. Missouri's largest wet prairie remnant (983 acres) is on the Refuge and it is home to Missouri's largest meta-population of the Eastern Massassauga rattlesnake.

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.

1.2 Refuge Purpose

Signed into existence by President Franklin D. Roosevelt as the "Squaw Creek Migratory Waterfowl Refuge" on August 23, 1935, in Executive Order 7156, the Refuge's purpose was to "... effectuate further the purposes of the Migratory Bird Conservation Act." The Executive Order further stated that lands are to be used "as a refuge and breeding ground for migratory birds and other wildlife."

Throughout the 100-year existence of the National Wildlife Refuge System, its functional direction and purpose have evolved to reflect its ever increasing value as a collection of irreplaceable habitats representing the diverse natural heritage of America. In so doing, the purposes of individual refuges such as Squaw Creek have broadened from somewhat narrow definitions aimed at specific animal groups to include entire ecosystems and all of the wildlife and plants within them.

Squaw Creek NWR is also managed to preserve, restore, and manage wetland and upland habitats that represent the Lower Missouri River ecosystem for the benefit of a diverse complex of fauna and flora, with emphasis on threatened and endangered species; and, to provide opportunities for the public to enjoy wildlife-dependent recreation, including environmental education and public outreach.

1.3 Refuge Vision for the Future

The Refuge staff envision a future that includes:

- # Restoration and preservation of the wetland ecosystems of the Missouri River floodplain continues to be the major management thrust of Squaw Creek National Wildlife Refuge.
- # Refuge wetlands, which include the largest remnant wet prairie in Missouri, continue to provide safe habitat for concentrations of waterfowl and other birds during the migration and nesting seasons.
- # The historic threat of wetland sedimentation has declined significantly as managers of the vast surrounding agriculture lands employ more conservative practices advocated by the Refuge staff and other agencies.
- # The Refuge habitat diversity emphasizes both wetland and grassland, interspersed with stands of mixed shrubs and woodlands, managed on a scale to minimize habitat fragmentation and to be attractive to indigenous species as well as neo-tropical and passerine birds.
- # Habitat diversity broadens each year as progress is made to convert former monotypic stands of reed canary grass, American lotus, and croplands to aquatic and upland species complexes that benefit both indigenous and migratory wildlife.
- # Squaw Creek National Wildlife Refuge continues to be a destination for people to enjoy wildlife-dependent recreation. Dynamic environmental education and interpretive displays and programs, presented in well designed facilities, help the public to understand and become supportive of the Refuge staff's efforts to conserve, preserve and manage wildlife resources and their habitats.

- The Refuge serves as an outdoor laboratory for biological researchers whose study results aid in the management for species of special concern such as the Eastern Massassauga rattlesnake, Blanding's turtle and the Least Bittern.
- The multi-disciplined staff of biologists, technicians, and support personnel are a well trained team proficient in their functions of serving Refuge visitors, cooperators, and the general public, in their stewardship of the resources put in their charge, and in their maintenance of Refuge facilities and equipment. This team places high value on its connections with the community and relies heavily on stakeholder input.
- The Refuge budget, staff, and administrative facilities are adequate to implement the strategies required to achieve the goals and objectives set forth in this plan.

1.4 Purpose and Need for the Plan

This Comprehensive Conservation Plan (CCP) identifies the role Squaw Creek NWR will play in supporting the mission of the National Wildlife Refuge System and provides primary management guidance for the Refuge. The plan articulates management goals for the next 15 years and defines objectives and strategies that will achieve those goals. Several legislative mandates within the National Wildlife Refuge System Improvement Act of 1997 have guided the development of this plan. These mandates include:

- Wildlife has first priority in the management of refuges.
- Wildlife-dependent recreation activities of hunting, fishing, wildlife observation, wildlife photography, environmental education and interpretation are the priority public uses of the Refuge System. These uses will be facilitated when they do not interfere with a refuge's purposes or the mission of the Refuge System.
- Other uses of the Refuge will only be allowed when they are determined to be appropriate and compatible with the Refuge purposes and mission of the Refuge System.

Following the recommendations in the CCP will enhance management of Squaw Creek NWR by:

- Providing a clear statement of direction for future management of the Refuge.
- Giving Refuge neighbors, visitors, and the general public an understanding of the Service's management actions on and around the Refuge.
- Ensuring that the Refuge's management actions and programs are consistent with the mandates of the National Wildlife Refuge System.
- Ensuring that Refuge management is consistent with federal, state and county plans.
- Establishing long-term Refuge management continuity.
- Providing a basis for the development of budget requests for Refuge operations, maintenance, and capital improvement needs.

1.5 The U.S. Fish and Wildlife Service

> "Working with others to conserve, protect, and enhance fish and wildlife and their habitats for the continuing benefit of the American people." *Mission of the U.S. Fish and Wildlife Service*

The U.S. Fish and Wildlife Service is the primary federal agency responsible for conserving, protecting, and enhancing fish and wildlife and their habitats for the continuing benefit of the American people. Specific responsibilities include enforcing federal wildlife laws, managing migratory bird populations, restoring nationally significant fisheries, administering the Endangered Species Act, and restoring wildlife habitat such as wetlands. A significant portion of the Service's mission is accomplished within the National Wildlife Refuge System.

1.5.1 The National Wildlife Refuge System

> "To administer a national network of lands and waters for the conservation, management and, where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans." *Mission of the National Wildlife Refuge System*

Managing the National Wildlife Refuge System has evolved into a significant role for the Service. Founded in 1903 by President Theodore Roosevelt with the designation of Florida's Pelican Island as a refuge for herons and egrets, the National Wildlife Refuge System is the world's largest collection of lands specifically managed for fish and wildlife. The System is a network of more than 500 national wildlife refuges encompassing more than 93 million acres of public land and water. The majority of these lands – 82 percent – is in Alaska, with approximately 16 million acres in the lower 48 states and several island territories. Refuges provide habitat for more than 5,000 species of birds, mammals, reptiles, amphibians, fish, and insects.

Like Pelican Island, many early national wildlife refuges were created for herons, egrets and other water birds. Others were set aside for large mammals such as elk and bison. Most refuges, however, have been created to conserve migratory birds. This is a result of the United States' responsibilities under international treaties for migratory bird conservation as well as other legislation, such as the Migratory Bird Conservation Act of 1929.

National wildlife refuges also play a vital role in preserving endangered and threatened species. Among the refuges that are well known for providing habitat for endangered species are Aransas NWR in Texas, the winter home of the whooping crane; the Florida Panther Refuge, which protects one of the nation's most endangered mammals; and the Hawaiian Islands Refuge, home of the Laysan duck, Hawaiian monk seal, and many other unique species.

Refuges are great places for people, too. When it is compatible with their establishing purposes, refuges can be used for wildlife-dependent activities such as hunting, fishing, wildlife observation, photography, environmental education and interpretation. Many refuges have visitor centers, nature trails, automobile tours, and environmental education programs. Nationwide, more than 35 million people visited national wildlife refuges in 1999.

The National Wildlife Refuge System Improvement Act of 1997 established many mandates aimed at making the management of national wildlife refuges more cohesive. The preparation of comprehensive conservation plans is one of those mandates. The legislation requires the Secretary of

the Interior to ensure that the mission of the National Wildlife Refuge System and purposes of the individual refuges are carried out. It also requires the Secretary to maintain the biological integrity, diversity, and environmental health of the Refuge System.

The administration, management, and growth of the System are guided by the following goals:

- To fulfill our statutory duty to achieve refuge purpose(s) and further the System mission.
- To conserve, restore where appropriate, and enhance all species of fish, wildlife, and plants that are endangered or threatened with becoming endangered.
- To perpetuate migratory bird, interjurisdictional fish, and marine mammal populations.
- To conserve a diversity of fish, wildlife, and plants.
- To conserve and restore where appropriate representative ecosystems of the United States, including the ecological processes characteristic of those ecosystems.
- To foster understanding and instill appreciation of native fish, wildlife, and plants, and their conservation, by providing the public with safe, high-quality, and compatible wildlife-dependent public use. Such use includes hunting, fishing, wildlife observation and photography, and environmental education and interpretation.

1.6 Existing Partnerships

Working with others via intra- and interagency partnerships is important in accomplishing the mission of the Fish and Wildlife Service as well as assisting Squaw Creek National Wildlife Refuge in meeting its primary objective of providing a resting and feeding area for migratory birds and other wildlife. Partnerships with other federal and state agencies and with a diversity of other public and private organizations are increasingly important. Other agencies can provide invaluable assistance in research and maintenance. Private groups and non-profit organizations greatly enhance public involvement in the Refuge, building enthusiasm and support for its mission.

Besides the partnerships that the Fish and Wildlife Service holds on a national level, Squaw Creek NWR maintains informal partnerships with:

- Friends of Squaw Creek
- Missouri Department of Conservation
- Missouri Department of Natural Resources
- Missouri Department of Transportation
- Missouri Highway Patrol
- Missouri Land Improvement Contractors Association
- Natural Resources and Conservation Service
- Holt County Soil and Water Conservation District
- U.S. Army Corps of Engineers
- U.S. Environmental Protection Agency
- Farm Service Agency
- Mound City Chamber of Commerce
- Burroughs Audubon Society
- Midland Empire Audubon Society
- Ducks Unlimited

- Missouri Western State College
- Northwest Missouri State University
- Towson University-Maryland
- Southern Illinois University
- St. Joseph Convention and Visitor Bureau
- St. Joseph Museum
- Mid-Buchanan High School
- U.S. Geological Survey
- Kickapoo Tribe
- Burlington Northern Railroad
- Oregon Rural Fire Department
- Rosendale Rural Fire Department
- Eastern Gamagrass Company
- Mound City Kiwanis
- Pony Express Boy Scout Council
- St. Joseph Public School System
- Holt County Public School System
- Southwest Missouri State University
- University of Missouri - Columbia
- Sac and Fox Tribe

1.7 Legal and Policy Guidance

In addition to the legislation establishing the Refuge and the National Wildlife Refuge System Improvement Act of 1997, other federal laws, executive orders, and regulations govern the administration of Squaw Creek National Wildlife Refuge. See Appendix E for a list of the guiding laws and orders.

Chapter 2: The Planning Process

Frank Durbian

The planning process for this CCP began with a "kick-off" meeting in July 1999. Initially, members of the CCP planning team and Refuge staff identified a list of issues and concerns that were associated with management of the Refuge. These preliminary issues and concerns were based on staff knowledge of the area and association with citizens in the community. The planning team, consisting of Refuge staff and Service planners, then invited Refuge neighbors, organizations, local government agencies and local staff of national and state government agencies, schools, and interested citizens to share their thoughts in a focus group meeting on August 18, 1999. Nineteen people attended the meeting. An open house was held on September 14, 1999, and 12 attended. The planning team accepted oral and written comments at the open house. Five written comments were received.

In October 1999, the planning team met for an intensive three-day workshop to develop and consider four management alternatives that addressed the issues and concerns in different ways. The alternatives generally describe levels of management varying from near passive to more intensive. Once alternative levels of management were selected, methods for achieving that level were developed.

Subsequent planning team meetings in November of 1999 and January of 2000 were held with Region 3 U.S. Fish and Wildlife Service officials and biologists in Fort Snelling, Minnesota, to critique and revise these draft alternatives and associated goals and objectives. In February 2000, the planning team again met for two days at DeSoto National Wildlife Refuge to further refine goals, objectives, and strategies. The planning team met at Squaw Creek NWR in February 2003 to continue this process.

The draft CCP and EA were released for public review on June 28, 2004, with the comment period closing on August 27, 2004. Eleven people attended a public open house on August 4, 2004. A total of 43 comments were received (see Appendix L) during the public review period.

2.1 Issues and Concerns

The issues and concerns presented in this section evolved through discussions among Service staff both at the Refuge and in the Regional Office, discussions with representatives of the State of Missouri, and public involvement.

As might be expected, the public participants at the focus group meeting and the open house meetings offered both positive and negative views to the issues; i.e, some supported Refuge expansion or on-refuge hunting while others were opposed.

The planning team considered all expressed views, written and oral, in its development of alternative actions and the goals and objectives presented in Chapter 4.

2.1.1 Wildlife Habitat and Resource Management

Extraordinary measures may be required to preserve the marsh environment that has historically attracted migratory waterfowl and other wildlife. Erosion from the steep slopes on the river side of the Loess Bluffs and intensive agriculture result in heavy silt loads in Squaw Creek and Davis Creek. The creeks deposit 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. Adequate renovation and conservation might require dredging, raising dike elevations, stream diversion, or other expensive landscape modifications.

2.1.2 Land Management within the Watershed Impacts Refuge Water Quality and Quantity

Beyond Refuge boundaries, land management practices within the watershed influence the quality and quantity of water that flows into the Refuge. Unrestricted surface runoff in the watershed depletes top soil and soil moisture conditions. The deposition of top soil and agricultural chemicals in the Refuge marshes during flood stages has an adverse cumulative effect. While neither the Refuge nor the Fish and Wildlife Service has any interest or authority to interfere with private lands management, we have the responsibility to conserve the public resources placed in our care. The Service can provide advice to landowners as well as assist more directly through existing cost share programs available to landowners aimed at improved soil and moisture conservation.

2.1.3 Snow Goose Management

Frank Durbian

The mid-continent population of Snow Geese is experiencing "a perilous abundance." The peril is their numbers: 900,000 in 1969 and 6 million in 1998, exceed the capacity of their Arctic breeding/nesting habitat in the vicinity of Hudson Bay. Recovery of damaged Arctic tundra vegetation is extremely slow and tends to continue towards self destruction once the moisture and chemical balance is upset. High Snow Geese survival rates over the last 20 years and quality wintering grounds has contributed to the over population. Action plans recently proposed by Canada wildlife experts, the U.S. Fish and Wildlife Service, and State and Provincial agencies focus on reducing the Snow Goose population, mainly through increased harvest. Concentrations of 300,000 to 400,000 Snow Geese at Squaw Creek NWR during the fall migration have become a site-seeing tradition that attracts thousands of Refuge visitors. The Snow Geese are also welcomed by waterfowl hunters in an area from Sioux City, Iowa to Kansas City, Missouri.

2.1.4 Refuge Expansion

Floodplain wetlands similar to those within Squaw Creek NWR have been preserved and managed as private and commercial waterfowl hunting clubs. High operations costs have caused some owners to consider selling their property to the Refuge. Some people feel that the Refuge marsh restoration and preservation problems associated with watershed management and runoff could be lessened if some of the adjacent agricultural land was added to the Refuge and converted to other uses. However, hydrological or biological data supporting this is incomplete or lacking. Approximately 400 acres of private land remain within the authorized Refuge boundaries.

2.1.5 Public Use

Public use at the Refuge has focused on non-consumptive uses and wildlife dependent recreation, but some people have suggested that the Refuge's public use program should be changed to allow other compatible uses that might include hunting waterfowl and deer. Currently there is a special 2-3-day, muzzle loader deer hunt with a specific number of permits issued. Angling is allowed where the roads cross the creek ditches. Historically, environmental education has been emphasized at Squaw Creek NWR.

2.1.6 Public Service

The staff at Squaw Creek NWR want to be good neighbors and contributors to the welfare of the community. As the Refuge strives to be of service to the public and the community, are there new or better ways it can be successful in its efforts? Public service activities now include environmental education programs for schools and special groups both on and off the Refuge, disaster assistance with staff and equipment, operations budgets that boost the local economy, annual payments to counties to offset losses of real property tax revenues, and cost share programs for environmental improvements on private lands. The Refuge attracts visitors to the area who patronize local businesses. The Refuge staff will continue to seek innovative ways to be of service to the public and the community.

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.

Frank Durbian

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.

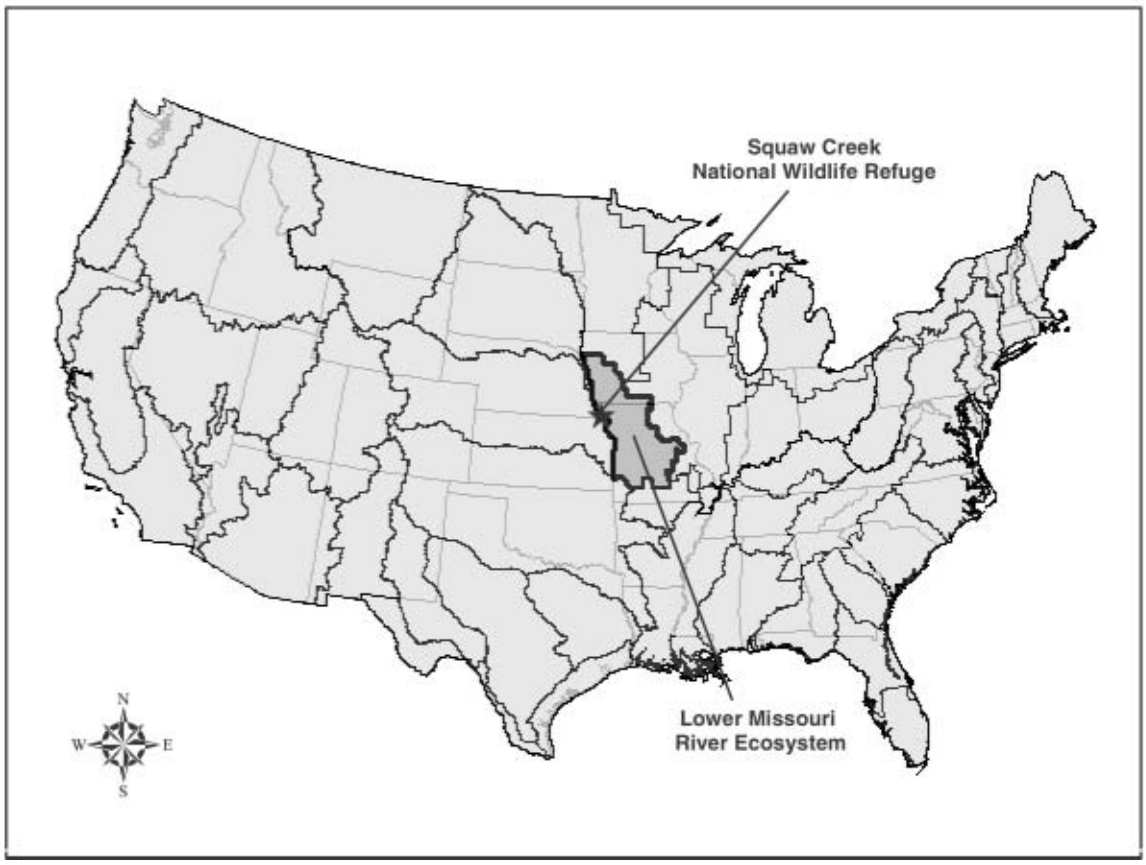
Most of the 7,415 acres comprising the Refuge are located along the eastern edge of the Missouri River floodplain in an historic wetland area. Habitat types include 1,000 acres of bottomland forest, 291 acres of bottomland mesic prairie, 1,077 acres of wet prairie, 378 acres of Loess Hills forest, 221 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.

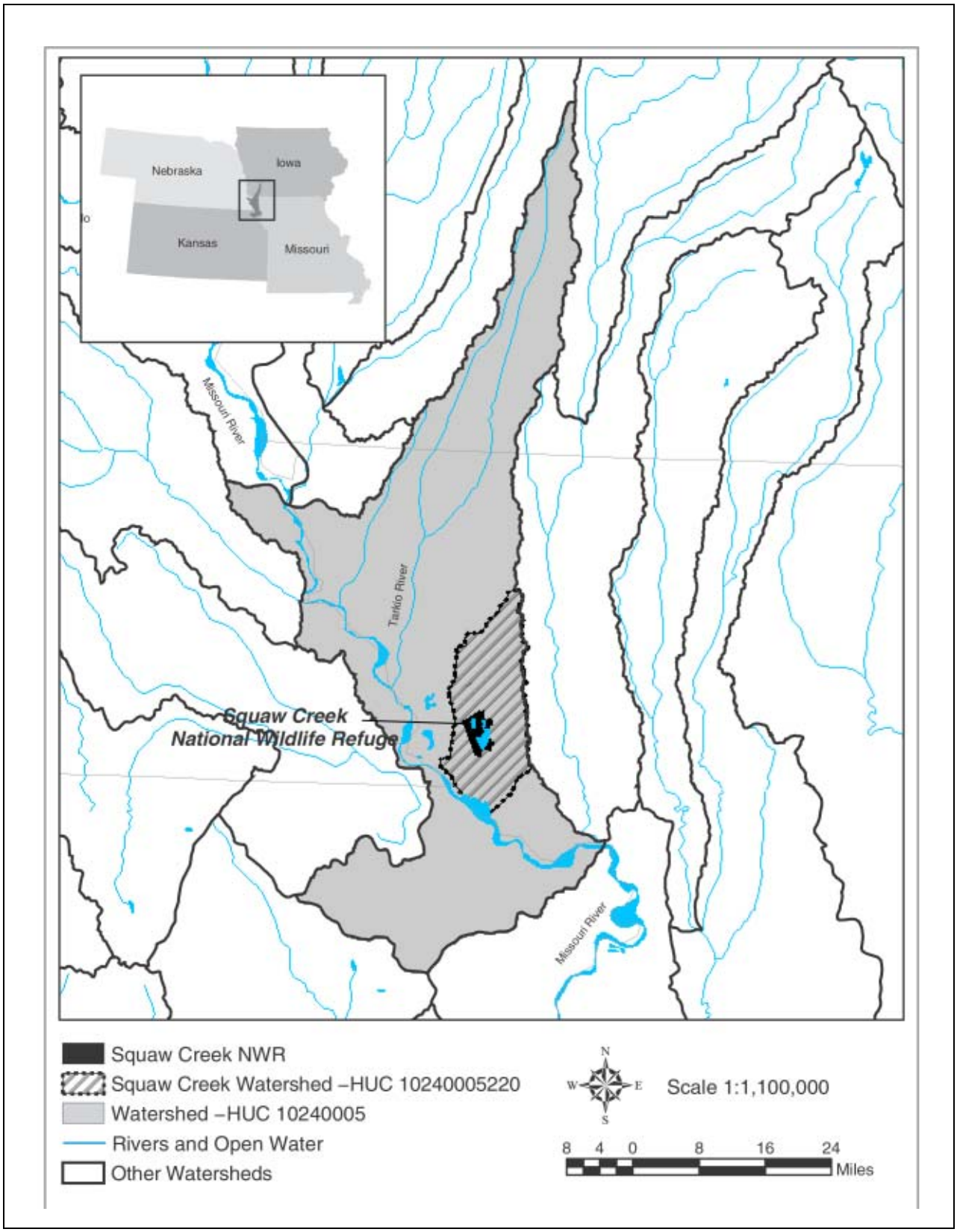
Davis Creek drains about 23 square miles (approximately 15,000 acres). The creek emerges from the hills at Mound City and directly enters the northeast corner of the Refuge after passing under Interstate Highway 29.

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

Frank Durbian

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).

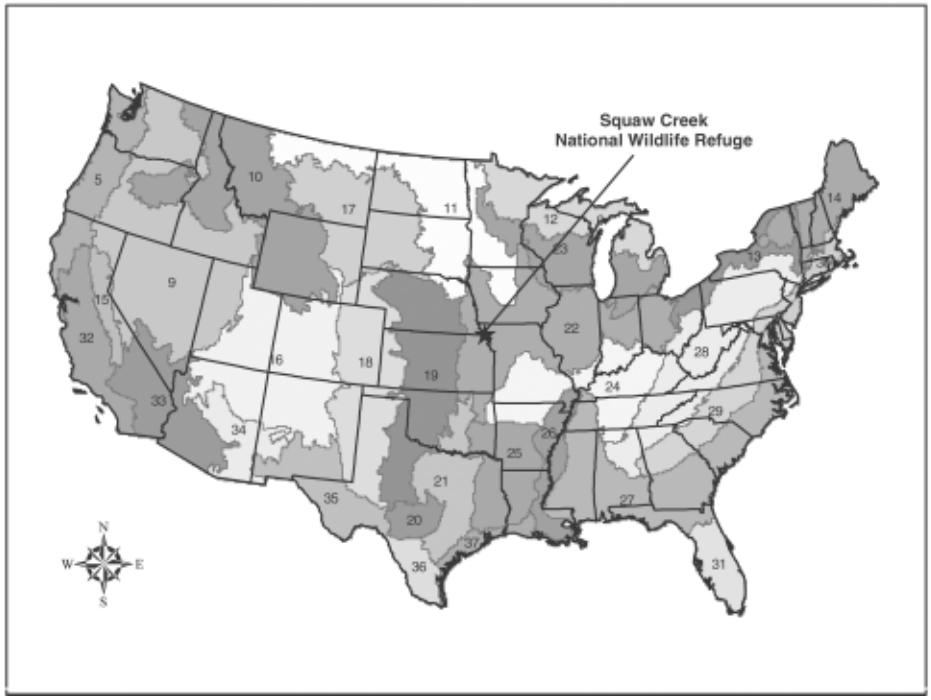
The U.S. Shorebird Conservation Plan) and the North American Waterbird Conservation Plan (see http://www.nacwcp.org) have regional components that identify priority species and conservation strategies, mostly focused around habitat, that will address the needs of these groups of birds. Squaw Creek NWR 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.

Frank Durbian

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.

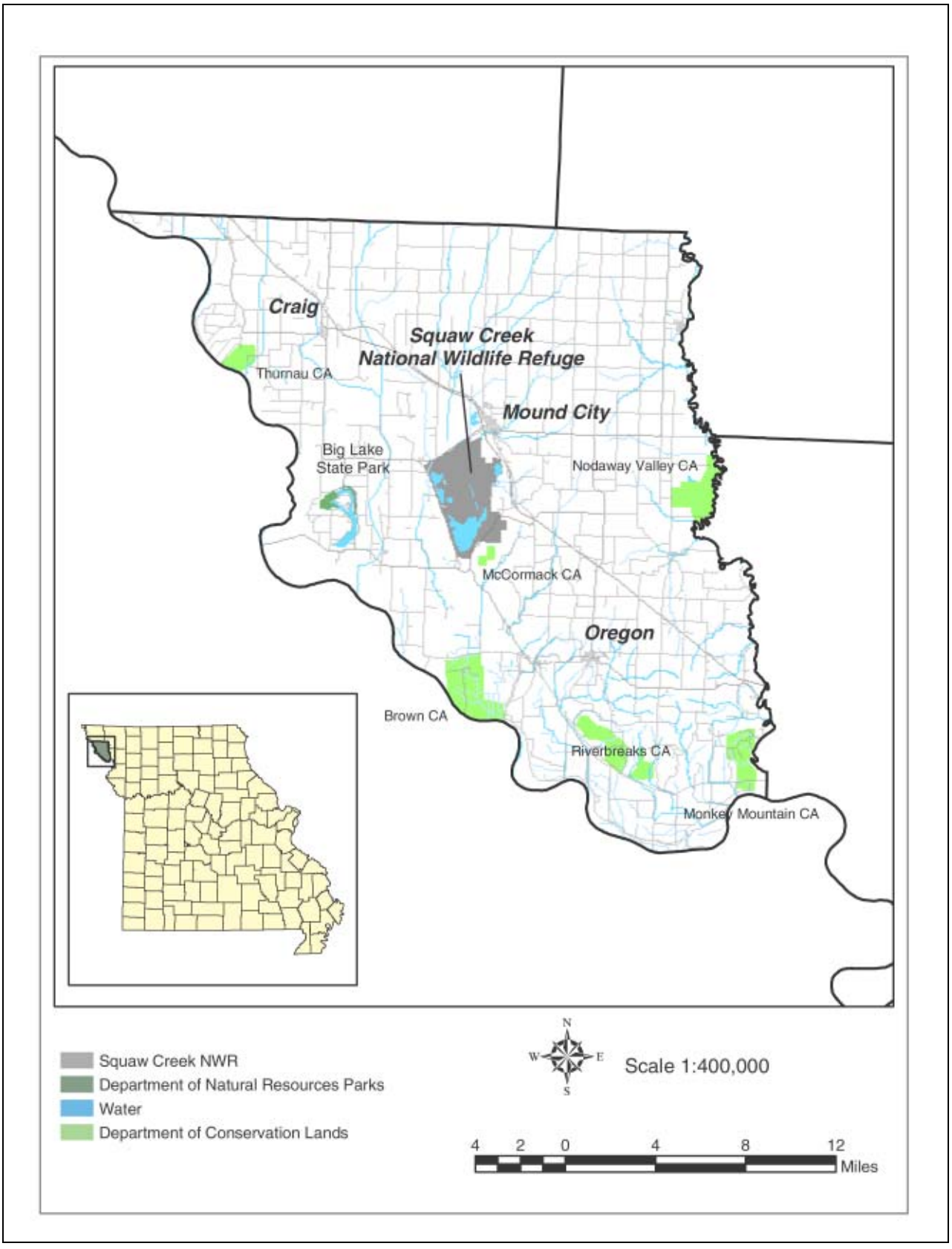
3.2 Refuge Resources, Cultural Values and Uses

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.

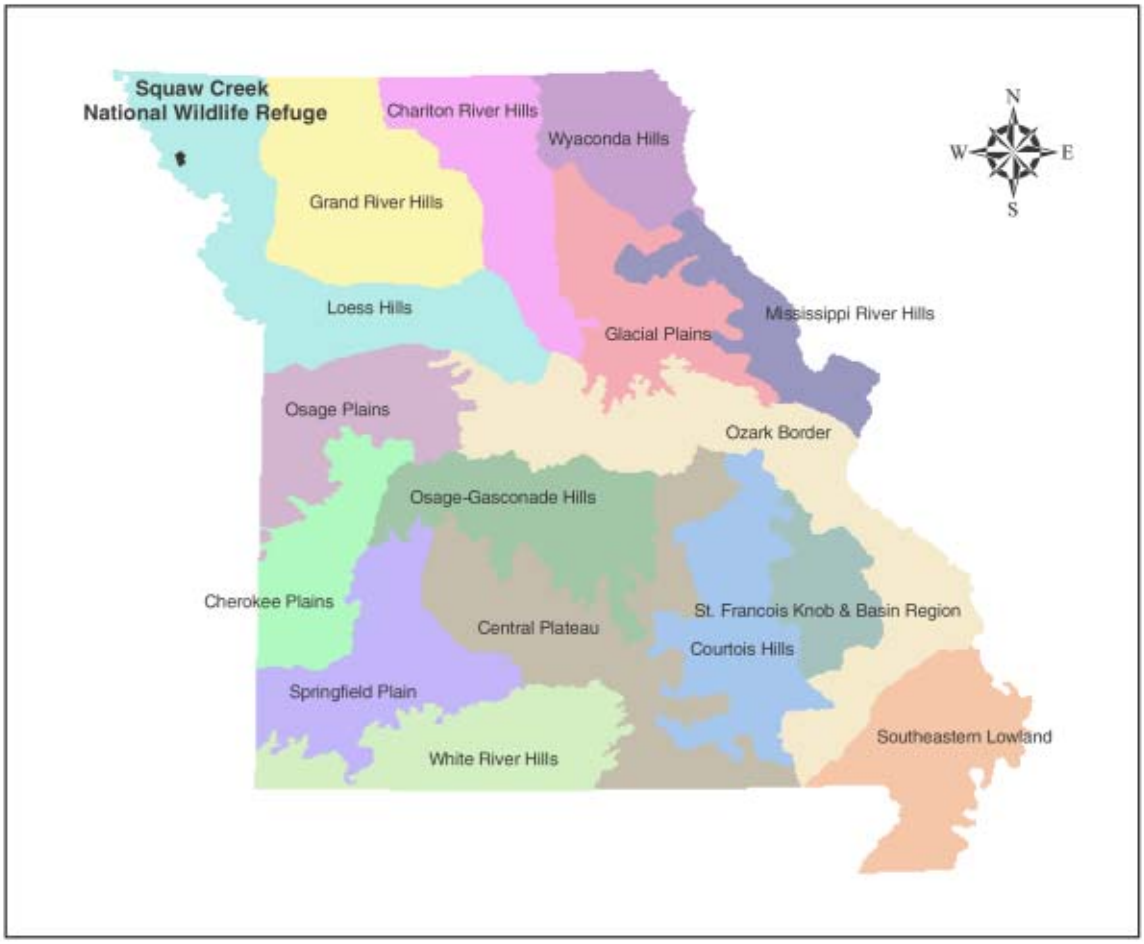
Background

> "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



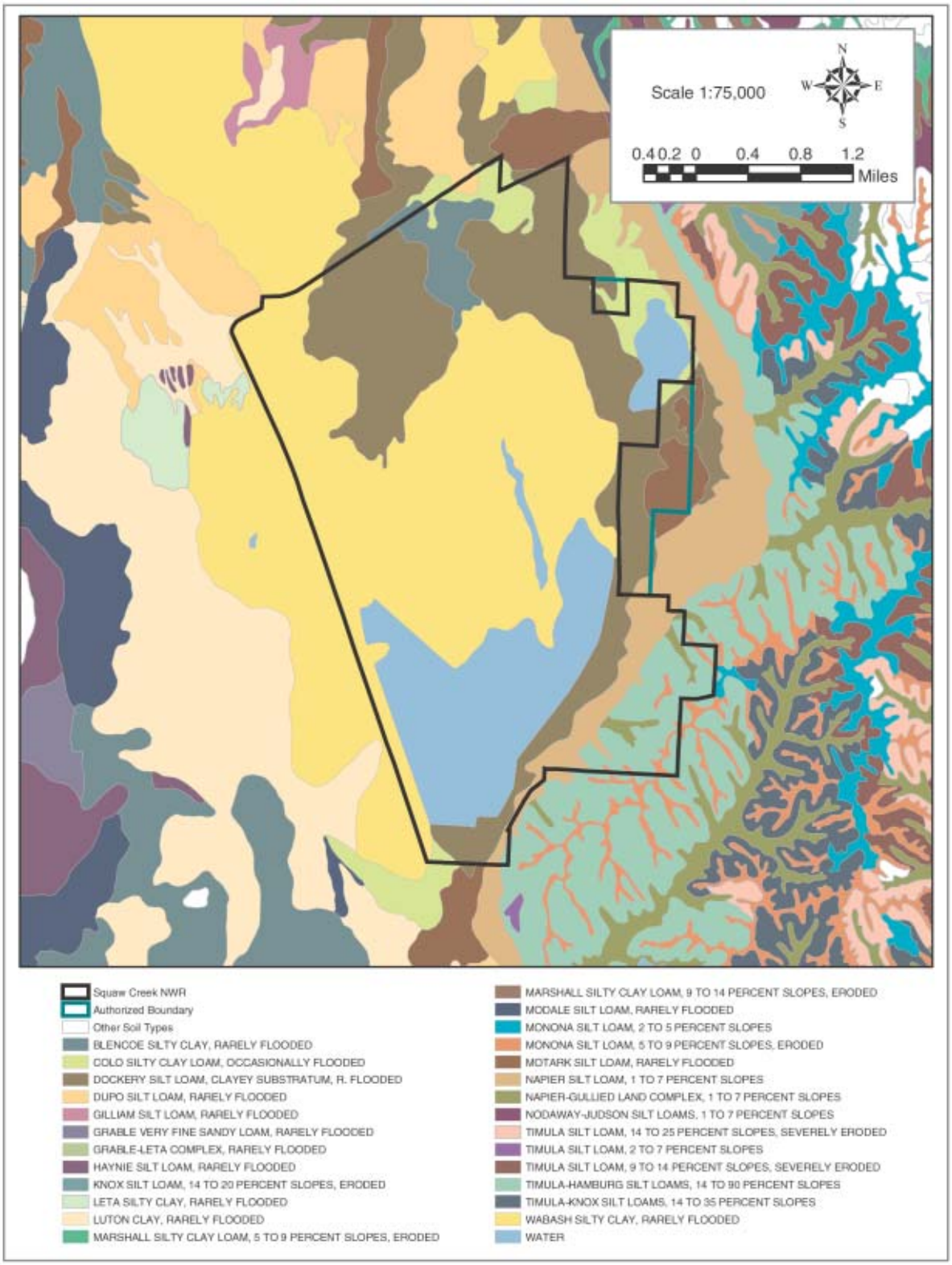
(depending upon seasonal moisture conditions) of some of the higher lands, 40 to 160 acre parcels are being rented for waterfowl shooting purposes to individuals and clubs. Some of the latter own their shooting grounds."

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

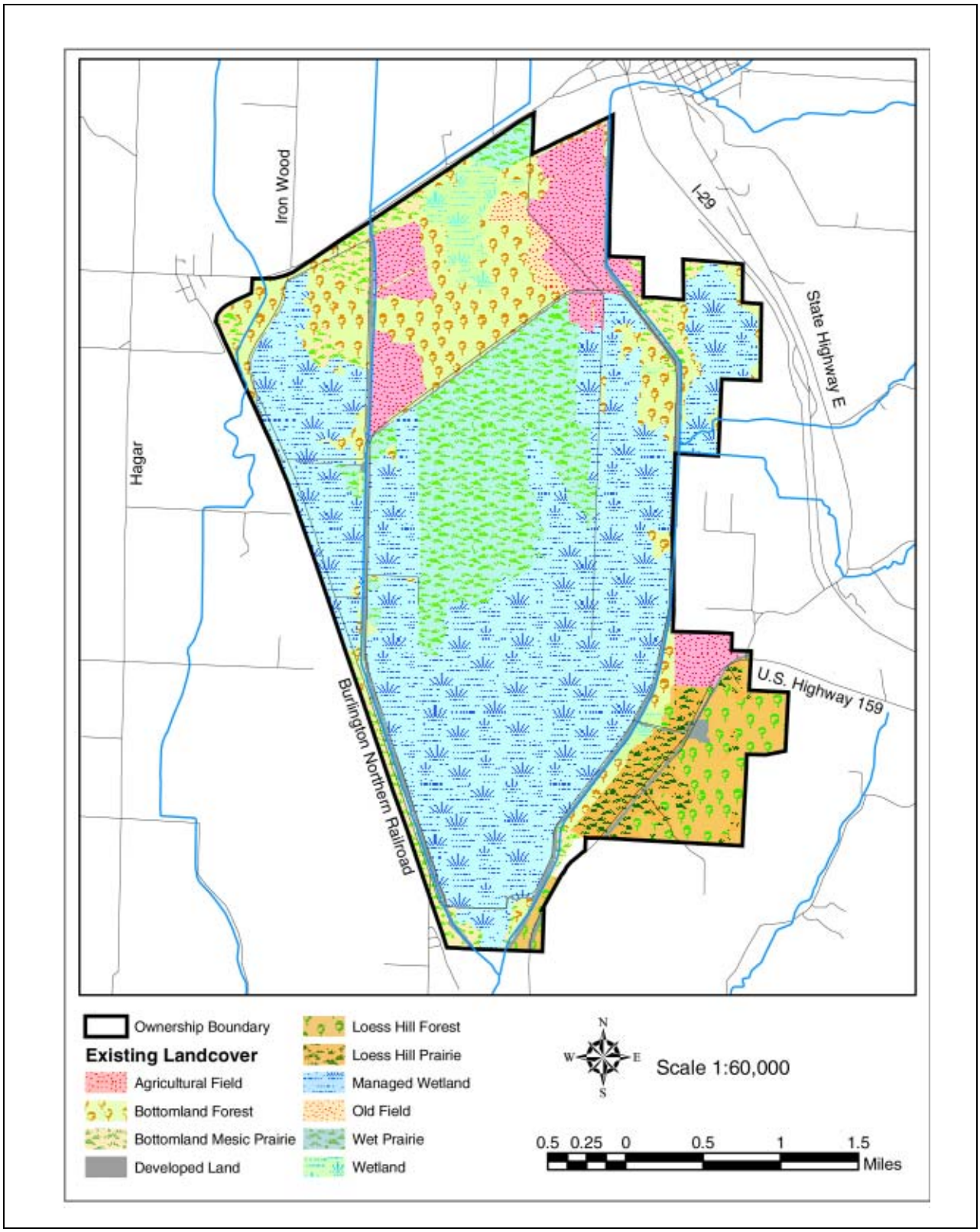
The Refuge has 1,378 acres of forests; common trees include Eastern cottonwood, black willow, and silver maple, oak, hickory, green ash, honey locust, dogwood, and redbud.

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.

Frank Durbian

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.

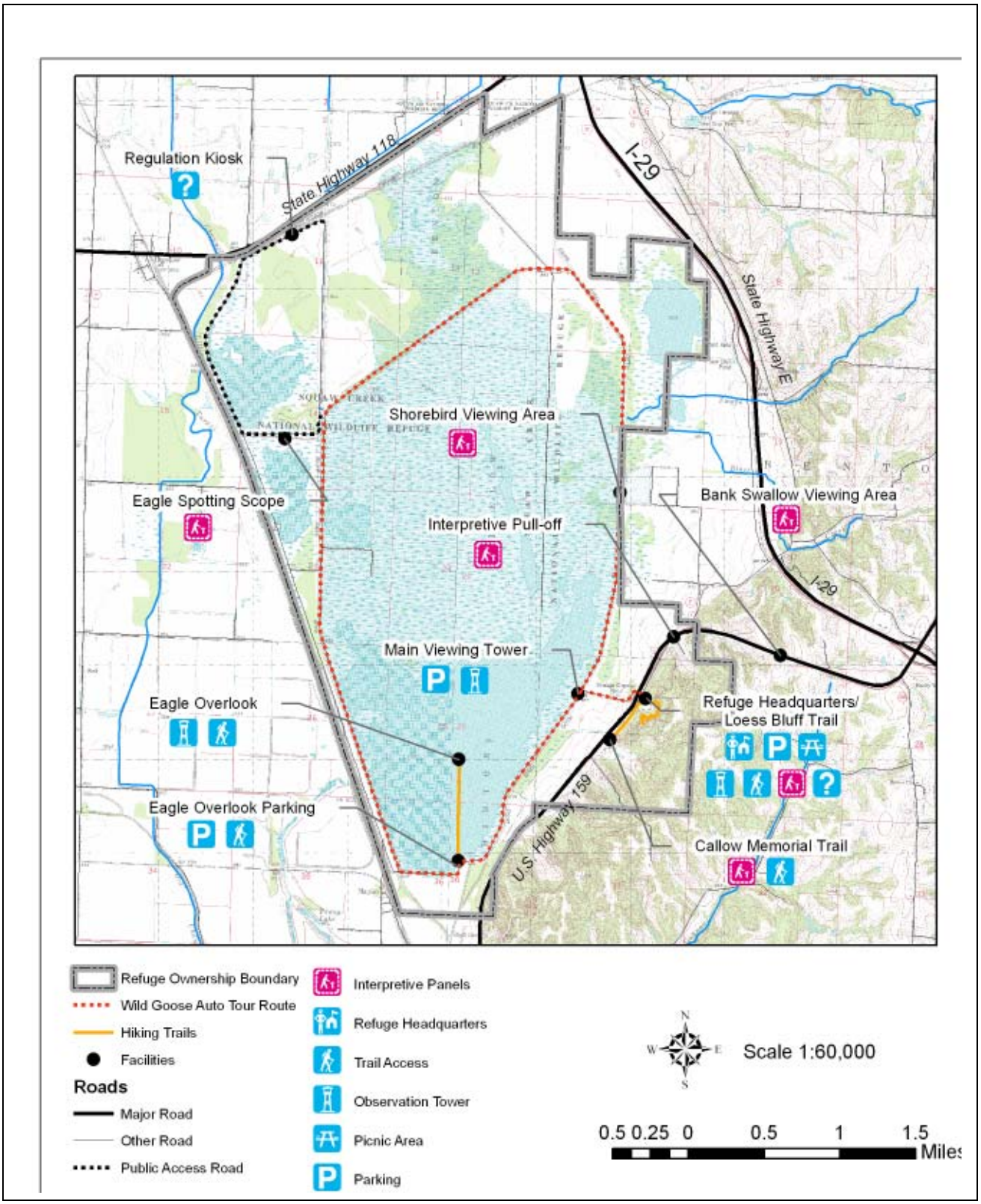
3.2.4 Socioeconomic Setting

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.

Frank Durbian

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

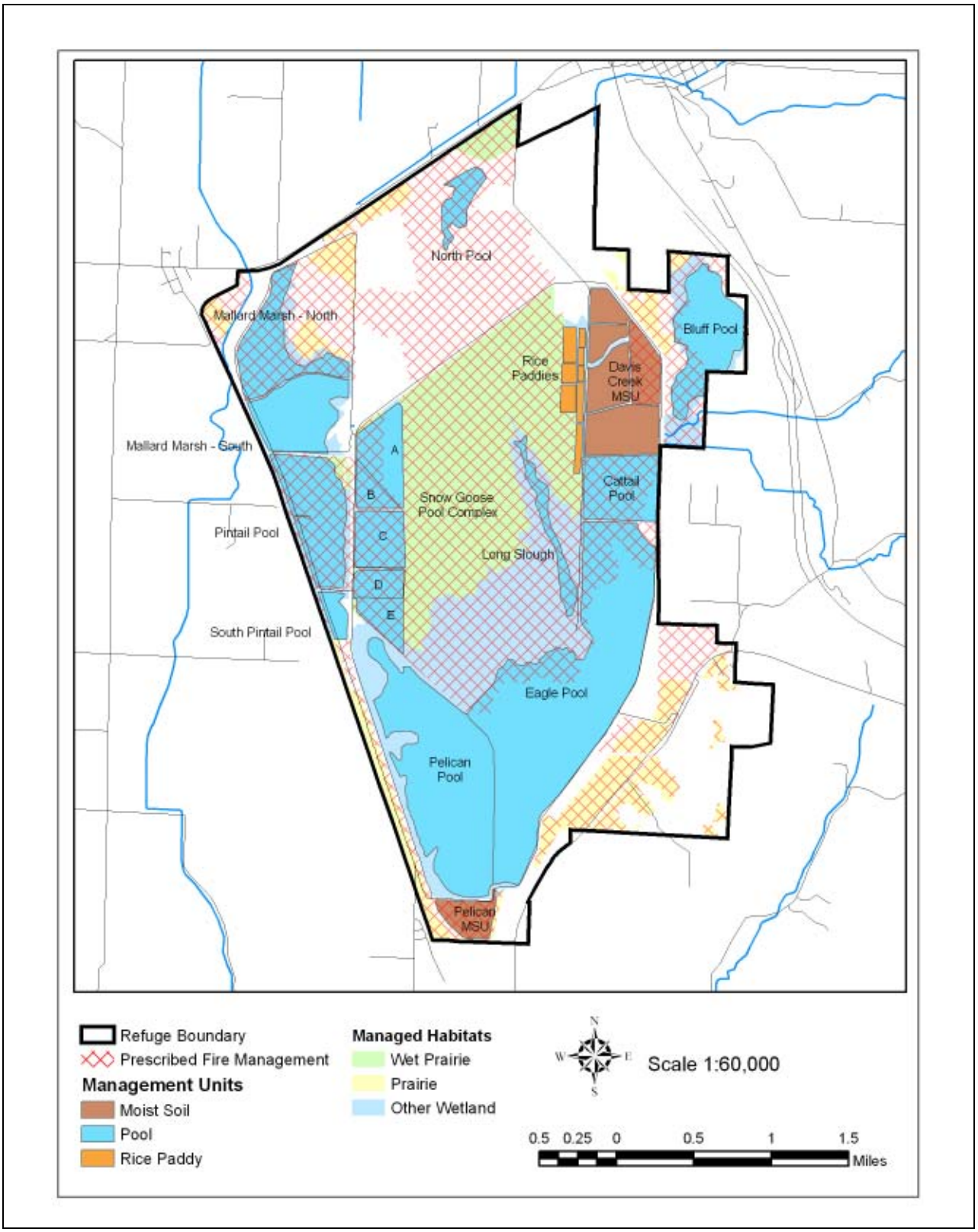
In a normal year, the water level is lowered during the summer to establish moist-soil vegetation. After plants are established in the summer, the units are gradually reflooded in the fall to optimize use of the seed resources. During the spring the water level will gradually be lowered for use by migrating 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.

Frank Durbian

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

Frank Durbian

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.

Chapter 4: Management Direction

4.1 Planned Refuge Programs

4.1.1 Introduction

Managing a national wildlife refuge demands that we chart a long-term course that will ensure the health and persistence of wildlife and habitat species. There may be too many variables to plot a course into the future that is as precise as a road map, but we can at least note a few landmarks to steer by. Through this comprehensive conservation plan, which has been developed with the participation of the State of Missouri and other partners, and with participation by neighbors and other interested people, we have defined goals that will guide Squaw Creek NWR for the next 15 years.

Frank Durbian

Section 4.2 details goals for the Refuge, the objectives we have identified for achieving those goals, and the strategies by which we mean to achieve our objectives. In this section, we provide a brief overview of our plans for Squaw Creek NWR.

4.1.2 Habitat

In considering the Refuge's future, we are mindful that the Refuge was established to provide a resting, breeding and feeding ground for migratory birds and other wildlife. We intend to accomplish this by providing a diversity of habitats, with particular emphasis on wetlands. We will maintain uplands that create diverse habitats. We will manage forest land to benefit migratory songbirds and to benefit threatened and endangered species, other migratory birds, and indigenous species. We will work with farm program cooperators to convert cropland to grassland or woodlands. By continuing our work with private landowners using existing programs, we will contribute to reducing erosion and sedimentation and improving the quality of surface runoff waters.

4.1.3 Fish and Wildlife

We will learn more about annual peak populations of wildlife using the Refuge so that we better understand species' needs and the Refuge's ability to meet those needs. We will maintain waterfowl use day levels at a minimum of 5 million, however we will assist in international efforts to reduce the mid-continent population of Lesser Snow Geese. This will include reducing cropland on the Refuge as well as offering a spring Snow Goose hunt. We will better manage deer populations to improve the quality of Refuge habitat. We will seek Refuge designation as a Western Hemispheric Shorebird

Reserve Network, which would contribute to funding initiatives and gain international recognition of the Refuge and its work to conserve indigenous species. We will maintain bottomland cottonwood forest areas in an effort to support Bald Eagles during fall and winter migration periods. We will maintain habitat that is critical to the Eastern Massassauga rattlesnake and Least Bittern.

4.1.4 Wildlife-dependent Recreation, Environmental Education and Interpretation

Our programs will inspire people to care about Squaw Creek NWR, natural resources, and the environment. Toward that end, we will focus on improving the quality of the visit. To accomplish this, we will design and implement interactive programs that meet Service standards and bring existing facilities up to Service standards. We will improve our orientation maps and signage. We appreciate traditional Refuge visitors and want them to continue coming to Squaw Creek NWR, and we will reach out to diverse groups of people who are not traditional Refuge visitors.

George Scheil

Volunteers play a critical role at the Refuge, and we want to strengthen our relationships with volunteers (and through them, the community) by drawing more people to contribute their time and talent to the Refuge. We will work to strengthen our relationship with Friends of Squaw Creek National Wildlife Refuge.

4.1.5 Avoidance of Impacts to Listed Species

To assure that listed species will not be adversely affected, proposed species are not jeopardized, or critical habitat is not adversely modified, we will observe the following guidelines as we implement the Squaw Creek NWR CCP.

Bald Eagle *(Haliaeetus leucocephalus)*
No disturbance will take place during critical periods within protective zones as described in the 1983 Northern States Bald Eagle Recovery Plan, Appendix E, Management Guidelines for Breeding Areas.

Eastern Massassauga Rattlesnake *(Sistrurus catenatus catenatus)*
Although not currently listed, the Eastern Massassauga rattlesnake is a candidate for listing. As the CCP is implemented, the Refuge will seek opportunities for conservation of this species on and off the Refuge. We will use Johnson et al., 2000, The Eastern Massassauga Rattlesnake: A Handbook for Land Managers, USFWS, Ft. Snelling, Minnesota, and the results of current research efforts to guide our conservation efforts.

Piping Plover *(Charadrius melodus)*
The Piping Plover is a rare transient on the Refuge and is not observed annually. They are generally seen during the spring migration but do not nest on the Refuge. If any birds were to attempt to nest, the location would be secured and free from disturbance.

4.1.6 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 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 to be considered in planning. The U.S. Department of Energy's "Carbon Sequestration Research and Development" (U.S. DOE, 1999) defines carbon sequestration as "...the capture and secure storage of carbon that would otherwise be emitted to or remain in the atmosphere."

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

Preserving natural habitat for wildlife is the heart of any long range plan for national wildlife refuges. The actions proposed in this comprehensive conservation plan would conserve or restore land and water, and would thus enhance carbon sequestration. This in turn contributes positively to efforts to mitigate human-induced global climate changes.

4.2 Goals, Objectives and Strategies

The following goals for habitat, wildlife and people are general statements of what we want to accomplish in the next 15 years.

The objectives are specific statements of what will be accomplished to help achieve a goal. Objectives describe the who, what, when, where, and why of what is to be accomplished. Strategies listed under each objective specify the activities that will be pursued to realize an objective. The strategies may be refined or amended as specific tasks are completed or new research and information come to light.

Goal 1: Habitat

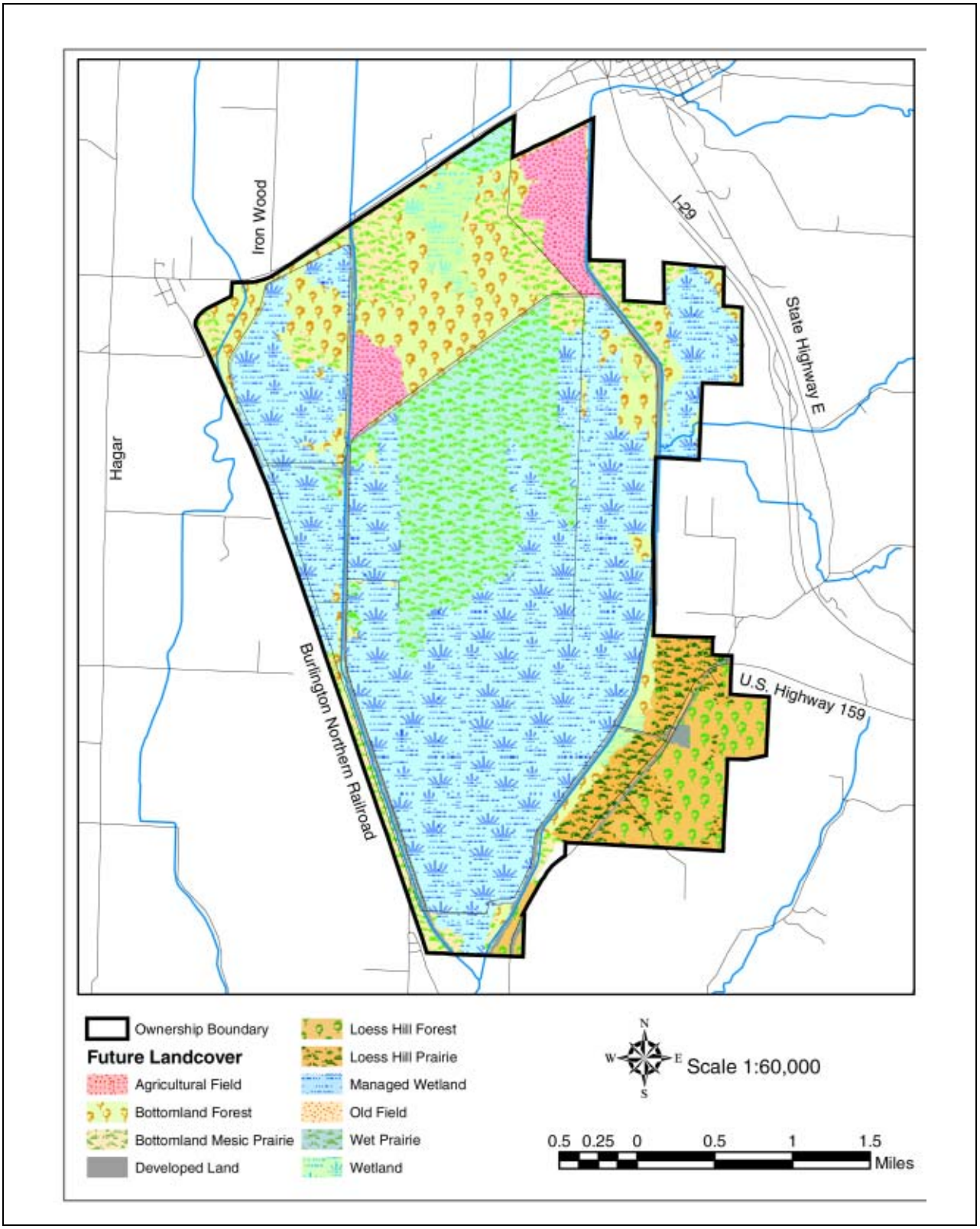
Manage a diversity of habitat to benefit threatened and endangered species, waterfowl, other migratory birds, and indigenous species in Lower Missouri River floodplain ecosystem and the Central Tallgrass Prairie ecosystem.

Rationale: Squaw Creek NWR was established in 1935 to provide a resting, breeding and feeding ground for migratory birds and other wildlife. A diversity of habitats will be maintained in optimum condition with particular emphasis on wetland enhancement to meet the primary Refuge purpose (Figure 12). The wetland diversity will include a mosaic of mudflats, shallow water, moist soil, flooded timber and deep water permanent marshes to support a large variety of marsh, water and shore birds with special emphasis on spring and fall habitat for migrating waterfowl. The upland will include the maintenance of native warm and cool season grasses, brushland, timber and croplands, to achieve a diverse mosaic of habitats rather than monotypic stands. These habitats will be managed to attract and support Federal and State listed endangered, threatened, and candidate species. Utilize existing programs to encourage private landowners to improve soil and water conservation management that will result in reduced soil erosion and sedimentation and improved quality of surface runoff waters.

1.1. Objective: Wetlands: Manage 3,452 acres of seasonally flooded impoundments that will be manipulated to provide open water, exposed shoreline and mudflats, and shallow wetlands traditionally preferred by migratory birds and other wetland- associated wildlife species.

Rationale: The Refuge is an important stopover during the spring and fall migration for marsh, water and shorebirds. Managed water impoundments on the Refuge help to offset the ever diminishing availability of wetland habitat along the Missouri River floodplain.

Figure 12: Future Desired Land Cover, Squaw Creek NWR



Strategies:

1. Manage water levels in Eagle Pool (900 acres) and Pelican Pool (600 acres) primarily for resting and roosting migrating waterfowl, by maintaining elevations at approximately 852.0 MSL during the fall and spring migratory periods. Start recharging pools no later than October 1 to achieve full pool level by November 15. Other species to benefit from this management action are Least Bittern, Pied-billed Grebe and Common Moorhen.
2. Provide for open water habitat in Eagle and Pelican pools by mechanical or chemical treatment or by burning to control American lotus, river bulrush, and cattail when vegetative surface area coverage exceeds 80 percent. Yearly vegetation monitoring will be conducted to assess status of problem vegetation.
3. Maintain a minimum of 15 percent of cattail stands; use summer drawdowns to encourage regrowth of cattail on Eagle and Pelican pools for nesting species such as Least Bittern, Yellow-headed Blackbird, and Marsh Wren.
4. Maintain minimum winter depths of 12 to18 inches in Eagle and Pelican pools for muskrat survival to assure open water areas (muskrat eat-out areas) will be available for roosting and resting waterfowl.
5. Drawdown water in 40 percent of the remaining wetland impoundments annually to encourage growth of shallow water and moist-soil plants to benefit waterfowl and provide mudflats and exposed shoreline to benefit shorebirds.
6. Allow water levels to fluctuate naturally in the remaining 60 percent of wetland impoundments for the benefit of species requiring standing water such as waterfowl broods, water birds, reptiles, amphibians, and muskrats.
7. On a 5-year cycle, mechanically or chemically treat or prescribe burn a minimum of 300 acres each year to maintain early successional stage, reduce undesirable plants, encourage preferred seed producing plants, create additional shoreline and mudflat habitat, and provide open water.
8. Davis Creek moist soil unit No. 1 (28 acres) and Cattail Triangle (14 acres) will be permanently managed as seasonal mudflat and open shallow water habitat specifically for spring and fall migrating shorebirds. This will be accomplished annually by early spring drawdown, summer mechanical manipulation, and late summer flooding.
9. Install water control outlet structures on Snow Goose Unit C into Squaw Creek to enhance water and habitat management capabilities.
10. Construct a bridge across the north end of Davis Creek to provide access to Bluff Pool for water management, wildlife surveys, and prescribed burning. The present access east of Davis Creek is through private land or along the top slopes of the creek which is not accessible during wet weather. (RONS Project No. 99018)

Frank Durbian

11. Repair the east dike of Mallard Marsh and Pintail Pool along Squaw Creek using material from the ditch. During high water regimes, silt-laden water continues to overtop the east dike in both pools in several locations, adversely affecting the long-term health of these marshes.
12. During the next 15 years, the inlet water control structures on Eagle Pool and Pelican Pool and outlet structures on Pelican Pool need to be replaced. In addition, the Eagle Pool radial gates, built in the late 1930's, are deteriorating and need to be replaced. (MMS Project No. 03012)
13. Remove excess silt from moist soil units and pools to improve the wetlands. Soil will be used to repair and to improve pool dikes and refuge roads.
14. Add seasonal tractor operator to enhance and to improve management of wetland and moist soil program (.5 FTE). (RONS Project No. 99015)
15. Place dead trees in wetland areas to provide resting and sunning areas for turtles and water snakes.
16. Conduct a study of the water supply to the Mallard Marsh pump as well as the hydrologic connection of the Loess Hills watershed to the Refuge to determine if acquisition and management of adjacent lands would increase the amount of available water and improve water management on the Refuge.

1.2. Objective: Wet Prairie: Conserve and enhance the largest remnant wet prairie in Missouri by preserving and maintaining the integrity of at least 1,077 acres of wet prairie through elimination of non-native species and restoration of associated natural functioning systems (e.g. hydrolic systems, fire, etc.).

Rationale: Squaw Creek's wet prairie contains the largest meta population of the Eastern Massassauga rattlesnake in Missouri. This snake is a State-listed endangered species and is being considered as a federally listed species. Other species benefitting from a healthy wet prairie are Sedge Wrens, rail species. and Short-eared Owls. In 1936 there were approximately 3,000 acres wet prairie on the Refuge. By 2003, 1,077 acres of wet prairie remained on the Refuge.

Strategies:

1. Conduct small mammal, invertebrate, reptile, and nongame bird surveys to assess diversity and usage of wet prairie.
2. Annually inventory and monitor wet prairie vegetation for species composition and successional changes to determine future management regimes.
3. Utilize a seasonal rotational prescribed burning program in the wet prairie to reduce exotic invasive species and woody encroachment and promote native grass and forb production.
4. Monitoring will be conducted to determine the effects of seasonal burning on wet prairie vegetative communities, invasive species, and Massassauga populations.
5. Efforts will be made to minimize any adverse effect of the prescribed burning program on the Massassauga population and other wetland species. This may be accomplished by burning smaller segments of the wet prairie during spring and summer months and mowing certain areas before burning. Section 7 consultations will be conducted as necessary for prescribed burning on designated wet prairie units.
6. Maintain current disced fire breaks and initiate additional mowed (hayed) firebreaks to improve seasonal prescribed burning opportunities and prevent

wildfires from consuming the entire wet prairie area, which would cause detrimental effects on the Eastern Massassauga rattlesnake and breeding bird populations.

7. Add a full-time prescribed fire specialist to implement and to advance the prescribed fire program.
8. Employ chemical applications to control invasive and exotic species such as honey locust and reed canarygrass.
9. Assess pre- and post-treatment conditions to evaluate treatment success of prescribed burns, chemical applications and rotational haying.
10. Restore prairie cordgrass south of Pintail Pool, the northeast corner of Pintail Pool and the triangle area in the northeast corner of Snow Goose Pool, Unit A.

1.3 Objective: Bottomland Mesic Prairie: Manage 508 acres of bottomland mesic prairie habitat to provide quality nesting cover for nongame migratory birds (dickcissels, grasshopper sparrows, field sparrows, and sedge wrens) as well as nesting and wintering cover for upland gamebird species, breeding waterfowl (mallards, blue wing teal, and shovelers), and other associated wildlife species, by maintaining, enhancing, and restoring grasslands to a mixture of warm and cool season native grasses. This habitat will be managed to maximize native vegetation abundance, minimize fragmentation and maximize the minimum patch size for area-dependant species.

Rationale: Bottomland mesic prairie is not commonly found off-Refuge due to habitat modifications.

Strategies:

1. Conduct small mammal, invertebrate, reptile and nongame bird surveys to assess diversity and usage of bottomland mesic prairie.
2. Utilize a seasonal rotational prescribed burning program in the bottomland prairie to reduce exotic invasive species and woody encroachment and promote native grass and forb production.
3. Monitoring will be conducted to determine the effects of seasonal burning on bottomland mesic prairie vegetative communities, wildlife species, and invasive species.
4. Maintain current fire breaks and initiate additional mowed (hayed) fire breaks where necessary to improve seasonal prescribed burning opportunities and prevent wildfires.
5. Add full-time prescribed fire specialist to implement and to advance the prescribed fire program.
6. Employ chemical applications to control invasive and exotic species such as honey locust and reed canarygrass.
7. Assess pre- and post-treatment conditions to evaluate treatment success of chemical applications and rotational haying.
8. Convert 200 acres of agricultural cropland and 59 acres of old field to 259 acres of native bottomland mesic prairie by 2015.
9. Utilize basic farming practices in grasslands restoration to control invasive species and to prepare seedbed for effective native seed establishment.

10. Plant native forbs in existing grassland areas after prescribed burns and include forbs in future grassland restoration efforts.

1.4 Objective: Loess Hills Prairie: Manage 299 acres of Loess Hill prairie habitat to provide quality nesting cover for nongame migratory birds and other associated wildlife species by maintaining, enhancing and restoring grasslands to a mixture of warm and cool season native grasses. This habitat will be managed to maximize native vegetation abundance, minimize fragmentation and maximize minimum patch size for area-dependant species.

Rationale: The Refuge currently contains 221 acres of Loess Hill prairie habitat, which is a rare and unique ecotype. There is also the potential to convert 78 acres of agricultural land to Loess Hill prairie. Preservation and management of this eco-type is important as it is threatened by conversion to agriculture, urbanization and succession.

Strategies:

1. Continue loess bluff grassland bird monitoring programs, especially for Region 3 Resource conservation Priority species.
2. Inventory loess bluff plant species to guide preservation and management of Missouri Species of Conservation Concern such as low milk vetch, hairy grama, downy painted cup, nine-anther dalea, skeleton plant and small soapweed yucca.
3. Conduct surveys for small mammals, reptile, amphibians and invertebrates.
4. Continue to restore native warm season grasses and forbs in the loess bluff hills. Hand-cut invading tree species and brush on the steep slopes. Utilize chemical applications on invading plant species such as roughleafed dogwood, honey locust, tree of heaven, and Illinois garlic mustard.
5. Convert 78 acres of agricultural land (Munkers Tract) to native loess hill prairie by 2006.
6. Utilize a seasonal rotational prescribed burning program for all upland grassland areas to reduce exotic invasive species and woody encroachment, promote native grass and forb production leaving a minimum of 60 percent of grassland for nesting and winter cover each year.
7. Plant native forbs such as liatris, purple cone flowers, rattlesnake master, wild indigo, and lead plants in existing grassland areas after prescribed burns and include forbs in future grassland restoration efforts. When available, local ecotypes seeds (within 100 miles of the Refuge) will be used.
8. Maximize grassland blocks and minimize fragmentation and edge effect by removing fence/tree rows where appropriate.
9. Implement a vegetative monitoring program to evaluate the effects of all management options including prescribed burning, haying, mowing and chemical treatment on invasive species and native grass and forb communities. (RONS Project No. 02002)
10. Add full-time prescribed fire specialist to implement and to advance the prescribed fire program.

1.5 Objective: Loess Hill Forest: Manage 378 acres of Loess Hills forest for the benefit of associated plant and wildlife species.

Rationale: The Refuge contains 378 acres of Loess Hill forest habitat, which is a rare and unique ecotype. Preservation and management of this eco-type is important as it is threatened by conversion to agriculture, urbanization and succession to other habitat types.

Strategies:

1. Conduct plant, small mammal, invertebrate, reptile, and nongame bird surveys to assess diversity and usage of loess hill forest.
2. Conduct a forest inventory.
3. Map distribution of Illinois garlic mustard to aid evaluation of control efforts. (RONS Project No. 99007)

1.6 Objective: Bottomland Forest: Manage the 1,000 acres of bottomland forest to provide optimum nesting, resting, and feeding habitats during breeding and migrational periods for migratory waterfowl and songbirds and to benefit threatened and endangered species, and other indigenous species. This habitat will be managed to maximize native vegetation abundance, minimize fragmentation and maximize the minimum patch size for area-dependant species.

Rationale: A number of bottomland forest-dependent, migratory songbirds are rare and declining as a result of insufficient or fragmented habitat. Conservation and management of suitable habitat are principal strategies for attaining more abundant populations of these birds. Wood Ducks and Hooded Mergansers also utilize woodland habitat.

Strategies:

1. Flood bottomlands within Davis Creek moist soil units 3, 4 and 5 during the spring and fall waterfowl migrations for use by Mallards, Wood Ducks and other waterfowl species.
2. Move wood duck nesting structures from open water areas and ditches to bottomland and upland woodland sites and annually maintain structures.
3. Complete a forest resources inventory to determine quality and quantity of woodlands. This will be accomplished utilizing federal as well as state expertise. The data will aid in determining management alternatives.
4. Study the causes for the loss of bottomland forests understory that is adversely affecting woodland birds and other wildlife. Investigate potential measures to restore the bottomland forest understory and tree regeneration.
5. Map distribution of Illinois garlic mustard and reed canarygrass to aid evaluation of control efforts.
6. Utilize prescribed burning to reduce invasive exotic species and encourage growth of tree saplings to restore a woodland understory.

1.7. Objective: Croplands and Old Fields: Implement a long range plan to convert 279 acres of the 579 existing cropland acres and 59 acres of existing old field to mesic bottomland prairie and Loess Hill prairie. The reduction will be accomplished by 2015 through attrition of current cooperators.

Rationale: Croplands attract wildlife concentrations that enhance opportunities for wildlife observation and photography. However, natural habitats and food sources

contribute more to overall Refuge biological objectives for wildlife. Conversion of cropland to other uses is costly and requires several seasons to implement, thus limiting the number of acres that can be converted to an average 25 acres annually.

Strategies:

1. Monitor utilization of croplands by all wildlife species to assess habitat benefits/ costs of maintaining some Refuge acreage in croplands.
2. Continue annual cooperative farming agreements with local farmers to provide share-crop grain for wildlife.
3. Implement phased reductions and complete by 2015.
4. Continue a 2-year crop rotation.
5. Convert the 78 acres of croplands on the Munkres tract to Loess Hill prairie by 2006, containing a mixture of warm season native grasses such as little bluestem and sideoats grama that are preferred by nongame birds (Grasshopper Sparrows, Field Sparrows, and Bob-o-links) and forbs such as liatris, purple cone flowers, rattlesnake master, wild indigo, and lead plants. Remove the fence adjacent to the headquarters grassland unit.
6. Convert the 200 acres of cropland and 59 acres of old field to bottomland mesic prairie by 2015, containing a mixture of warm season native grasses such as little bluestem and sideoats grama, which are preferred by nongame birds (Grasshopper Sparrows, Field Sparrows and Bobolinks) and native forbs.

1.8. Objective: Exotic, Invasive, and Nuisance Species: Control and reduce the presence of exotic, invasive, and nuisance species of plants and animals on the Refuge. Non-native species will not exceed 2003 density or distribution levels.

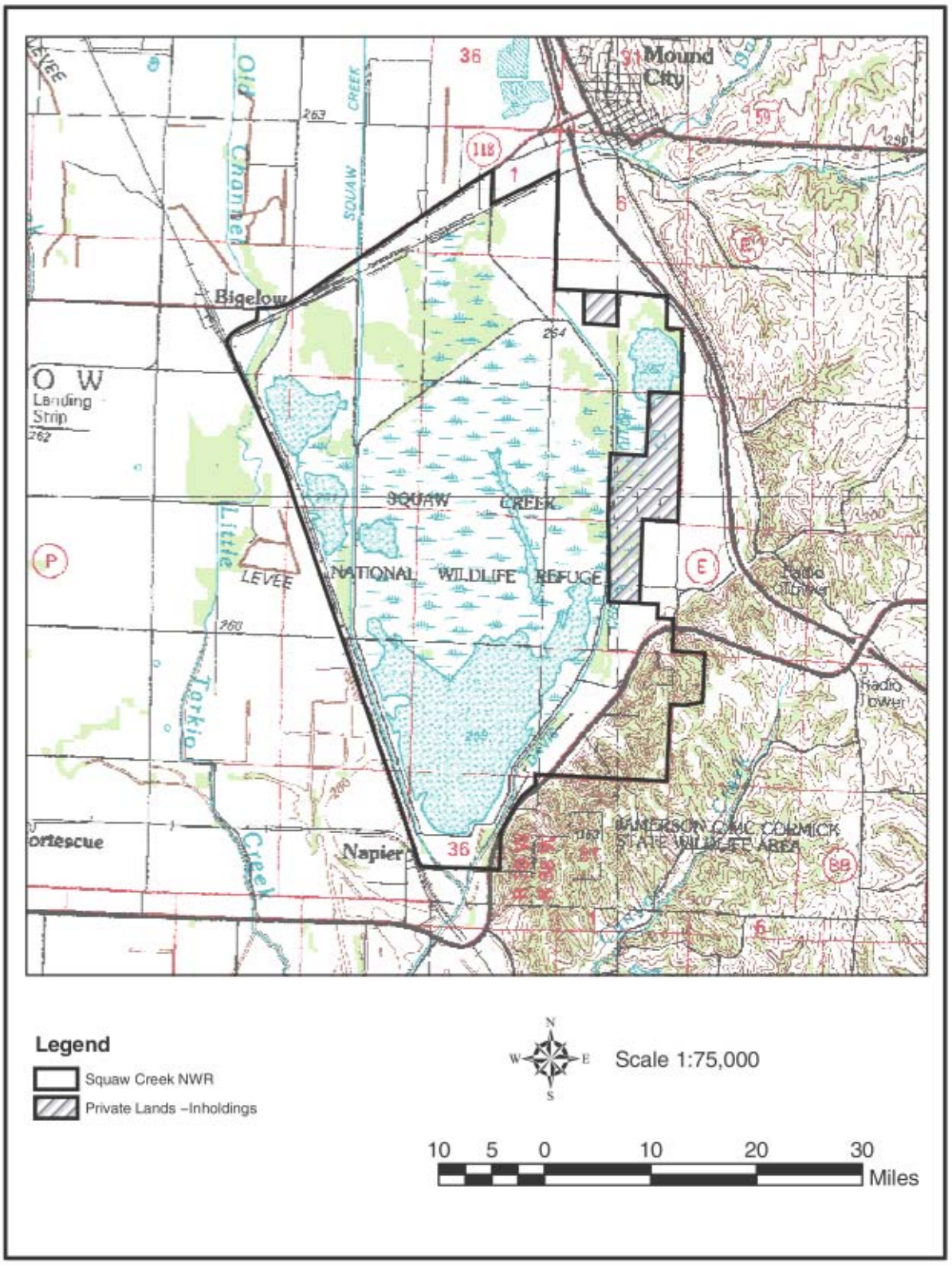
Rationale: Control of exotic plants is a long-term challenge. Methods used will depend on particular species, severity of impact and overall circumstances.

Strategies:

l. Develop a plot or grid system for assessing the magnitude of the problem using GIS technology and design a monitoring protocol incorporating means of measuring or estimating infestations. (RONS Project No. 99011)
2. Use appropriate integrated pest management techniques such as prescribed burning, herbicides, mechanical and biological control techniques.
3. Involve volunteers, including members from Audubon Societies, Friends groups, students and Scouts in control efforts of Illinois garlic mustard.
4. Continue active monitoring to be able to detect invasions and to take appropriate control measures.
5. Utilize short-term farming to eliminate invasive species in grassland restoration efforts.
6. Continue monitoring of gypsy moth traps.

1.9 Objective: Land Acquisition: Working with willing sellers, acquire up to 400 acres in fee title of existing and restorable wetlands within the authorized Refuge boundaries (Figure 13).

Figure 13: Existing and Authorized Refuge Boundary



Rationale: Completion of the authorized boundaries will provide additional wildlife habitat and reduce total miles of boundaries to maintain.

Strategies:

1. Initiate action to identify willing sellers and to proceed with getting the acquisition proposal included in the Land Acquisition Priority System.
2. Prioritize acquisition of wetland and prairie habitat types.

Private Lands

Rationale: Excessive sedimentation and poor water quality is a major challenge to the maintenance and management of Refuge wetlands and moist soil units. To deal with these issues in the watershed, existing programs will be used to encourage private landowners to improve soil and water conservation management. Spillways and ditches will be maintained to prevent flood damage and siltation. We will continue to work with the Natural Resource and Conservation Service, Holt County Soil and Water Conservation District, the Geological Survey and local upstream private landowners in Squaw, Davis and Porter Creek watersheds to reduce soil erosion and to improve water quality, particularly as it affects the Refuge.

1.10 Objective: Watershed Improvement: Reduce sedimentation from soil erosion and improve water quality on Squaw Creek NWR from private lands in the 60,000-acre upstream watershed using conservation practices fostering improved soil and water uses. By 2010, approximately 100 percent of the goals established in the Agricultural Non-Point Source Pollution (AgNPS) project in Squaw Creek will be accomplished, including erosion practices, water quality, riparian conservation and nutrient management.

Rationale: Although Squaw Creek was established with the knowledge that sedimentation was a problem, its frequency of occurrence and magnitude were greater than expected. In order for the Refuge wetlands to survive in to the future, work has to be accomplished in the 60,000-acre upstream watershed to reduce flood events and to improve water quality.

Strategies:

1. Continue to work (through Partners for Fish and Wildlife cost sharing) with the Holt County Soil and Water Conservation District and Natural Resources and Conservation Service to improve water quality and to reduce peak flows entering Squaw Creek.
2. Continue to provide financial incentives to private landowners through the above partners to implement conservation measures within the Squaw and Davis Creek watershed.
3. Monitor water quality and quantity entering the Refuge in both Squaw and Davis Creeks in cooperation with the U.S. Geological Survey.
4. Look for opportunities to purchase land from willing sellers as it becomes available within the authorized Refuge boundaries. (See Strategy 1.10).

Refuge Wildlife Management District

Rationale: Refuge staff will continue to manage and conserve the 15-county Refuge Wildlife Management District to develop, improve, and maintain the wetland and riparian habitats within the management district to benefit a broad spectrum of both

game and non-game migratory birds and other resident wildlife species and to maintain riparian corridors, wetlands and upland habitats for erosion control and wildlife values. These areas are not open to public use.

1.11 Objective: Wildlife Management District: Develop, improve, and maintain native riparian, wetland, and grassland habitats consistent with the existing dominant vegetative structure (non-agricultural crop), contributing to soil and water conservation within the Management District and also benefitting a broad spectrum of both game and non-game migratory birds and other resident wildlife species.

Rationale: A number of grassland-dependent, migratory songbirds are rare or declining as a result of insufficient or fragmented habitat. Conserving, restoring and managing suitable habitat is one of the principal strategies for attaining more abundant populations of these birds. Therefore habitat restoration and resource conservation will be aggressively pursued on the fee title and easement lands within the Refuge Wildlife Management District.

Frank Durbian

Strategies:

1. Actively manage all established native grasslands through a rotation of prescribed burning, mowing, haying, flash grazing or chemical treatments for control of invasive woody species and for maintaining quality grassland habitat.
2. Work with the easement owners to convert former cropland areas, with suitable soil types, to native warm and cool season grasses. This may require the use of short-term farming to eliminate invasive species and to prepare the seed bed for native grass seeding.
3. Monitor grasslands to formulate a yearly strategy of management activities to benefit Region 3 Conservation Priority Species.
4. Develop or restore all suitable wetland and riparian sites on easement properties.
5. Work with property owners to educate them of moist soil benefits and to accomplish management and maintenance requirements of the wetlands and riparian corridors on their easements.
6. Fence riparian areas as necessary to prevent damage from cattle.
7. Survey easement and fee title lands on the Kier, Shonk, Christensen, Harris, Woody, Landes, Orndorff, and Riley properties to delineate boundaries to protect the land from trespass and other unauthorized uses. (RONS Project No. 99001)
8. Document violations on easement and fee title wetlands and riparian corridors and request assistance from zone officers and Missouri Department of Conservation state officers.
9. Take an active role in the private lands program (Partners) whenever possible, particularly in the floodplain and Loess Hills. Assist the Natural Resource and Conservation Service in WRP evaluations.

4.2.2 Goal 2: Wildlife

Conserve species indigenous to the Refuge, the Lower Missouri River Ecosystem, and the Central Tallgrass Prairie Ecosystem with emphasis on those species identified in the Service's Fish and Wildlife Resource Conservation Priorities.

2.1 Objective: Regional Shorebird Designation: designation of Squaw Creek National Wildlife Refuge as a regional shorebird site of the Western Hemispheric Shorebird Reserve Network (WHSRN) by 2005.

Rationale: The WHSRN designation will support funding initiatives, obtains international recognition of the Refuge, emphasizing the value of conserving the indigenous species. The designation is a measure of success in meeting the habitat needs of shorebirds.

Strategies:

1. Conduct fall and spring migration season surveys to document shorebird use and abundance and to determine if the Refuge will qualify for the designation.
2. After data collection, complete nomination form with applicable data and forward to the Regional Director for approval and submission to WHSRN for designation.

2.2. Objective: Population Counts: Obtain annual peak population counts and use days for Bald Eagles, Snow Geese, other waterfowl, and other indicator species using procedures outlined in the Wildlife Inventory Plan.

Rationale: The population surveys will help staff document priority use habitats, monitor for disease, provide information of interest to the public and other agencies, evaluate the success in habitat management to meet species needs, and to document presence or absence of less common species.

Strategies:

1. Utilize the most efficient, state-of-the-art technologies and survey methods available. (RONS Project 00008)
2. Maintain a high level of disease monitoring of waterfowl during the spring and fall migrations and readiness to deal with a major disease outbreak.
3. Monitor any encroachment by non-native wildlife and plant species to be able to effectively implement control measures.
4. Document the utilization of different habitats by indicator species to better predict effects of future natural and induced habitat changes on populations.
5. Monitor marsh and water bird nesting.
6. Continue inventory of Refuge reptiles, amphibians, fish and plants in order to document known species for determining long-term monitoring, habitat preservation and management.
7. Continue and increase grassland bird monitoring, especially for Region 3 Resource Conservation Priority species, such as the Grasshopper Sparrow, Henslow's Sparrow and Dickcissel.
8. Document the utilization of Wood Duck and Eastern Bluebird boxes.

2.3 Objective: Waterfowl Use Days: Maintain annual waterfowl use day levels of a minimum of 5 million by providing adequate habitat as discussed under the habitat goal and based on a 5- year running average of waterfowl data, excluding Snow Geese.

Rationale: The Refuge provides valuable waterfowl migration habitat consistent with the Refuge purpose. Due to habitat loss throughout the flyway, it is important that Refuges maintain or increase their ability to support waterfowl.

Strategies:

1. Monitor arrivals and concentration build-ups in accordance with the Wildlife Inventory Plan, with the specific intent to witness and record annual peak numbers and date of occurrence of special interest species.
2. Monitor waterfowl activity during migration periods in order to evaluate the use of various habitat types.
3. Monitor waterfowl concentration for indication of disease and stress and be prepared to implement the Disease Plan.
4. When waterfowl concentration exceeds objective levels to the extent the welfare of the waterfowl is at risk, such as in the control of disease outbreaks, implement disturbance measures that result in concentration reductions.
5. Record population data in a consistent format that enables comparisons of actual populations and trends with stated objectives.

2.4 Objective: Reduction of Snow Geese: Actively assist international efforts to reduce the mid-continent population of Snow Geese by at least 5 percent each year until the Arctic Goose Working Group reduction goal has been achieved.

Rationale: The Arctic Goose Habitat Working Group has determined that the 1998 base population of 3 million should be reduced by 50 percent. Enhanced food supplies and winter survival have led to a mid-continent Snow Goose population increasing 5 percent annually in recent years. Their numbers now far exceed the carrying capacity of their summer breeding range in the Arctic tundra of northern Canada. Consequently, the birds are causing extensive, long-term damage to tundra vegetation and soils, taking a toll on the entire critical roosting area during the fall as well as spring migrations. Geese leave the Refuge in the morning and evening each day to feed on private agricultural fields, thereby allowing hunting opportunities in and around Northwest Missouri and Northeast Kansas. Squaw Creek NWR typically harbors an average peak population of 250,000 to 350,000 snow geese. Short of draining the Refuge wetlands, which would negatively impact other species, there is little the Refuge can do to actively reduce Snow Goose use of the Refuge. Reduction of some habitats attractive to the geese and facilitating increased hunting opportunities will allow the Refuge to participate in the effort to reduce Snow Geese populations as outlined by the Arctic Goose Working Group.

Strategies:

1. Within 1 year of completion of this CCP, Refuge staff will initiate a managed spring snow goose hunt.
2. Reduce cropland acreage from 579 acres to approximately 300 acres by 2015.
3. Discourage Snow Geese from utilizing Refuge croplands in the spring by disking stubble fields in late winter or early spring or by strategically manipulating Refuge shares on field edges.

4. Continue to provide open water night time roosting areas in Eagle and Pelican pools for Snow Geese. Snow Geese fly out in the morning and evening each day to feed off-Refuge. As a result, the Refuge acts as a magnet for birds in Northwest Missouri and Northeast Kansas yet provides hunting opportunities as birds leave the Refuge twice per day to feed.
5. Increase the effort to obtain Snow Goose neck collar readings during the spring and fall migrations to assist in determining the status and the movement of birds.

2.5 Objective: White-tailed Deer Management: Manage the size of the white-tailed deer herd on the Refuge through controlled hunts to reduce a Refuge white-tailed deer herd at a fall relative density of 20 to 25 deer per square mile.

Rationale: Hunting is one of the six compatible, wildlife-dependent recreational uses. Accurate density is difficult to determine because the population fluctuates both seasonally and annually. Current high deer densities negatively impact habitats, such as understory vegetation in the bottomland forests. This negatively impacts other species of interest.

Strategies:

l. Continue to monitor the size of the herd through annual spotlight surveys in cooperation with universities and other State and federal agencies.
2. Monitor for signs of habitat damage such as browse lines, vegetative conditions, and crop depredation on Refuge lands.
3. Monitor health of herd using standard techniques at the Refuge check station in cooperation with universities and other State and federal agencies.
4. Continue muzzleloading firearm deer hunts by issuing permits commensurate with the need to control population size while providing a quality recreational experience.
5. Initiate a research study to determine the effects of browse damage by white-tailed deer on the woodland understory that could impact migratory birds and other wildlife and recommend potential restoration measures.

Species of Special Concern

Rationale: The Service's Region 3 has identified Fish and Wildlife Resource Conservation Priorities, including species indigenous to the Refuge and the Lower Missouri River Ecosystem. These species and their habitats will be actively conserved, restored, and managed on Service lands managed by the Refuge staff.

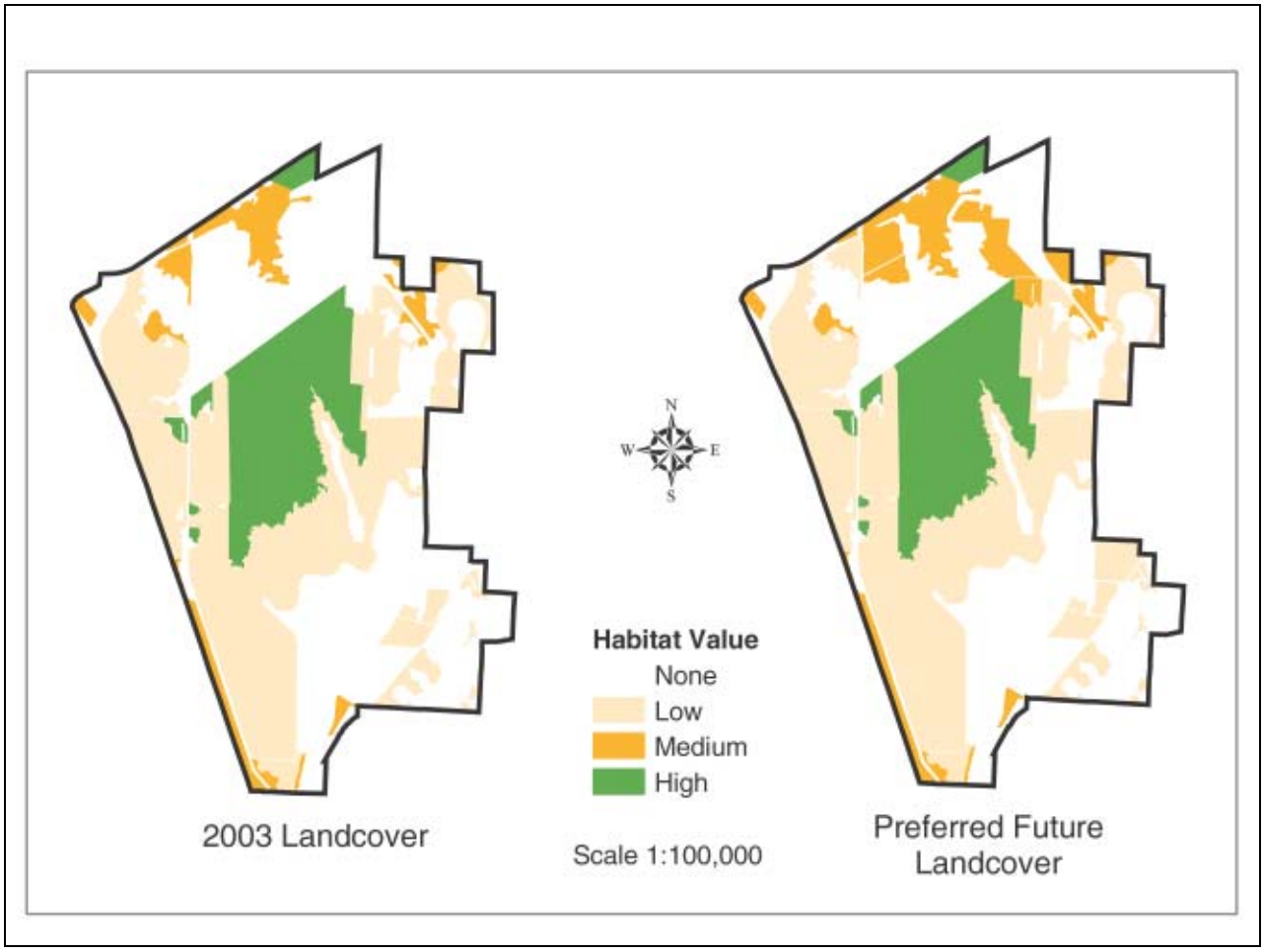
2.6 Objective: Bald Eagle: Maintain the bottomland cottonwood forest areas and isolated mature cottonwood stands that provide roosting and nesting sites and that exist in 2005 and continue to provide habitat that maximizes Bald Eagle use days during fall and winter migration periods.

Rationale: Bald Eagle populations peak at 200-plus birds during fall and winter migration periods. At least one pair has attempted to nest on the Refuge since 1997; there was one successful nest in 1998 and again in 2001.

Strategies:

1. Manage riparian cottonwood forests to ensure sustained stands of mature roost and nest trees. Protect live trees from beaver damage with wire shields.

Figure 14: Eastern Massassauga Rattlesnake Landcover, Squaw Creek NWR



2. Develop designated regeneration sites that will allow flooding and other treatments to encourage seedling development.
3. Manage public access to assure that breeding and nesting habitat is undisturbed.

2.7 Objective: Eastern Massassauga Rattlesnake: Maintain existing wet prairie habitat of 1,077 acres and increase bottomland mesic prairie by 217 acres for a total of 508 acres (Figure 14). This will enhance the habitat used by the Eastern Massassauga rattlesnakes on Squaw Creek NWR (see objective 1.3 regarding increasing the habitat acreage). The population numbers and habitat use will be monitored to assess the response to the habitat manipulation.

Rationale: The Refuge supports one of only three remaining massassauga populations in Missouri, out of 13 historical populations in the state.

Strategies:

1. Continue to participate in studies and research projects.
2. Continue to monitor local population status and responses to habitat manipulation such as prescribed burns and water management.

3. Participate in cooperative studies to determine the current range of Eastern Massassauga rattlesnake to determine if acquisition of adjacent lands would benefit the species.

2.8 Objective: Least Bittern: By providing hemi-marsh cattail habitat suitable for nesting, the Refuge will benefit Least Bitterns, a species that is ranked as an "imperiled" species by the State of Missouri. The population distribution and numbers will be monitored through surveys and other research.

Rationale: Even though the Region 3 Fish and Wildlife Resource Conservation Priorities list does not include the Least Bittern in the Lower Missouri River ecosystem as a species of special concern, it is ranked as 'imperiled' by the State of Missouri. Studies on the Refuge indicate that more than 90 percent of Least Bittern nests are found in cattail stands, which are diminishing with the loss of wetland habitat. The Refuge includes one of the largest nesting sites for this species in the Midwest.

Strategies:

1. Maintain the presence of cattail stands. (See Objective 1.2).
2. Continue to monitor Least Bittern nesting activity.

2.9 Objective: Passerine Species: The Refuge will support and follow the recommendations listed in Region 3's Resource Conservation Priorities for the rare and declining passerine species identified in Appendix I. Management interest will focus upon species for which the Refuge is or was within their primary range.

Rationale: Many passerine species identified in the Region's Resource Conservation Priorities have suffered population declines due to habitat loss.

Strategies:

1. Refuge staff will collect biological data when applicable from routine censuses and monitoring activities. (See the strategy under Objective 2.2.)
2. Habitat critical for the rare and declining species identified in Appendix I will be conserved and restored. (See Objective 1.4)
3. When possible, the Refuge staff will support partners in cooperative conservation actions to benefit passerine species.
4. The Refuge staff will encourage and support efforts to educate the public about rare and declining species.

2.10 Objective: State of Missouri species of concern, such as long-tailed weasels and Franklin's ground squirrels, will be reported to Missouri Department of Conservation staff when observed on or near the Refuge.

Rationale: Reporting rare species sightings to Missouri Department of Conservation staff will assist that agency in tracking the distribution and abundance of these species.

Strategy:

1. Report any observation of these species, including the date and location of the observation, to the Department of Conservation.

4.2.3 Goal 3: People

Visitors, nearby residents and other stakeholders will enjoy wildlife-dependent recreation and education; appreciate the natural resources and ecological processes and cultural resources of Squaw Creek NWR; help achieve the objectives of the Refuge; and support the Service's mission.

Rationale: The 1991 National Survey of Fishing, Hunting and Wildlife-Associated Recreation (page 58 of that document) provides data that indicate 16 percent (160,000) of the 1 million people living within a 100-mile radius of the Refuge are potential non-consumptive visitors. Approximately 130,000 people now visit the Refuge annually. Some of these visitors may only visit the Refuge once in a lifetime, while others are repeat or even frequent visitors. We want to provide dynamic programs, displays, interactive facilities, wildlife viewing, and printed materials that will encourage every visitor to share their experience with others and to make return visits. We also want visitors of all abilities to feel welcome and to enjoy a safe visit to an area that they recognize as a national wildlife refuge.

3.1 Objective: Interpretation: Design, fund and implement interpretive programs and facilities that meet Service standards and that will attract and accommodate up to 130,000 visitors annually.

Rationale: Environmental interpretation raises public awareness of the reasons to conserve and manage natural resources.

Strategies:

1. Develop clear Refuge interpretive themes related to key resource issues that will guide the creation of exhibits, signs, brochures and programs.
2. Advocate interpretive program funding in accordance with RONS Project No. 00009.
3. Replace auto tour leaflet and trail leaflets with interpretive signs and sound posts that incorporate an interpretive them and that meet FWS sign standards. RONS Project No. 97003
4. Continue the development of interpretive aids for the Callow Memorial Trail.
5. Explore the possibility of extending the Loess Bluff Trail along the bluffs, making it a loop trail that connects to the Callow Memorial Trail. Install interpretive panels covering prairie and fire themes at the shelter at the peak of the Loess Bluff Trail.
6. Prepare new interpretive leaflets specifically for the following: mammals, reptiles and amphibians; the Loess Bluff Trail; and the history and work of the Civilian Conservation Corps on the Refuge in the 1930s.
7. Update all existing leaflets to current Service graphic standards. RONS Project No. 99016
8. Contract with an exhibit design and production firm to develop a concept plan for the visitor center/headquarters.
9. Remove the picnic tables and grills near the headquarters and create an accessible amphitheater in their place. Form a planning team to design the new facility.
10. Update the Refuge orientation video and add closed captioning.

3.2 Objective: Environmental Education: Offer environmental education programs, materials and facilities that meet Service standards and accommodate up to 6,000 students annually. Evaluate the effectiveness of the environmental education program by 2013.

Rationale: Environmental education raises public awareness of the reasons to conserve and manage natural resources.

Strategies:

1. Contact schools to alert them to Refuge facilities, resources and educational opportunities by means of fliers, letters or personal contacts with individual teachers.
2. Conduct annual teacher workshops to demonstrate various environmental education activities teachers can use on the Refuge during the school year; sample lesson plans will be used to augment the workshop demonstrations.
3. Encourage teachers to recommend the Refuge environmental education program to their colleagues.
4. Develop accessible, Refuge-specific environmental education activities that are linked to local and state education standards. Solicit active involvement from local teachers. Develop a teacher's manual for school visits consisting of a pre-visit planning guide and pre-visit and post-visit activities.
5. Expand the outdoor classroom facilities by adding a boardwalk with a learning station into a marsh area so school children can experience the importance of wetlands and wildlife habitats. The learning station will encourage participants to collect water samples and discover the dynamics of aquatic life. RONS Project No. 99017
6. Add a seasonal clerk to staff the visitor contact station desk during the peak public use periods (fall and spring migrations) to greet visitors and school groups and assist the Park Ranger in giving programs (0.3 FTE). RONS Project Nos. 00009 and 02001
7. Recruit and train volunteers to conduct activities and to give an introduction to school groups when they visit the Refuge.

3.3. Objective: Wildlife Observation and Photography: Maintain, improve, and develop to Service standards facilities and programs to encourage more interactive visitor participation resulting in a higher quality outdoor experience. This includes the existing 10-mile circular auto tour route, the 2-mile Mallard Marsh Road, the three walking trails and, by 2013, an extension of the Callow Memorial Trail to form a looped trail with the Loess Bluff Trail and a one-quarter-mile boardwalk to a marsh.
Rationale: Well maintained service facilities and quality programs help create a positive visitor experience, increasing the likelihood that the Refuge's conservation message will be appreciated and understood.

Strategies:

1. Upgrade the surface of the auto tour route by raising and resurfacing approximately 7,900 feet along Davis Creek, which continues to be overtopped by flood water from Davis Creek. MMS Project No. 96242
2. Develop one or more accessible wildlife observation blinds to be used by an increasing number of photographers and by the general public.
3. Study, develop and construct an accessible boardwalk by 2015 that will permit visitors to experience the marsh by foot. (Same project as 3.2.6. above) RONS Project No. 99017

4. Replace the deteriorated black top surface in the headquarters entrance road, the visitor parking lot, staff parking lot and maintenance courtyard. MMS Project No. 98151
5. Maintain the auto tour route and public use signs so visitors can explore the Refuge safely and easily. MMS Project No. 01014 and RONS Project No. 97003
6. Maintain walking trails so that they are free of debris and litter and are safe for visitors.
7. Seal the blacktop surface of the Callow Memorial Trail and complete the extension of the gravel walk out to the grasslands as well as complete a looped trail from the Loess Bluff Trail to the Callow Trail by 2010.
8. Maintain the gravel and wood chip walking surface on the Loess Bluff Trail and provide a 6-foot-wide path for walking. Continue to ensure rock steps and railing are secure and steps clean of debris.
9. Maintain the walking surface of the Eagle Overlook Trail and regularly inspect the observation tower for wasp nests and loose steps. Install a kiosk at the trail entrance.
10. Provide a shorter alternate tour route loop within the existing Wild Goose interpretive loop. Change signs and all maps.
11. Create a two-way road between the beginning of the auto tour and the Eagle Pool hiking trail. Create an area for vehicles (including large vehicles) to turn around near the hiking trail. Create a parking lot with an accessible space at the trailhead. Install appropriate traffic signs and wayfinding signs and change the Refuge maps accordingly.
12. Create several pull-off areas on the tour route to allow passing and to allow short-term parking for viewing wildlife.
13. At overlooks, provide a quality photo of the optimum view (e.g., concentrations of geese, fall foliage) so that visitors with low vision can examine the view on a sign. With a good photo, all visitors will be able to see the optimum view even when conditions are not optimal (for instance, the weather is poor, it is outside of migration season, etc.). At the Loess Bluff trailhead, provide a quality photo of the view from the bluff top for use by visitors with mobility disabilities.

Frank Durbian

14. On a kiosk at each trailhead, provide a simple map of each trail and information about what visitors can expect to see on the trail at different times of the year. If the trail is long, or if there are loops and intersections (e.g., extended Bluff Trail), provide additional maps indicating "You Are Here," direction to trailhead and distance to trailhead, as appropriate.
15. Improve the surface of the Eagle Pool hiking trail to FWS accessibility standards and add accessible benches.

3.4 Objective: Hunting and Fishing: Provide quality recreational hunting opportunities for up to 135 deer hunters per season. Continue to allow bank fishing at legal public access points throughout the Refuge.

Rationale: More than 135 deer hunters will increase hunter complaints/conflicts and likely increase hunter density to unsafe levels. Additional hunting opportunities will be provided by allowing the take of multiple deer by individual hunters according to the herd reduction needs. Incentives may also be offered, such as requiring hunters to take two antlerless deer before they can take one buck.

Strategies:

1. Continue measuring the quality of the deer hunt through 1) informal interviews with hunters and/or responses to questionnaire developed to facilitate feedback, 2) number of participating hunters, and 3) annual harvest rate.
2. Continue to manage the deer hunt to minimize conflicts with other uses and resources.
3. Continue to work with the Missouri Department of Conservation regarding deer hunting regulations and harvest quotas.
4. Continue to permit public fishing at legal public access points.
5. Inform the public when snagging of rough fish is permitted.
6. Provide at least one accessible deer hunting blind (visually screened from auto tour route) with signage and a parking space. Establish a reservation system so that the blind or blinds are available to disabled hunters if needed and available to all hunters if not needed by hunters with disabilities. Advise prospective hunters about the availability of an accessible blind through prehunt information materials. Plant a vegetation screen or remove the blind after the hunt season. The blind will be available during the regular hunting season.
7. Update the Refuge's Fishing Plan.

3.5 Objective: Mushroom Gathering: Allow opportunities for mushroom gathering in selected areas.

Rationale: Mushroom gathering is minimal most years depending on the size of the crop. However, there is a demand for gathering mushrooms in the Refuge bluffs particularly during the spring turkey hunt that occurs on adjacent Missouri Department of Conservation lands. During this 40-day period, mushroom gatherers can pick mushrooms on the Refuge without the conflict of turkey hunting. In addition, the attraction of gathering mushrooms leads to public enjoyment of getting outside and into the woods.

Strategies:

1. Allow morel mushroom gathering in the loess bluffs from April 10 to May 20 annually.
2. Patrol areas closed to mushroom picking during gathering season.

3.6 Objective: Public Information: By 2025, 60 percent of the people within 100 miles of the Refuge will be aware of the Refuge, its mission, its facilities and scheduled events. We will emphasize reaching diverse groups of people who are not part of the traditional Refuge audience.

Rationale: A public that is aware of the mission of Squaw Creek NWR and the National Wildlife Refuge System will more likely support management efforts of the Refuge and of the National Wildlife Refuge System.

Strategies:

1. Implement additional means of publicizing the Refuge using various media, including electronic technologies and personal computers.
2. Ask visitors how they heard about the Refuge as a means of evaluating the success of publicity efforts.
3. Provide 24-hour telephone information to visitors with weekly updates of upcoming events and waterfowl numbers.
4. Create and keep current an accessible Refuge Internet website.
5. Reinstitute the public service announcement slide show on the movie theaters in St. Joseph and expand to other theaters in the surrounding region.
6. Explore the possibility of utilizing highway billboards to increase visibility of Squaw Creek NWR and the Refuge System.
7. Continue to participate in the Oregon Fall Festival parade, the Apple Blossom Parade, and the Mound City Fourth of July Parade, and expand to parades in other surrounding communities.
8. Maintain a current list of newspapers, radio and television station addresses and distribute a minimum of 35 Squaw Creek Digest news releases annually. Increase coverage to more news outlets.
9. Cultivate relationships with reporters, which can help interest them in covering the Refuge.
10. Report significant events to the Regional FWS public affairs staff promptly so they may become involved or provide follow-up information.
11. Report activities via the Accomplishment Report System so that information about events, activities and accomplishments can be disseminated to appropriate Congressional representatives.
12. Continue coordination with the St. Joseph Visitors and Convention Bureau in promoting Squaw Creek NWR.
13. Develop or obtain educational materials such as brochures and audio-visuals for dissemination to visitors.
14. Continue to participate in the local Boy Scouts of America Council to build interest in natural resource conservation ethics and careers.
16. Participate in "career day" programs in area schools and colleges to encourage a broad cross section of ethnic backgrounds to support and be involved in natural resource conservation.
17. Create a standard Refuge slide show that incorporates FWS, Refuge System and Refuge themes for use by staff and volunteers. Incorporate closed captioning.
18. Work with the Missouri DOT to improve the Bank Swallow wayside.

3.7 Objective: Volunteers: Increase the number of volunteer hours to 7,500 by 2013, with a 5 percent annual increase thereafter, with volunteers serving both in the Visitor Contact Station and around the Refuge as interpretive and educational guides and in supervised habitat management projects.

Rationale: A dedicated corps of volunteers can significantly improve various Refuge programs as well as foster interaction with the surrounding community and provide an additional pillar of civic support and pride.

Strategies:

1. Increase volunteer recruitment efforts through web sites, news releases, public service ads, movie screen promotions and outreach to civic and educational groups.
2. Be actively involved with and continue to encourage members of the Burroughs and Midland Empire Audubon societies, both of which have officially adopted Squaw Creek NWR, to increase their volunteer efforts.
3. Provide temporary housing, when available, for volunteers.

Objective 3.8: Friends of Squaw Creek NWR: Maintain and enhance a close working relationship with Friends of Squaw Creek NWR that helps foster common goals supporting the Refuge mission.

Rationale: Refuge Friends groups increase community understanding of Refuge resource management issues as well as providing significant support in dealing with issues.

Strategy:

1. Continue to support the Friends of Squaw Creek, which incorporated in 2000. Be actively involved by attending Board of Directors' meetings and providing advice and assistance.

3.9 Objective: Governmental Agencies and Non-governmental Organizations: To increase awareness of and support for the Refuge, increase the level of active cooperation with non-governmental organizations (NGOs) and governmental agencies on different aspects of on-Refuge and off-Refuge management and educational efforts, both in terms of the number of NGOs and the level of effort. The 2003 level of involvement with NGOs and governmental agencies (see Chapter 5, Partnerships) will be maintained, but additional efforts will be made to share Refuge information with these agencies and organizations during routine interactions with them.

Rationale: Partnerships will disseminate Refuge information and key messages more broadly and effectively than if the Refuge were to work alone.

Strategies:

1. Continue to work with the Natural Resources Conservation Service, Holt County Soil and Water Conservation District and the U.S. Geological Survey to reduce sedimentation in the Refuge's 60,000-acre upstream watershed (see 2.10. 1.). RONS Project No. 97006
2. Continue to work with the Burroughs and Midland Empire Audubon societies.
3. Increase activity with the St. Joseph Visitor and Convention Bureau in promoting the Refuge and activities.
4. Increase activity and partnership with the Mound City Chamber of Commerce, Kiwanis and other local groups in the community.
5. Actively look for partnering opportunities with other regional conservation groups, service organizations and educational institutions.

3.10 Objective: Research: Actively encourage and provide technical assistance and logistical support to qualified researchers to support ongoing cooperative investigations of long-term management importance to the Refuge or that supports other compatible projects.

Rationale: By facilitating, encouraging and supporting research project on the Refuge, and by determining research needs on the Refuge, we can address management issues of long-term importance such as endangered species, sedimentation, water quality, biodiversity, and visitor satisfaction and appreciation of the Refuge.

Strategies:

1. Cooperate with the U. S. Geological Survey on its project to quantify stream flow and sediment entering the Refuge.
2. Solicit assistance from additional researchers and partners interested in the long-term viability of the Refuge wetlands (i.e. Ducks Unlimited, National Fish and Wildlife Foundation).
3. Continue to work with the Missouri Western State College staff and students and encourage interest in white-tailed deer, grassland birds and other potential research projects.
4. Continue research on the Eastern Massassauga rattlesnake. Experimental summer prescribed burning on small acreages will be conducted, and the Refuge biologist will use a Global Positioning System to record Massassauga hibernacula and movements.
5. Promote other potential research opportunities in a number of other forums and media, including the Squaw Creek NWR website, conferences and presentations to college and university faculty/student meetings.
6. Provide temporary housing (when available) for researchers conducting projects on the Refuge.

3.11 Objective: Cultural Resources: Evaluate and preserve archeological and historic resources.

Rationale: The Archaeological Resources Protection Act of 1979 expands upon the Antiquities Act to protect all archeological sites more than 100 years old on Federal land, and to ensure that archeological investigations on Federal land are performed in the public interest by qualified persons.
Strategies:

l. Contract an archeological survey to identify and/or to preserve any potential Native American sites on new land acquisitions.
2. Determine status of buildings that are considered good examples of an early 1900s farmstead on Munkre's property. RONS Project No. 99002

3.12 Objective: Health and Safety: Ensure the health and safety of visitors, volunteers, and employees, and conserve the natural resources and physical property of the Refuge. Strive for zero accidents for visitors and no accidents resulting in loss of work for employees.

Rationale: Refuge staff need a safe and healthy environment in which to perform their duties. Refuge visitors also need a safe environment to fully appreciate and enjoy their time at the Refuge.

Strategies:

1. Work with the zone officer and state conservation agents to provide adequate law enforcement presence.
2. Add a new electric gate at the main entrance and an emergency telephone for visitors to use if they are locked in after the gate closes. RONS Project No. 03003
3. Complete a boundary survey on Munkre's tract to determine property lines between four adjacent property landowners. The land was homesteaded in the mid-1850s and remained with the same family for the past 150 years. The assumed boundary line follows a deteriorated fence line. Well defined property lines will ensure that adjacent property rights are protected. (RONS Project No. 99002)
4. Provide routine maintenance and inspect annually all public use and Refuge facilities.
5. Promptly replace, upgrade or temporarily close any facility that, through damage or long-term wear and tear, compromises public safety.
6. Review and revise annually Maintenance Management System proposals to reflect current and future needs.
7. Administer and monitor required permits, licenses and inspections annually under the Federal Facility Compliance Act and U.S. Fish and Wildlife Service Policy.
8. Revise station safety plan and ensure that safety procedures, personal protective equipment and supplies are in place and kept current. Regularly update emergency information.
9. Conduct regular safety meetings covering a variety of pertinent topics.
10. Refresh staff in CPR (4 hours every 2 years) and first aid techniques and ensure employees receive all other required safety training and physical exams.

Objective 3.13: Welcome and Orient Visitors: Provide visitors with a welcoming, comfortable experience through adequate guidance that does not detract from appreciating nature.

Rationale: In order to have an enjoyable experience, visitors need clear wayfinding and visitor services information that is logically and conveniently located.
Strategies:

1. In brochures and at appropriate locations, provide enough information for visitors to evaluate whether they want to travel to a particular site.
2. Enhance the kiosks at the headquarters, the first observation deck and the Mallard Marsh entrance.
3. Revise and implement the station sign plan.
4. Indicate the location of restrooms on every Refuge map.
5. Install all information and wayfinding signs and sign mounts following FWS Sign Handbook format and standards.
6. Install wayfinding signs at intersections that indicate distance and directions to features of interest, the visitor center, local towns, etc. as appropriate to aid first-time visitors. Install site identification signs (e.g., "Eagle Pool Trail") that can

easily be read from within vehicles. Place a directional sign at the intersection between the U.S. 159 and the Headquarters indicating a right turn to reach Headquarters for arriving visitors.

7. Orient visitors with a "You Are Here" mark on all outdoor maps.
8. In brochures and on kiosks, inform visitors of what there is to see, when and where to see it, how to see it 9i.e., viewing tips similar to those of the Forest Service) at Headquarters and on the auto tour route.
9. At each kiosk, display a Fish & Wildlife Service shield and inform visitors of the Refuge regulations and hours, visitor center/office hours, the Refuge telephone number, and permitted and prohibited activities. Provide a map of the Refuge that indicates visitor facilities, closed areas, features of interest and accessible facilities.
10. With signs and/or brochures, inform visitors about the National Wildlife Refuge System and the role of Squaw Creek NWR at the auto tour route and at Headquarters.
11. Include a statement in Refuge publications encouraging visitors to call and inform the Refuge before visiting if they have special needs due to disability.
12. At headquarters, provide orientation publications upon request in alternate formats for visitors with visual disabilities.
13. Upgrade all orientation to be accessible to visitors with visual disabilities following guidelines in the FWS Sign Handbook, the FWS Accessibility Guidelines or both.
14. Inform visitors at each hiking trailhead about the length of the trail and the difficulty for people with mobility disabilities (i.e. condition of trail, availability of benches and shade, maximum running slope, average cross slope, surface material).
15. Identify and remove items that detract from the naturalness and aesthetic quality of the tour route experience. Remove excessive traffic signage, unnecessary gates, posts, reflective markers, etc. Remove or screen (with vegetation) stored items, stockpiles and equipment in view from auto tour route and from the Headquarters overlook.
16. On the auto tour route, create pedestrian places (landscaped and out of traffic) and parking at interpretive signs so that visitors can safely read the signs.
17. Create an attractive pedestrian-oriented place at the beginning of the auto tour that will encourage visitors to park and leave their vehicles to read information at a kiosk.
18. Clarify the information about when tour route gates may be closed before sunset or eliminate signs that conflict with the posted closing time.
19. At the beginning of the auto tour route, provide information about the approximate time required to drive the complete tour route. Note whether or not there are rest rooms on the route.
20. At the beginning of the auto tour route, provide information regarding the suitability of the route for large vehicles such as recreation vehicles and buses.
21. Develop an accessible Refuge web site that includes information similar to the items found on Refuge kiosks.

Chapter 5: Implementation and Monitoring

Frank Durbian

5.1 Personnel Needs

Currently the staff of Squaw Creek National Wildlife Refuge consists of seven positions: refuge manager, refuge operations specialist, administrative technician, wildlife biologist, a park ranger, a maintenance mechanic, and tractor operator (Figure 15).

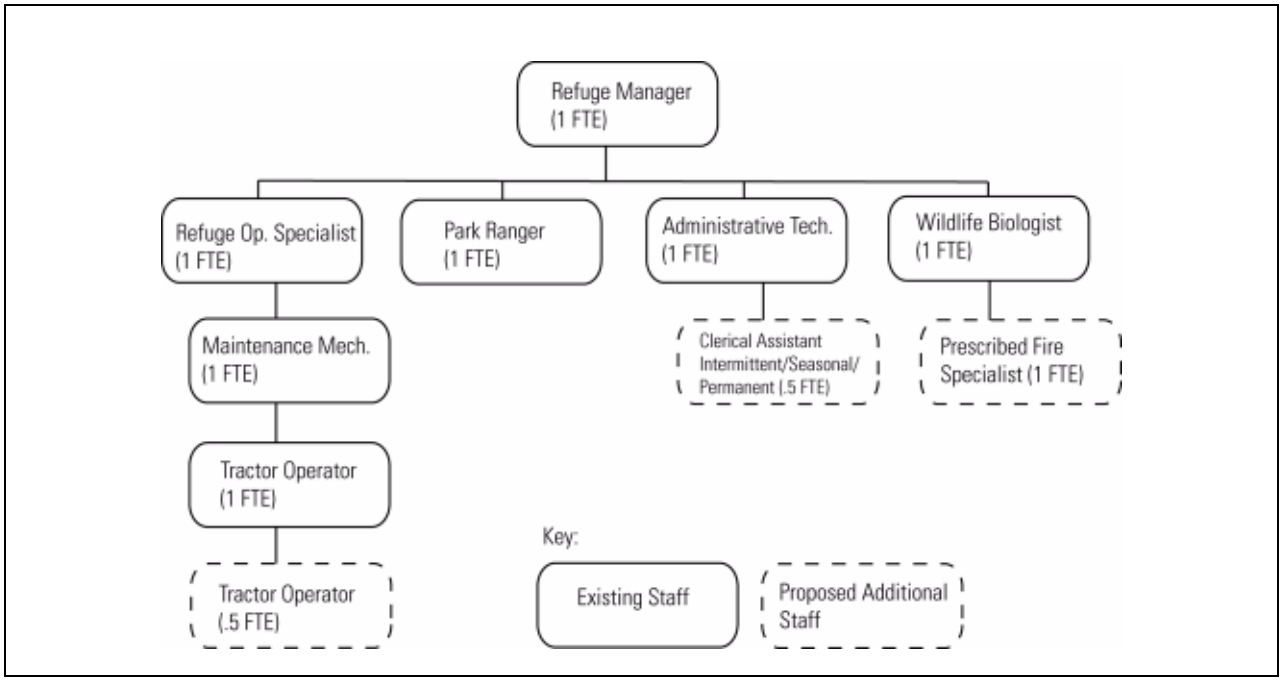
As the Refuge activities have expanded over recent years and Refuge visitation has increased, it has become difficult to efficiently run the Refuge to meet the demands of the resources as well as the public. To meet all of these needs, our plan is to fill the currently approved but vacant 0.5 maintenance position and add a 0.5 seasonal clerical position (permanent seasonal or intermittent), add a full-time law enforcement officer, and add a full-time fire technician. The Refuge would continue to seek the assistance of interns to work in the headquarters greeting visitors.

A well-trained, highly motivated, professional staff with a mix of ages, genders, and race and adequate in numbers will aid in achieving the goals, objectives, and strategies of the CCP. Therefore, the Refuge must maintain a technically skilled and diverse work force that efficiently performs the tasks required to meet the goals of the Refuge.

To meet the staffing needs of the Refuge, ensuring a diverse, well trained, highly motivated, professional staff, Refuge management must:

- # Maintain a full staff in accordance with the station's staffing plan.
- # Recruit in compliance with Service diversity directives.
- # Continue serving as official representatives on the Historically Black Colleges and Universities team and as the official contact with Missouri Western State College to facilitate diversity recruitment goals of the Service.
- # Provide training, development, and work responsibilities that promote job satisfaction and self development among Refuge employees and volunteers.
- # Provide all staff members opportunities for 40 hours of training annually; at least one such session will be at the Service's National Conservation Training Center.
- # Utilize special assignments or other means to broaden the experience of each employee.:

Figure 15: Squaw Creek NWR Staffing Chart, 2003-2018



Assure that each employee prepares an Individual Development Plan and receives assistance and encouragement to carry it out.

To allow each employee and volunteer to adequately perform their work, the Refuge must provide adequate work space and sufficient equipment. To accomplish this the Refuge must:

Expand existing office space to accommodate the proposed staff of 10 employees requiring desk space. (RONS Project No. 00007)
Maintain an adequate inventory of tools of the trade, computers and accessories, office machinery, audiovisual equipment, etc. to enable each employee to perform proficiently and efficiently.

5.2 New and Existing Projects

This CCP outlines an ambitious course of action for the future management of Squaw Creek National Wildlife Refuge. It will require staff and funding commitments to actively manage the wildlife habitats and improve public use facilities. The Refuge will continually need appropriate operational and maintenance funding to implement the objectives in this plan.

The following paragraphs describe the highest priority Refuge projects (Tier 1), as chosen by the Refuge staff. A full listing of unfunded Refuge projects and operational needs can be found in Appendix F.

Improve moist-soil/wetland vegetation (seasonal tractor operator)
Improve visitor services/outreach environmental education
Restore Loess Bluff/upland grasslands
Improve visitor services - interpretation and auto-tour route

- # Expand outdoor classroom facilities
- # Revise Refuge leaflets
- # Provide access east of Davis Creek
- # Law enforcement equipment
- # Improve visitor services operating and maintenance

5.3 Step-down Management Plans

Step-down management plans help meet the goals and objectives of the CCP. Some step-down plans are required by Service policy and others are used to specify strategies and implementation schedules beyond the detail of the CCP. The step-down plans identified in Table 1 will be reviewed and revised as necessary to achieve the objectives of the CCP.

Table 1: Step-down Management Plan Schedule

Plan	Completion Date
Safety Program	2005
Hazardous Materials Operations	2005
Pest Management/Exotic Species	2007
Hunting	2006
Habitat Management Planning	2005
Inventory and Monitoring	2006

5.4 Partnership Opportunities

Partnerships have become an essential element for the successful accomplishment of Squaw Creek National Wildlife Refuge goals, objectives and strategies. The objectives outlined in this CCP need the support and the partnerships of federal, state and local agencies, non-governmental organizations and individual citizens. This broad-based approach to managing refuge resources extends beyond social and political boundaries and requires a foundation of support from many organizations and people. Squaw Creek National Wildlife Refuge will continue to seek creative partnership opportunities to achieve its vision for the future. Partnerships will focus in particular on volunteers, Friends of Squaw Creek NWR, governmental and non-governmental organizations, and researchers working on the Refuge.

5.5 Monitoring and Evaluation

The direction set forth in this CCP plus specifically identified strategies and projects will be monitored throughout the life of this plan. Periodically, the Regional Office will assemble a station review team to visit Squaw Creek National Wildlife Refuge and evaluate current Refuge activities in light of this plan. The team will review all aspects of Refuge management, including direction, accomplishments and funding. The goals and objectives presented in this CCP will provide the baseline from which this field station will be evaluated.

5.6 Plan Amendment and Revision

The CCP for Squaw Creek NWR is meant to provide guidance to Refuge managers and staff over the next 15 years. However, the CCP is also a dynamic and flexible document and several of the strategies contained in the plan are subject to natural, uncontrollable events such as floods and droughts. Likewise, many of the strategies are dependent upon Service funding for staff and projects. Because of these factors, the recommendations in the CCP will be reviewed periodically and, if necessary, revised to meet new circumstances. If any revisions are major, the review and revision will include the public.

Appendix A: Environmental Assessment

FINDING OF NO SIGNIFICANT IMPACT

Squaw Creek National Wildlife Refuge Comprehensive Conservation Plan and Environmental Assessment

For the reasons briefly presented below and based on an evaluation of the information contained in the supporting references enumerated below, I have determined that adoption and implementation of the Comprehensive Conservation Plan (CCP) covering the Squaw Creek National Wildlife Refuge is not a major Federal action which would significantly affect the quality of the human environment within the meaning of Section 102(2)(c) of the National Environmental Policy Act of 1969. An Environmental Impact Statement will, accordingly, not be prepared.

Reasons:

1. Acquisition and management of land within the authorized refuge boundary by the U.S. Fish and Wildlife Service will be from willing sellers only and annual revenue sharing payments will be made to the Townships to help off-set potential impacts to the tax base.

2. Cultural resource inventory surveys will be conducted as necessary to insure protection of archeological, historical, and architectural resources.

3. Refuge management actions will not have any long-term adverse impacts to threatened or endangered species. Refuge management actions will improve habitat conditions for the eastern massasauga rattlesnake (federal candidate).

4. The CCP provides a clear statement of direction for future management of the Refuge.

5. The CCP gives refuge neighbors, visitors and the general public an understanding of the Service's management actions on and around the refuge.

6. The CCP ensures that Refuge management actions and programs are consistent with the mandates of the National Wildlife Refuge System.

7. The CCP ensures that Refuge management is consistent with federal, state and county plans.

8. All issues raised were addressed.

Supporting References:

1. Squaw Creek National Wildlife Refuge Final Comprehensive Conservation Plan and Environmental Assessment
2. Statement of Compliance
3. Environmental Action Statement
4. Intra-Service Section 7 Biological Evaluation Form

ACTING Regional Director, FWS, Region 3 — Date 12/19/05

U.S. Fish and Wildlife Service
Department of the Interior

ENVIRONMENTAL ASSESSMENT FOR
IMPLEMENTATION OF COMPREHENSIVE CONSERVATION PLAN
FOR SQUAW CREEK NATIONAL WILDLIFE REFUGE

Abstract: The U.S. Fish and Wildlife Service is proposing to implement a Comprehensive Conservation Plan (CCP) for the Squaw Creek National Wildlife Refuge in Missouri. This Environmental Assessment (EA) considers the biological, environmental, and socioeconomic effects that implementing the CCP (the preferred alternative is the proposed action) and four other alternatives would have on the issues and concerns identified during the planning process. The purpose of the proposed action is to establish the management direction for the Refuges for the next 15 years. This management action will be achieved by implementing a detailed set of goals, objectives, and strategies described in a CCP.

Responsible Agency and Official:
Robyn Thorson, Regional Director
U.S. Fish & Wildlife Service
Bishop Henry Whipple Federal Building
1 Federal Drive
Ft. Snelling, MN 55111

Contacts for additional information about this project:

Ron Bell, Refuge Manager
Squaw Creek National Wildlife Refuge
P.O. Box 158
Mound City, Missouri 64470
660/442-3187

Thomas Larson, Chief of Conservation Planning
U.S. Fish & Wildlife Service
NWRS/Conservation Planning
Bishop Henry Whipple Federal Building
1 Federal Drive
Ft. Snelling, MN 55111
612/713-5430

Chapter 1: Purpose and Need for the Proposed Action

1.1 Purpose And Need For Action

1.1.1 Purpose

The U.S. Fish and Wildlife Service is proposing to prepare and implement a Comprehensive Conservation Plan (CCP) for Squaw Creek National Wildlife Refuge (Refuge). The Refuge is located in northwestern Missouri near Mound City and approximately 70 miles north of Kansas City, Missouri (Figure 1).

The purpose of the proposed action is to establish the management direction of the Refuge for the next 15 years. The action is needed because adequate, long-term management direction does not exist for the Refuge. Management is now guided by several general policies and short-term plans. Future management direction will be defined in a detailed set of goals, objectives, and strategies described in the CCP. Another purpose is to adopt the Fire Management Plan for the Refuge and make it available to the public again.

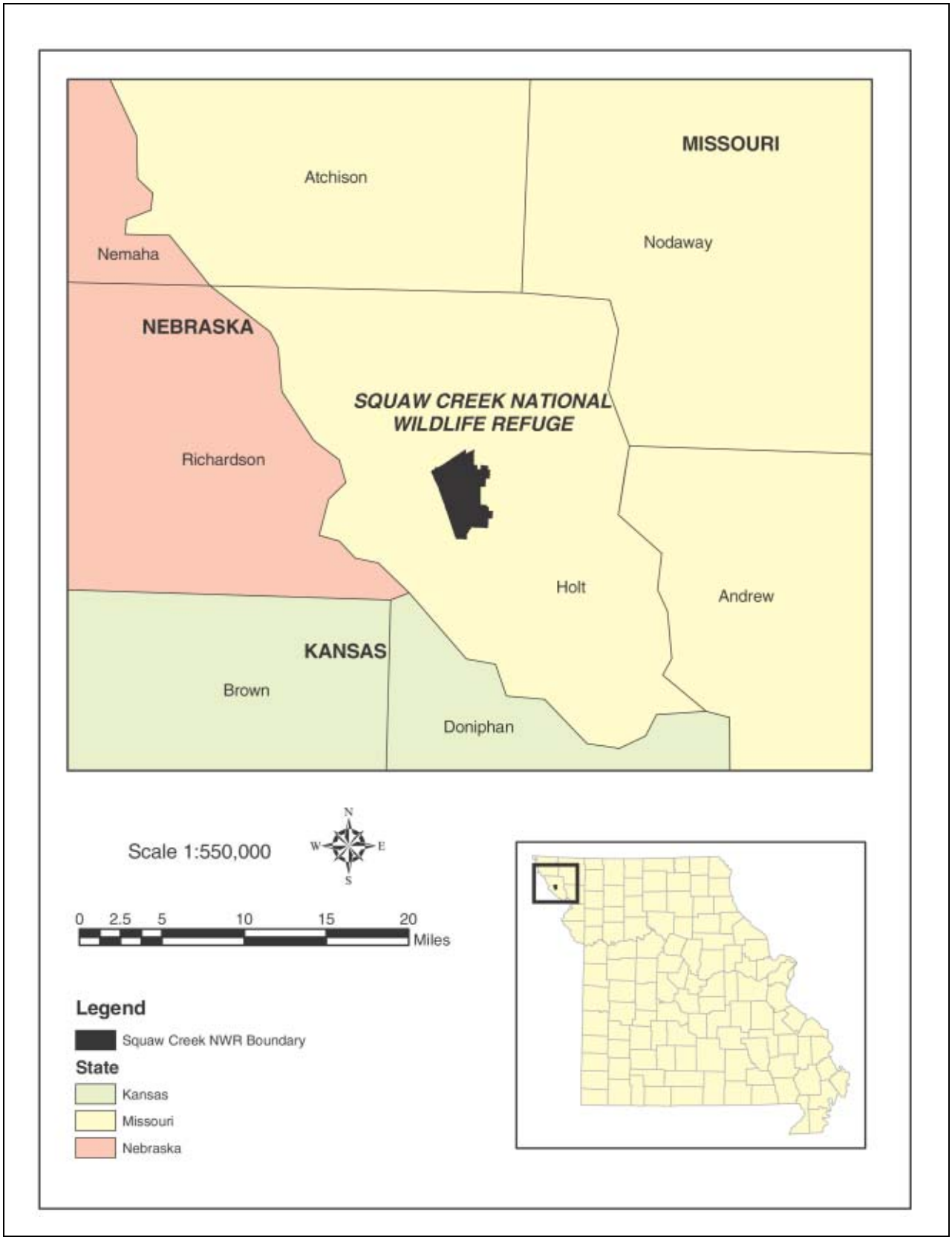
Refuge Purpose Statements are primary to the management of each refuge within the System. The Purpose Statement is derived from the legislative authority used to acquire specific refuge lands and is, along with Refuge System mission, the basis on which primary management activities are determined. Additionally, these statements are the foundation from which "allowed" uses of refuges are determined through a defined "compatibility process."

The Refuge was established on August 23, 1935, by Executive Order 7156 of President Franklin D. Roosevelt "in order to effectuate further the purposes of the Migratory Bird Conservation Act" and the lands are to be used "as a refuge and breeding ground for migratory birds and other wildlife." This is the formal purpose of the Refuge.

Throughout the 100-year existence of the National Wildlife Refuge System, its functional direction and purpose has evolved to reflect its ever increasing value as a collection of irreplaceable habitats representing the diverse natural heritage of America. In so doing, the purposes of individual refuges such as Squaw Creek have broadened from somewhat narrow definitions aimed at specific animal groups to include entire ecosystems and all the wildlife species and plants within them.

Other aims of Squaw Creek NWR include preserving, restoring, and managing wetland and upland habitats that represent the Lower Missouri River ecosystem for the benefit of a diverse complex of fauna and flora, with emphasis on threatened and endangered species; and providing opportunities for the public to enjoy wildlife-dependent recreation.

Figure 1: Map of Squaw Creek National Wildlife Refuge



This Environmental Assessment (EA) and the CCP are also needed to assess existing management issues, opportunities and alternatives, and then determine the best course for managing the natural resources of the Refuge. Further, this action will satisfy the legislative mandate of the National Wildlife Refuge System Improvement Act of 1997, which requires the preparation of a CCP for all national wildlife refuges.

This EA was prepared using guidelines of the National Environmental Policy Act of 1969. The Act requires us to examine the effects of proposed actions on the natural and human environment. This EA describes five alternatives for future Refuge management, the environmental consequences of each alternative, and our preferred management direction. Each alternative has a reasonable mix of fish and wildlife habitat prescriptions and wildlife-dependent recreational opportunities. Selection of the identified preferred alternative was based on its environmental consequences and ability to achieve the Refuge's purpose.

1.1.2 Need for Action

The following needs have been identified for Squaw Creek National Wildlife Refuge:

- # There is a need to specify the kinds of habitats that can be maintained for the next 15 years.
- # There is a need to address the siltation of Refuge marshes.
- # There is a need to specify how the habitats of the Refuge should be managed to fulfill its purpose of providing for waterfowl and other migratory birds.
- # There is a need to specify how habitats should be managed for Eastern Massassauga rattlesnakes and Bald Eagles, two species of particular concern on the Refuge.
- # There is a need to specify how the Refuge can contribute to the reduction of the continental population of Snow Geese and also a need to reduce the deer population on the Refuge.
- # There is a need to specify how the mandate to facilitate wildlife-dependent recreation can be fulfilled.
- # In addition, a plan is needed to satisfy the legislative mandates of the National Wildlife Refuge System Improvement Act of 1997, which requires the Service to develop and implement a Comprehensive Conservation Plan for all national wildlife refuges.

1.2 Decision Framework

This EA is an important step in the Service's formal decision-making process. In compliance with the National Environmental Policy Act, the Regional Director of the Great Lakes/Big Rivers Region will consider the information presented in this document to select the alternatives.

The Regional Director will determine whether the preferred alternative is a major Federal action that would significantly affect the quality of the human environment within the meaning of Section 102(2)(c) of the National Environmental Policy Act of 1969. If it is determined not to be a major Federal action, a Finding of No Significant Impact (FONSI) will be issued. A FONSI means that the preferred alternative is selected and can be implemented in accordance with other laws and regulations. A Decision of Significant Impact would indicate the need to conduct more detailed environmental analysis in an Environmental Impact Statement.

1.3 Background

1.3.1 The United States Fish and Wildlife Service

The United States Fish and Wildlife Service (Service) is the primary Federal agency responsible for conserving, protecting, and enhancing the Nation's fish and wildlife resources and their habitats for the continuing benefit of the American people. Some responsibilities are shared with Federal, state, tribal, and local entities, but the Service has specific responsibilities for "trust species" – which include endangered species, migratory birds, interjurisdictional fish, and certain marine mammals – as well as management and conservation of lands and waters administered by the Service.

The Service's mission is "Working with others to conserve, protect, enhance and, where appropriate restore fish, wildlife and plants and their habitats for the continuing benefit of the American people."

The Service is guided by four principal mission goals:

Sustainability of fish and wildlife populations: Conserve, protect, restore and enhance fish, wildlife and plant populations entrusted to our care.

Habitat Conservation: A Network of Land and Waters: Cooperating with others, we will conserve an ecologically diverse network of lands and waters of various ownerships providing habitats for fish, wildlife and plant resources.

Public Use and Enjoyment: Provide opportunities to the public to enjoy, understand and participate in use and conservation of fish and wildlife resources.

Partnerships in Natural Resources: Support and strengthen partnerships with tribal, state and local governments and others in their efforts to conserve and enjoy fish, wildlife, plants and their habitats.

1.3.2 The National Wildlife Refuge System

The National Wildlife Refuge System (System) is an integral component of the Service with the mission of administering a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

The Service manages more than 535 national wildlife refuges covering more than 93 million acres that are specifically managed for fish and wildlife and their habitats. The majority of these lands, almost 83 percent of the land in the Refuge System is found in the 16 refuges in Alaska, with the remaining acres spread across the remaining 49 states and several territories. More than 88 percent of the acreage in the System was withdrawn from the Public Domain. The remainder has been acquired through purchase, transfer from other Federal agencies, as gifts, or through easement/lease agreements.

The currently proposed goals of the National Wildlife Refuge System are to:

- Fulfill our statutory duty to achieve refuge purposes and further the System mission.
- Conserve, restore where appropriate, and enhance all species of fish, wildlife, and plants that are endangered or threatened with becoming endangered.
- Perpetuate migratory bird, interjurisdictional fish, and marine mammal populations.
- Conserve a diversity of fish, wildlife, and plants.
- Conserve and restore, where appropriate, representative ecosystems of the United States, including ecological processes characteristic of those ecosystems.

Foster understanding and instill appreciation of fish, wildlife, and plants, and their conservation, by providing the public with safe, high-quality, and compatible wildlife-dependent public use. Such use includes hunting, fishing, wildlife observation and photography, and environmental education and interpretation.

1.3.3 Squaw Creek National Wildlife Refuge

This 7,415-acre refuge includes approximately 6,700 acres of floodplain that is managed as wetland, grassland and riparian habitats that attract up to 476 Bald Eagles, 400,000 Snow Geese, and 160,000 ducks during fall and winter seasons.

The 500 acres of Refuge upland include a segment of the 200-mile long band of hills known as the Loess Hills. The Loess Hills, which were formed by wind-deposited, silt-sized soil particles, are a geologic phenomenon unique to the Missouri River Valley. While loess deposits do exist elsewhere in North America and the world, only in the Missouri River Valley are the deposits deep enough to create such an extensive land form. The Loess Hills support rare remnants of native prairie and prairie associated wildlife.

The Refuge hosts 301 species of birds, 33 mammals, and 35 reptiles and amphibians. Missouri's largest wet prairie remnant is on the Refuge and it is home to Missouri's largest meta-population of the Eastern Massassauga rattlesnake.

The quality of Squaw Creek NWR wetland habitat is affected by silt from the 60,000-acre Loess Hills watershed that is carried into the Refuge by five creeks that converge to become Squaw and Davis creeks.

1.3.4 Squaw Creek NWR Vision Statement for Desired Future Condition

For thousands of years, time in the Missouri River Basin has been measured by the migration of waterfowl. Each spring and fall, northwestern Missouri was inundated by a noisy confusion of ducks and geese. From northern Canada and the prairie pothole country, they flocked into the marshes and backwaters of wild Missouri.

However, far reaching changes have transformed the valley in the past 150 years. Marshland drainage and deepening and straightening of the channel largely eliminated oxbow lakes and marshes and the natural, sandbar-studded Missouri River channel.

In fulfilling its purpose “as a refuge and breeding ground for migratory birds and other wildlife,” the vision for the future of Squaw Creek NWR includes the following:

Restoration and preservation of the wetland ecosystems of the Missouri River floodplain as well as the habitats native to the adjacent Loess Hills will be the major management thrust of Squaw Creek National Wildlife Refuge.
Refuge wetlands, which includes the largest remnant wet prairie in Missouri, continue to provide safe habitat for concentrations of waterfowl and other birds during the migration and nesting seasons.
The historic threat of wetland sedimentation has declined significantly as managers of the vast surrounding agricultural lands employ more conservative practices advocated by the Refuge staff and other agencies.
The Refuge habitat diversity emphasizes both wetland and grassland, interspersed with stands of mixed shrubs and woodlands, managed on a scale to minimize habitat fragmentation and to be attractive to indigenous species as well as neo-tropical and passerine birds.

- # Habitat diversity broadens each year as progress is made to convert former monotypic stands of reed canary grass, American lotus, and croplands to aquatic and upland species complexes that benefit both indigenous and migratory wildlife.
- # Squaw Creek NWR continues to be a destination for people to enjoy wildlife-dependent recreation. Dynamic and current environmental education and interpretive displays and programs, presented in well designed facilities, help the public to understand and become supportive of the Refuge staff's efforts to conserve, preserve and manage wildlife resources and their habitats.
- # The Refuge will provide wetland habitat that will support a large variety of marsh, water and shore birds with special emphasis during the spring and fall waterfowl migration. We will manage for increased use by listed and candidate federal and state endangered and threatened species, including the Bald Eagle. We will maintain white-tailed deer population levels consistent with available habitat yet provide ample viewing opportunities for the visiting public.
- # The Refuge serves as an outdoor laboratory for biological researchers whose study results aid in the management for species of special concern such as the eastern Massassauga rattle snake and the Least Bittern.
- # The multi-disciplined staff of biologists, technicians, and support personnel are a well trained team proficient in their functions of serving Refuge visitors, cooperators, and the general public; in their stewardship of the resources put in their charge, and in their maintenance of Refuge facilities and equipment. This team places high value on its connections with the community and relies heavily on stakeholder input.
- # The Refuge budget, staff and administrative facilities are adequate to implement the strategies required to achieve the goals and objectives set forth in this plan.

1.3.5 Refuge Goals

Based on the purposes of the Refuge, the mission of the National Wildlife Refuge System and ecosystem considerations, and the vision for the Refuge, the planning team established the following goals for what we want to accomplish in the next 15 years:

Goal 1 Habitat: Manage a diversity of habitat to benefit threatened and endangered species, waterfowl, other migratory birds, and indigenous species in Lower Missouri River floodplain ecosystem and the Central Tallgrass Prairie ecosystem.

Goal 2 Wildlife: Conserve species indigenous to the Refuge, the Lower Missouri River Ecosystem, and the Central Tallgrass Prairie Ecosystem with emphasis on those species identified in the Service's Fish and Wildlife Resource Conservation Priorities.

Goal 3 People: Visitor services programs, facilities and outreach efforts will motivate nearby residents and other stakeholders to appreciate the natural resources and ecological processes and cultural resources of Squaw Creek NWR, will help achieve the objectives of the Refuge, and will support the Service's mission.

1.4 Scoping and Public Involvement

The planning process for this CCP began with a "kick-off" meeting in July 1999. Initially, members of the CCP planning team and Refuge staff identified a list of issues and concerns that were associated with management of the Refuge. These preliminary issues and concerns were based on staff knowledge of the area and association with citizens in the community. The planning team, consisting of Refuge staff and Service planners, then invited Refuge neighbors, organizations, local government

agencies and local staff of national and state government agencies, schools, and interested citizens to share their thoughts in a focus group meeting on August 18, 1999. Nineteen people attended the meeting. An open house was held on September 14, 1999, and 12 attended. The planning team accepted oral and written comments at the open house. Five written comments were received.

In October 1999, the planning team met for an intensive three-day workshop to develop and consider four management alternatives that addressed the issues and concerns in different ways. The alternatives generally describe different emphases in habitat and public use management. Once alternative approaches to management were selected, methods for achieving that level were developed.

Subsequent planning team meetings in November of 1999 and January of 2000 were held with Region 3 U.S. Fish and Wildlife Service officials and biologists in Fort Snelling, Minnesota, to critique and revise these draft alternatives and associated goals and objectives. In February 2000, the planning team again met for two days at DeSoto National Wildlife Refuge to further refine goals, objectives, and strategies. The planning team met at Squaw Creek NWR in February 2003 to continue this process.

The draft CCP and EA were released for public review on June 28, 2004, with the comment period closing on August 27, 2004. Eleven people attended a public open house on August 4, 2004. A total of 43 comments were received (see Appendix L of the CCP) during the public review period.

1.4.1 Issues and Concerns

Issue 1. Wildlife Habitat and Resource Management

Extraordinary measures may be required to preserve the marsh environment that has historically attracted migratory waterfowl and other wildlife. Squaw Creek 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. Deer numbers exceed the desired density of 20-25 deer per square mile, negatively impacting habitats such as understory vegetation in the bottomland forests. This negatively impacts other species of interest.

Issue 2. Land Management within the Watershed Impacts Refuge Water Quality and Quantity

While neither the Refuge nor the Fish and Wildlife Service has any interest or authority to interfere with private lands management, they do have the responsibility to conserve the public resources placed in their care. The Refuge is at the bottom of a 60,000-acre watershed. Land management practices within the watershed influence quality and quantity of water that flows into the Refuge. Unrestricted surface runoff in the watershed depletes top soil and soil moisture conditions. The deposition of top soil and agricultural chemicals in the Refuge marshes during flood stages has an adverse cumulative effect. There are existing cost share programs available to landowners aimed at improved soil and moisture conservation.

Issue 3. Snow Goose Management

The mid-continent population of Snow Geese and Ross' Geese are in trouble because there are too many – what some refer to as "a perilous abundance." The peril is their numbers. The estimate of Snow and Ross' Geese in the central and eastern arctic increased from 1.1. million in 1973 to 5.8 million in 1998. These geese now exceed the carrying capacity of habitats on several breeding colony sites in northern Canada. Overgrazing and grubbing by geese causes a removal of the vegetative mat that insulates underlying sediments. Exposure of sediments causes an increase in the rate of evaporation

and greater concentration of inorganic salts from marine clays. Increased soil salinity eventually eliminates growth of the salt-marsh community and desertification ensues. Bare mudflats may become colonized by salt-tolerant plants, which are utilized by few, if any, wildlife species.

Recovery of damaged Arctic tundra vegetation is extremely slow and tends to continue towards self destruction once the moisture and chemical balance is upset. High Snow Geese survival rates over the last 20 years and quality wintering grounds has contributed to the over population. Action plans developed by both the Canadian and U.S. Fish and Wildlife Service and State and Provincial agencies focus on reducing the Snow Goose population.

Concentrations of 300,000 to 400,000 Snow Geese at Squaw Creek NWR during the fall migration has become a sight-seeing tradition that attracts thousands of Refuge visitors. The Snow Geese are also welcomed by waterfowl hunters in an area from Sioux City, Iowa to Kansas City, Missouri. The large concentrations of geese on the Refuge provides significant hunting opportunity on adjacent public and private hunting areas. Some felt goose hunting on the Refuge would help address the mid-continent Snow Goose over-abundance while others expressed concern that opening the Refuge to more hunting would restrict other public uses and scare the geese out of the area, reducing overall hunting opportunity and take of birds.

Issue 4. Refuge Expansion

Floodplain wetlands similar to those within Squaw Creek NWR have been preserved and managed as private and commercial waterfowl hunting clubs. High operations costs have caused some owners to consider selling their property to the Refuge. Some of the Refuge marsh restoration and preservation problems associated with watershed management and runoff might be lessened if some of the adjacent agricultural land was added to the Refuge and converted to other uses. However, hydrological and biological data supporting this is incomplete or lacking.

Issue 5. Public Use

Public use at the Refuge has focused on nonconsumptive uses and wildlife dependent recreation, but some people have suggested that the Refuge's public use program should be changed to allow other compatible uses that might include hunting waterfowl and deer. Currently there is a special two-day muzzle loader deer hunt with a specific number of permits issued. Angling is allowed where the roads cross the creek ditches. Historically, environmental education has been emphasized at Squaw Creek NWR.

Issue 6. Public Service

The staff at Squaw Creek NWR want to be good neighbors and contributors to the welfare of the community. Public benefits now include environmental education programs for schools and special groups both on and off the Refuge, disaster assistance with staff and equipment, operations budgets that boost the local economy, annual payments to counties to offset losses of real property tax revenues, cost share programs for environmental improvements on private lands, and attraction of visitors who patronize local businesses. As the Refuge strives to be of service to the public and the community, are there new or better ways it can be successful in its efforts?

1.5 Legal, Policy, And Administrative Guidelines

1.5.1 Legal Mandates

Administration of refuges is guided by laws, Executive Orders, and Service policy. A list of pertinent statutes and policy guidance can be found in Appendix E of the CCP, “Compliance Requirements.”

Chapter 2: Description of Alternatives

This chapter describes five alternatives analyzed for the Squaw Creek NWR, including Alternative D, the proposed action.

2.1 Rationale for Alternative Designs

Each alternative was formulated with the understanding that it must be capable of achieving all Refuge goals. Each alternative will achieve the goals, but to varying degrees. The focus of the alternatives is on the habitats, visitor use opportunities, or both. All alternatives consider the potential for the land to sustain specific habitats and visitor uses.

2.2 Alternatives Considered But Not Analyzed in Detail

Expansion of the Refuge was considered as a possible alternative. The primary purpose of an expansion would be to provide an additional tool to deal with the adverse affects of the silt and sediment that originate in the 95 square miles of watersheds that drain through the Refuge. The Refuge's ability to control water passing through the Refuge during high sediment load periods would conserve Refuge habitats from the negative impacts of sediment accumulation to some degree. But these measures would likely only delay the eventual total siltation of the wetland basins. To effectively deal with the problem, the sediment load entering the Refuge must be reduced significantly. We considered an expansion of the Refuge that would take place within a 43,300-acre watershed. Within that area, we considered the possibility of acquiring easements from willing sellers only. The easements would allow Refuge staff to establish permanent grassland or woody cover in erodible areas or to permanently conserve areas of existing cover. The land would remain in private ownership with the requirement that the cover encompassed by the easement be preserved permanently. While it was unlikely that the entire easement acreage would ever be acquired, because the program would function on a willing seller basis only, we thought that it would be important that an adequately large area be available to increase the chance that there are willing sellers interested in participating. We estimated that 2,500 to 4,500 acres of easements could be obtained over the next 15 years.

In addition to the easements in the watershed, we considered acquiring full interests in certain lands adjacent to the Refuge as an alternative. To the west and north of the Refuge, up to 11,000 acres could be acquired to provide additional wetland, grassland, and bottomland forest habitat restoration opportunities. We speculated that these lands would benefit Eastern Massassauga rattlesnakes and affect the hydrology of the area by increasing the recharge of ground water, which would help water management on the Refuge.

To the southeast, approximately 5,700 acres in the Loess Hills could be acquired to preserve those rare habitats and to complement existing Refuge habitat. We estimated that approximately 4,500

acres could be acquired in these two areas within the next 15 years. Like the easements, lands would be acquired only from willing sellers.

We did not evaluate the possible expansion alternatives in detail because we felt that we did not have enough background data and that additional studies are needed before an expansion can be reasonably evaluated. In the comprehensive conservation plan, strategies address obtaining enough data to better evaluate potential expansion of the Refuge. There are still approximately 400 acres to be acquired within the currently authorized Refuge boundaries.

2.3 Description of Alternatives

The alternatives are compared and summarized by goal in Table 1. A more detailed comparison of alternatives by specific objectives and general strategies can be found in Appendix K of the Comprehensive Conservation Plan. Archaeological and cultural values would be protected as mandated by law under all alternatives.

2.3.1 Alternative A: Current Management Practices (No Action)

Under this alternative there would be no major change in Refuge goals, objectives, and strategies. Some strategies would be revised to incorporate improved techniques, which have been learned from current management practices. The current goals and objectives call for maintenance and modest enhancement of wetland habitat, upland habitat, fish and wildlife populations, public use, resource conservation, facilities, work force and administration. This alternative does not fully address long-term needs and issues such as constant sedimentation in the wetland management units, the mid-continent Snow Goose population problem, and land acquisition that would allow increased preservation and restoration of the Missouri River floodplain habitat.

Additional information describing this alternative can be found in Table 1.

2.3.2 Alternative B: Restore Historic Wet and Mesic Prairie

Squaw Creek NWR presently contains the largest remaining wet prairie remnant in public ownership in Missouri. Wet prairie is an important habitat for several State-listed threatened and endangered species, including the Massassauga rattlesnake. This alternative would attempt to expand the present wet prairie, restore the wet prairie vegetation and reintroduce fauna found prior to the mid-1840's in the Missouri River ecosystem. The restored area would be a showcase example of the historic conditions, particularly relevant on the 200th anniversary of the Lewis and Clark expedition, and would be of great interpretive value to visitors.

Some of the current management practices would be altered or eliminated. Prescribed burning frequencies and seasons would be changed to more accurately reflect natural burns. Active water level manipulations would be eliminated and the natural seasonal ebb and flow via watershed runoff would be encouraged. Farming and vegetative habitat management (mowing, haying, chemical spraying) would be eliminated to permit natural ecological successional changes to occur.

Additional information describing this alternative can be found in Table 1.

2.3.3 Alternative C: Enhance Public Use/Current Resource Management Level

Under this alternative, the six priority wildlife-dependent uses highlighted in the Refuge Improvement Act would be promoted and enhanced. These uses include hunting, fishing, environmental education and interpretation, and wildlife observation and photography. Environmental education efforts and outreach would be stepped up considerably. Additional facilities would be developed on the Refuge to accommodate increased public use.

Table 1: Comparison of Alternatives by Refuge Goals

Goal	Alternative A: Current Management (No Action)	Alternative B: Restore Historic Wet and Mesic Prairie	Alternative C: Enhance Public Use with Current Resource Management Level	Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation
Goal 1: Habitat *Manage a diversity of habitat to benefit threatened and endangered species, waterfowl, other migratory birds, and indigenous species in Lower Missouri River floodplain ecosystem and the Central Tallgrass Prairie Ecosystem*	3,409 acres of managed wetlands.	1,227 acres of managed wetlands.	Same as Alternative A	3,452 acres of managed wetlands.	Same as Alternative A
	176 acres of semi-natural wetlands.	Same as Alternative A	Same as Alternative A	Same as Alternative A	Same as Alternative A
	1,077 acres of wet prairie.	3,259 acres of wet prairie.	Same as Alternative A	Same as Alternative A	Same as Alternative A
	291 acres of bottomland mesic prairie	870 acres of bottomland mesic prairie.	Same as Alternative A	508 acres of bottomland mesic prairie.	570 acres of bottomland mesic prairie.
	221 acres of Loess Hill prairie.	Same as Alternative A	Same as Alternative A	299 acres of Loess Hill prairie.	Same as Alternative A
	378 acres of Loess Hill forest.	Same as Alternative A	Same as Alternative A	Same as Alternative A	Same as Alternative A
	1,000 acres of bottomland forest.	Same as Alternative A	Same as Alternative A	Same as Alternative A	Same as Alternative A
	579 acres of cropland, 59 acres of old field (no change from current management).	0 acres cropland.	Same as Alternative A	300 acres of cropland, 0 acres of old field.	Same as Alternative D
	Control exotic, invasive and nuisance species.	Same as Alternative A	Same as Alternative A	Same as Alternative A	Same as Alternative A
	400 acres within existing authorized boundaries.	Same as Alternative A	Same as Alternative A	Same as Alternative a	Same as Alternative A
	Reduce watershed sediment entering the Refuge.	Same as Alternative A	Same as Alternative A	Same as Alternative A	Same as Alternative A
	Manage Wildlife Management District lands to benefit soil and water conservation and associated wildlife.	Same as Alternative A	Same as Alternative A	Same as Alternative A	Same as Alternative A

Table 1: Comparison of Alternatives by Refuge Goals (Continued)

Goal	Alternative A: Current Management (No Action)	Alternative B: Restore Historic Wet and Mesic Prairie	Alternative C: Enhance Public Use with Current Resource Management Level	Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation
Goal 2: Wildlife *Conserve species indigenous to the Refuge, the Lower Missouri River floodplain ecosystem, and the Central Tallgrass Prairie Ecosystem with emphasis on those species identified in the Service's Fish and Wildlife Resource Conservation Priorities.*	Western Hemispheric Shore Bird Designation will be sought.	Same as Alternative A	Same as Alternative A	Same as Alternative A	Same as Alternative A
	Wildlife populations will be surveyed and monitored.	Same as Alternative A	Same as Alternative A	Same as Alternative A	Same as Alternative A
	5 million waterfowl use days.	2 million waterfowl use days.	Same as Alternative A	Same as Alternative A	5.3 million waterfowl use days.
	Reduce Snow Goose numbers primarily be discouraging cropland use of the Refuge and by providing a roosting site that holds birds in the area for hunting around the Refuge.	Same as Alternative A, with the exception that cropland is eliminated completely under this alternative, thereby having a greater impact on Snow Geese.	Same as Alternative A	Same as Alternative A, with the exception that there is a spring Snow Goose hunt and cropland is reduced.	Same as Alternative A, with the exception that there is a greater reduction in Snow Goose numbers.
	Deer numbers will be regulated through a managed hunt.	Same as Alternative A	Same as Alternative A	Same as Alternative A, with one accessible deer blind added and permit system adjusted to allow more deer taken when necessary.	Same as Alternative A
	Maintain Bald Eagle habitat.	Same as Alternative A	Same as Alternative A	Same as Alternative A	Same as Alternative A

Table 1: Comparison of Alternatives by Refuge Goals (Continued)

Goal	Alternative A: Current Management (No Action)	Alternative B: Restore Historic Wet and Mesic Prairie	Alternative C: Enhance Public Use with Current Resource Management Level	Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation
	Monitor Eastern massasauga rattlesnake numbers and distribution and maintain 1,077 acres wet prairie.	Same as Alternative A, but increase wet prairie to 3,259 acres.	Same as Alternative A	Same as Alternative A, but mesic prairie increased by 217 acres to 508 acres total.	Same as Alternative A
	Least Bittern populations will be monitored and habitat will be maintained.	Same as Alternative A, but 349 acres of hemi-marsh provided.	Same as Alternative A	Same as Alternative A	Same as Alternative A
	Support conservation of priority passerine species.	Same as Alternative A	Same as Alternative A	Same as Alternative A	Same as Alternative A
	Report sightings of state species of concern to the MDOC.	Same as Alternative A	Same as Alternative A	Same as Alternative A	Same as Alternative A
Goal 3: People *Visitors and nearby residents will appreciate the natural resources, ecological processes and cultural resources of Squaw Creek NWR and will support the Service's mission.*	Minor improvement in environmental interpretation materials and programs; accommodate 130,000 visitors annually.	Same as Alternative A	Increased environmental interpretation efforts; trail extension; brochure revision; accommodate 175,000 visitors annually.	Same as Alternative C with the exception that the Refuge would accommodate 130,000 visitors annually.	Same as Alternative A
	Environmental education programming at the 2004 level.	Same as Alternative A	Enhanced environmental education efforts to accommodate 6,000 students annually, add boardwalk, teacher workshops.	Same as Alternative C	Same as Alternative A
	Wildlife observation and photography programs at 2004 level and existing facilities.	Same as Alternative A	Extend trail, observation blind, add pull-offs on the Auto Tour route.	Same as Alternative C	Same as Alternative A
	Hunting and fishing: 135 deer hunters per year, bank fishing in select areas.	Same as Alternative A	135 deer hunters, spring goose hunt, accessible deer blind.	Same as Alternative C	Same as Alternative A
	Public information at 2004 level.	Same as Alternative A	Expanded public information effort.	Same as Alternative C	Same as Alternative A

Table 1: Comparison of Alternatives by Refuge Goals (Continued)

Goal	Alternative A: Current Management (No Action)	Alternative B: Restore Historic Wet and Mesic Prairie	Alternative C: Enhance Public Use with Current Resource Management Level	Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation
	Maintain and enhance relations with Friends of Squaw Creek NWR.	Same as Alternative A	Same as Alternative A	Same as Alternative A	Same as Alternative A
	Involvement with government agencies and non-government organizations at 2004 level.	Same as Alternative A	Additional efforts to work with government agencies and non-government organizations.	Same as Alternative C	Same as Alternative A
	Actively support and encourage research on the Refuge.	Same as Alternative A	Same as Alternative A	Same as Alternative A	Same as Alternative A

Additional information describing this alternative can be found in Table 1.

2.3.4 Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)

This alternative seeks to maximize wildlife habitat and population management practices and opportunities without adversely impacting current levels of wildlife-dependent recreational opportunities. Compared to Alternative A, a greater effort would be made toward conserving, managing, and restoring habitats native to the Lower Missouri River ecosystem, both on Refuge lands and FSA easements within the management district and watershed. Management would include additional wetland, riparian, and native grass development and enhancement. Increased biological monitoring would evaluate wildlife responses to management efforts and track population trends of species of concern, including Massassauga rattlesnakes and grasslands birds. We would seek to quantify the need and benefit of various approaches to reducing sedimentation and improving water quality. Additional efforts would be made to accommodate all migratory bird species, such as fall migrating shorebirds. Snow Goose populations would be actively managed, which for the immediate future means participating in the mid-continent efforts of population reduction.

All wildlife-dependent recreational opportunities would continue as in Alternative A, but with a slight additional effort exerted to increase visitation or additional public use activities and improvement in the quality of services and facilities.

Additional information describing this alternative can be found in Table 1.

2.3.5 Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation

This alternative would selectively emphasize the creation and maintenance of the widest possible variety of wetland habitats (e.g. lacustrine, palustrine, moist soil, green tree, riverine, bottomland hardwoods, wet meadows, exposed flats, and others) with the intention of attracting highly diverse populations of aquatic wildlife. Targeted wildlife species would include waterfowl (e.g. ducks, and geese), shorebirds and wading birds, aquatic animals and plants that are of high interest to the public (e.g., otters), and species that require additional conservation (e.g., rare, threatened or endangered species of aquatic plants and animals).

The Refuge would be maintained as a showcase of Lower Missouri River Ecosystem wetland habitats and aquatic wildlife diversity. The value of this alternative would include conservation/preservation, public education, and scientific research. Outreach and education activities would focus on helping people understand the importance of wetlands. The alternative would include demonstration areas to teach the public how to create and maintain wetlands.

Under this alternative, visitor numbers and programs would be restricted to minimize conflicts with the wetlands management and aquatic biodiversity conservation goals.

Under this alternative, extreme measures may be necessary to maintain various habitat types. These measures might include dredging and constructing dikes and water control structures.
Additional information describing this alternative can be found in Tables 1 and Appendix K.

2.3.6 Elements Common to All Alternatives

2.3.6.1 Fire

Under each alternative we propose to adopt the Fire Management Plan for the Refuge, which was drafted in 2002 and is available at the Refuge Office for inspection.

2.3.6.1.1 Prescribed Fire

Prescribed fire is a habitat management tool that is used on the Refuge regularly. Refuge staff annually burn areas of the Refuge to enhance habitat for upland game, waterfowl, and other species of interest. The periodic burning of grasslands and sedge meadows reduces encroaching vegetation such as willow. It also encourages the growth of desirable species such as cord grass.

All prescribed burns are carried out by highly trained and qualified personnel who perform the operation under very precise plans. The Refuge has an approved fire management plan that describes in detail how prescribed burning will be conducted on the Refuge. No burning takes place unless it meets the qualifications of the prescription for each burn unit. A prescription is a set of parameters that define the air temperature, fuel moisture, wind direction and velocity, soil moisture, relative humidity, and several other environmental factors under which a prescribed burn may be ignited. This insures that there is minimal chance the fire will escape the unit boundaries and that the fire will have the desired effect on the plant community.

Prescribed burns will occasionally be conducted within or near Refuge development zones, sensitive resources, and boundaries to reduce the risk from wildfire. To the greatest extent possible, prescribed fires to reduce hazards will only be used when they complement resource management objectives.

Combustion of fuels during prescribed fire operations may temporarily impact air quality, but the impacts are mitigated by small burn unit size, the direction of winds the burns are conducted with, and the distance from population centers. All efforts will be taken to assure that smoke does not impact smoke sensitive areas such as roads and local residences.

Burn frequency will vary from every 3 to 5 years or longer on established grassland, savanna, and wet prairie units depending on management objectives, historic fire frequency, and funding. As part of the prescribed fire program, a literature search will be conducted to determine the effects of fire on various plant and animal species, and a monitoring program will be instituted to verify that objectives are being achieved.

Prescribed fires cannot and will not be ignited when the area is at an extreme fire danger level and/or the National Preparedness level is V, without the approval of the Regional Fire Management Coordinator. In addition, the Refuge will not ignite prescribed fires without the applicable State concurrence when the county or the State has instituted a burning ban.

Drought can have an effect on fire severity and control. One or more drought indicators (PDI - KBI) will be used to determine the degree of drought. These indicators can be accessed on the web at http://www.boi.noaa.gov/fwxweb/ fwoutlook.htm

Spot fires, slop-overs, and escapes can be an expected occurrence on any prescribed fire. They can be caused by any of a number of factors that can not always be accounted for in the planning process. A few minor occurrences of these events on a prescribed burn can usually be controlled by the burn crew. If so, they do not constitute a wildfire. The burn boss is responsible for evaluating the frequency and severity of these events and taking mitigating measures such as slowing down or stopping the burn operation, ordering additional holding forces from within Refuge staff, or taking measures to extinguish the prescribed burn. Should an escape exceed the ability of existing holding forces to control, and additional assistance becomes necessary in the form of State agency involvement, the event will be classified a wildfire and controlled accordingly. Once controlled by these forces, the prescribed burning operation will be stopped for the burning period. A fire number will be obtained to implement wildfire funding to cover the cost of control, a wildfire report will be generated and a Wildland Fire Situation Analysis will be prepared.

Prescribed burns can be conducted at any time of year depending on resource objectives and prescription. However, the normal prescribed fire season begins approximately April 1 and ends by May 31, due to early bird nesting. Fall burning may begin again August 15 and end October 31.

Precautions will be taken to protect threatened and endangered species during prescribed burning. Nesting trees for Bald Eagles will be protected and burning will not be conducted at a time or in a way to negatively impact any nesting eagles. If any of the known populations of Massassauga rattlesnake are in or near a burn unit, precautions will be taken to avoid the reptiles.

Existing firebreaks will be used. They may undergo minor improvements such as rotovation (vegetation disruption). General policy dictates that any new firebreaks or below surface improvements to existing firebreaks will be approved by the Regional Historic Preservation Officer.

The Refuge Biologists will be responsible for supervising the development of resource management objectives for individual units. The Refuge staff will provide assistance in the selection of the appropriate management tool needed to meet objectives. Prescribed fire is just one of a combination of tools available. If needed, the Zone Fire Management Officer (Zone FMO) will be consulted for assistance in developing a prescription that will achieve the desired results.

Burn plans (the Fire Management Plan) are written to document the treatment objectives, the prescription, and the plan of action for carrying out the burn. Burn plans are written by or under the guidance of a qualified burn boss. The burn plan follows the format in the Service's Fire Management Handbook or a format approved by the Regional Fire Management Coordinator and addresses all aspects as specified in the Service's Fire Management Handbook. Details regarding fire resources and procedures may be found in the Refuge Fire Plan. All burn plans are reviewed by the Refuge Manager, Zone FMO, and approved by the individual Refuge Managers prior to implementation.

2.3.6.1.2 Fire Prevention and Detection

Although fire may have historically played a role in the development of habitats on the Refuge, human ignited fires and natural ignitions burning without a prescription are likely to result in unwanted damage to cultural and/or natural resources. In order to prevent wildfire, an educational program will be utilized to reduce the threat of human caused fires. Ongoing monitoring will be conducted by Refuge staff, visitors, and cooperators to detect fire ignitions. Actions taken to implement this include:

- Fire prevention will be discussed at safety meetings, prior to the fire season, and during periods of high fire danger. Periodic training of staff in regard to fire prevention will be conducted.
- During periods of extreme fire danger, warnings will be posted at visitor information stations.
- Public contacts will be made via press releases and verbal contacts during periods of extreme fire danger.
- A thorough investigation will be conducted of all fires suspected to have been illegally set. Upon completion of the investigation, appropriate action will be taken.
- The Refuge relies on neighbors, visitors, cooperators, and staff to detect and report fires. In addition, the step-down plan provides for increased patrols by Refuge personnel during periods of very high and extreme fire danger.
- All fires occurring within or adjacent to (within 2 miles) the individual Refuges will be reported to the respective Refuge headquarters. The person receiving the report will be responsible for implementing the Fire Dispatch Plan and assume duties of Fire Dispatcher until relieved or released.

For local fires, the Fire Dispatcher will stay on duty until: (1) all Refuge resources return; (2) relieved by another dispatcher; or (3) advised by IC that he/she can leave. The Fire Dispatcher will not be required to stay on duty if the fire occurs outside Refuge radio coverage but before leaving the dispatcher must notify the applicable State Dispatcher that a Dispatcher is not on duty at the Refuge.

The Fire Dispatcher will be responsible for coordinating the filling and delivery of any resource orders made by the Incident Commander (IC) for all operational and logistical needs, including engines, aircraft, tools, supplies, and meals. The IC will place all resource orders through the Dispatcher, and specify what is needed, when it is needed, and where it is needed. The Dispatcher will promptly determine if the resource orders can be filled or procured locally and notify the IC. If a resource order can not be filled locally, the Dispatcher will place the order with the Interagency Fire Dispatcher in. The Zone FMO for the Refuge will generally be able to assist with ordering resources from outside the area.

Requests for assistance by cooperators on fires not threatening an individual Refuge must be made to the Refuge Manager or designee. Only qualified and properly equipped resources meeting National Wildfire Coordinating Group (NWCG) standards will be dispatched off of the Refuge.

Firefighter and public safety always take precedence over property and resource protection during any fire management activity. Under moderate to severe fire danger index ratings, flaming fronts are capable of moving at fast speeds in all fuel models. In order to eliminate safety hazards to the public, all public access into the burn units will be closed the day of the burn. Fire crews will be briefed that should an individual who is not a member of the fire crew be observed in the prescribed burn unit, they will be immediately escorted out of the area. The fire crew will keep the fire scene clear of people except for Service firefighters and cooperating fire crews.

2.3.6.1.3 Fire Suppression

Service policy requires the Refuge to utilize the Incident Command System (ICS) and firefighters meeting NWCG qualifications for fires occurring on Refuge property. All suppression efforts will be directed toward safeguarding life while protecting the Refuge's resources and property from harm. Mutual aid resources responding from Cooperating Agencies will not be required to meet NWCG standards, but must meet the standards of their Agency. Mutual aid resources will report to the Incident Commander (IC) in person or by radio and receive their duty assignment. Mutual aid forces will be first priority for release from the fire. If additional firefighters are needed, appropriate procedures will be used to acquire them.

All fires occurring on the Refuge and staffed with Service employees will be supervised by a qualified IC. The IC will be responsible for all management aspects of the fire. If a qualified IC is not available, one will be ordered through the appropriate area office dispatch center. All resources will report to the IC (either in person or by radio) prior to deploying to the fire and upon arrival to the fire. The IC will be responsible for: (1) providing a size-up of the fire to dispatch as soon as possible; (2) determine the resources needed for the fire; and (3) advising dispatch of resource needs on the fire. The IC will receive general suppression strategy from the Fire Management Plan, but appropriate tactics used to suppress the fire will be up to the IC to implement. Minimum impact suppression tactics (MIST) will be used whenever possible.

Severity funding may be essential to provide adequate fire protection for the Refuge during periods of drought, as defined by the Palmer Drought Index or other appropriate drought indicators. Severity funds may be used to hire additional firefighters, extend firefighter seasons, or to provide additional resources. The Service Fire Management Handbook provides guidelines for use of severity funding.

The incident commander (IC) on a wildland fire or the prescribed fire burn boss on a prescribed burn will be responsible for the completion of a DI-1202 Fire Report as well as Crew Time Reports for all personnel assigned to an incident and return these reports to the Assistant Manager. The IC or burn boss should include a list of all expenses and/or items lost on the fire and a list of personnel assignments on the DI-1202. The Zone FMO will enter all data into the FMIS computer database within 10 days after the fire is declared out. The Zone FMO will also inform the timekeeper of all time and premium pay to be charged to the fire and ensure expended supplies are replaced. In addition, the following provisions will apply:

- # Utilize existing roads and trails, bodies of water, areas of sparse or non-continuous fuels as primary control lines, anchor points, escape routes, and safety zones.
- # When appropriate, conduct backfiring operations from existing roads and natural barriers to halt the spread of fire.
- # Use burnouts to stabilize and strengthen the primary control lines.
- # Depending upon the situation, either direct or indirect attack methods may be employed. The use of backfire in combination with allowing the wildfire to burn to a road or natural firebreak would be least damaging to the environment. However direct attack by constructing control lines as close to the fire as possible may be the preferred method to establish quicker control.
- # Retardants may be used on upland areas.
- # Constructed fire line will be rehabilitated prior to departure from the fire or scheduled for rehabilitation by other non-fire personnel.
- # The Incident Commander will choose the appropriate suppression strategy and technique. As a guide: On low intensity fires (generally flame lengths less than 4 feet) the primary suppression strategy will be direct attack with hand crews and engines. If conditions occur that sustain higher intensity fires (those with flame lengths greater than 4 feet) then indirect strategies that utilize back fires or burning out from natural and human-made fire barriers may be utilized. Those barriers should be selected to safely suppress the fire, minimize resource degradation and damage and be cost effective.
- # The use of earth-moving equipment for suppression activities (dozers, graders, plows) on the Refuge will not be permitted without the approval of the individual Refuge Manager or his/her designated representative in the event of their absence.
- # All areas in which wildfires occur on the Refuge or Refuge administered lands will be evaluated prior to the aerial or ground application of foams and/or retardants. Only approved chemical foams and retardants will be used (or not used) in sensitive areas such as those with riparian vegetation.
- # Hazard reduction prescribed fires may be used in fire adapted communities that have not had significant fire for more than twice the normal fire frequency for that community type.
- # Utilization of heavy equipment during high intensity fires will be allowed only with the approval of the individual Refuge managers of the Refuge.
- # Wild fire use for resource benefit will not be utilized.
- # Engines will remain on roads and trails to the fullest extent possible.
- # Whenever it appears a fire will escape initial attack efforts, leave Service lands, or when fire complexity exceeds the capabilities of command or operations, the IC will take appropriate, proactive actions to ensure additional resources are ordered. The IC, through dispatch or other means, will notify the Refuge FMO of the situation. With Zone FMO assistance the Refuge Manager will complete a Wildland Fire Situation Analysis (WFSA) and Delegation of Authority.

The IC will be responsible for mop-up and rehabilitation actions and standards on Refuge fires. Refuge fires will be monitored until declared out.

Rehabilitation of suppression actions will take place prior to firefighters being released from the fire. Action to be taken include: 1) All trash will be removed; 2) Fire lines will be refilled and water bars added if needed; 3) Hazardous trees and snags cut and all stumps cut flush; and 4) Damage to improvements caused by suppression efforts will be repaired, and a rehabilitation plan completed if necessary. Service policy states that only damage to improvements caused by suppression efforts can be repaired with fire funds. Service funds cannot be used to repair damage caused by the fire itself (i.e. burnt fence lines). If re-seeding is necessary, it will be accomplished according to Service policy and regulations.

2.3.6.2 Listed Species and Other Species of Interest

Chapter 3 of this EA describes the current status of fish and wildlife in and near the Refuge. The discussion highlights one threatened species (Bald Eagle) found on the Refuge in addition to other species of interest described in Chapter 3. In all alternatives the present acreage of bottomland forest and mature cottonwood stands are maintained for Bald Eagles. The current acreage of wet prairie, which benefits eastern Massassauga rattlesnakes, is maintained in all alternatives, except Alternative B where the acreage increases.

Section 7 of the Endangered Species Act outlines a mechanism for ensuring that actions taken by Federal agencies do not jeopardize the existence of any listed species. We conducted a “Section 7" review concurrent with the review of the draft CCP.

2.3.6.3 Archaeological and Cultural Resource Values

As part of its larger conservation mandate and ethic, the Service through the Refuge Manager applies several historic preservation laws and regulations to ensure historic properties are identified and are protected to the extent possible within its established purposes and Refuge System mission.

The Refuge Manager early in project planning for all undertakings, informs the RHPO (Regional Historic Preservation Officer) to initiate the Section 106 process. Concurrent with public notification and involvement for environmental compliance and compatibility determinations if applicable, or cultural resources only if no other issues are involved, the Refuge Manager informs and requests comments from the public and local officials through presentations, meetings, and media notices; results are provided to the RHPO.

When the Service and one or more other Federal agencies have Section 106 responsibilities, the Service initiates the procedures in 36 CFR Part 800 independently of other agencies unless a lead Federal agency has been determined.

Archeological investigations and collecting are performed only in the public interest by qualified archeologists or by persons recommended by the Governor working under an Archaeological Resources Protection Act permit issued by the Regional Director. The Refuge Manager has found this third-party use of Refuge land to be compatible. The requirements of ARPA apply to Service cultural resources contracts; the contract is the equivalent of a permit. The Refuge Manager issues special permits for archeological investigations. Refuge personnel take steps to prevent unauthorized collecting by the public, contractors, and Refuge personnel; violators are cited or other appropriate action taken. Violations are reported to the Regional Historic Preservation Officer.

Chapter 3: Affected Environment

3.1 Description Of Squaw Creek National Wildlife Refuge

This chapter provides a brief introduction to the existing physical and social environment of Squaw Creek NWR, including the location, size and habitat of the Refuge, geomorphology, sedimentation and water quality, soils, habitat, wildlife, public use activities, the social environment and cultural resources that are known to exist on Refuge lands. Greater detail on the affected environment is provided in Chapter 3 of the comprehensive conservation plan.

The Refuge is a 7,415-acre area of wetlands, wet and mesic prairie, bottomland forest, and upland forest. It lies in the floodplain of the Missouri River and extends into the hillside prairie and woodlands of the Loess Hills of northwestern Missouri.

3.2 Habitat Overview

Squaw Creek NWR is part of what once was a large natural marsh in the Missouri River floodplain and historically was heavily used by waterfowl and other migratory birds during their spring and fall migrations. Today, the Refuge supports a diverse array of upland and floodplain habitat. Habitats include islands, marshes, moist soil, open waters, bottomland forests, croplands, wet and mesic prairie, and upland forest that assist a variety of birds, mammals, amphibians, reptiles and fish in their life cycles.

Throughout the area surrounding the Refuge, the most historically prevalent and now highly impacted habitat types are wet and mesic prairie, bottomland and upland forest, and aquatic vegetation.

Trees and other plants include Eastern red cedar, Eastern cottonwood, black willow, silver maple, smooth sumac, coralberry, false indigo, swamp milkweed, blue wild indigo, swamp buttercup, monkeyflower, blue lobelia, downy painted cup (Indian paintbrush), prairie larkspur, dotted blazing star, hoary puccoon, round-headed bush-clover, soaptree yucca, prairie ragwort, goldenrods, sunflowers, asters, and numerous grasses (including big and little bluestems, and hairy grama).

3.2.1 Forested Resources

The Refuge has approximately 1,000 acres of bottomland forest and 375 acres of loess hill forest. Common trees on the Refuge include Eastern red cedar, Eastern cottonwood, black willow, and silver maple.

3.2.2 Wetland Resources

The Refuge is impounded by a dam. Water management within this main dam is a result of small dikes and levees that subdivide the wetlands into marshes and moist soil units. The compartmentalizing counters the effects of long term siltation within the upper end of the large marsh created in the early 1940's. In addition to the managed wetlands, there are about 175 acres of semi-natural wetlands on the Refuge.

The Refuge contains 15 independently managed marshes in 10 designated pools of approximately 3,400 acres and 14 independently managed lowlands in three designated moist soil units of approximately 350 acres. Water levels are manipulated in each of the marshes and moist soil units to provide water depths and vegetative conditions attractive to spring and fall migrating waterfowl as well as to provide nesting habitat for waterfowl and a variety of marsh and water birds during the summer. The moist soil units are drawn down to encourage moist soil plant production and/or to prescribe burn and to permit mechanical vegetative control.

3.2.3 Grassland Resources

Grasslands on the Refuge consist of approximately 290 acres of bottomland mesic prairie, 220 acres of loess hill prairie, and 1,077 acres of wet prairie.

The diversity of plants on the Refuge includes such plants as smooth sumac, coralberry, false indigo, swamp milkweed, blue wild indigo, swamp buttercup, monkeyflower, blue lobelia, downy painted cup (Indian paintbrush), prairie larkspur, dotted blazing star, hoary puccoon, round-headed bush-clover, soaptree yucca, prairie ragwort, goldenrods, sunflowers, asters, and numerous grasses (including big and little bluestems, 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, and white snakeroot.

3.2.4 Invasive Species

Non-native mammals, birds, insects, mollusks, fish and plants have been introduced to the Refuge during the past 100 years. Exotic, invasive or alien species cause vast ecological and economic damage, sometimes impacting human health. These species range across almost every ecosystem of the country. Invading species are usually very successful when introduced to a new environment because they have no natural enemies, and they can usually find a niche to exploit.

Many areas of the Squaw Creek NWR have noxious and exotic weeds that are controlled biologically, mechanically, physically and chemically. Missouri has State noxious weed laws that require public land managers to control specific weeds including marijuana (*Cannabis sativa*), musk thistle (*Carduus nutans* L.), Canada thistle (*Cirsium arvense*), Johnson grass (*Sorghum halepense*), field bindweed (*Convolvulus arvensis*) and purple loosestrife (*Lythrum salicaria*).

The Service has made prevention and control of invasive plant and animal species a top priority. It is the policy of the Department of Interior, the Service and Region 3 that all reasonable steps should be taken to minimize or, when feasible, eliminate dependence on chemical pest control agents. Reduction of chemical usage on Service lands is unquestionably the best thing to do for the resources in our care.

3.2.5 Sedimentation and Water Quality

Water resources for the Refuge include gravity flow from Squaw Creek, gravity flow from Davis Creek, and a well and pump on the Rice Paddy moist soil unit and in Mallard Marsh. Silt from the five creeks that converge to become Squaw Creek and Davis Creek is a primary concern for the Refuge. Chemicals from non-point agricultural sources are also a concern for their affect on Refuge wetlands.

3.2.6 Geomorphology and Soils

3.2.6.1 Geomorphology

The Refuge lies in a area that has been shaped by glaciers, water, and wind. The area has been studied and described by the Geological Survey and Resource Assessment Division of the Missouri Department of Natural Resources.

During the last period of glaciation, called the Wisconsin glaciation, the exposed rocks of northern Missouri, eroded by earlier glacial advances, were scoured again by advancing ice sheets. The result of glacial scouring is a combination of pre-glacial and postglacial eroded surfaces.

Glacial till or drift, composed of sand, clay, silt, gravel, cobbles, and boulders, deposited on the surface and in valleys that were eroded earlier, can be quite thick, up to several hundred feet. These glaciated plains and glacial till are constantly being eroded by rainfall and dissected by runoff, gradually destroying the formerly nearly level topography. The drainage pattern consists of nearly parallel streams trending north-south toward the Missouri River, the major drainage stream.

In the glaciated area, particularly near the Missouri River, post-glacial winds carried large quantities of fine silt into the air, subsequently depositing it in the "river hills." These deposits are a noticeable characteristic of the landscape along I-29 from Kansas City to Iowa. The silty material, deposited in wind-blown drifts (like sand dunes, but finer-grained), is called loess. Because of the way the silt particles were wind-deposited, the particles are "stacked" vertically, and when these deposits must be excavated, as in road-building, the road cuts are typically vertical, rather than sloped, to reduce erosion by storm water runoff. (Water Resources Report Number 61)

3.2.6.2 Soils

The soils of the Refuge fall into three major associations. The slope, depth, drainage, and other characteristics of the soils can differ within an association. The association gives a general idea of soil characteristics. More detailed soil descriptions are needed to evaluate the suitability of a site for specific projects such as building or road construction.

The west and central portion of the Refuge occupies the Luton-Wabash-Blencoe Association. This association is characterized as nearly level, poorly drained and somewhat poorly drained, clayey soils that formed in alluvium; on high flood plains along the Missouri River. The area of the Refuge between the previous association and the hills occupies the Motark-Dupo-Dockery Association, which is nearly level, moderately well drained and somewhat poorly drained, silty soils that formed in alluvium; on flood plains. The soils in this association are on flood plains along secondary streams that cross the Missouri River flood plain. The eastern portion of the Refuge occupies the Timula-Monona-Napier Association. This association is characterized as very gently sloping to steep, well drained, silty soils that formed in loess and slope alluvium; on uplands and foot slopes. The soils in this association are on very dissected, narrow, branching ridgetops, on steep gullied side slopes, and on the lower foot slopes adjacent to the Missouri River flood plain. (USDA, NRCS)

3.3 Wildlife

3.3.1 Migratory Bird Species

The Refuge bird list (see Appendix C) contains species that have been recorded on the Refuge. Another 33 birds, listed under "Accidental" birds, have been reported but are not normally expected to be present.

Waterfowl are the most prominent and economically important group of migratory birds using the Refuge. Non-consumptive use of bird resources also is important on the Refuge. Birdwatching on the Refuge accounted for approximately 25 percent of public-use days in 2001.

3.3.2 Fish Species

The Refuge lies within the floodplain of the Missouri River. Temporary wetlands do not typically hold enough water to support fisheries, and species found at Squaw Creek NWR come mostly from Davis Creek and Squaw Creek. There are at least 10 species of fish present on the Refuge. About three species are common or abundant in certain pools or reaches. Carp, gar and bullhead are the most common species. Although the Refuge still hosts most of the species that were present historically, the relative abundance and distribution of some species has changed dramatically in the last 100 years. Some of these changes are attributable to events such as the introduction of the common carp, reduction in overall wetland abundance, and sedimentation.

Species found on the Refuge include: shortnose gar, common carp, smallmouth buffalo, largemouth buffalo, river carpsucker, channel catfish, black bullhead, largemouth bass, white crappie, and green sunfish.

3.3.3 Freshwater Mussels

Four species of freshwater mussels have been recorded on the Refuge: Yellow sandshell (Davis and Squaw creeks); Giant floater (Davis and Squaw creeks); Pondhorn (Davis and Squaw creeks); and Fingernail Clam, which are present in wetlands. Freshwater mussels are typically found buried in the substrate in beds containing several different species with similar habitat requirements. Most of these species require flowing water and coarse gravelly substrates, although some survive well in silty, lake-like conditions in backwaters. Water and sediment quality are important habitat criteria for mussels.

3.3.4 Mammals

Squaw Creek NWR is home to many resident mammal species. A total of 34 mammals have been observed on the Refuge since 1935 by Refuge personnel and visiting mammalogists (see Appendix C). An additional 13 mammals have been documented as occurring in nearby counties.

Bats found on the Refuge include the little brown bat, big brown bat, red bat, and hoary bat.

3.3.5 Upland Game Birds

Four species of upland game birds – Northern Bobwhite, Ring-necked Pheasant, Wild Turkey and Mourning Dove – reside on Refuge lands (see Appendix C).

3.3.6 Amphibians and Reptiles

Thirty-five species of amphibians and reptiles are known to use the Refuge. Species regularly seen are common snapping turtles, painted turtles, box turtles, fox snakes, water snakes and various garter snakes (see Appendix C).

3.3.7 Federally Listed Threatened and Endangered Species

3.3.7.1 Mammals

No Federally listed endangered or threatened mammal species occur on the Refuge, however the Indiana bat has been recorded in adjoining counties.

3.3.7.2 Birds

Federally listed threatened and endangered species sighted in the recent past have included the Peregrine Falcon, Piping Plover, Least Tern and Bald Eagle.

The interior Least Tern was federally listed as endangered in May 1985. The interior population of the Least Tern (*Sterna antillarum athalassos*) currently nests in the Mississippi, Missouri and Rio Grande River basins from Montana south to Texas, and from eastern New Mexico and Colorado to Indiana and Louisiana. Loss of sandbar habitat due to dams, river channelization, and water level changes has caused a decline in interior Least Tern populations. Undisturbed sandbars are critical for successful Least Tern nesting. Predation, flooding and recreational activities on sandbars can cause nest disturbance and abandonment.

The Piping Plover (*Chadarius melodus*) (Great Plains Population) is rarely seen on Squaw Creek NWR. Piping Plovers nest in coastal areas, but they are also prairie birds, nesting across the Great Plains of the United States and Canada, but in perilously low numbers. The Great Plains population is listed as threatened. The loss of sandbar habitat and 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.

The formerly listed Peregrine Falcon uses the Refuge, as well.

The Bald Eagle, a federally listed threatened species, nests in three sites on the Refuge. From mid-November into January, 250 to 400 Bald Eagles commonly gather at the Refuge, preying upon weak and dying waterfowl and roosting in the large cottonwood trees. This is one of the largest wintering eagle concentrations in the lower 48 states.

3.3.7.3 Reptiles

A number of Missouri state-listed endangered and threatened species are found on the Refuge, including the Eastern Massassauga rattlesnake, Blanding's turtle and Western fox snake. Squaw Creek NWR is most likely the home of the last viable breeding population of the Eastern Massassauga rattlesnake, which is also a candidate species for federal listing.

Candidate species are plants and animals for which the Service has sufficient information on their biological status and threats to propose them as endangered or threatened under the Endangered Species Act (ESA), but for which development of a listing regulation is precluded by other higher priority listing activities.

The Candidate Conservation Program provides a means for conserving these species. Early conservation preserves management options, minimizes the cost of recovery, and reduces the potential for restrictive land use policies in the future. Effective candidate conservation may reverse the species' decline, ultimately eliminating the need for ESA protection.

Candidate species receive no statutory protection under the ESA. However, the Service encourages the formation of partnerships to conserve these species because they are by definition species that may warrant future protection under the ESA.

3.3.7.4 Plants

No Federally endangered or threatened plant species occur on the Refuge.

3.4 Public Use

The 1997 Refuge System Improvement Act gives priority to six wildlife-dependent recreational uses of national wildlife refuges when these uses are compatible with the purposes for which the refuge was established. These uses include hunting, fishing, wildlife photography, wildlife observation, environmental education and interpretation.

The Refuge is open daily during daylight hours. There is no entrance fee. The Refuge headquarters/ visitor contact station is open on weekdays, except national holidays. Open-house weekends for public visitation are held during spring and autumn migration periods. Volunteers, who staff the visitor contact station, provide information and conduct sales of educational materials.

Visitor activities include birdwatching, photography, hiking, viewing interpretive exhibits in the visitor contact station, environmental education programs for teachers and student groups, and driving the 10-mile Wild Goose Interpretive Auto Tour Loop (but periods of rain can make Refuge roads impassable). Visitors fish on the Refuge. In the fall visitors pursue white-tailed deer as part of the Refuge's managed hunt. Camping is not permitted on the Refuge. Campground facilities are available at nearby Big Lake State Park.

A wheelchair-accessible observation tower overlooking the 900-acre Eagle Pool provides an excellent opportunity for wildlife watching and photography. Hiking opportunities include the wheelchair-accessible half-mile Mike Callow Memorial Trail from Refuge headquarters to the base of the Loess Bluff grasslands; the 0.5-mile Loess Bluff Interpretive Trail near headquarters; and the 1.5-mile Eagle Pool Trail between Eagle and Pelican pools. In early December, the Refuge and the Missouri Department of Conservation co-sponsor “Squaw Creek Eagle Days” the first full weekend in December. This weekend event features special educational programs, displays, and eagle-viewing opportunities.

The Refuge, located in a rural region, is within 30 miles of a St. Joseph, Missouri, and within 100 miles of Kansas City, Missouri. The population of the two urban areas exceeds half a million people. With a new addition to the Refuge office and visitor center, the potential exists for the Refuge to play a greater role as an educational resource and wildlife observation destination.

3.5 Socioeconomics

The National Environmental Policy Act (NEPA) of 1969 requires agencies to disclose to decision makers and to the public what society gains or loses with projects that have the potential of altering the environment. In addition, Executive Order 12898 requires agencies within the Department of Interior to evaluate whether any notable impacts to minority and low-income populations and communities will occur with the proposed project action.

Based upon 2000 census data (or as indicated), Holt County can be characterized by the following statistics:

- Population 5,268 (2001 data); a reduction of 1.6 percent from 2000 data
- 99.1 percent are white with the balance other races
- Median age 41.8
- 26.2 percent 19 years old or younger
- 24.2 percent 62 years old or older
- 81.9 percent of persons over 25 years old are high school graduates

- # 11.7 percent of persons over 25 years old have a bachelors degree or higher
- # 23 minutes mean travel time to work for workers over 16 years old
- # Farmland (1997) 231,040 acres (78 percent of county area)
- # Personal income per capita (1999) $15,876
- # Median household income (1999) $29,461

Agricultural land dominates Holt County, representing 78 percent of land. In 2002, 105,700 acres of soybeans and 94,900 acres of corn were planted in the county (Missouri Agricultural Statistics Service). Other prevalent land use includes grassland and deciduous upland mixed oak forest.

The Service produced "Banking on Nature: The Economic Benefits to Local Communities of National Wildlife Refuge Visitation." This 1997 report, which was updated in 2002, is the first of a multi-phase study investigating the impact of national wildlife refuges on their local economies. It is a broad spectrum report that discusses the income and employment effects that recreational visitors to refuges have on the economies of local regions. In addition to the economic effects of refuge hunting and fishing programs in local communities, it measures the economic impact of eco-tourism, the relatively recent phenomenon of large numbers of people traveling substantial distances to take part in non-consumptive uses of the natural environment. Eco-tourism is one way to derive economic benefits from the conservation of wildlife and habitat.

The study found that recreational visits to national wildlife refuges generate substantial economic activity. In fiscal year 2002, people visited refuges more than 35.5 million times for recreation and environmental education. Their spending generated $809.2 million of sales in regional economies. As this spending flowed through the economy, more than 19,000 people were employed and $315.2 million in employment income was generated.

3.6 Archeological and Cultural Values

Holt County contains a site with evidence of the Paleo people, the Grundel Mastodon site 25-HO-11. The earliest commonly accepted cultural period in Missouri is the Paleo Period (and Dalton), 12,000-7,000 B.C.; various points of this culture have been found in Holt County. Thus, sites along the Mississippi and Missouri rivers could be deeply buried in the Refuge area; a private collector has a Dalton-type point reportedly from the Derr tract on the Refuge. For the Archaic culture, 7000-1000 B.C., numerous sites have been reported in Holt County but not within the Refuge; but again, the private collector has material reportedly from the Derr tract. The Altithermal, a significantly warm period, peaked just prior to 2000 B.C., resulting in Archaic cultural changes. The Woodland culture, 1,000 B.C.-A.D. 900, is represented by numerous sites in Holt County and a few within the Refuge. People during this period developed pottery and the bow-and-arrow, buried their dead in mounds, and commenced gardening. Late prehistoric Mississippian (e.g., Oneota) sites have been reported in Holt County.

In the early historic period the Sac and Fox tribes claimed territory that includes the Refuge. The Missouria and Oto tribes migrated into Missouri around 1673, but apparently did not stay long. By the early 19th century the Kansa tribe occupied the Refuge area. The Kickapoo and Delaware may have been in the Refuge area, too. The Refuge area is in the Royce Cession 151, a common hunting area for tribes created as a result of the Treaty of Prairie du Chien in 1830. But in 1833 the U.S. Government settled the Potawatomi in this area until it became state property in 1837. No Indian sites from this period have been reported in Holt County.

The cultural history of Service properties within the Squaw Creek Management District (e.g., Worth County), appears to be much the same as for the Refuge, except no sites have been identified on any of these properties.

The Refuge benefited from the 1930s New Deal federal employment efforts. A Civilian Conservation Corps (CCC) camp was located 5 miles north of the Refuge in Mound City. Corpsmen constructed a number of facilities, including the Loess Bluff hiking trail, using flagstone rock for the steps, a shelter at the top of the bluff trail, the south dam and water control structure, the flagstone rock wall around the present parking lot, an equipment building and a major portion of the auto tour route. In 1940 and 1941, men from the Works Progress Administration (WPA) constructed the rest of the building, including a horse barn, a chicken coop, shop, fur house, corn crib, headquarters building, garage, grain shed, dragline shed, and pump house.

Cultural resources investigations have covered approximately 550 acres of the Refuge and 35 acres of management district land. These studies and other sources have identified 12 sites, including the headquarters complex, on the Refuge. Sites within the pools can be anticipated but would be deeply buried. Sites on the adjacent uplands, based on the survey of the Derr tract, are likely numerous and shallow.

No National Register properties are located on the Refuge or the management district. As of April 1, 2003, four properties are listed in Holt County, none being indicative of what might be found on the Refuge. Andrew County contains three, Daviess County contains three, Gentry County contains three, Mercer County contains two, and Worth County contains one National Register property.

The following listed Indian tribes have been recognized by the Federal government or self-identified by the tribe as having a potential concern for traditional cultural resources, sacred sites, and cultural hunting and gathering areas in the counties in which the Refuge and management district are located.

Andrew, Holt, and Worth counties:

- Iowa Tribe of Kansas and Nebraska
- Iowa Tribe of Oklahoma
- Omaha Tribe of Nebraska
- Otoe-Missouria Tribe of Indians
- Sac & Fox Nation of Missouri in Kansas and Nebraska
- Sac & Fox Nation of Oklahoma
- Sac & Fox Tribe of the Mississippi in Iowa

Daviess and Mercer counties:

- Iowa Tribe of Kansas and Nebraska
- Iowa Tribe of Oklahoma

Gentry County: None

Although Indian tribes are generally considered to have concerns about traditional cultural properties, other groups such as church congregations, civic groups, and county historical societies could identify similar concerns.

The Refuge archeological collections contain prehistoric artifacts currently not associated with any modern tribe. The collections contain no human remains and no recognized funerary objects, sacred

objects or objects of cultural patrimony as defined in the Native American Graves Protection and Repatriation Act. Although sites of historic period Indian occupation have not been identified on the Refuge, they could be located and could contain cultural items.

The Refuge has museum collections that are managed under a Region-wide Scope of Collection Statement (10-31-94). To date, one archeological investigation has produced 94 artifacts from Refuge lands; artifacts are stored at the University if Missouri, Columbia, under a cooperative agreement. Artifacts are owned by the Federal Government and can be recalled by the Service at any time. The Refuge has an on-site collection of 83 zoological specimens.

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 conserve fish, wildlife, and plant resources.

Chapter 4: Environmental Consequences

4.1 Effects Common to All Alternatives

4.1.1 Environmental Justice

Executive Order 12898 "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" was signed by President Bill Clinton on February 11, 1994, to focus Federal attention on the environmental and human health conditions of minority and low-income populations with the goal of achieving environmental protection for all communities. The Order directed Federal agencies to develop environmental justice strategies to aid in identifying and addressing disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations. The Order is also intended to promote nondiscrimination in Federal programs substantially affecting human health and the environment, and to provide minority and low-income communities access to public information and participation in matters relating to human health or the environment.

None of the proposed management alternatives disproportionately place an adverse environmental, economic, social, or health impacts on minority or low-income populations.

4.1.2 Archaeological and Cultural Values

The activities that are most positive for cultural resources are those that reduce or eliminate activities on the Refuge. In general, recreation activities and invasive species control have little potential to affect cultural resources and are envisioned as having a neutral effect on cultural resources. However, non motorized use of trails may have a negative impact on cultural resources by increasing visitor traffic to sensitive cultural areas. Cultural resources are sensitive to ground disturbing activities. Activities that may have a negative impact on cultural resources include farming, dredging, and construction of new trails or facilities. Fire suppression activities can also damage archaeological sites if new roads and firelines are constructed while combating the fire.

The impacts of the alternatives on cultural resources were evaluated with the assumption that significant, but as yet unidentified, cultural resources may occur on the Refuge. Under any alternative, site specific actions such as construction of facilities will be subject to additional environmental review in accordance with the National Environmental Policy Act, which affords protection to significant cultural resources as prescribed by the National Historic Preservation Act and other applicable regulations and guidelines. Although avoidance is the preferred approach, mitigation of effect is an acceptable treatment and development activities may, therefore, result in a net loss of resources.

4.1.3 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 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 to be considered in planning. The U.S. Department of Energy's "Carbon Sequestration Research and Development" (U.S. DOE, 1999) defines carbon sequestration as "...the capture and secure storage of carbon that would otherwise be emitted to or remain in the atmosphere."

The land is a tremendous force in carbon sequestration. Terrestrial biomes of all sorts (grasslands, forests, wetlands, tundra, perpetual ice and desert) are effective both in preventing carbon emission and acting as a biological "scrubber" of atmospheric carbon monoxide. 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.

Preserving natural habitat for wildlife is the heart of any long range plan for national wildlife refuges. The actions proposed under any of the alternatives would conserve or restore land and water, and would thus enhance carbon sequestration. This in turn contributes positively to efforts to mitigate human-induced global climate changes.

4.1.4 Prescribed Fire as a Management Tool

The Refuge's Fire Management Plan (FMP) provides additional detail beyond what is captured in this section and will be adopted through this EA.

4.1.4.1 Social Implications

Prescribed burns will have an effect on the local public. Public concern is noticed every time a fire is set. A prescribed burn will effect and benefit the local community in many ways. These benefits must be explained to the public at every opportunity.

A prescribed burn on the Refuge will be a direct benefit to the public in creating recreational opportunities through increased wildlife populations for hunting and observation. If a wildfire is started on or near the Refuge, the areas that were previously prescribed burned and the firebreaks intended for prescribed burning will be of extreme benefit in controlling the fire.

The aspect of the fire that will solicit the most public concern will be the smoke. Smoke from a Refuge fire could impair visibility on roads and become a hazard. Actions to manage smoke include: use of road guards and car, signing, altering ignition techniques and sequence, halting ignition, suppressing the fire, and use of local law enforcement as traffic control. Burning will be done only on days that the smoke will not be blown across the community or when the wind is sufficient as not to cause heavy concentrations.

If Missouri institutes smoke regulations, the FMP will be amended to ensure consistency with those regulations. Combustion of fuels during prescribed fire operations may temporarily impact air quality, but the impacts are mitigated by small burn unit size, the direction of winds the burns are conducted with, and the distance from population centers. All efforts will be taken to assure that smoke does not impact smoke sensitive areas such as roads and local residences. In the event of wind direction changes, mitigative measures will be taken to assure the public safety and comfort. Refuge staff will work with neighboring agencies and in consultation with State air quality personnel to address smoke issues that require additional mitigation.

The fire prescription portion of the Annual Prescribed Fire Plan for each unit proposed to be burned during the burning season will have specific mitigative measures to deal with unexpected smoke management problems. This will include identified problems that unforecasted wind changes may cause and measures to be employed to protect the public.

Public concern may arise with any kind of smoke from the Refuge. This concern can be relieved only by a concerted effort by Refuge personnel to carefully inform the local citizens about the prescribed burning program. Emphasis will be placed on the benefits to wildlife as well as the safety precautions in effect. Formal interpretive programs both on and off the Refuge, explaining the prescribed burning program, will be encouraged.

4.1.4.2 Archaeological and Cultural Values

There may be archaeological sites within prescribed burn units. When these units are burned, it is doubtful that the fire will have any adverse impact on the sites. The fire will be only a temporary disturbance to the vegetation in the area and in no way destroy or reduce the archeological value. All artifacts are buried well beneath the surface. No above ground evidence exists. No known sites will be impacted by prescribed burning operations.

4.1.4.3 Flora

The prescribed burning program will have a visible impact on vegetation and the land. Immediately after a fire much of the land will be blackened. There will be no grasses or ground forbs remaining and most of the higher brush such as oak sprouts and willow will be bare of leaves. Trees will be scorched up to 20 feet above the ground. This will be particularly noticeable on the light colored bark of aspen and birch. There may be large areas up to 1 acre in size interspersed throughout the burn that are untouched by the fire. This may be a result of wet ground conditions or a break in fuel continuity.

Within 3 days after the burn, the grasses and forbs will begin to grow. The enriched soil will promote rapid growth such that after 2 or 3 weeks the ground will be completely covered. The willow and oak will, in many cases, re-sprout. The bases of the trees as well as the burned slash and stumps will be partially or completely covered by the new growth. Some of the less fire resistant trees will show signs of wilting and may succumb within a month or two. Generally, after one season any sign of the prescribed burn will be difficult to detect without close examination. After 2 or 3 years it will be virtually impossible to detect the presence of the fire.

Other more long lived signs will remain for an indefinite period of time. The firebreaks will not be allowed to grow over in order to realize their benefit during wildfires and future prescribed burns. Vehicle tracks through the burn are visible on the freshly burned ash and may be longer lived if the vehicle became stuck or created tire grooves in the ground. Travel across the burn area will be kept to a minimum. Vehicle travel may be necessary in some instances, such as lighting the fire lines or quickly getting water to an escape point. A fire plow will be used only in the event that a break-over does occur and cannot be controlled by any other method. The deep trench of the plow would leave a very long lived scar. This trench could be repaired by filling, which would eliminate it from view after 5 to 10 years.

4.1.4.4 Listed Species

The potential impacts of fire on listed species is likely to be positive, if there is any impact. Of the federally listed threatened and endangered species on or near the Refuge, three are birds (Bald Eagle, Piping Plover, and Interior Least Tern). Bald Eagles that roost, nest, and feed on the Refuge, if affected at all by burning, will only be so temporarily by smoke or human activity. Nesting trees will be protected and burning will not be conducted at a time or in a way to negatively impact any nesting eagles.

The Interior Least Tern favors sandbar habitat for nesting. This generally is not habitat that will be burned. If a burn were to be conducted to clear vegetation on a sandbar to benefit the Terns, it would be done at a time of the year that would not conflict with the Tern use of the area.

Squaw Creek NWR is within the historical range of the Massassauga rattlesnake. The Massassauga is a candidate species for listing. During a prescribed burn in 2001, Refuge staff discovered the snake in an area not previously believed to harbor the species. Eight snakes were killed in that burn, and since then we have continued snake research in an effort to avoid conducting spring burns in areas where there are snakes. While it is positive that the Eastern Massassauga rattlesnake appears to be thriving on the Refuge, populations expanding into new areas pose a problem for spring burns. The Refuge's prescribed burning program has been modified to account for any potential problems. Modifications include burning early in the spring, prior to the snakes emerging from their underground hibernation areas, as well as burning later in the fall after the snakes have gone back into hibernation.

We conducted a Section 7 review concurrent with the review of the draft CCP. The Section 7 review will examine the modified prescribed burning program.

Missouri is the southern edge of the Northern Great Plains population of Piping Plover. In this area, Plovers make their nests on beaches, sand bars, and dredged material islands of major river systems. The Northern Great Plains birds are federally listed as threatened, and with approximately 1,398 breeding pairs it is the largest population of Piping Plovers in the United States. Beaches, sandbars and islands are not typically locations where prescribed burns are conducted. If a burn were to be conducted in this kind of habitat, it would be scheduled so that conflict with the Plovers would be avoided.

4.1.4.5 Soils

The effect of fire on the soil depends largely on the fire intensity and duration. On areas with high fuel loads, a slow backing fire is usually required for containment and desirable results. The intense heats generated by this type of fire will have a greater effect on the soils than fast, cool head-fires used on farm fields and wildlife openings. The cool, moist soils of wetter areas in the burn units or areas with little fuel will be unaffected by the fire.

The severity of damage to the soil depends to a great degree on the thickness and composition of the organic mantle. In cases where only the top layer of the mantle is scorched or burned, no damage will result to the soil below. This is usually the case in forested areas.

In open areas such as dry grassland or wet meadow sites, the blackening of the relatively thin mantle will cause greater heat absorption and retention from the sun. This will encourage earlier germination during the spring growing season. Nutrient release occurs as a result of the normal decomposition process. Fire on the soil will greatly speed up the process. The rate and amount of nutrients released will be dependent on the fire duration and intensity as well as the amount of humus, duff and other organic materials present in the mantle. The increase, immediately after a burn, of calcium, potash, phosphoric acid and other minerals will give the residual and emergent vegetation a short-term boost. However, the rapid leaching through the sandy soils will cause rapid runoff of these nutrients and only short-term benefits. The increased nutrification of the soil by the emergent vegetation and increased nutrient release result in rapid regrowth of grasses and other succulent vegetation on the sites.

There is no evidence to show that the direct heating of the soil by the burning of material above it with a fire of low intensity has any significant adverse effect. Fire of this type has little total effect on the soils and, in most cases, would be beneficial.

4.1.4.6 Escaped Fire

With any prescribed fire there always exists the possibility of its escape into the surrounding area. This can be caused by one or more factors that may or may not be preventable. Inadequate firebreaks,

too few personnel, unpredicted changes in weather conditions, peculiar fuel type, being in too big a hurry, and insufficient knowledge of fire behavior are a few factors which could cause loss of control. An escaped fire could turn into a very serious situation. The damage that could result would be much less severe on the Refuge than if it encroached on private land where buildings, equipment, and land improvements would be involved. Many of the prescribed burn areas are well within the Refuge and of minimal threat to private or other improved lands in the event of an escape. Extreme care, careful planning, and adherence to the unit prescription will be exercised when prescribed burning all units, particularly when burning areas that are near or adjacent to the Refuge boundary.

In the event that a prescribed fire does jump a firebreak and burn into unplanned areas, there is a high probability of rapid control with minimal adverse impact. The network of firebreaks and roads will greatly assist in rapid containment. In most cases all of the Refuge fire fighting equipment will be immediately available at the scene with all nearby water sources previously located. The applicable DNR fire suppression crews and local fire departments will always be notified of a prescribed burn. Thus, maximum numbers of experienced personnel and equipment are immediately available for wildfire suppression activities.

4.1.5 Trapping

Trapping is occasionally used as a management tool under permit or by Refuge staff. Removing beaver that are plugging water control structures or muskrats, beaver, or woodchucks that are damaging dikes by undermining them with tunnels are examples of management uses for trapping. The direct impact upon the animal trapped is fatal, but impacts on the overall population of the species in the area is negligible due to the small number of animals taken and the restricted areas trapped.

4.1.6 Snow Goose Management

All five alternatives propose to assist in international efforts to reduce the mid-continent population of Snow Geese by 5 percent each year. While this action would result in higher Snow Goose mortality in the short-term, this course is likely to improve the species as a whole. The mid-continent population is experiencing a “perilous abundance” and numbers are beyond the carrying capacity of the nesting grounds in Canada. Reducing the Snow Goose population is essential to the long-term health of the population.

4.1.7 Squaw Creek Wildlife Management District

All five alternatives would benefit migratory game birds and non-game birds as well as resident species by developing, improving and maintaining native riparian, wetland, and grassland habitats consistent with the existing dominant non-agricultural structure. Soil and water conservation would benefit by converting land to a natural state.

4.2 Alternative A: Current Management Practices (No Action)

Under this alternative there would be no major change in Refuge goals, objectives, and strategies.

4.2.1 Listed and Other Species of Interest

Under this alternative, Bald Eagles would benefit from the Refuge maintaining bottomland cottonwood forest areas and isolated mature cottonwood stands that provide nesting and roosting sites. The Eastern Massassauga rattlesnake would benefit somewhat because the Refuge would maintain existing wet prairie (1,077 acres) habitat. Piping Plovers and Least Terns, both of which use sandbars and beaches for nesting, would benefit less under this alternative because it does nothing to alleviate sedimentation, which is filling in these habitats. Some species would benefit if the Refuge is successful is gaining regional shorebird designation as more attention is given to shorebird species. While studies monitoring the Blanding's turtle would continue, habitat would continue to degrade as marshes filled with silt.

4.2.2 Wildlife and Habitat Resource Management

Alternative A would not drastically change wildlife and resource habitat management (see Table 3). Wetland, wet prairie, grassland and bottomland forest habitat acreages would change only slightly as the Refuge continued its current management trend toward less cropland. Current efforts to restore Loess Hill habitat would continue. All habitats would benefit from continued efforts to control invasive, exotic and nuisance species. Less habitat would be restored than under alternatives B, D, and E because only minor land acquisition would occur. All Refuge habitats would benefit from the Refuge working with private landowners on watershed improvements to reduce sedimentation caused by soil erosion. Wet prairie would be maintained at its current acreage; three of the four other alternatives would increase the amount of wet prairie on the Refuge.

Continuing current management would benefit wildlife species using the Refuge. Efforts to reduce sedimentation, manage bottomland uplands for waterfowl, work with others to reduce the Snow Goose population, and reduce the size of the deer herd on the Refuge will all improve the carrying capacity of Refuge habitat. Grassland birds and upland game birds would benefit from current grassland management, but not as much as under alternatives D and E, which provide somewhat more habitat.

4.2.3 Sedimentation and Water Quality

The Refuge would benefit from work with private landowners within the watershed to implement conservation practices that would reduce erosion and the resulting sedimentation.

4.2.4 Public Use and Education

Under Alternative A (as well as alternatives B and E), public use and education efforts would see modest improvement. Completion of the visitor center will likely attract some additional users and open some new opportunities to convey refuge messages. Interactive programs and facilities would be developed with a goal of accommodating 130,000 visitors a year. Refuge staff would maintain environmental education programs at 2003 levels, and wildlife observation facilities and programs would be improved to encourage greater participation and more interaction with visitors. Opportunities to hunt white-tailed deer would be increased as part of the effort to reduce the Refuge deer herd. Public use efforts would not seek to reach out to nontraditional Refuge users. Community awareness of the Refuge and Refuge goals might increase as greater focus is placed on involving volunteers and the Refuge's relationship with Friends of the Squaw Creek NWR.

Table 2: Landcover Acreages for Alternatives A, B, C, D and E

Habitat Description	Alternative A Current Management (No Action)	Alternative B Restore Historic Wet and Mesic Prairie	Alternative C Enhance Public Use with Current Resource Management Level	Alternative D Optimize Resource Management with Enhanced Public Use Level (Preferred Alternative)	Alternative E Intensive Wetland Management with Extreme Measures to Combat Sedimentation
Agricultural Field					
Agricultural Field	579	0	579	300	300
Bottomland Forest					
Alluvial Bottomland Hardwoods	865	865	865	865	865
Semi-permanently Flooded Alluvial Bottomland Hardwoods	112	112	112	112	112
Tree Row	23	23	23	23	23
Subtotal	1,000	1,000	1,000	1,000	1,000
Bottomland Mesic Prairie					
Bottomland Mesic Prairie	291	870	291	508	570
Developed Land					
Administrative Area	9	9	9	9	9
Channelized Drainage Ditch	135	135	135	135	135
Major Roads and Adjacent Right-of-ways	108	108	108	108	108
Subtotal	251	251	251	251	251
Loess Hill Forest					
Loess Hill Mixed Hardwood Upland Forest	366	366	366	366	366
Mixed Lowland Hardwood Forest	8	8	8	8	8
Tree Row	4	4	4	4	4
Subtotal	378	378	378	378	378
Loess Hill Prairie					
Eastern Gamma Grass Seed Prairie	75	75	75	75	75
Loess Hill Prairie	147	147	147	268	147
Subtotal	221	221	221	299	221
Managed Wetland					
Permanently Flooded Non-emergent Wetland	878	878	878	878	878

Table 2: Landcover Acreages for Alternatives A, B, C, D and E (Continued)

Habitat Description	Alternative A Current Management (No Action)	Alternative B Restore Historic Wet and Mesic Prairie	Alternative C Enhance Public Use with Current Resource Management Level	Alternative D Optimize Resource Management with Enhanced Public Use Level (Preferred Alternative)	Alternative E Intensive Wetland Management with Extreme Measures to Combat Sedimentation
Seasonally Flooded Emergent Marsh	2,531	349	2,531	2,531	2,531
Subtotal	3,403	1,227	3,403	3,452	3,403
Old Field					
Old Field	59	59	59	0	59
Wet Prairie					
Wet Prairie	1,077	3,259	1,077	1,077	1,077
Wetland					
Bulrush/Reed Canary Grass Wetland	148	148	148	148	148
Reed Canary Grass/Willow Wetland	24	24	24	24	24
Seasonally Flooded Emergent Marsh	5	5	5	5	5
Subtotal	176	176	176	176	176

4.3 Alternative B: Restore Historic Wet and Mesic Prairie

4.3.1 Listed and Other Species of Interest

Same as Alternative A, except that an increase in wet prairie habitat from 1,077 acres to 3,259 acres would likely benefit Eastern Massassauga rattlesnakes on the Refuge. Under Alternative B, more emphasis would be placed on monitoring the snakes to determine how they respond to habitat manipulation.

4.3.2 Wildlife and Habitat Resource Management

Under this alternative, 579 acres of cropland would be converted to grasslands or wet prairie, potentially benefitting waterfowl and grassland bird species. While waterfowl would lose cropland forage, converting it to natural vegetation would improve nesting habitat and provide more natural foods. This alternative, with its elimination of cropland, would have the most drastic effect of any alternative on the redistribution and dispersion of the large flocks of Snow Geese. More wet prairie would be conserved under this alternative than Alternative B, which would result in more habitat suitable to the eastern Massassauga rattlesnake.

We used a modeling process developed by USGS scientists (Rohweder et al. 2002) to examine the relative effects of different alternatives on selected wildlife that use the Refuge. For each species of interest, habitat potential for each land cover type was given a rank of 0, 1, 2 or 3 (no, low, medium,

and high potential, respectively). The acreage of each habitat times its value to that species or group of species was summed and divided by the entire refuge acreage (PSO=[(habitat potential Habitat A*acres of Habitat A)+(habitat potential Habitat B*acres of Habitat A)+...+(habitat potential Habitat Z*acres of Habitat Z)]/total refuge acreage). This resulted in a weighted average Potential Species Occurrence (PSO) score for each species or group of species for each alternative. For example, if the entire Refuge were high potential habitat for a given species, it would receive a PSO score of 3.0 (i.e. 3*total refuge acreage/total refuge acreage). If half of the Refuge were medium potential habitat for a given species, and half were low, it would receive a PSO score of 1.5. Habitat potential ranks were based on the integrated life cycle needs of each species as determined by FWS biologists. The land cover is based upon color infrared aerial photos taken in August, 2001 and classified by the Refuge biologist. The cover type data were manipulated using Geographic Information System (GIS) to develop the land cover alternatives.

In order to assess the broad impacts of the Comprehensive Conservation Plan, 30 bird and one reptile species were chosen to represent several important habitat types found on the Refuge (Table 3). We selected the species because they are Region 3 conservation priority species (USFWS 2002) that use the major habitat types on the Refuge. Potential Species Occurrence scores were calculated for Bald Eagle (threatened), Eastern Massassauga rattle snake, and six groups of species (six forest birds, six grassland birds, two secretive marsh birds, eight shorebirds, two wet prairie birds, and five species of waterfowl).

There was little difference under the various alternatives in Potential Species Occurrence scores for any one species or group of species except in Alternative B. Under that alternative, acreages were converted from cropland and wetland to prairie, with a slight increase in forest as well. That change in habitats benefits the Massassauga rattle snake, grassland birds, and forest birds. In response to this change in habitats under Alternative B, the PSO scores for the Bald Eagle, waterfowl, and secretive marsh birds declined.

Potential Species Occurrence scores are rough estimates of the effects of different alternatives and focus more on habitat quantity than quality. Factors not considered in this modeling process will also affect the value of a given habitat to wildlife. For example, the age a Refuge's habitats can affect their value to wildlife and will change as they continue to mature. would enhance these habitats for many wildlife species, but this is not reflected in the PSO scores.

4.3.3 Sedimentation and Water Quality

The Refuge would benefit from work with private landowners within the watershed to implement conservation practices that would reduce erosion and the resulting sedimentation. (Same as Alternative A.)

4.3.4 Public Use and Education

Under this alternative, we expect fewer visitors than in Alternative A. Because fewer Snow Geese would use the Refuge under this alternative, the Refuge would be less attractive as a destination for wildlife observation, especially to see large concentrations of birds. Environmental education and the other priority public uses would be the same as in Alternative A.

Table 3: Weighted Average Species Occurrence for Selected Species Groups

Species Group	Number of Species	Alternative A (No Action) Average	Alternative B Restore Historic Wetland Mesic Prairie	Alternative C Enhance Public Use with Current Resource Management.	Alternative D Optimize Resource Management. with Enhanced Public Use Level (Preferred Alt.)	Alternative E Intensive Wetland Management. with Extreme Measures to Combat Sedimentation
Forest Neotropical Migrants[1]	6	0.38	0.46	0.38	0.39	0.39
Forest Raptor[2]	1	1.36	0.77	1.36	1.36	1.36
Grassland Birds[3]	6	0.32	0.82	0.32	0.40	0.39
Secretive Marsh Birds[4]	2	1.49	0.79	1.49	1.50	1.50
Shorebirds[5]	8	1.07	0.52	1.07	1.07	1.07
Waterfowl[6]	5	1.47	0.67	1.47	1.48	1.48
Wet Prairie Birds[7]	2	0.47	0.51	0.47	0.48	0.49
Wet Prairie Reptile[8]	1	0.92	1.66	0.92	0.99	0.99

1.Black-billed Cuckoo; Whip-poor-Will; Redheaded Woodpecker; Northern Flicker; Wood Thrush; Orchard Oriole
2.Bald Eagle
3.Loggerhead Shrike; Field Sparrow; Grasshopper Sparrow; Dickcissel; Bobolink; Eastern Meadowlark
4.Black-crowned Night Heron; Common Moorhen
5.Piping Plover; Greater Yellowlegs; Hudsonian Godwit; Marbled Godwit; Stilt Sandpiper; Buff-breasted Sandpiper; Short-billed Dowitcher; Wilson's Phalarope
6.Snow Goose; Canada Goose (resident); Canada Goose (migrant)
7.Northern Harrier; Long-eared Owl
8.Eastern Massassauga rattlesnake

4.4 Alternative C: Enhance Public Use/Current Resource Management Level

4.4.1 Listed and Other Species of Interest

Under this alternative, Bald Eagles would benefit from the Refuge maintaining bottomland cottonwood forest areas and isolated mature cottonwood stands that provide nesting and roosting sites. The Eastern Massassauga rattlesnake would benefit somewhat because the Refuge would maintain existing wet prairie (1,077 acres) habitat. Piping Plovers and Least Terns, both of which use sandbars and beaches for nesting, would benefit less under this alternative because it does nothing to alleviate sedimentation, which is filling in these habitats. Some species would benefit if the Refuge is successful is gaining regional shorebird designation as more attention is given to shorebird species. While studies monitoring the Blanding's turtle would continue, habitat would continue to degrade as marshes filled with silt. (Same as Alternative A.)

4.4.2 Wildlife and Habitat Resource Management

Direct resource effects same as Alternative A. If budget and staff are shifted to maximize public use, the shifts could negatively effect habitat management, fish and wildlife populations, and resource conservation as funding and staff are decreased for these programs.

4.4.3 Sedimentation and Water Quality

The Refuge would benefit from work with private landowners within the watershed to implement conservation practices that would reduce erosion and the resulting sedimentation. (Same as Alternative A.)

4.4.4 Public Use and Education

More visitors would be attracted to and accommodated on the Refuge (up to 175,000 annually). The visitor experience would change from a feeling of seeing few other people to a more social experience. There would be an increased positive economic effect on the community. Increases in environmental education would lead to long term changes in adoption of environmental stewardship. More visitors would experience the benefits of wildlife-dependent recreation.

4.5 Alternative D: Optimize Resource Management With Enhanced Public Use / Preferred Alternative

4.5.1 Listed and Other Species of Interest

Under this alternative, Bald Eagles would benefit from the Refuge maintaining bottomland cottonwood forest areas and isolated mature cottonwood stands that provide nesting and roosting sites. The Eastern Massassauga rattlesnake would benefit slightly more than in Alternative A because the Refuge would increase bottomland mesic prairie by 217 acres. Some species would benefit if the Refuge is successful in gaining regional shorebird designation as more attention is given to shorebird species. Management is not likely to either benefit or harm the Indiana bat. Bat habitat and conservation measures would be unchanged.

4.5.2 Wildlife and Habitat Resource Management

This alternative shares many characteristics with Alternative A. Under this alternative, 279 acres of cropland would be converted to grasslands or prairie, potentially benefitting waterfowl and grassland bird species. While waterfowl would lose cropland forage, converting it to natural vegetation would improve nesting habitat and provide more natural foods. This alternative, with its reduction of cropland and a spring Snow Goose hunt, will contribute to the Snow Goose reduction efforts. Deer numbers would be decreased with the reduction of cropland acreage as an attractant. With an increase in mesic prairie in this alternative, there would be an increase in the carrying capacity for grassland dependent species.

4.5.3 Sedimentation and Water Quality

Under this alternative we would seek to quantify the need and benefit of various approaches, including land acquisition, to reducing sedimentation and improving water quality. In the long term this may lead to new management proposals that would benefit the ecological health of the Refuge.

4.5.4 Public Use and Education

Under Alternative D, public use and education efforts would see modest improvement. Completion of the visitor center will likely attract some additional users and open some new opportunities to convey refuge messages. Interactive programs and facilities would be developed with a goal of accommodating 130,000 visitors a year. Refuge staff would maintain environmental education programs at 2003 levels, and wildlife observation facilities and programs would be improved to encourage greater participation and more interaction with visitors. Opportunities to hunt white-tailed deer would be increased as part of the effort to reduce the Refuge deer herd. Opportunities to hunt

Snow Geese would be created with a spring Snow Goose hunt on the Refuge. Reducing the population may result in less spectacular viewing opportunities for visitors at the Refuge. However, we believe that the need to prevent further Arctic nesting habitat loss overrides this concern. Public use efforts would seek to reach out to nontraditional Refuge users. Community awareness of the Refuge and Refuge goals would increase as greater focus is placed on involving volunteers and the Refuge's relationship with Friends of the Squaw Creek NWR.

4.6 Alternative E: Intensive Wetland Management with Extreme Measures to Combat Sedimentation

4.6.1 Listed and Other Species of Interest

Under this alternative, Bald Eagles would benefit from the Refuge maintaining bottomland cottonwood forest areas and isolated mature cottonwood stands that provide nesting and roosting sites. The Eastern Massassauga rattlesnake would benefit somewhat because the Refuge would maintain existing wet prairie (1,077 acres) habitat. Piping Plovers and Least Terns, both of which use sandbars and beaches for nesting, would benefit less under this alternative because it does nothing to alleviate sedimentation, which is filling in these habitats. Some species would benefit if the Refuge is successful is gaining regional shorebird designation as more attention is given to shorebird species. While studies monitoring the Blanding's turtle would continue, habitat would continue to degrade as marshes filled with silt. (This alternative is the same as Alternative A.)

4.6.2 Wildlife and Habitat Resource Management

Alternative E would not drastically change wildlife and resource habitat management (See Table 3). Wetland, wet prairie, grassland and bottomland forest habitat acreages would change only slightly as the Refuge continued its current management trend toward less cropland. Current efforts to restore Loess Hill habitat would continue. All habitats would benefit from continued efforts to control invasive, exotic and nuisance species. All Refuge habitats would benefit from the Refuge working with private landowners on watershed improvements to reduce sedimentation caused by soil erosion.

Under this alternative, 279 acres of cropland would be converted to grasslands or prairie, potentially benefitting waterfowl and grassland bird species. While waterfowl would lose cropland forage, converting it to natural vegetation would improve nesting habitat and provide more natural foods. This alternative, with its reduction of cropland, would effect the redistribution and dispersion of the large flocks of Snow Geese. Deer numbers would be decreased with the reduction of cropland acreage as an attractant. With an increase in mesic prairie in this alternative, there would be an increase in the carrying capacity for grassland dependent species.

4.6.3 Sedimentation and Water Quality

Under this alternative we would seek to quantify the need and benefit of various approaches, including land acquisition, to reducing sedimentation and improving water quality. In the long term this may lead to new management proposals that would benefit the ecological health of the Refuge. (Same as Alternative D).

4.6.4 Public Use and Education

Under Alternative E, public use and education efforts would see modest improvement. Completion of the visitor center will likely attract some additional users and open some new opportunities to convey refuge messages. Interactive programs and facilities would be developed with a goal of accommodating 130,000 visitors a year. Refuge staff would maintain environmental education programs at 2003 levels, and wildlife observation facilities and programs would be improved to

encourage greater participation and more interaction with visitors. Opportunities to hunt white-tailed deer would be increased as part of the effort to reduce the Refuge deer herd. Public use efforts would not seek to reach out to nontraditional Refuge users. Community awareness of the Refuge and Refuge goals might increase as greater focus is placed on involving volunteers and the Refuge's relationship with Friends of the Squaw Creek NWR. (Same as Alternative A).

4.7 Cumulative Impacts

"Cumulative impact" is the term that refers to impacts on the environment that result from the incremental impact of the proposed action when added to other past, present and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. In this section, the cumulative impacts of each of the three alternatives are discussed in terms of waterfowl, migratory birds, listed species, wetland and riparian habitat, and prairie restoration.

4.7.1 Listed Species and Other Species of Special Interest

- # Habitat loss and other factors across the range of certain wildlife species have caused declines in their populations to levels of special concern and classification. The Eastern Massassauga rattlesnake, Least Bittern, and Bald Eagle have special classifications and occur on the Refuge.
- # Massasaugas are historically known from 13 sites in eight counties in Missouri. Eight populations (comprising four counties) are extirpated and two others are likely extirpated. Of the remaining three populations one is secure and two are vulnerable. Threats to the Massassauga still exist. Those threats will cause its numbers and range to continue declining and, as a result of those threats, it may become extinct in the future. Habitat loss is one of the primary factors in the decline of the eastern Massassauga.
- # Least Bitterns are widespread, abundant, and secure globally, but are quite rare in parts of their range. They are classified as imperiled in Missouri because of rarity or because of factors making it very vulnerable to extirpation from the state. Least Bitterns were described as locally common in large permanent marshes in most parts of the state in the early 1900s. Squaw Creek, Swan Lake, Mingo and the Mark Twain National Wildlife Refuges and the Ted Shanks and Marais Temps Clair state conservation areas now harbor the largest known breeding populations in the state.
- # Bald Eagles were once very common throughout most of the United States. Their population numbers have been estimated at 300,000 to 500,000 birds in the early 1700s. Their population fell to "threatened" levels in the continental United States of less than 10,000 nesting pairs by the 1950s, and to "endangered" levels of less than 500 pairs by the early 1960s. The Bald Eagle is making a gradual dramatic recovery. There are now over 6,000 nesting eagle pairs and more than 20,000 individual birds in the lower 48 states. (American Eagle Foundation) The U.S. Fish & Wildlife Service is studying the removal of the Bald Eagle from the "threatened" species list.

4.7.1.1 Impacts of Alternatives

Alternatives A and C

Alternatives A and C would benefit the Eastern Massassauga rattlesnake by maintaining existing habitat (2003) and monitoring to assess habitat management impacts on snake populations. Alternatives A and C provide existing levels (2003) of habitat for the Least Bittern, an imperiled species in the State of Missouri. Both alternatives would benefit Bald Eagles by maintaining existing levels (2003) of bottomland cottonwood forest areas and isolated mature cottonwood stands

Alternatives B, D and E

Alternatives B, D and E increase wet prairie habitat by about 75 acres, providing a somewhat greater benefit to the species. Alternatives B, D and E provide slightly varied increases in acreages of Least Bittern habitat, resulting in somewhat greater long-term benefit for the species. Alternatives B and D would benefit Bald Eagles by maintaining existing levels (2003) of bottomland cottonwood forest areas and isolated mature cottonwood stands. However, in the long-term, Alternative E provides greater benefit to Bald Eagles by increasing acreages of habitat to support more wintering Bald Eagles.

4.7.2 Wildlife and Habitat Resource Management

- # Prairies once occurred in every part of Missouri, including extensive prairies in the Ozarks and Bootheel.
- # Of the remaining 90,000 acres of native prairie in Missouri, about 68,000 acres are in private ownership.
- # An estimated 22,000 acres of native prairie are owned by the Missouri Department of Conservation the Department of Natural Resources, The Nature Conservancy, the Missouri Prairie Foundation, the University of Missouri and the Ozark Regional Land Trust. These agencies and organizations maintain prairie through selective cutting of woody species, periodic haying, grazing and prescribed burning.
- # When Lewis and Clark embarked on their historic exploration of the west in 1803, the Missouri River was a diverse, 2,300-mile-long system of floodplain, braided channels, riparian lands, chutes, sloughs, islands, sandbars, and backwaters. The River constantly reshaped the channel and the floodplain, resulting in a complex natural system supporting an incredible diversity of fish, wildlife and plants.
- # Six major dams were built in the upper reaches of the Missouri River in the first half of the 20th century. These dams and other river projects transformed the Missouri River from a free-flowing river into a series of reservoirs and channelized waterways, effectively separating the river from its floodplain. By 1972, the river's length had been shortened by 46 miles and its surface area decreased from 121,739 acres to 71,151 acres.
- # Statewide, the loss of historic wetlands in Missouri has exceeded the national rate; approximately 87 percent of Missouri's original 4.5 million acres of wetlands have been lost.
- # Roughly 168,000 acres of natural channel and 354,000 acres of associated habitat have been lost on the lower 730 miles of river.
- # By 1972, floodplain forest that once made up 76 percent of floodplain vegetation comprised only 13 percent.
- # Habitat loss and other factors have caused declines in species populations to the level of concern that warrants special classification.

4.7.2.1 Background

Historic losses of habitat and current struggles with sedimentation and water quality make habitat conservation a vital interest at Squaw Creek NWR. The Refuge is fortunate to have two other agencies, the U.S. Army Corps of Engineers and the Missouri Department of Conservation, also taking active roles in acquiring and restoring habitat in Holt County.

The Department of Conservation has identified adding limited critical areas to existing conservation areas as one of the agency's 10-year goals. In Holt County, the Department manages eight conservation areas, one of which is located adjacent to the Refuge.

In 2001, the Department of Conservation projected that willing landowners would restore 20,000 acres of wetlands in the northwest region, with the goal of targeting wetlands that are most valuable to wildlife. In addition, an estimated 3,300 acres of wetlands and bottomland hardwoods are scheduled

for restoration on public lands, according to the Department of Conservation (http://www.conservation.state.mo.us/areas/areaplans/nwest).

The U.S. Army Corps of Engineers is also engaged in acquiring land in Holt County for habitat restoration purposes. The Missouri River Mitigation Project is designed to mitigate, or compensate, for fish and wildlife habitat losses that resulted from past channelization efforts on the Missouri River. The purpose of the project is to acquire, restore and preserve aquatic and terrestrial habitat on individual sites found along the project length. Under this project, existing natural areas would be improved and new areas created. Ultimately, the Project will develop approximately 166,750 acres of land in separate locations along the River in Missouri, Nebraska, Iowa and Kansas. In Holt County, four projects are under way: Corning (1,662 acres); Deroin Bend (1,082 acres); Rush Bottom Bend (811 acres) and Thurnau (1,349 acres).

4.7.2.2 Impacts of Alternatives

Under all five alternatives, watershed improvements would be achieved through conservation on private lands within the 60,000-acre watershed. The Refuge, in partnership with others, would work with land owners to reduce sedimentation from soil erosion and improve water quality through improved management practices.

Alternative A

Over time, wetland habitat could be expected to decline under Alternative A (No Action) and a corresponding decline in wildlife health and populations could be expected. Alternative A does not call for major changes in Refuge goals, objectives and strategies. Habitat would be conserved as it is today, which would not fully address long-term issues such as sedimentation in the wetland management units. There would be no further acquisition, thus expanded preservation and restoration of Missouri River floodplain habitat would not occur.

Under the No Action alternative, the U.S. Fish and Wildlife Service and Squaw Creek NWR would be failing to seize opportunities to contribute to the U.S. Army Corps of Engineers' achievements in the Missouri River Mitigation Project. In the same vein, the Refuge would not be capitalizing on the ongoing acquisition of conservation areas by the Department of Conservation. Habitat acquired by these agencies would likely be more fragmented if the Service were not in a position to buy tracts adjoining other public lands.

This alternative does not contribute to reversing the dramatic loss of habitat, including prairies and wetlands, that the State of Missouri has experienced.

Alternative B

Restoring wet prairie habitat would be the focus of Alternative B (Historic Wet and Mesic Prairie), resulting in benefits for that particular habitat and somewhat diminished conditions for other habitats now fostered on the Refuge, such as floodplain forest and prairie. Discontinuation of burning, mowing and chemical spraying would diminish efforts to control invasive species. Species depending on wet prairie, such as the Eastern Massassauga rattlesnake, would benefit greatly while species that depend on other habitat types would see no benefit over current management. Wetland-dependent species would see a somewhat negative impact as the acres of managed wetland dropped from 3,409 to 1,227. In the short-term this alternative has a neutral impact on other waterfowl species; in the long-term, it does not enhance breeding and migration habitat needed to boost declining waterfowl populations.

Alternative C

Under Alternative C (Enhanced Public Use/Current Resource Management Level), land cover would remain essentially unchanged when compared to Alternative A (No Action). Because management focus and, with it funding, would be shifted to wildlife-dependent recreation, habitat and wildlife would likely experience negative impacts under this alternative. Habitat management, fish and wildlife

monitoring, and resource conservation would have lesser priority than providing the six wildlife-dependent public uses: hunting, fishing, wildlife observation and photography, and environmental education and interpretation. A spring Snow Goose hunt would be implemented to help control the continental population. Staff availability for monitoring and inventorying projects would be decreased as visitor services programming increased.

Habitat restoration by the Corps of Engineers as part of the Missouri River Mitigation Project would be less effective if the Service did not contribute to acquisition and restoration efforts. The effectiveness of conservation areas in reducing sedimentation and restoring habitat would be negatively impacted without similar efforts by the Refuge. Like Alternative A, this alternative does nothing to reverse trends in habitat loss in northwestern Missouri.

Alternative D

Of the five alternatives, the preferred alternative, Alternative D (Optimized Resource Management With Enhanced Public Use, Preferred Alternative), would generate the greatest benefits for wildlife and habitat by optimizing resource management and maintaining the current level of public use. A more concerted effort to conserve, manage and restore habitats that are native to the Lower Missouri River ecosystem would benefit wildlife species. A greater diversity of species would benefit from this alternative because it would include additional wetland, riparian, and native grass development and enhancement. Biological monitoring would increase, resulting in greater knowledge that could be used to better manage habitat. Greater monitoring of listed species would help staff manage more effectively for these species. A spring Snow Goose hunt would be implemented to help control the continental population.

Under this alternative, the Refuge would aggressively study the needs and benefits of improving water quality coming onto the Refuge. The study may lead to a proposal for additional acquisition and restoration by governmental and non-governmental organizations. More land would be restored, potentially parcels located near one another, which would benefit all wildlife species using the Refuge. Restoring a larger land mass for habitat purposes would improve water quality by eliminating agricultural runoff over a greater area, and changing land use would contribute to reducing soil erosion and, ultimately, sedimentation. This alternative would, in the long-term, contribute to replacing some of the vast amounts of habitat that have been lost in northwestern Missouri.

Alternative E

Under Alternative E (Emphasize Wetland Management for the Benefit of Migratory Waterfowl, Shorebirds, Wading Birds, and Other Aquatic Life), aquatic wildlife would see the greatest benefit over the long-term. The widest possible variety of wetland habitats (lacustrine, palustrine, moist soil, green tree, riverine, bottomland hardwoods, wet meadows, exposed flats) would be created and maintained. Species that would benefit would include ducks and geese, shorebirds and wading birds, and aquatic species such as otters. This alternative would benefit the Blanding's turtle, a state-listed endangered species.

4.7.3 Perilous Abundance of Snow Geese

- In 2001, 384,000 Snow Geese were counted on the Refuge in November.
- 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.

- # Over-grazing and grubbing of the tundra vegetation has been degrading and destroying the native plant community.
- # 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 1/2 hour after sunset.

4.7.3.1 Impacts of Alternatives

Under all five alternatives, Squaw Creek NWR would assist in international efforts to reduce the mid-continent population of Snow Geese. Snow Goose populations would be actively managed, resulting in greater mortality in the short-term but greater long-term benefits to the health of the species. Cropland would be reduced in alternatives B, D and E, which would make these alternatives more effective for Snow Goose reduction in the long-term because they would provide less wintering habitat. With a spring Snow Goose hunt proposed in both, Alternatives C and D provide an additional means of dealing with the Snow Goose issue.

4.7.4 Sedimentation and Water Quality

- # Squaw Creek NWR is filling in due to siltation.
- # Within the Lower Missouri River Ecosystem, nearly 95 percent of the basin's land mass is applied to agriculture. Nonpoint source pollution is a major contributor to the contamination in the river and its floodplain.
- # Erosion of farmland soils as well as direct rainfall runoff can introduce fertilizers and a variety of pesticides into the bottomland ecosystem.
- # The presence of heavy metals such as mercury, selenium, copper and cadmium in sediments and fauna of the Missouri River and its tributaries have been documented over the years.
- # Most of the 15,000 miles of streams in the Northwest Region of Missouri have suffered extensive channelization, unrestricted livestock access and sedimentation.

4.7.4.1 Impacts of Alternatives

All five alternatives would benefit the watershed and alleviate sedimentation by encouraging conservation practices and fostering improved soil and water uses. Under Alternative D, benefits would be somewhat greater because the Refuge would be actively studying additional means for improving water quality and reducing sedimentation.

The floodplain capacity to store flood water will increase under all alternatives. Increased flood storage capability means reduced flooding downstream and greater sediment retention and nutrient recycling. This in turn could reduce the sediment and nutrient load that eventually reaches the Gulf of Mexico. A reduction in nutrients reaching the Gulf could help moderate the hypoxia situation that results in depletion of oxygen and the subsequent death of many aquatic species in the broad area that is affected.

While the individual contribution to sediment retention and nutrient recycling is small under any alternative compared to the total sediment and nutrient load reaching the Gulf, the cumulative impact of the Refuge with other federal, state and non-governmental organizations together can be significant.

While significant efforts have been made by various states in the watershed and other agencies, including the Service, to restore wetlands and to restore habitats that reduce sediment runoff, much work still needs to be done. Over time, the Service's efforts working through the Squaw Creek Refuge and other national wildlife refuges and Waterfowl Production Areas, the Partners for Fish and Wildlife Program, and through partnerships with the State, the Corps of Engineers, and other agencies, the cumulative impact of the various programs can provide measurable positive results in improving water quality within the Missouri River floodplain.

4.7.5 Public Use

- # Squaw Creek NWR receives an estimated 130,000 visitors annually.
- # The U.S. Fish & Wildlife Service has identified six priority wildlife-dependent public uses: hunting, fishing, wildlife observation and photography, and environmental education and interpretation.
- # Big Lake State Park, which is managed by the Missouri Department of Natural Resources, is a major feeding and resting area for birds and migratory waterfowl. The park offers lakeshore cabins and recreation.
- # Several conservation areas owned by the Missouri Department of Conservation in Holt County, including the Bob Brown Conservation Area (3,302 acres), provide wildlife habitat as well as public use opportunities such as hunting, bird watching, camping and hiking.

Alternatives A, B, D and E

Under Alternative A (No Action), Alternative B, Alternative D and Alternative E, the Refuge would design and fund programs with the goal of supporting 130,000 visitors annually. The goal for environmental education would be to provide services to accommodate visitors at the same level as occurred in 2003. All Big Six programs would be developed or improved to meet Service standards. Under Alternative D, hunting on the Refuge would be expanded with the addition of a spring Snow Goose hunt. In the short-term, these programs would meet existing needs in the area surrounding the Refuge. In the long-term, maintaining current levels under alternatives A, B and E would result in the Refuge failing to reach non-traditional visitors. However, like Alternative C, Alternative D would see efforts to reach out to non-traditional users. Refuge staff would work to enhance working relationships with volunteers and the Friends of Squaw Creek NWR and to increase the number of volunteer hours in the Visitor Contact Station and around the Refuge as interpretive guides. The focus on expanding volunteer hours would improve the Refuge's ability to engage visitors in environmental education programs and enhance visitors' experience on the Refuge. Under Alternative D and Alternative C, Refuge visitor facilities would be enhanced to improve the visitor experience.

Alternative C

Under Alternative C, wildlife-dependent recreation would be optimized. The Refuge would design and fund interpretive programs and facilities with the goal of accommodating 175,000 visitors annually by 2008, and increasing visitation by 2 percent annually after that year. The Refuge would become a more visible part of the community and a major element in environmental education and wildlife-dependent recreation in the area. The higher visitation numbers would result in greater appreciation for conservation, a better understanding of the National Wildlife Refuge System, and greater support for Squaw Creek NWR. A more informed local population would result in greater support for conservation in general and greater focus on local conservation issues. The proximity of Missouri Department of Conservation areas would enhance access to wildlife-dependent recreation in the area.

Table 4: Comparison of Impacts by Issue and Alternative

Issue	Alternative A Current Management (No Action)	Alternative B Historic Wet & Mesic Prairie	Alternative C Enhanced Public Use/ Current Resource Management Level	Alternative D Optimized Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E Intensive Wetland Management with Extreme Measures to Combat Sedimentation
Issue No. 1: Wildlife and habitat resource management.: Extraordinary measures may be required to preserve the marsh environment that has historically attracted migratory waterfowl and other wildlife.	No change from current level of conservation. Carrying capacity remains unchanged by management.	Deer numbers will be decreased by removing the cropland as an attractant. Massassauga rattlesnakes would likely increase due to greater available habitat. Increase in carrying capacity of wet and mesic grasslands for dependent species, including associated threatened and endangered species. Significant decrease in carrying capacity for wetland-dependent species. Carrying capacity for woodland-dependent species unchanged.	No change from current level of conservation. Carrying capacity remains unchanged by management.	Greater reduction in Snow Geese numbers than Alternative A with reduced cropland and spring hunt. Deer numbers will be decreased by reducing the cropland acreage as an attractant. Massassauga rattlesnakes would likely increase due to greater available habitat. Increase in carrying capacity of wet and mesic grasslands for dependent species, including associated threatened and endangered species. Carrying capacity of woodland-dependent species decreased.	Greater reduction in Snow Goose numbers than Alternative A due to reduced cropland. Deer numbers will be decreased by reducing the cropland acreage as an attractant. Massassauga rattlesnakes would likely increase due to greater available habitat. Increase in carrying capacity of wet and mesic grasslands for dependent species, including associated threatened and endangered species. Slight decrease in carrying capacity for wetland-dependent species.
Issue No. 2: Land management within the watershed impacts Refuge water quality: Beyond Refuge boundaries, land management practices within the watershed influence the quality and quantity of water that flows into the Refuge.	No change.	No change.	No change.	Study of needs and benefits would lead to long-term improvement in water quality.	No change.

Table 4: Comparison of Impacts by Issue and Alternative (Continued)

Issue	Alternative A Current Management (No Action)	Alternative B Historic Wet & Mesic Prairie	Alternative C Enhanced Public Use/ Current Resource Management Level	Alternative D Optimized Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E Intensive Wetland Management with Extreme Measures to Combat Sedimentation
Issue No. 3: Snow Geese Management: The mid-continent population of Snow Geese is experiencing a "perilous abundance."	Possible slight reduction in Snow Goose numbers.	Greater reduction in Snow Goose numbers over Alternative A due to elimination of cropland.	Possible slight reduction in Snow Geese.	Greater reduction in Snow Goose numbers over Alternative A due to reduced cropland and hunting program.	Greater reduction in Snow Geese numbers over Alternative A due to reduction in cropland.
Issue No. 4: Refuge Expansion: Some Refuge marsh restoration and preservation problems associated with watershed management and runoff might be lessened if some adjacent agricultural land was added to the Refuge and converted to other uses.	No change in boundaries. Complete acquisition of 400 acres of inholdings.	Same as Alternative A.	Same as Alternative A.	Study of possible benefits may lead to proposal for increased land acquisition.	Same as Alternative A.
Issue No. 5: Public Use: Some people have suggested that the Refuge's public use program should be changed to allow other compatible uses, specifically waterfowl hunting and deer hunting.	No change.	Some increased expressed dissatisfaction with lost opportunities to see large concentration of waterfowl.	Increase in public use opportunities.	Increase in public use opportunities, but to a lesser degree than in Alternative C.	Same as Alternative A.

Table 4: Comparison of Impacts by Issue and Alternative (Continued)

Issue	Alternative A Current Management (No Action)	Alternative B Historic Wet & Mesic Prairie	Alternative C Enhanced Public Use/ Current Resource Management Level	Alternative D Optimized Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E Intensive Wetland Management with Extreme Measures to Combat Sedimentation
Issue No. 6: Public Service: Refuge staff want to be good neighbors and contributors to the welfare of the community.	No change.	No change.	Increase in Refuge visitors increasing use of local businesses. Increased environmental education opportunities and special events.	Greater increase in operating budgets and resulting input to the local economy than under Alternative b. Increased environmental education opportunities and special events but to a lesser degree than Alternative C.	No change.
Listed Species	Bald Eagle and Eastern Massassauga rattlesnake continue with current habitat.	Same as Alternative A.	Same as Alternative A.	Bald Eagle continues with current habitat. Eastern Massassauga rattlesnake benefits from increased habitat.	Same as Alternative D.
Environmental Justice	No disproportionate adverse effects on minority or low-income populations.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.

Chapter 5: List of Preparers

Squaw Creek NWR Staff Contributors:

Ron Bell, Refuge Manager, Squaw Creek NWR
Frank Durbian, Wildlife Biologist, Squaw Creek NWR
Charles Marshall, Park Ranger, Squaw Creen NWR

Branch of Conservation Planning Staff (Lead in EA Preparation):

Tom Larson, Branch Chief, Branch of Conservation Planning
John Schomaker, Refuge Planning Specialist, Branch of Conservation Planning
Jim Salyer, Southern Missouri Ascertainment Office, Wildlife Biologist
H. John Dobrovolny, Regional Historic Preservation Officer, Region 3. Historian.
Jane Hodgins, Technical Writer/Editor, Branch of Conservation Planning
Jane Lardy Nelson, Editorial Assistant, Branch of Conservation Planning
Judy McClendon, formerly Wildlife Biologist, Southern Missouri Ascertainment Office, currently Wildlife Biologist/Planner, Southern Louisiana Refuges Refuge

Chapter 6: List of Agencies, Organizations, and Persons Contacted

Elected Federal Officials

- U.S. Senator Christopher Bond
- U.S. Senator Jim Talent
- U.S. Representative Samuel Graves
- U.S. Representative Roy Blunt
- U.S. Representative JoAnn Emerson
- U.S. Representative Kenny Hulshof
- U.S. Representative Dick Gephardt
- U.S. Representative Todd Akin

Federal Agencies

- U.S. Army Corps of Engineers, Vicksburg Division, Rock Island and St. Louis Districts
- U.S. Geological Survey, Long Term Monitoring Program; Jackson, Missouri; Alton, Illinois
- U.S. Department of Agriculture/Natural Resources Conservation Service, Columbia, Missouri
- Environmental Protection Agency, Chicago, IL; Kansas City, Kansas
- Columbia Environmental Research Center, Columbia, Missouri
- Upper Midwest Science Center, LaCrosse, Wisconsin
- U.S. Coast Guard, Keokuk, Iowa
- Illinois River National Wildlife Refuge
- Shawnee National Forest, Murphysboro, Illinois
- U.S. Fish and Wildlife Service, Ecological Services, Rock Island, Illinois
- U.S. Fish and Wildlife Service Historic Preservation Officer

Elected State Officials

- Missouri Governor Bob Holden

State Agencies

- Missouri Department of Natural Resources
- Missouri Department of Conservation

Missouri Department of Transportation
University of Missouri, Extension Services
State Historic Preservation Officer
Office of the State Archeologist
Indian Affairs Council
Archaeological and historic preservation state-wide groups
The Advisory Council on Historic Preservation

City/County/Local Governments

Holt County
Mound City

Public Libraries

Mound City
Oregon

Organizations

Sierra Club, Kaskaskia Group Conservation Chair, Columbia, IL
The Sierra Club, Washington, D.C.
Ducks Unlimited
Pheasants Forever
Wild Turkey Federation
The American Fisheries Society, Columbia, MO
The Missouri Prairie Foundation, Columbia, MO
The Wildlife Society, Missouri Chapter, MO Dept. of Conservation, Columbia, Missouri
Missouri Wildlife Society, Hannibal, Missouri
Missouri Conservation Foundation, Jefferson, Missouri
Missouri Chapter American Fisheries Society, Missouri Department of Conservation, Jefferson City, Missouri
The Conservation Federation of Missouri, Jefferson City, Missouri
The Missouri Audubon Council, Jefferson City, Missouri
The Missouri Bass Chapter Federation, Lake St. Louis, Missouri
Missouri State Chapter, Soil and Water Conservation Society, Springfield, Missouri
The Audubon Society of Missouri, St. Louis, Missouri
Wildlife Management Institute, Washington, D.C.
National Wildlife Foundation, Office of Federal and International Affairs, Washington, D.C.
American Rivers, Washington, D.C.
The Clean Water Fund, National Office, Washington, D.C.
Defenders of Wildlife, Washington, D.C.
The National Waterways Conference, Inc., Washington, D.C.
The National Wildlife Refuge Association, Washington, D.C.

The Natural Resources Council of America, Washington, D.C.

National Audubon Society, Washington, D.C.

Northeast Midwest Institute, Washington, D.C.

Individuals

Individuals who participated in open house sessions or who requested to be on the Comprehensive Conservation Plan mailing list.

Chapter 7: Appendices

Appendix 1: References

Bellrose, F.C. 1954. The value of waterfowl refuges in Illinois. Journal of Wildlife Management. 18(2): 160-169.

Black, R., B. McKenney, A. O(Connor, E. Gray, and R. Unsworth. 1999. Economic profile of the Upper Mississippi River Region. Prepared for the United States Fish and Wildlife Service Division of Economics by Industrial Economics, Inc., Cambridge, MA. 84 pp. + Appendices.

Brown, M.D. 1988. Soil survey of Louisa County, Iowa. U.S. Dep. Agric. Soil Conserv. Serv., in cooperation with the Iowa Agric. and Home Econ. Exp. Stn., the Coop. Ext. Serv., Iowa State Univ., and the Dep. of Soil Conserv., State of Iowa. 255 pp.

Carlson, B.D., D.B. Propst, D.J. Stynes, and R.S. Jackson. 1995. Economic impact of recreation on the Upper Mississippi River System. Technical Report EL-95-16. U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, MS.

Clark County Soil and Water Conservation District. 1990. Soil resource inventory of Clark County, Missouri. Cooperating with U.S. Dep. Agric., Soil Conserv. Serv., Miss. Dep. Of Nat. Res., and Miss. Agric. Exp. Stn.123 pp.

Herman, R.J., C.C. Miles, L.A. Dungan, B.E.Currie, and P.W. Ice. 1979. Soil survey of Jackson County, Illinois. U.S. Dep. Agric. Soil Conserv. Serv. and Forest Serv., in cooperation with Ill. Agric. Exp. Stn. 192 pp.

Laughland, A. and J. Caudill. 1997. Banking on nature: The economic benefits to local communities of national wildlife refuge visitation. Division of Economics, United States Fish and Wildlife Service, Department of Interior. Washington, D.C.

Lilly, M.E. 1989. Soil survey of Calhoun County, Illinois. U.S. Dep. Agric., Soil Conserv. Serv., in cooperation with the Ill. Agric. Exp. Stn. 113 pp.

Love, C.L. 1997. Soil survey of Pike County, Missouri. U.S. Dep. Agric. Nat. Res. Conserv. Serv., in cooperation with the Miss. Agric. Exp. Stn. 155 pp.

Lubinski, K. and C. Theiling, eds. Ecological status and trends of the Upper Mississippi River System 1998: A report of the Long Term Resource Monitoring Program. U.S. Geological Survey, Upper Midwest Environmental Sciences Center, LaCrosse, Wisconsin. April 1999. LTRMP 99-T001. 236 pp.

Rusch, L., J. McKay, and K. Karstens. 1999. An archeological and historical records study for the Squaw Creek National Wildlife Refuge in Illinois, Iowa and Missouri. Department of Interior, U.S. Fish and Wildlife Service, Region 3. Purchase Order No. 301818M602.

Schwegman, J. E. and R. W. Nyboer. 1985. The Taxonomic and Population Status of Boltonia Decurrens (Torr. and Gray) Wood. Castanea 50: 112-115.

Smith, M. and T. M. Keevin. 1998. Achene Morphology, Production, and Germination, and Potential for Water Dispersal in Boltonia Decurrens (Decurrent false aster), a Threatened Floodplain Species. Rhodora 100: 69-81.

Smith, M. and T. Keevin, P. Mettler-McClure, and R. Barkau. 1998. Effect of the Flood of 1993 on Boltonia Decurrens, a Rare Floodplain Plant. Regul. Rivers: Res. Mgmt. 14: 191-202.

Theiling, C.H. 1996. An ecological overview of the Upper Mississippi River system: Implications for postflood recovery and ecosystem management, in Galat, D.L., and Frazier, A.G., eds., Overview of river-floodplain ecology in the Upper Mississippi River Basin, v. 3 of Kelmelis, J.A., ed., Science for floodplain management into the 21st century: Washington, D.C., U.S. Government Printing Office, p. x-y.

U.S. Department of Agriculture, Natural Resources Conservation Service, Soil Survey of Holt County, Missouri

17-22. Topics in Water Use: Northwest Missouri. Water Resources Report Number 61.

Whitney, S.D., K.D. Blodgett, and R.E. Sparks. 1996. A comprehensive evaluation of three mussel beds in Reach 15 of the Upper Mississippi River. Illinois Natural History Survey Aquatic Ecology Technical Report 1996(7), Havana. Reprinted by U.S. Geological Survey, Environmental Management Technical Center, Onalaska, Wisconsin, October 1997. LTRMP 97-R022. 15 pp. + Appendixes A - H.

Appendix 2: Acronyms and Abbreviations Used in the Environmental Assessment

AgNPS - Agricultural Non-Point Source Pollution
CCP - Comprehensive Conservation Plan
COE - Corps of Engineers
CRP - Conservation Reserve Program
DNR - Department of Natural Resources
EA - Environmental Assessment
EWRP - Emergency Wetland Reserve Program
FONSI - Finding Of No Significant Impact
FmHA - Farmer(s Home Administration (now FSA)
FSA - Farm Service Agency
GIS - Geographic Information System
IADNR - Iowa Department of Natural Resources
MODOC - Missouri Department of Conservation
NEPA - National Environmental Policy Act
NRCS - Natural Resources Conservation Service
NWR - National Wildlife Refuge
PFW - Partners for Fish and Wildlife
RM - River Mile
ROS - Refuge Operations Specialist
USDA - United States Department of Agriculture
USEPA - United States Environmental Protection Agency
USFWS - United States Fish and Wildlife Service
USGS - United States Geological Survey
WRP - Wetland Reserve Program

Appendix B: Glossary

Appendix B: Glossary

Alternative — A set of objectives and strategies needed to achieve refuge goals and the desired future condition.

Biological Diversity — The variety of life forms and its processes, including the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur.

Compatible Use — A wildlife-dependent recreational use, or any other use on a refuge that will not materially interfere with or detract from the fulfillment of the mission of the Service or the purposes of the refuge.

Comprehensive Conservation Plan — A document that describes the desired future conditions of the refuge, and specifies management actions to achieve refuge goals and the mission of the National Wildlife Refuge System.

Ecosystem — A dynamic and interrelated complex of plant and animal communities and their associated non-living environment.

Ecosystem Approach — A strategy or plan to protect and restore the natural function, structure, and species composition of an ecosystem, recognizing that all components are interrelated.

Ecosystem Management — Management of an ecosystem that includes all ecological, social and economic components that make up the whole of the system.

Endangered Species — Any species of plant or animal defined through the Endangered Species Act as being in danger of extinction throughout all or a significant portion of its range, and published in the Federal Register.

Environmental Assessment — A systematic analysis to determine if proposed actions would result in a significant effect on the quality of the environment.

Extirpation — The local extinction of a species that is no longer found in a locality or country, but exists elsewhere in the world.

Goals — Descriptive statements of desired future conditions.

Interjurisdictional Fish — Fish that occur in waters under the jurisdiction of one or more states, for which there is an interstate fishery management plan or which migrates between the waters under the jurisdiction of two or more states bordering on the Great Lakes.

Issue	Any unsettled matter that requires a management decision. For example, a resource management problem, concern, a threat to natural resources, a conflict in uses, or in the presence of an undesirable resource condition.
Meta-population	A set of local populations connected by migratory individuals.
National Wildlife Refuge System	All lands, waters, and interests therein administered by the U.S. Fish and Wildlife Service as wildlife refuges, wildlife ranges, wildlife management areas, waterfowl production areas, and other areas for the conservation of fish, wildlife and plant resources.
Objectives	Actions to be accomplished to achieve a desired outcome.
Preferred Alternative	The Service's selected alternative identified in the Comprehensive Conservation Plan.
Scoping	A process for determining the scope of issues to be addressed by a comprehensive conservation plan and for identifying the significant issues. Involved in the scoping process are federal, state and local agencies; private organizations; and individuals.
Species	A distinctive kind of plant or animal having distinguishable characteristics, and that can interbreed and produce young. A category of biological classification.
Strategies	A general approach or specific actions to achieve objectives.
Wildlife-dependent Recreational Use	A use of refuge that involves hunting, fishing, wildlife observation and photography, or environmental education and interpretation, as identified in the National Wildlife Refuge System Improvement Act of 1997.
Threatened Species	Those plant or animal species likely to become endangered species throughout all of or a significant portion of their range within the foreseeable future. A plant or animal identified and defined in accordance with the 1973 Endangered Species Act and published in the Federal Register.
Vegetation	Plants in general, or the sum total of the plant life in an area.
Vegetation Type	A category of land based on potential or existing dominant plan species of a particular area.
Watershed	The entire land area that collects and drains water into a stream or stream system.

Wetland	Areas such as lakes, marshes, and streams that are inundated by surface or ground water for a long enough period of time each year to support, and that do support under natural conditions, plants and animals that require saturated or seasonally saturated soils.
Wildlife Diversity	A measure of the number of wildlife species in an area and their relative abundance.

Appendix C: Species Lists

Mammals of Squaw Creek National Wildlife Refuge

+ one or more specimens actually observed
* possible occurrence (within range)

Marsupials:

Opossum (*Didelphis marsupials*+

Insectivores:

Shirttail Shrew (*Blarina brevicauda)*+
Least Shrew (*Cryptotis parva)*+
Eastern Mole (*Scalopus Aquaticies)*+
Masked Shrew (*Surex cenereus)**

Bats:

Indiana Bat (*Myotis sodalis*)*
Little Brown Bat (*Myotis lucifugus*)+
Red Bat (*Lasiurus borealis*)+
Silver-haired Bat (*Lasionycteris noctivagans*)*
Eastern Pipistrel (*Pipistrellus subflavus*)*
Big Brown Bat (*Eptesicus fuscus*)*
Hoary Bat (*Lasiurus cinereus*)+
Evening Bat (*Nycticeius humeralis*)*
Northern Long-eared Bat (*Myotis septentrionalis*)*

Rabbits:

Eastern Cottontail (*Sylvilagus floridanus*)+

Rodents:

Woodchuck (*Marmota monax*)+
Franklin's Ground Squirrel (*Spermophilus franklinii*)+
Eastern Fox Squirrel (*Sciurus niger*)+
Plains Pocket Gopher (*Geomys bursaruis*)+
Beaver (*Castor canadensis*)+
Western Harvest Mouse (*Reithrodontomys megalotis*)+
Deer Mouse (*Peromyscus maniculatus*)+
White-footed Mouse (*Peromyscus leucopus*)+
Southern Bog Lemming (*Synaptomys cooperi*)+
Prairie Vole (*Microtus ochrogaster*)+
Muskrat (*Ondatra zibethicus*)+
Norway Rat (*Rattus norvegicus*)+
House Mouse (*Mus musculus*)+
Meadow Jumping Mouse (*Zapus hudsonius*)+
Thirteen-lined Ground Squirrel (*Spermephilus tridecemlineatus*)*
Southern Flying Squirrel (*Glaucomys volans*)*
Plains Pocket Mouse (*Perognathus flavescens*)*
Meadow Vole (*Microtus pennsylvanicus*)*
Pine Vole (*Microtus pinetorum)**

Carnivores:

Coyote (*Canis latrans*)+
Red Fox (*Vulpes vulpes*)+
Gray Fox (*Urocyon cinereoargenteus*)+
Raccoon (*Procyon lotor*)+
Longtail Weasel (*Mustela frenata*)+
Least Weasel (*Mustela nivalis*)*
Mink (*Mustela vison*)+
Badger (*Taxidea taxus*)+
Striped Skunk (*Mephitis mephitis*)+
Bobcat (*Lynx rufus*)+
River Otter (*Lutra canadensis*)+

Hoofed Mammals:

Whitetailed Deer (*Odocoileus virginianus*)+

Reptiles of Squaw Creek National Wildlife Refuge

+ one or more specimens actually observed
* possible occurrence (within range)

Turtles:

Blandings Turtle (*Emydoidea blandingii*)+
Midland Smooth Softshell (*Apalone mutica mutica*)+
Eastern Spiny Softshell (*Apalone spinifera spinifera*)+
Common Snapping Turtle (*Chelydra s. serpentina*)+
Red-eared slider (*Trachemys scripta elegans*)+
Ornate Box Turtle (*Terrapene o. ornata*)+
Western Painted Turtle (*Chrysemys pictabellii*)+
False Map Turtle (*Graptemys pseodogeographica*)*

Lizards:

Five-lined Skink (*Eumeces fasciatus*)+
Six-lined Racerunner (*Cnemidophorus sexlineatus*)+
Western Slender Glass Lizard (*Ophisaurus a. attenuatus*)*
Great Plains Skink (*Eumeces obsoletust*)+

Snakes:

Graham's Crayfish Snake (*Regina granamii)*)+
Diamond-backed Water Snake (*Nerodia rhombifer rhombifer*)+
Texas Brown Snake (*Storeria dekayi texana*)+
Western Plains Garter Snake (*Thamnophis radix radix*)+
Western Ribbon Snake (*Thamnophis proximus proximus*)+
Red-Sided Garter Snake (*Thamnophis sirtalis sirtalis*)+
Prairie Ringneck Snake (*Diadophis punctatus arnyi*)+
Eastern Yellow-bellied Racer (*Coluber constrictor flaviventris*)+
Black Rat Snake (*Elapha o. obsoleta*)+
Western Fox Snake (*Elaphe v. vulpina*)+
Bull Snake (*Pituophis catenifer sayi*)+
Prairie King Snake (*Lampropeltis c. calligaster*)+
Red Milk Snake (*Lampropeltis triangulum syspila*)+
Eastern Massasauga (*Sistrurus catenatus catenatus*)+
Western Worm Snake (*Carphophis amoenus vermis*)+
Northern Water Snake (*Nerodin sipedon sipedon*)*
Lined Snake (*Tropidoclonion lineatum*)*
Eastern Hognose Snake (*Heterodon platyrhinos*)*
Speckled King Snake (*Lampropeltis getulus holbrooki*)*
Great Plains Rat Snake (*Elaphe guttata emoryi*)*

Amphibians of Squaw Creek National Wildlife Refuge

Salamanders:

Small-mouthed Salamander (*Ambystoma texanum*)+
Eastern Tiger Salamander (*Ambystoma t. tigrinum*)+

Toads:

Woodhouse's Toad (*Bufo w. woodhousii*)+
Eastern American Toad (*Bufo a. americanus*)+
Great Plains Toad (*Bufo cognatus*)+
Great Plains Narrow-mouthed Toad (*Gastrophryne olivacea*)*
Plains Spadefoot (*Spea bombifrons*)+

Frogs:

Blanchard's Cricket Frog (*Acris creptians blanchardi*)+
Cope's Gray Treefrog (*Hyla chrysoscelis)*)+
Western Chorus Frog (*Pseudacris t. triseriata*)+
Bullfrog (*Rana catesbeiana blairi*)+
Plains Leopard Frog (*Rana pipiens*)+

+ one or more specimens actually observed
* possible occurrence (within range)

Bird Species

Legend
Refuge personnel and visiting ornithologists have contributed to this list, which contains 277 species that have been recorded on the refuge. Another 33 species, listed under "Accidental" birds, have been reported, but are not normally expected to be present.

Season, abundance, and nesting status for each bird's suitable habitat are coded as follows:
S – Spring March – May
S – Summer June – July
F – Fall August – November
W – Winter December – February

a – abundant – common species that is very numerous
c – common – certain to be seen in suitable habitat
u – uncommon – present, but not certain to be seen
o – occasional – seen only a few times during a season
r – rare – seen only at intervals of 2 – 5 years
(E) – Endangered
* - indicates birds which nest locally

This bird list is in accordance with the Seventh American Ornithologist's Union Checklist of North American birds as amended. Squaw Creek NWR was officially named one of America's top 500 Globally Important Bird Areas by the American Bird Conservancy in July 2001.

Note: During August shorebirds and warblers and other passerines are well into migration. The Audubon Society of Missouri also uses June & July = summer and August – November = fall for its seasonal surveys.

Bird List, Squaw Creek NWR

Common Name	S	s	F	w
LOONS				
Common Loon	r		r	
GREBES				
Pied-billed Grebe*	c	u	c	r
Horned Grebe	u		u	
Eared Grebe	u	r	u	
Western Grebe	r		r	
PELICANS				
American White Pelican	a	u	a	r
CORMORANTS				
Double-crested Cormorant	c	r	c	r
HERONS, EGRETS AND BITTERNS				
American Bittern*	o	u	u	r

Bird List, Squaw Creek NWR

Common Name	S	s	F	w
Least Bittern*	u	c	o	
Great Blue Heron	c	c	c	o
Great Egret	u	u	u	
Snowy Egret	u	r	u	
Little Blue Heron	o	u	o	
Cattle Egret	u	u	u	
Green Heron*	u	c	o	
Black-crowned Night-Heron*	o	u	o	
Yellow-crowned Night-Heron*	o	o	o	
IBIS				
White-faced Ibis	o	r	o	
NEW WORLD VULTURES				
Turkey Vulture	u	c	u	
DUCKS, GEESE AND SWANS				
Greater White-fronted Goose	u		c	r
Snow Goose	a	o	a	u
Ross's Goose	u		u	o
Canada Goose	a	u	a	c
Trumpeter Swan	o			o
Tundra Swan	r		r	r
Wood Duck*	u	c	c	r
Gadwall	c	r	c	o
American Wigeon	c	r	c	o
American Black Duck	o	r	o	u
Mallard*	a	c	a	a
Blue-winged Teal*	c	o	c	r
Cinnamon Teal	o		r	
Northern Shoveler	c	r	c	r
Northern Pintail*	a	r	a	o
Green-winged Teal	c	r	c	u
Canvasback	u		u	r
Redhead	o	r	o	r
Ring-necked Duck	c		u	r
Greater Scaup			r	
Lesser Scaup	c	r	c	r
White-winged Scoter			r	
Bufflehead	u		u	r

Bird List, Squaw Creek NWR

Common Name	S	s	F	w
Common Goldeneye	o		o	u
Hooded Merganser	u	u	u	r
Common Merganser	c	r	o	c
Red-breasted Merganser	o		o	r
Ruddy Duck	u	o	u	r
OSPREY				
Osprey	o		o	
HAWKS, EAGLES AND KITES				
Bald Eagle*(E)	u	c	c	c
Northern Harrier*	u	o	u	u
Sharp-shinned Hawk	u	r	u	u
Cooper's Hawk	o	o	o	o
Northern Goshawk				r
Red-shouldered Hawk	r	r	r	r
Broad-winged Hawk	o	r	r	
Swainson's Hawk	o		o	
Red-tailed Hawk*	c	u	c	c
Rough-legged Hawk			o	o
Golden Eagle			r	r
FALCONS				
American Kestrel	o	o	o	r
Merlin	r		o	r
Peregrine Falcon(E)	o		o	r
Prairie Falcon			r	r
PHEASANTS AND PARTRIDGES				
Ring-necked Pheasant*	c	c	c	c
TURKEYS				
Wild Turkey*	u	u	u	u
NEW WORLD QUAIL				
Northern Bobwhite*	u	u	u	u
RAILS, GALLINULES AND COOTS				
Yellow Rail	r		r	
King Rail*	o	o	o	

Bird List, Squaw Creek NWR

Common Name	S	s	F	w
Virginia Rail*	u	o	u	
Sora	c	o	c	
Common Moorhen*	o	u		
American Coot*	a	o	a	r
CRANES				
Sandhill Crane	u	u	u	r
PLOVERS				
Black-bellied Plover	u		u	
American Golden-Plover	u		o	
Snowy Plover	r			
Semipalmated Plover	u	o	u	
Piping Plover(E)	r	r	r	
Killdeer*	c	c	c	o
AVOCETS AND STILTS				
Black-necked Stilt	r		r	
American Avocet	u	o	u	
SANDPIPERS				
Greater Yellowlegs	c	u	c	
Lesser Yellowlegs	a	c	a	
Solitary Sandpiper	u	u	u	
Willet	u	r	o	
Spotted Sandpiper*	c	c	c	
Upland Sandpiper*	o	o	o	
Whimbrel	r			
Long-billed Curlew	r	r		
Hudsonian Godwit	u	r	u	
Marbled Godwit	o	o	r	
Ruddy Turnstone	u	o	r	
Red Knot	r	r		
Sanderling	o	o	o	
Semipalmated Sandpiper	c	c	c	
Western Sandpiper	o	o	r	
Least Sandpiper	c	c	c	
White-rumped Sandpiper	c	u	o	
Baird's Sandpiper	u	u	o	
Pectoral Sandpiper	c	u	c	

Bird List, Squaw Creek NWR

Common Name	S	s	F	w
Dunlin	u	r	u	
Stilt Sandpiper	u	u	o	
Buff-breasted Sandpiper	r	o	o	
Ruff	r	r		
Short-billed Dowitcher	u	u	o	
Long-billed Dowitcher	c	o	c	
Wilson's Snipe	u	r	u	r
American Woodcock*	o	o	o	
Wilson's Phalarope	u	o	o	
Red-necked Phalarope	o	o	o	
GULLS				
Franklin's Gull	o	o	o	r
Bonaparte's Gull	o	r	o	r
Ring-billed Gull	u	o	u	r
Herring Gull	o	r	o	r
TERNS				
Caspian Tern	o	r	o	
Common Tern	o		u	
Forster's Tern	u	o	u	
Least Tern(E)	r	r	r	
Black Tern	c	o	u	
PIGEONS AND DOVES				
Rock Dove*	o	o	o	o
Mourning Dove*	c	c	c	o
CUCKOOS				
Black-billed Cuckoo*	o	o	o	
Yellow-billed Cuckoo*	c	c	u	
OWLS				
Barn Owl*	r	r	r	r
Eastern Screech-Owl*	c	c	c	c
Great Horned Owl*	c	c	c	c
Barred Owl*	c	c	c	c
Long-eared Owl	o	r	u	
Short-eared Owl	o	r	o	u
Northern Saw-whet Owl*				r

Bird List, Squaw Creek NWR

Common Name	S	s	F	w
NIGHTJARS				
Common Nighthawk	o	u	o	
Chuck-will's-widow*	o	o		
Whip-poor-will*	u	u	u	
SWIFTS				
Chimney Swift*	c	a	u	
HUMMINGBIRDS				
Ruby-throated Hummingbird*	o	u	o	
KINGFISHERS				
Belted Kingfisher	u	u	u	r
WOODPECKERS				
Red-headed Woodpecker*	u	u	u	u
Red-bellied Woodpecker*	c	c	c	c
Yellow-bellied Sapsucker	o		o	u
Downy Woodpecker*	c	c	c	c
Hairy Woodpecker*	u	u	u	u
Northern Flicker*	c	c	c	u
Pileated Woodpecker*	r	r	r	r
FLYCATCHERS				
Olive-sided Flycatcher	o	r	o	
Eastern Wood-Pewee*	c	c	o	
Yellow-bellied Flycatcher	r		r	
Acadian Flycatcher*	u	o	u	
Alder Flycatcher	u		u	
Willow Flycatcher*	u	u	u	
Least Flycatcher	u		u	
Eastern Phoebe*	u	u	u	
Great Crested Flycatcher*	u	u	u	
Western Kingbird	o	r	o	
Eastern Kingbird*	c	c	c	
SHRIKES				
Loggerhead Shrike	u	u	u	u
Northern Shrike				r

Bird List, Squaw Creek NWR

Common Name	S	s	F	w
VIREOS				
White-eyed Vireo	o	o	r	
Bells Vireo*	c	c	u	
Yellow-throated Vireo*	u	u	u	
Blue-headed Vireo	o		o	
Warbling Vireo*	c	c	u	
Philadelphia Vireo	o		o	
Red-eyed Vireo*	c	c	u	
CROWS AND JAYS				
Blue Jay*	c	c	c	c
American Crow*	c	c	c	c
LARKS				
Horned Lark*	u	u	u	c
SWALLOWS				
Purple Martin*	c	c	c	
Tree Swallow*	c	u	c	
Northern Rough-winged Swallow	u	u	u	
Bank Swallow*	a	c	a	
Cliff Swallow	c	a	a	
Barn Swallow*	c	c	a	
CHICKADEES AND TITMOUSE				
Black-capped Chickadee*	c	c	c	c
Tufted Titmouse*	c	c	c	c
NUTHATCHES				
Red-breasted Nuthatch	r		r	o
White-breasted Nuthatch*	u	u	u	u
CREEPERS				
Brown Creeper	u		u	u
WRENS				
Carolina Wren*	o	o	o	o
Bewick's Wren	r	r	r	
House Wren*	c	c	u	

Bird List, Squaw Creek NWR

Common Name	S	s	F	w
Winter Wren	u		u	o
Sedge Wren*	c	c	c	
Marsh Wren*	u	u	u	
KINGLETS				
Golden-crowned Kinglet	u		u	u
Ruby-crowned Kinglet	c		c	r
GNATCATCHERS				
Blue-gray Gnatcatcher*	u	u	o	
THRUSHES				
Eastern Bluebird*	u	u	u	r
Veery	r		r	
Gray-cheeked Thrush	u		u	
Swainson's Thrush	c		c	
Hermit Thrush	u		u	r
Wood Thrush*	u	u	o	
American Robin*	c	c	c	o
MOCKINGBIRDS AND THRASHERS				
Gray Catbird*	c	c	o	
Northern Mockingbird*	o	o	o	r
Brown Thrasher*	c	c	u	
STARLINGS				
European Starling*	c	c	c	a
PIPITS				
American Pipit	o		o	
WAXWINGS				
Bohemian Waxwing				r
Cedar Waxwing*	u	u	u	o
WOOD WARBLERS				
Golden-winged Warbler	o		o	
Tennessee Warbler	c		c	
Orange-crowned Warbler	u		u	
Nashville Warbler	c		c	

Bird List, Squaw Creek NWR

Common Name	S	s	F	w
Northern Parula	u	o	u	
Yellow Warbler*	c	c	u	
Chestnut-sided Warbler	u		u	
Magnolia Warbler	u		u	
Cape May Warbler	r			
Yellow-rumped Warbler	c		c	
Black-throated Green Warbler	u		u	
Blackburnian Warbler	u		u	
Palm Warbler	o		o	
Bay-breasted Warbler	r			
Blackpoll Warbler	u		u	
Black-and-white Warbler	u		u	
American Redstart*	c	u	u	
Prothonotary Warbler*	r	r	r	
Ovenbird*	u	o	u	
Northern Waterthrush	u		r	
Louisiana Waterthrush	o	o	o	
Kentucky Warbler*	u	u		
Mourning Warbler	r		r	
Common Yellowthroat*	c	c	u	r
Hooded Warbler	r			
Wilson's Warbler	u		u	
Canada Warbler	u		u	
Yellow-breasted Chat*	u	u		
TANAGERS				
Summer Tanager*	o	u	r	
Scarlet Tanager*	o	o	r	
SPARROWS, TOWHEES, JUNCOS				
Spotted Towhee	r		o	o
Eastern Towhee*	c	c	u	r
American Tree Sparrow	c		c	c
Chipping Sparrow*	u	u	o	
Clay-colored Sparrow	o		o	
Field Sparrow*	u	u	u	
Vesper Sparrow*	u	o	u	r
Lark Sparrow*	u	u	o	
Savannah Sparrow	c		c	r
Grasshopper Sparrow*	o	u	o	

Bird List, Squaw Creek NWR

Common Name	S	s	F	w
Henslow's Sparrow	r	r	r	
Le Conte's Sparrow	u		u	r
Nelson's Sharp-tailed Sparrow	u		o	
Fox Sparrow	u		u	o
Song Sparrow*	c	c	c	u
Lincoln's Sparrow	u		u	r
Swamp Sparrow*	c		c	u
White-throated Sparrow	c		c	o
Harris's Sparrow	u		u	u
White-crowned Sparrow	u		u	o
Dark-eyed Junco	c		c	c
Lapland Longspur	r		o	o
CARDINALS AND ALLIES				
Northern Cardinal*	c	c	c	c
Rose-breasted Grosbeak*	u	u	o	
Blue Grosbeak*	u	u		
Indigo Bunting*	c	c	u	
Dickcissel*	c	c		
BLACKBIRDS, ORIOLES, GRACKLES.				
Bobolink*	u	r	u	
Red-winged Blackbird*	a	a	a	a
Eastern Meadowlark*	c	u	c	o
Western Meadowlark	o	u	o	o
Yellow-headed Blackbird*	c	c	c	r
Rusty Blackbird	u		u	o
Brewer's Blackbird	o		o	r
Great-tailed Grackle*	o	r	o	r
Common Grackle*	a	c	a	c
Brown-headed Cowbird*	a	c	a	o
Orchard Oriole*	c	c	o	
Baltimore Oriole*	c	c	u	
FINCHES, SISKINS, CROSSBILLS				
Purple Finch			o	o
House Finch	o	o	o	o
Red Crossbill				r
White-winged Crossbill				r
Common Redpoll				r

Bird List, Squaw Creek NWR

Common Name	S	s	F	w
Pine Siskin	o		o	o
American Goldfinch*	c	c	c	u
OLD WORLD SPARROWS				
House Sparrow*	a	a	a	a
ACCIDENTALS				
The following 33 species are considered accidentals; they have been observed on Squaw Creek National Wildlife Refuge only once or twice.				
Tri-Colored Heron, White Ibis, Glossy Ibis, Greater Flamingo, Barnacle Goose, Brant, Black-bellied Whistling-Duck, Fulvous Whistling-Duck, Eurasian Wigeon, Long-tailed Duck, Surf Scoter, Black Scoter, Mississippi Kite, Gyrfalcon, Greater Prairie-Chicken, Whooping Crane(E), Red Phalarope, Parasitic Jaeger, Laughing Gull, Sabine's Gull, Black-legged Kittiwake, Common Ground-Dove, Snowy Owl, Black-backed Woodpecker, Say's Phoebe, Scissor-tailed Flycatcher, Black-billed Magpie, Mountain Bluebird, Townsend's Solitaire, Lark Bunting, Snow Bunting, Bronzed Cowbird and Evening Grosbeak.				

Plants of Squaw Creek National Wildlife Refuge Herbarium Collection

Common Name	Family	Genus and Species
Wild Petunia	Acanthianeae	*Ruellia pedunculata*
Parsnip	Apiaceae	*Pastinaca sativa*
Indian Hemp	Apocynaceae	*Apocynum sibiricum*
Butterfly Weed	Asclepiadaceae	*Asclepias tuberosa*
Green Milkweed	Asclepiadaceae	*Asclepias viridiflora*
Fleabane Daisy	Asteraceae	*Erigeron philadelphicus*
Prairie Sunflower	Asteraceae	*Helianthus laetiflorus*
Skeleton Weed	Asteraceae	*Lygodesmia juncea*
Black-eyed Susan	Asteraceae	*Rudbeckia hirta*
Prairie Ragwort	Asteraceae	*Senecio plattensis*
Ironweed	Asteraceae	*Vernonia fasciulata*
Ironweed	Asteraceae	*Vernonia missurica*
Downy Painted Cup	Bignoniaceae	*Castilleja sessiliflora*
Jorrey Puccoon	Boraginaceae	*Lithospermum canescens*
Rough-leaved Dogwood	Cornaceae	*Cornus drummondi*
Sedge spp.	Cyperaceae	*Cyperus odoratus*
Comperssa	Cyperaceae	*Eleocharis compressa*
Rush	Cyperaceae	*Eleocharis macroctachya*
Rush	Cyperaceae	*Eleocharis smallii*
Wolfii	Cyperaceae	*Eleocharis wolfi*
River Bull Rush	Cyperaceae	*Scripus flaviatilis*
Horsetail	Equisetaceae	*Equisetum laevigatum*
Snow on the Mountain	Euphorbiaceae	*Euphorbia marginata*
Lead Plant	Fabaceae	*Amorpha canescens*
Crown Vetch	Fabaceae	*Coronilla varia*
Dalea	Fabaceae	*Dalea enneandra*
White Sweet Clover	Fabaceae	*Melilotus albus*
Yellow Sweet Clover	Fabaceae	*Melilotus officinalis*
Purple Prairie Clover	Fabaceae	*Petalostemon purpureuim*
Blue Flag Iris	Iridaceae	*Iris virginica*
Prairie Blue-eyed Grass	Iridaceae	*Sisyrinchium campestre*
Soft Stem Rush	Juncaceae	*Juncus effusus*
Path Rush	Juncaceae	*Juncus tenuis*
Wild Bergamot	Lamiaceae	*Monarda fistulosa*
Salvia	Lamiaceae	*Salvia reflexa*
Wood Sage	Lamiaceae	*Teucium canadense*
Orange Day Lily	Liliaceae	*Hemerocallis fulva*
Green Brier	Liliaceae	*Smilax tamnoides*
Rose Mallow	Malvaceae	*Hibiscus lasiocarpos*
Japanese Hops	Moraceae	*Humulus japonicus*
Wild 4 O-clock	Nyctaginaceae	*Mirabilis nyctaginea*
Green Ash	Oleaceae	*Fraxinus pennsylvanica*
Hoary Plantain	Plantaginaceae	*Plantago vitginica*
Western Wheat Grass	Poaceae	*Agropyron smithii*
Big Blue Stem	Poaceae	*Andropogon gerardi*
Side Oats Grama	Poaceae	*Bouteloua curtipendula*
Rescue Grass	Poaceae	*Bromus catharticus*
Japanese Brome	Poaceae	*Bromus japonicus*
Downy Chess	Poaceae	*Bromus tectorum*

Barnyard Grass	Poaceae	*Echinochloa crusgalli*
Wild Rye	Poaceae	*Elymus virginicus*
Witch Grass	Poaceae	*Panicum capillare*
Schribner-s Panicum	Poaceae	*Panicum oligasanthes*
Blue Grass	Poaceae	*Poa chapmaniana*
Arrowhead	Poaceae	*Sagittaria monteridensis*
Bristly Foxtail	Poaceae	*Setaria verticillata*
Squirrel Tail	Poaceae	*Sitanion longifolium*
Purple Top	Poaceae	*Tridens flavus*
Prairie Larkspur	Ranunculaceae	*Delphium virescens*
Hustonia	Rubiaceae	*Houstonia nigricans*
Bastard Toad Flax	Santalaceae	*Comandra richardsiana*
Digitalis	Scrophulariaceae	*Penstemon digitalis*
Mullein	Scrophulariaceae	*Verbascum thapsus*
Ground Cherry	Solanaceae	*Physalis longifolia*
Horse Nettle	Solanaceae	*Solanum carolinense*
Buffalo Burr	Solanaceae	*Solanum rostratum*
Vervain	Vervenaceae	*Verbena stricta*
Sand Grape	Vitaceae	*Vitis rupestris*

Wildflower Gardens

Common Name	Genus and Species
Beardtongue	*Penstemon digitalis*
Blue-eyed Grass	*Sisyrinchium campestre*
Butterfly Weed	*Asclepias tuberosa*
Great Blue Lobelia	*Lobelia siphilitica*
Lance-leaf Coreopsis	*Coreopsis lanceolata*
Lead Plant	*Amorpha canescens*
Little Bluestem	*Andropogon scoparius*
New Jersey Tea	*Ceanothus americanus*
Purple Coneflower	*Echinacea purpurea*
Rattlesnake Master	*Eryngium yuccifolium*
Rose Verbena	*Verbena canadensis*
Showy Evening Primrose	*Oenothera speciosa*
Shrubby St. John-s Wort	*Hypericum spathulatum*
Whorled Milkweed	*Asclepias verticillata*
Wild Petunia	*Ruellia humilis*
Wild Sweet William	*Phlox divaricata*
Blue Wild Indigo	*Baptisia australis*
Cat-s Paw	*Antennaria plantaginifolia*
Christmas Fern	*Polystichum acrostichoides*
Culver-s Root	*Veronicastrum virginicum*
Indian Grass	*Sorgastrum nutans*
Pussy-s Toes	*Antennaria neglecta*
Spiderwort	*Tradescantia ohiensis*
Blue Star	*Amsonia illustric*
Ostrich Fern	*Matteuccia struthiopteris*
Wild Columbine	*Aquilegia canadensis*
Fragile Fern	*Cystopteris fragilis*

Dutchman=s Breeches	*Dicentra cucullaria*
Jack-in-the-Pulpit	*Arisaema triphyllum*
Lady Fern	*Athyrium filix-femina*
May Apple	*Podophyllum peltatum*
Sensitive Fern	*Onoclea sensibilis*
Big Bluestem	*Andropogon gerardii*
Black-eyed Susan	*Rudbeckia hirta*
Canada Milk Vetch	*Astraglus canadensis*
Prairie Smoke	*Geum triflorum*
Queen of the Prairie	*Filipendula rubra*
Solomon=s Seal	*Polygonatum canaliculatum*
White Snakeroot	*Eupatorium rugosum*

Loess Bluffs

Big Blue Stem	*Andropogon gerardii*
Hairy Grama	*Bouteloua hirsuta*
Panicum	*Panicum oligosanthes*
Fescue	*Festuca spp.*
Downy Chess	*Bromus tectorum*
Japanese Brome	*Bromus japonicus*
Blue Grass	*Poa spp.*
Green Pussy=s Toes	*Antennaria neglecta*
Oblong-leaf Aster	*Aster oblongifolius*
Silky Aster	*Aster sericeus*
Ground Plum	*Astragalus crassicarpus*
Low Milk Vetch	*Astragalus lotiflorus*
False Boneset	*Brickllia eupatorioides*
Downy Painted Cup	*Castilleja sessiliflora*
Nine Anthered Prairie Clover	*Dalea enneandra*
Purple Prairie Clover	*Dalea purpurea*
Prairie Larkspur	*Delphinium virescens*
Bluet	*Hedyotis nigricans*
Prairie Sunflower	*Helianthus rigida*
Lespedeza	*Lespedeza capitata*
Dotted Blazing Star	*Liatris punctata var.*
Orange Puccoon	*Lithospermum canescens*
Yellow Puccoon	*Lithospermum incisum*
Skeleton Weed	*Lygodesmia juncea*
Prairie Ragwort	*Senecio plattensis*
Stiff Goldenrod	*Solidago rigida*
Goldenrod spp.	*Solidago spp.*
Vervain	*Verbena stricta*
Azure Aster	*Aster azureus*
Lead Plant	*Amorpha canescens*
Redroot	*Caenothus ovatus*
Cedar	*Juniperus virginiana*
Smooth Sumac	*Rhus glabra*
Coral Berry	*Symphoricarpos orbiculatus*
Soapweed	*Yucca glauca var. glauca*
Alfalfa	*Medicago sativa*
Goat=s Beard	*Tragopogon dubius*
Yellow Sweet clover	*Melilotus officinalis*

Common Ragweed	*Ambrosia artemisiifolia*
Tall Green Milkweed	*Asclepias hirtella*
Whorled Milkweed	*Asclepias verticillata*
Side-oats Grama	*Bouteloua curtipendula*
Rough False Foxglove	*Gerardia asper*
Wild Bergamot	*Monarda fistulosa*
Locoweed	*Oxytropis lambertii*
Little Bluestem	*Schizachyrium scoparius*
Prairie Blue-eyed Grass	*Sisyrinchium campestre*
Indian Grass	*Sorghastrum nutans*
Germander	*Teucrium canadense*

Appendix D: Compatibility Determinations

Appendix D: Compatibility Determinations

The following compatibility determinations were presented for public review and have been approved. The final signature copies are available at the Refuge Headquarters.

- Recreational Fishing
- Environmental Education and Interpretation
- Hunting White-tailed Deer
- Wildlife Observation and Photography
- Farming and Haying
- Visitor Center Parking / Auto Tour Route Improvements
- Mushroom Gathering
- Light Goose Hunting

Appendix E: Compliance Requirements

Appendix E / Compliance Requirements

Rivers and Harbor Act (1899) (33 U.S.C. 403): Section 10 of this Act requires the authorization by the U.S. Army Corps of Engineers prior to any work in, on, over, or under a navigable water of the United States.

Antiquities Act (1906): Authorizes the scientific investigation of antiquities on Federal land and provides penalties for unauthorized removal of objects taken or collected without a permit.

Migratory Bird Treaty Act (1918): Designates the protection of migratory birds as a Federal responsibility. This Act enables the setting of seasons, and other regulations including the closing of areas, Federal or non Federal, to the hunting of migratory birds.

Migratory Bird Conservation Act (1929): Establishes procedures for acquisition by purchase, rental, or gift of areas approved by the Migratory Bird Conservation Commission.

Fish and Wildlife Coordination Act (1934), as amended: Requires that the Fish and Wildlife Service and State fish and wildlife agencies be consulted whenever water is to be impounded, diverted or modified under a Federal permit or license. The Service and State agency recommend measures to prevent the loss of biological resources, or to mitigate or compensate for the damage. The project proponent must take biological resource values into account and adopt justifiable protection measures to obtain maximum overall project benefits. A 1958 amendment added provisions to recognize the vital contribution of wildlife resources to the Nation and to require equal consideration and coordination of wildlife conservation with other water resources development programs. It also authorized the Secretary of Interior to provide public fishing areas and accept donations of lands and funds.

Migratory Bird Hunting and Conservation Stamp Act (1934): Authorized the opening of part of a refuge to waterfowl hunting.

Historic Sites, Buildings and Antiquities Act (1935), as amended: Declares it a national policy to preserve historic sites and objects of national significance, including those located on refuges. Provides procedures for designation, acquisition, administration, and protection of such sites.

Refuge Revenue Sharing Act (1935), as amended: Requires revenue sharing provisions to all fee-title ownerships that are administered solely or primarily by the Secretary through the Service.

Transfer of Certain Real Property for Wildlife Conservation Purposes Act (1948): Provides that upon a determination by the Administrator of the General Services Administration, real property no longer needed by a Federal agency can be transferred without reimbursement to the Secretary of Interior if the land has particular value for migratory birds, or to a State agency for other wildlife conservation purposes.

Federal Records Act (1950): Directs the preservation of evidence of the government's organization, functions, policies, decisions, operations, and activities, as well as basic historical and other information.

Fish and Wildlife Act (1956): Established a comprehensive national fish and wildlife policy and broadened the authority for acquisition and development of refuges.

Refuge Recreation Act (1962): Allows the use of refuges for recreation when such uses are compatible with the refuge's primary purposes and when sufficient funds are available to manage the uses.

Wilderness Act (1964), as amended: Directed the Secretary of Interior, within 10 years, to review every roadless area of 5,000 or more acres and every roadless island (regardless of size) within National Wildlife Refuge and National Park Systems and to recommend to the President the suitability of each such area or island for inclusion in the National Wilderness Preservation System, with final decisions made by Congress. The Secretary of Agriculture was directed to study and recommend suitable areas in the National Forest System.

Land and Water Conservation Fund Act (1965): Uses the receipts from the sale of surplus Federal land, outer continental shelf oil and gas sales, and other sources for land acquisition under several authorities.

National Wildlife Refuge System Administration Act (1966), as amended by the *National Wildlife Refuge System Improvement Act (1997)*16 U.S.C. 668dd668ee. (Refuge Administration Act): Defines the National Wildlife Refuge System and authorizes the Secretary to permit any use of a refuge provided such use is compatible with the major purposes for which the refuge was established. The Refuge Improvement Act clearly defines a unifying mission for the Refuge System; establishes the legitimacy and appropriateness of the six priority public uses (hunting, fishing, wildlife observation and photography, or environmental education and interpretation); establishes a formal process for determining compatibility; established the responsibilities of the Secretary of Interior for managing and protecting the System; and requires a Comprehensive Conservation Plan for each refuge by the year 2012. This Act amended portions of the Refuge Recreation Act and National Wildlife Refuge System Administration Act of 1966.

National Historic Preservation Act (1966), as amended: Establishes as policy that the Federal Government is to provide leadership in the preservation of the nation's prehistoric and historic resources.

Architectural Barriers Act (1968): Requires federally owned, leased, or funded buildings and facilities to be accessible to persons with disabilities.

National Environmental Policy Act (1969): Requires the disclosure of the environmental impacts of any major Federal action significantly affecting the quality of the human environment.

Uniform Relocation and Assistance and Real Property Acquisition Policies Act (1970), as amended: Provides for uniform and equitable treatment of persons who sell their homes, businesses, or farms to the Service. The Act requires that any purchase offer be no less than the fair market value of the property.

Endangered Species Act (1973): Requires all Federal agencies to carry out programs for the conservation of endangered and threatened species.

Rehabilitation Act (1973): Requires programmatic accessibility in addition to physical accessibility for all facilities and programs funded by the Federal government to ensure that anybody can participate in any program.

Archaeological and Historic Preservation Act (1974): Directs the preservation of historic and archaeological data in Federal construction projects.

Clean Water Act (1977): Requires consultation with the Corps of Engineers (404 permits) for major wetland modifications.

Surface Mining Control and Reclamation Act (1977) as amended (Public Law 95-87) (SMCRA): Regulates surface mining activities and reclamation of coal-mined lands. Further regulates the coal industry by designating certain areas as unsuitable for coal mining operations.

Executive Order 11988 (1977): Each Federal agency shall provide leadership and take action to reduce the risk of flood loss and minimize the impact of floods on human safety, and preserve the natural and beneficial values served by the floodplains.

Executive Order 11990: Executive Order 11990 directs Federal agencies to (1) minimize destruction, loss, or degradation of wetlands and (2) preserve and enhance the natural and beneficial values of wetlands when a practical alternative exists.

Executive Order 12372 (Intergovernmental Review of Federal Programs): Directs the Service to send copies of the Environmental Assessment to State Planning Agencies for review.

American Indian Religious Freedom Act (1978): Directs agencies to consult with native traditional religious leaders to determine appropriate policy changes necessary to protect and preserve Native American religious cultural rights and practices.

Fish and Wildlife Improvement Act (1978): Improves the administration of fish and wildlife programs and amends several earlier laws including the Refuge Recreation Act, the National Wildlife Refuge System Administration Act, and the Fish and Wildlife Act of 1956. It authorizes the Secretary to accept gifts and bequests of real and personal property on behalf of the United States. It also authorizes the use of volunteers on Service projects and appropriations to carry out a volunteer program.

Archaeological Resources Protection Act (1979), as amended: Protects materials of archaeological interest from unauthorized removal or destruction and requires Federal managers to develop plans and schedules to locate archaeological resources.

Federal Farmland Protection Policy Act (1981), as amended: Minimizes the extent to which Federal programs contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses.

Emergency Wetlands Resources Act (1986): Promotes the conservation of migratory waterfowl and offsets or prevents the serious loss of wetlands by the acquisition of wetlands and other essential habitats.

Federal Noxious Weed Act (1990): Requires the use of integrated management systems to control or contain undesirable plant species, and an interdisciplinary approach with the cooperation of other Federal and State agencies.

Native American Graves Protection and Repatriation Act (1990): Requires Federal agencies and museums to inventory, determine ownership of, and repatriate cultural items under their control or possession.

Americans With Disabilities Act (1992): Prohibits discrimination in public accommodations and services.

Executive Order 12898 (1994): Establishes environmental justice as a Federal government priority and directs all Federal agencies to make environmental justice part of their mission. Environmental justice calls for fair distribution of environmental hazards.

Executive Order 12996 Management and General Public Use of the National Wildlife Refuge System (1996): Defines the mission, purpose, and priority public uses of the National Wildlife Refuge System. It also presents four principles to guide management of the System.

Executive Order 13007 Indian Sacred Sites (1996): Directs Federal land management agencies to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners, avoid adversely affecting the physical integrity of such sacred sites, and where appropriate, maintain the confidentiality of sacred sites.

National Wildlife Refuge System Improvement Act (1997): Considered the "Organic Act of the National Wildlife Refuge System. Defines the mission of the System, designates priority wildlife-dependent public uses, and calls for comprehensive refuge planning.

National Wildlife Refuge System Volunteer and Community Partnership Enhancement Act (1998): Amends the Fish and Wildlife Act of 1956 to promote volunteer programs and community partnerships for the benefit of national wildlife refuges, and for other purposes.

National Trails System Act: Assigns responsibility to the Secretary of Interior and thus the Service to protect the historic and recreational values of congressionally designated National Historic Trail sites.

Treasury and General Government Appropriations Act of 2001 (Public Law 106-554): In December 2002, Congress required federal agencies to publish their own guidelines for ensuring and maximizing the quality, objectivity, utility, and integrity of information that they disseminate to the public (44 U.S.C. 3502). The amended language is included in Section 515(a). The Office of Budget and Management (OMB) directed agencies to develop their own guidelines to address the requirements of the law. The Department of the Interior instructed bureaus to prepare separate guidelines on how they would apply the Act. The U.S. Fish and Wildlife Service has developed "Information Quality Guidelines" to address the law.

Appendix F: Refuge Operations Needs (RONS) and Maintenance Management System (MMS)

Refuge Operations Needs (RONS)

RONS Project No.	Strategy No.	Project Description	First Year Need	Recurring Annual Need
99015	1.2.17/11.1.1	Improve moist soil/wetland vegetation (seasonal tractor operator)	$59,000	$26,000
00001	7.2.5	Improve visitor services/outreach\Environmental Education	$92,000	$5,000
00002	1.4.10	Restore Loess Bluff/upland grasslands	$32,000	$1,000
97003	7.1.2	Improve visitor services /interpretation auto tour route	$117,000	$5,000
99017	7.2.6/7.3.5	Expand Outdoor Classroom facilities	$179,000	$2,000
99016	7.1.5	Revise Refuge leaflets	$79,000	
99018	1.2.10	Provide access - east of Davis Creek	$204,000	$1,000
00009	7.1.1/7.2.7/ 11.1.1	Improve visitor services - O&M	$113,000	$13,000
99002	10.1.6/10.4.1	Boundary/historic survey- Munkres	$32,000	
97008	1.5.3	Restore loess bluff native grasslands	$25,000	$1,000
99001	5.1.8	Survey easement/fee title lands	$43,000	
97006	5.1.1/9.2.1 / 11.1.1	Restore private lands wetlands and improve watershed water quality.	$118,000	$53,000
99007	1.5.4	Biology of Illinois garlic mustard	$32,000	
02002		Biology of Reed Canary Grass	$32,000	
99003		Improve wetlands and water level management.	$34,000	$1,000
00008		Manage biological programs and provide biological monitoring.	$32,000	$32,000
02001		Improve visitor services/enhance quality of office efficiency.	$56,000	$23,000
02003		Prescribed Fire Specialist		
99011		Geographic information/global positioning capability	$108,000	$10,000
Total			$1,387,000	

Deferred Maintenance and Equipment Needs (MMS)

MMS	Refuge Rank	Strategy No.	Project Description	Fund Type	Year	Cost
03003	2		Replace worn-out inadequate entrance gate	DM	2003	$14,000
95441	3		Replace deteriorated 3-stall garage	DM	2999	$200,000
02001	6		Replace deteriorated items in office building	DM	2999	$60,000
98049	9		Rehab deficient Squaw Creek water control structure	DM	2005	$33,000
01007	10		Replace deteriorated Squaw Creek roller gate	DM	2004	$326,000
01001	11		Replace wildlife observation tower	DM	2004	$40,000
03012	12		Replace deteriorated Eagle Pool water control structure	DM	2999	$450,000
99103	13		Retrofit shop bldg. for energy reduction	DM	2005	$250,000
02003	15		Restore deteriorated Squaw Creek ditch	DM	2999	$450,000
02004	16		Restore deteriorated Davis Creek ditch	DM	2999	$485,000
99343	17		Replace deteriorated equip. storage bldg.	DM	2999	$40,000
Total Deferred Maintenance					$2,348,000	
995442	2		Replace worn-out D-7 dozer	EQ	2011	$228,000
99342	3		Replace worn-out road grader	EQ	2010	$245,000
01020	4		Replace worn-out Ford 6600 tractor	EQ	2999	$80,000
98192	5		Replace worn-out JD 350 dozer	EQ	2004	$93,000
99341	6		Replace worn-out IHC dump truck	EQ	2005	$88,000
99343	7		Replace worn-out JD backhoe	EQ	2010	$67,000
95440	8		Replace worn-out JD 70hp tractor	EQ	2011	$93,000
00216	9		Replace worn-out D-4 dozer	EQ	2011	$129,000
01006	10		Replace worn-out tracked excavator	EQ	2999	$220,000
01015			Replace worn-out JD 130hp tractor	EQ	2999	$70,000
01018	12		Replace worn-out Case scoop loader	EQ	2999	$130,000
01019	13		Replace worn-out Ford F450	EQ	2999	$38,000
03007	14		Replace worn-out IH dump truck	EQ	2999	$80,000
03002	15		Replace worn-out Komatsu scraper	EQ	2999	$368,000
Total Heavy Equipment					$1,929,000	
00214	1		Replace worn-out 1995 GMC Suburban	EQ	2003	$35,000
03011	3		Replace worn-out JD 210 ag disk	EQ	2999	$23,000
03010	4		Replace worn-out IH tractor w/mower	EQ	2999	$35,000
03001	5		Replace worn-out Totem-all trailer	EQ	2999	$35,000
03009	6		Replace worn-out JD F525 riding mower	EQ	2999	$10,000
03013	7		Replace worn-out Woods flexwing mower	EQ	2999	$9,000
03008	8		Replace worn-out JD F145H plow	EQ	2999	$16,000
03006	9		Replace worn-out Rhino mower	EQ	2999	$8,000
00217	10		Replace deteriorated Truax seed drill	EQ	2999	$26,000
00213	11		Replace worn-out 1996 Dodge truck	EQ	2999	$31,000
01013	12		Replace worn-out 1997 Ford truck	EQ	2999	$35,000

Deferred Maintenance and Equipment Needs (MMS)

MMS	Refuge Rank	Strategy No.	Project Description	Fund Type	Year	Cost
01002	13		Replace worn-out bush hog harrow/disk	EQ	2999	$18,000
01004	14		Replace worn-out Cascade slipon pumper	EQ	2999	$12,000
01005	15		Replace worn-out Kewannee harrow/disk	EQ	2999	$10,000
01007	16		Replace worn-out Honda 4x4 atv	EQ	2999	$8,000
01008	17		Replace worn-out beavertail trailer	EQ	2999	$20,000
01009	18		Replace worn-out extendavator	EQ	2999	$10,000
01010	19		Replace worn-out Chevy 3500 crewcab	EQ	2999	$37,000
91337	20		Replace worn-out boom ax mower	EQ	2999	$73,000
01014	21		Replace deteriorated Gulfstream trailer	EQ	2999	$25,000
01016	22		Replace worn-out Cascade pumper	EQ	2999	$15,000
01017	23		Replace worn-out JD 1218 mower	EQ	2999	$12,000
03004	24		Replace worn-out Polaris 6x6 atv	EQ	2999	$12,000
03005	25		Replace worn-out Honda TRX 4x4 atv	EQ	2999	$7,000
03014	26		Replace worn-out 2001 Dodge Caravan	EQ	2999	$35,000
03015	27		Replace worn-out 2001 Dodge 318	EQ	2999	$35,000
03016	28		Replace worn-out 2001 Dodge 350	EQ	2999	$40,000
Total Small Equipment					$652,000	
00007 99044		11.3.1	Environmental Learning Center/ office expansion	CON	2999	$1,200,000
Total Construction					$120,000	
93159			Replace deteriorated bridge over Tarkio Creek	DM	2999	$58,000
96242		7.3.1	Repair 7,900 LF of eroded auto tour route	DM	2999	$84,000
98151		7.3.2/ 7.3.6	Repair deteriorated asphalt surface on entrance road	DM	2999	$90,000
01013			Replace deteriorated Squaw Creek bridge	DM	2999	$400,000
01014			Repair deteriorated gravel auto tour route	DM	2999	$50,000
Total TEA 21 Refuge Roads					$592,000	

Appendix G: Mailing List

Appendix G: Mailing List

Elected Federal Officials

- # U.S. Senator Christopher Bond
- # U.S. Senator Jim Talent
- # U.S. Representative Samuel Graves
- # U.S. Representative Roy Blunt
- # U.S. Representative JoAnn Emerson
- # U.S. Representative Kenny Hulshof
- # U.S. Representative Dick Gephardt
- # U.S. Representative Todd Akin

Federal Agencies

- # U.S. Army Corps of Engineers, Vicksburg Division, Rock Island and St. Louis Districts
- # U.S. Geological Survey, Long Term Monitoring Program; Jackson, MO; Alton, IL
- # U.S. Department of Agriculture/Natural Resources Conservation Service, Columbia, MO
- # Environmental Protection Agency, Chicago, IL; Kansas City, KS
- # Columbia Environmental Research Center, Columbia, MO
- # Upper Midwest Science Center, LaCrosse, WI
- # U.S. Coast Guard, Keokuk, IA
- # Illinois River National Wildlife Refuge
- # Shawnee National Forest, Murphysboro, IL
- # U.S. Fish and Wildlife Service, Ecological Services, Rock Island, IL
- # U.S. Fish and Wildlife Service Regional Historian

Elected State Officials

- # Missouri Governor Bob Holden

State Agencies

- # Missouri Department of Natural Resources
- # Missouri Department of Conservation
- # University of Missouri, Extension Services
- # State Historic Preservation Officer
- # Office of the State Archeologist
- # Indian Affairs Council
- # The Advisory Council on Historic Preservation

City/County Governments

- # Holt County
- # Mound City

Public Libraries

Mound City
Oregon

Organizations

Sierra Club, Kaskaskia Group Conservation Chair, Columbia, IL
The Sierra Club, Washington, DC
Ducks Unlimited
Pheasants Forever
Wild Turkey Federation
The American Fisheries Society, Columbia, MO
The Missouri Prairie Foundation, Columbia, MO
The Wildlife Society, Missouri Chapter, MO Dept. of Conservation, Columbia, MO
Missouri Wildlife Society, Hannibal, MO
Missouri Conservation Foundation, Jefferson, MO
Missouri Chapter American Fisheries Society, Missouri Department of Conservation, Jefferson City, MO
The Conservation Federation of Missouri, Jefferson City, MO
The Missouri Audubon Council, Jefferson City, MO
The Missouri Bass Chapter Federation, Lake St. Louis, MO
Missouri State Chapter, Soil and Water Conservation Society, Springfield, MO
The Audubon Society of Missouri, St. Louis, MO
Wildlife Management Institute, Washington, DC
National Wildlife Foundation, Office of Federal and International Affairs, Washington, DC
American Rivers, Washington, DC
The Clean Water Fund, National Office, Washington, DC
Defenders of Wildlife, Washington, DC
The National Waterways Conference, Inc., Washington, DC
The National Wildlife Refuge Association, Washington, DC
The Natural Resources Council of America, Washington, DC
National Audubon Society, Washington, DC
Northeast Midwest Institute, Washington, DC

Individuals

Individuals who participated in open house sessions or who requested to be on the Comprehensive Conservation Plan mailing list.

Appendix H: List of Preparers

Appendix H: List of Preparers

Ronald L. Bell, Refuge Manager, Squaw Creek NWR
Frank Durbian, Wildlife Biologist, Squaw Creek NWR
Charles Marshall, Park Ranger, Squaw Creek NWR
Joanna Foster, Administrative Technician, Squaw Creek NWR
Thomas Larson, Chief, Conservation Planning
John Schomaker, Refuge Planning Specialist, Conservation Planning
Jim Salyer, Refuge Planner, Southern Missouri Branch of Conservation Planning
Gabriel DeAlessio, Biologist/GIS, Conservation Planning
Jane Hodgins, Technical Writer/Editor, Conservation Planning
Jane Lardy Nelson, Editorial Assistant, Conservation Planning
Judy McClendon, formerly with the Southern Missouri Branch of the Region 3 Conservation Planning

Appendix I: Wildlife Resource Conservation Priority Species for the Lower Missouri River Ecosystem

Appendix I: Wildlife Resource Conservation Priority Species for the Lower Missouri River Ecosystem

Federal and state species of concern that are known to occur or have the potential to occur on Squaw Creek NWR (SCNWR) as identified in the U.S. Fish and Wildlife Service Region 3 Fish and Wildlife Resource Conservation Priorities (1999) and/or the Missouri Department of Conservation Species of Concern Checklist (2001). Both federal and state status are provided where applicable. State rank: S1 = critically imperiled in the state because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation from the state, S2 = Imperiled in the state because of rarity or because of some factor(s) making it especially vulnerable to extirpation from the state, S3 = Rare and uncommon in the state, S4 = Widespread, abundant, and apparently secure in the state, with many occurrences, but the species is of long-term concern, S? = State status is not known. Habitat types listed are only those that occur on SCNWR. Identified species may occur in other habitat types that are not found on SCNWR.

Common Name	Scientific Name	Status	Federal Classification	State Classification	Habitat Type
MAMMALS					
Indiana Bat	*Myotis sodalis*	Potential	Endangered	Endangered, S1	Forests
Long-tailed Weasel	*Mustela frenata*	Present		S2	Forests
Least Weasel	*Mustela nivalis*	Potential		S4	Grasslands
BIRDS					
Pied-Billed Grebe	*Podilymbus podiceps*	Present		S2	Palustrine
American Bittern	*Botaurus lentiginosus*	Present	Rare/Declining	Endangered, S1	Palustrine, Grasslands
Least Bittern	*Ixobrychus exilis*	Present	Rare/Declining	S2	Palustrine
Black-Crowned Night-Heron	*Nycticorax nycticorax*	Present		S2	Palustrine
Snow Goose	*Chen caerulescens*	Present	Recreational/ Economic Value, Nuisance		Palustrine
Canada Goose - Giant Population	*Branta canadensis*	Present	Recreational/Economic Value		Palustrine
Canada Goose - Eastern Prairie Population	*Branta canadensis*	Present	Recreational/ economic value		Palustrine
Trumpeter Swan	*Cygnus buccinator*	Present	Rare/Declining, Recreational/ Economic Value	S?	Palustrine
Wood Duck	*Aix sponsa*	Present	Recreational/ Economic Value		Palustrine, Riverine, Forests
Mallard	*Anas platyrhynchos*	Present	Recreational/ Economic Value		Palustrine, Grasslands, Forests
Bald Eagle	*Haliaeetus leucocephalus*	Present	Threatened, Tribal Trust	Endangered, S2	Palustrine, Riverine, Forests
Red-shouldered Hawk	*Buteo lineatus*	Present	Rare/Declining	S3	Forests
Peregrine Falcon	*Falco peregrinus anatum*	Present	Endangered, Recreational/ Economic Value	Endangered, S1	Palustrine, Riverine
Common Moorhen	*Gallinula chloropus*	Present		S2	Palustrine

Common Name	Scientific Name	Status	Federal Classification	State Classification	Habitat Type
Piping Plover	*Charadrius melodus*	Present	Endangered		Palustrine
Least Tern - Interior Population	*Sterna antillarum*	Present	Endangered	Endangered, S1	Palustrine
Black Tern	*Chlidonias niger*	Present	Rare/Declining	S?	Palustrine
Sedge Wren	*Cistothorus platensis*	Present	Rare/ declining		Palustrine, Grasslands
Marsh Wren	*Cistothorus palustris*	Present		S2	Palustrine, Grasslands
Wood Thrush	*Hylocichla mustelina*	Present	Rare/Declining		Forests
Loggerhead Shrike	*Lanius ludovicianus*	Present	Rare/Declining	S1, S2	Grasslands
Dickcissel	*Spiza americana*	Present	Rare/Declining		Grasslands
Grasshopper Sparrow	*Ammodramus savannarum*	Present	Rare/Declining		Grasslands
Bobolink	*Dolichonyx oryzivorus*	Present	Rare/ declining		Grasslands
Eastern Meadowlark	*Stumella magna*	Present	Rare/ declining		Grasslands
Yellow-Headed Blackbird	Xanthocephalus xanthocephalus	Present		S2	Palustrine
REPTILES					
Eastern Massasauga	*Sistrurus catenatus catenatus*	Present	Rare/Declining (status assessment pending)	Endangered, S1	Palustrine, Forests, Grasslands
Western Fox Snake	*Elaphe vulpina vulpina*	Present		Endangered, S1	Palustrine, Forests, Grasslands
Blanding-s Turtle	*Emydoidea blandingii*	Present		Endangered, S1	Palustrine, Riverine
PLANTS					
Hairy Grama	*Bouteloua hirsuta*	Present		S2	Grasslands
Buffalo Grass	*Buchloe dactyloides*	Present		S1	Grasslands
Creeping Love Grass	*Eragrostis reptans*	Potential		S1	Grasslands
Bayonet Grass	*Bolboschoenus maritimus ssp. paludosus*	Potential		S1	Grasslands
Arigrostas	*Arigrostas reptans*	Potential		S1	Grasslands
A Rush	*Eleocharis wolfii*	Present		S2	Grasslands
Hall-s Bulrush	*Schoenoplectus hallii*	Potential	Rare/Declining	S1	Barren Lands
Pale Bulrush	*Scirpus pallidus*	Potential		S2	Palustrine
A Sedge	*Carex stricta*	Present		S2	Grasslands
A Sedge	*Carex abscondita*	Present		S1	Grasslands
Lake-Bank Sedge	*Carex lacustris*	Potential		S2	Grasslands
Sartwell-s Sedge	*Carex sartwellii*	Present		S1	Grasslands
Missouri Bladderpod	*Lesquerella filiformis*	Potential	Threatened	Endangered, S3	Grasslands
Mead-s Milkweed	*Asclepias meadii*	Potential	Threatened	Endangered, S2	Grasslands

Common Name	Scientific Name	Status	Federal Classification	State Classification	Habitat Type
Prairie Bush-clover	*Lespedeza leptostachya*	Potential	Threatened		Grasslands
Western Prairie Fringed Orchid	*Platanthera praeclara*	Potential	Threatened	Endangered, S1	Palustrine
Downy Painted Cup	*Castilleja sessiliflora*	Present		S2	Grasslands
Nine-anther Dalea	*Dalea enneandra*	Present		S2	Grasslands
Blazing Star	*Liatris punctata*	Present		S3	Grasslands
Skeleton Plant	*Lygodesmia juncea*	Present		S3	Grasslands
Small Soapweed Yucca	*Yucca glauca*	Present		S2	Grasslands
Low Milk Vetch	*Astragalus lotiflorus*	Present		S2	Grasslands
Thimbleweed	*Anemone cylindrica*	Potential		S2	Grasslands
Silvery Psoralea	*Pediomelum argophyllum*	Potential		S1	Grasslands
Great St.John-s-Wort	*Hypericum pyramidatum*	Potential		S1	Grasslands
INSECTS					
Perlid Stonefly	*Attaneuris ruralis*	Potential		S3	Palustrine
Regal Fritillary	*Speyeria idalia*	Potential		S3	Palustrine

Appendix J: References

Appendix J: References

Missouri Department of Conservation agency's website, May 2003, http://www.conservation.state.mo.us/nathis/natcom/prairies/pubprairies/history.htm

Missouri Department of Natural Resources / Geological Survey and Resource Assessment Division Fact Sheet No. 4)

Nagel, Tom, Missouri Conservationist Online, 2001, www.conservation.state.mo.us/conmag/2001/12/30.htm)

U.S. Department of Agriculture, Natural Resources Conservation Service, Soil Survey of Holt County, Missouri; 1997.

U.S. Fish & Wildlife Service, Bureau of Sport Fisheries, 1934, "The Squaw Creek Bottoms."

U.S. Department of Energy. 1999. Carbon Sequestration Research and Development. Washington, D.C.

Appendix K: Comparison of Alternatives by Objective and Strategy

Squaw Creek NWR Objectives and Strategies by Alternative

Alternative A: Current Management (No Action)	Alternative B: Restore Historic Wet and Mesic Prairie	Alternative C: Enhance Public Use With Current Resource Management Level	Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation
Goal 1 Habitat: Manage a diversity of habitat to benefit threatened and endangered species, waterfowl, other migratory birds, and indigenous species in the Lower Missouri River floodplain ecosystem and the Central Tallgrass Prairie ecosystem.				
1.1 Objective: Wetlands – Manage 3,409 acres of wetland (877.5 acres of semipermanent water and 2,531 acres of seasonally flooded impoundments) which will be manipulated to provide open water, exposed shoreline and mudflats, and shallow wetlands traditionally preferred by migratory birds and other wetland associated wildlife species. Strategies: Continue to manipulate water levels to maintain existing habitat structure and waterfowl use.	1.1 Objective: Wetlands – Manage 1,227 acres of wetlands and convert 2,181 managed wetlands to wet prairie. Strategies: Same as Alternative A.	1.1 Objective: Wetlands – Same as Alternative A. Strategies: Same as Alternative A.	1.1 Objective: Wetlands – Same as Alternative A except will manage 3,452 acres of wetlands will be managed for the habitats cited. Strategies: Replace water control structures on Eagle and Pelican pools; install water control outlet structures on Snow Goose Pond, Unit C, to enhance water and habitat management; manage water levels for resting and roosting waterfowl; use mechanical or chemical treatment or burning to provide open water, reduce undesirable plants, and encourage preferred seed producing plants; maintain cattail stands; add seasonal tractor operator; construct a bridge across the north end of Davis Creek to provide access to Bluff Pool for water management, monitoring and prescribed burning.	1.1 Objective: Wetlands – Same as Alternative A. Strategies: Same as Alternative D, with less opportunity for public access.

Squaw Creek NWR Objectives and Strategies by Alternative (Continued)

Alternative A: Current Management (No Action)	Alternative B: Restore Historic Wet and Mesic Prairie	Alternative C: Enhance Public Use With Current Resource Management Level	Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation
1.2 Objective: Wet Prairie – Conserve and enhance the largest remnant wet prairie in Missouri by preserving and maintaining the integrity of at least 1,077 acres of wet prairie through elimination of non-native species and restoration of associated natural functioning systems (e.g. hydraulic systems, fire, etc.). Strategies: Lower water level during summer to establish moist-soil vegetation; reflood units in the fall.	1.2 Objective: Wet Prairie – Same as Alternative A but at least 3,259 acres of wet prairie managed by 2018. Strategies: Same as Alternative A.	1.2 Objective: Wet Prairie – Same as Alternative A. Strategies: Same as Alternative A.	1.2 Objective: Wet Prairie – Same as Alternative A. Strategies: Conduct species surveys; inventory wet prairie vegetation; reduce exotic invasives through prescribed burning; add a full-time prescribed fire specialist; employ chemical applications to control invasives; restore prairie cordgrass south of Pintail Pool; minimize adverse effects of prescribed burning on Massassauga rattlesnakes and other wetland species by burning smaller units and mowing some areas prior to burning; maintain current disced firebreaks; assess effectiveness of prescribed burning.	1.2 Objective: Wet Prairie – Same as Alternative A. Strategies: Same as Alternative D.

Squaw Creek NWR Objectives and Strategies by Alternative (Continued)

Alternative A: Current Management (No Action)	Alternative B: Restore Historic Wet and Mesic Prairie	Alternative C: Enhance Public Use With Current Resource Management Level	Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation
1.3 Bottomland Mesic Prairie – Manage 291 acres of bottomland mesic prairie to provide quality nesting cover for nongame migratory birds as well as nesting and wintering cover for upland gamebird species, breeding waterfowl, and other associated wildlife species by maintaining, enhancing and restoring grasslands to a mixture of warm and cool season native grasses. Strategies: Continue the use of prescribed fire to combat invasive species; work with volunteers to restore Loess Hill prairies.	1.3 Bottomland Mesic Prairie – Manage 870 acres of bottomland mesic prairie to provide quality nesting cover for nongame migratory birds as well as nesting and wintering cover for upland gamebird species, breeding waterfowl, and other associated wildlife species by maintaining, enhancing and restoring grasslands to a mixture of warm and cool season native grasses. Strategies: Same as Alternative A.	1.3 Bottomland Mesic Prairie – Same as Alternative A. Strategies: Same as Alternative A.	1.3 Bottomland Mesic Prairie – Manage 508 acres of bottomland mesic prairie habitat to provide quality nesting cover for nongame migratory birds as well as nesting and wintering cover for upland gamebird species, breeding waterfowl, and other associated wildlife species by maintaining, enhancing and restoring grasslands to a mixture of warm and cool season native grasses. This habitat will be managed to maximize native vegetation abundance, minimize fragmentation and maximize the minimum patch size for area-dependent species. Strategies: Conduct species surveys and monitoring; use seasonal, rotational prescribed burning to combat invasives; add a full-time fire specialist position; use chemical applications to control invasives; convert 200 acres of agricultural cropland and 59 acres of old field to 259 acres of native bottomland mesic prairie; use basic farming techniques to prepare a seedbed; plant native forbs in existing grassland areas following prescribed burning.	1.3 Bottomland Mesic Prairie – Manage 570 acres of bottomland mesic prairie to provide quality nesting cover for nongame migratory birds as well as nesting and wintering cover for upland gamebird species, breeding waterfowl, and other associated wildlife species by maintaining, enhancing and restoring grasslands to a mixture of warm and cool season native grasses. Strategies: Same as Alternative C.

Squaw Creek NWR Objectives and Strategies by Alternative (Continued)

Alternative A: Current Management (No Action)	Alternative B: Restore Historic Wet and Mesic Prairie	Alternative C: Enhance Public Use With Current Resource Management Level	Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation
1.4 Loess Hills Prairie – Manage 221 acres of Loess Hill prairie habitat to provide quality nesting cover for nongame migratory birds and other associated wildlife species by maintaining, enhancing and restoring grasslands to a mixture of warm and cool season native grasses. This habitat will be managed to maximize native vegetation abundance, minimize fragmentation and maximize the minimum patch size for area-dependent species. Strategies: Continue the use of prescribed fire to combat invasive species; work with volunteers to restore Loess Hill prairies.	1.4 Loess Hills Prairie – Same as Alternative A. Strategies: Conduct species surveys and monitoring; use seasonal prescribed burning, continue to restore native warm season grasses and forbs in the Loess Bluff hills, hand-cutting invading tree species and brush; convert 78 acres of agricultural land to native Loess Hill prairie; use seasonal rotational prescribed burning for upland areas; plant native forbs; maximize grassland blocks and minimize fragmentation and edge effect by removing fence/tree rows where appropriate; add a full-time prescribed fire specialist to implement the prescribed fire program.	1.4 Loess Hills Prairie – Same as Alternative A. Strategies: Same as Alternative A.	1.4 Loess Hills Prairie – Manage 299 acres of Loess Hills Prairie for the purposes described under Alternative A. Strategies: Same as Alternative B with addition of full-time fire specialist.	1.4 Loess Hills Prairie – Same as Alternative A. Strategies: Same as Alternative A.
1.5 Loess Hill Forest – Manage 378 acres of Loess Hills forest for the benefit of associated plant and wildlife species. Strategies: Conduct studies on the effects of browsing.	1.5 Loess Hill Forest – Same as Alternative A. Strategies: Same as Alternative A.	1.5 Loess Hill Forest – Same as Alternative A. Strategies: Same as Alternative A.	1.5 Loess Hill Forest – Same as Alternative A. Strategies: Conduct species surveys; conduct forest inventory; map distribution of Illinois garlic mustard.	1.5 Loess Hill Forest – Same as Alternative A. Strategies: Same as Alternative A.

Squaw Creek NWR Objectives and Strategies by Alternative (Continued)

Alternative A: Current Management (No Action)	Alternative B: Restore Historic Wet and Mesic Prairie	Alternative C: Enhance Public Use With Current Resource Management Level	Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation
1.6 Objective: Bottomland Forest – Manage the 1,000 acres of bottomland forest to provide optimum nesting, resting and feeding habitats during breeding and migrational periods for migratory waterfowl and songbirds and to benefit threatened and endangered species other migratory birds, and indigenous species. Strategies: Conduct studies on the effects of browsing.	1.6 Objective: Bottomland Forest – Same as Alternative A. Strategies: Same as Alternative A.	1.6 Objective: Bottomland Forest – Same as Alternative A. Strategies: Same as Alternative A.	1.6 Objective: Bottomland Forest – Same as Alternative A. Strategies: Flood bottomlands within Davis Creek units during spring and fall migration; move wood duck nesting structures to bottomland and upland woodland sites; complete a forest resources inventory; study causes for the loss of bottomland forests understory; map distribution of Illinois garlic mustard; use prescribed burning to reduce invasive species.	1.6 Objective: Bottomland Forest – Same as Alternative A. Strategies: Same as Alternative D.
1.7 Objective: Croplands and Old Fields – Maintain the 579 cropland acres and 59 old field acres existing in 2003. Strategies: Continue agreements with cooperative farmers to leave one-third of crop standing.	1.7 Objective: Croplands – Convert the 501 cropland acres existing in 2003 to bottomland mesic prairie and convert 78 acres of croplands to Loess Bluff prairie and 59 acres of old field to bottomland mesic prairie. Strategies: Monitor wildlife use of croplands; continue annual cooperative farming agreements; implement phased reductions in cropland; continue crop rotation; convert 78 acres of cropland on Munkres tract to Loess Hill prairie by 2006; convert 200 acres of cropland and 59 acres of old field to bottomland mesic prairie by 2015.	1.7 Objective: Croplands – Same as Alternative A Strategies: Same as Alternative A.	1.7 Objective: Croplands – Implement a long range plan to convert 279 acres of the 579 cropland acres and 59 acres of existing old field to mesic bottomland prairie and Loess Hill prairie. The reduction will be accomplished by 2015 through attrition of current cooperators. Strategies: Same as Alternative B.	1.7 Objective: Croplands – Reduce the cropland acreage to 300 acres, with resulting increases in bottomland mesic prairie. Strategies: Same as Alternative A.

Squaw Creek NWR Objectives and Strategies by Alternative (Continued)

Alternative A: Current Management (No Action)	Alternative B: Restore Historic Wet and Mesic Prairie	Alternative C: Enhance Public Use With Current Resource Management Level	Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation
1.8 Objective: Exotic, Invasive and Nuisance Species – Control and reduce the presence of exotic, invasive and nuisance species of plants and animals on the Refuge. Non-native species will not exceed 2003 density or distribution levels. Strategy: Continue existing burn plan.	1.8 Objective: Exotic, Invasive and Nuisance Species – Same as Alternative A. Strategies: Use GIS technology to assess problem of invasive exotic species; use appropriate integrated species management techniques; work with volunteers in manual control efforts of Illinois garlic mustard; continue active monitoring to detect invasive species; use short-term farming to deter invasive species; continue monitoring gypsy moths.	1.8 Objective: Exotic, Invasive and Nuisance Species – Same as Alternative A. Strategies: Same as Alternative A.	1.8 Objective: Exotic, Invasive and Nuisance Species – Same as Alternative A. Strategies: Same as Alternative B.	1.8 Objective: Exotic, Invasive and Nuisance Species – Same as Alternative A. Strategies: Same as Alternative A.
1.9 Land Acquisition – Working with willing sellers, acquire up to 400 acres in fee title of existing and restorable wetlands within the authorized Refuge boundaries. Strategies: Initate action to identify willing sellers and to proceed with getting the acquisition proposal included in the Land Acquisition Priority System; prioritize acquisition of wetland and prairie habitat types.	1.9 Land Acquisition – Same as Alternative A. Strategies: Same as Alternative A.	1.9 Land Acquisition – Same as Alternative A. Strategy: Same as Alternative A.	1.9 Land Acquisition – Same as Alternative A. Strategy: Same as Alternative A.	1.9 Land Acquisition – Same as Alternative A. Strategies: Same as Alternative A.

Squaw Creek NWR Objectives and Strategies by Alternative (Continued)

Alternative A: Current Management (No Action)	Alternative B: Restore Historic Wet and Mesic Prairie	Alternative C: Enhance Public Use With Current Resource Management Level	Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation
1.10 Objective: Watershed Improvement – Reduce sedimentation from soil erosion and improve water quality on Squaw Creek NWR from private lands in the 60,000-acre upstream watershed using conservation practices fostering improved soil and water uses. By 2010, approximately 100 percent of the goals established in the AgNPS project in Squaw Creek will be accomplished, including erosion practices, water quality, riparian conservation and nutrient management. Strategies: Continue work with Partners for Fish and Wildlife, the Holt County Soil and Water Conservation District, and the Natural Resources and Conservation Service to improve water quality and reduce peak flows entering Squaw Creek; continue to provide financial incentives to private landowners through the cited partners to implement conservation measures within the Squaw Creek and Davis Creek watershed; monitor water quality; look for opportunities to purchase land from willing sellers within authorized boundaries.	1.10 Objective: Watershed Improvement – Same as Alternative A. Strategies: Same as Alternative A.	1.10 Objective: Watershed Improvement – Same as Alternative A. Strategies: Same as Alternative A.	1.10 Objective: Watershed Improvement – Same as Alternative A. Strategies: Same as Alternative A.	1.10 Objective: Watershed Improvement – Same as Alternative A. Strategies: Same as Alternative A.

Squaw Creek NWR Objectives and Strategies by Alternative (Continued)

Alternative A: Current Management (No Action)	Alternative B: Restore Historic Wet and Mesic Prairie	Alternative C: Enhance Public Use With Current Resource Management Level	Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation
1.11 Objective: Wildlife Management District – Develop, improve and maintain native riparian, wetland, and grassland habitats consistent with the existing dominant vegetative structure (non-agricultural crop) contributions to soil and water conservation within the Management District and also benefitting a broad spectrum of both game and non-game migratory birds and other resident wildlife species. Strategies: Continue current surveys and monitoring.	1.11 Objective: Wildlife Management District – Same as Alternative A. Strategies: Same as Alternative A.	1.11 Objective: Wildlife Management District – Same as Alternative A. Strategies: Same as Alternative A.	1.11 Objective: Wildlife Management District – Same as Alternative A. Strategies: Actively manage established native grasslands using prescribed fire and chemical treatments for invasive species; work with easement owners to convert former croplands; develop or restore riparian and wetland sites on easement properties; monitor grassland to formulate an annual strategy; fence riparian areas to prevent damage from cattle; survey easement and fee title lands to delineate boundaries; document easement violations; take an active role in the private lands program when possible.	1.11 Objective: Wildlife Management District – Same as Alternative A. Strategies: Same as Alternative A.

Squaw Creek NWR Objectives and Strategies by Alternative (Continued)

Alternative A: Current Management (No Action)	Alternative B: Restore Historic Wet and Mesic Prairie	Alternative C: Enhance Public Use With Current Resource Management Level	Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation
Goal 2 Wildlife: Conserve species indigenous to the Refuge, the Lower Missouri River Ecosystem, and the Central Tallgrass Prairie Ecosystem with emphasis on those species identified in the Service Fish and Wildlife Resource Conservation Priorities.				
2.1 Objective: Regional Shorebird Designation – Designation of Squaw Creek NWR as a regional shorebird site of the Wester Hemispheric Shorebird Reserve Network (WHSRN) by 2005. Strategies: Strategies: Conduct fall and spring migration surveys to document shorebird use; complete a nomination form; document Wood Duck and Eastern Bluebird houses.	2.1 Objective: Regional Shorebird Designation – Same as Alternative A. Strategies: Same as Alternative A.	2.1 Objective: Regional Shorebird Designation – Same as Alternative A. Strategies: Same as Alternative A.	2.1 Objective: Regional Shorebird Designation – Same as Alternative A. Strategies: Same as Alternative A.	2.1 Objective: Regional Shorebird Designation – Same as Alternative A. Strategies: Same as Alternative A.
2.2 Objective: Population Counts – Obtain annual peak population counts and use-days for Bald Eagles, Snow Geese, and other waterfowl and other indicator species using procedures outlined in the Wildlife Inventory Plan. Strategies: Continue current population counts, including Bald Eagles, waterfowl, shorebirds, marsh birds, and deer counts.	2.2 Objective: Population Counts – Same as Alternative A. Strategies: Same as Alternative A.	2.2 Objective: Population Counts – Same as Alternative A. Strategies: Same as Alternative A.	2.2 Objective: Population Counts – Same as Alternative A. Strategies: Use most efficient technology available; maintain a high level of disease monitoring during spring and fall migration; monitor encroachment by non-native species; document use of different habitats by indicator species; monitor marsh and water bird nesting; continue inventory of plant and wildlife species to determine long-term monitoring needs.	2.2 Objective: Population Counts – Same as Alternative A. Strategies: Same as Alternative A.

Squaw Creek NWR Objectives and Strategies by Alternative (Continued)

Alternative A: Current Management (No Action)	Alternative B: Restore Historic Wet and Mesic Prairie	Alternative C: Enhance Public Use With Current Resource Management Level	Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation
2.3 Objective: Waterfowl Use Days – Maintain annual waterfowl use day levels of a minimum of 5 million by providing adequate habitat as discussed under the Habitat Goal and based on a 5-year running average of waterfowl data, excluding Snow Geese. Strategies: Monitor arrivals and concentration build-ups in accordance with the Wildlife Inventory Plan; monitor waterfowl activity during migration; monitor waterfowl concentration during migration; for indication of disease or stres; when waterfowl concentration exceeds objective levels to the extent that the welfare of waterfowl is at risk, implement distrubance measures; record population data in a consistent format that enables comparison of population.	2.3 Objective: Waterfowl Use Days – Waterfowl use days will decrease by approximately 60 percent to approximately 2 million use days, in response to a comparable decrease in wetland acres and a corresponding increase in wet prairie. Strategies: Same as Alternative A.	2.3 Objective: Waterfowl Use Days – Same as Alternative A. Strategies: Same as Alternative A.	2.3 Objective: Waterfowl Use Days – Same as Alternative A. Strategies: Same as Alternative A.	2.3 Objective: Waterfowl Use Days – Waterfowl use days will increase by approximately 5 percent to approximately 5.3 million use days in response to a comparable increase in wetland acres and corresponding decrease in other habitats. Strategies: Same as Alternative A.

Squaw Creek NWR Objectives and Strategies by Alternative (Continued)

Alternative A: Current Management (No Action)	Alternative B: Restore Historic Wet and Mesic Prairie	Alternative C: Enhance Public Use With Current Resource Management Level	Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation
2.4 Objective: Reduction of Snow Geese – Actively assist international efforts to reduce the mid-continent population of Snow Geese by at least 5 percent each year until the Arctic Goose Working Group reduction goal has been achieved. Strategies: Actively discourage Snow Geese from using Refuge croplands; continue to provide open water for roosting in an area that provides hunting opportunities off-Refuge; increase the effort to obtain Snow Geese neck collar readings during spring and fall migrations.	2.4 Objective: Reduction of Snow Geese – Same as Alternative A. Strategies: Same as Alternative A.	2.4 Objective: Reduction of Snow Geese – Same as Alternative A. Strategies: Same as Alternative A.	2.4 Objective: Reduction of Snow Geese – Same as Alternative A, with addition of initiating a spring Snow Goose hunt within 1 year of completion of the CCP. Strategies: Offer spring Snow Goose hunt within 1 year of plan completion; reduce cropland from 579 acres to 300 acres by 2015; actively discourage Snow Geese from using Refuge croplands; continue to maintain open water in Eagle and Pelican pools; increase the effort to obtain Snow Geese neck collar readings during spring and fall migrations.	2.4 Objective: Reduction of Snow Geese – Same as Alternative A. Strategies: Same as Alternative A.
2.5 Objective: White-tailed Deer Management – Manage the size of the white-tailed deer herd on the Refuge through controlled hunts to reduce the Refuge white-tailed deer herd to a fall relative density of 20 to 25 deer per square mile. Strategies: Monitor herd size and health; monitor habitat for damage; continue deer hunts; initiate a research project to determine the effects of browse damage.	2.5 Objective: White-tailed Deer Management – Same as Alternative A. Strategies: Same as Alternative A.	2.5 Objective: White-tailed Deer Management – Same as Alternative A. Strategies: Same as Alternative A.	2.5 Objective: White-tailed Deer Management – Same as Alternative A. Strategies: Same as Alternative A.	2.5 Objective: White-tailed Deer Management – Strategies: Same as Alternative A.

Squaw Creek NWR Objectives and Strategies by Alternative (Continued)

Alternative A: Current Management (No Action)	Alternative B: Restore Historic Wet and Mesic Prairie	Alternative C: Enhance Public Use With Current Resource Management Level	Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation
2.6 Objective: Bald Eagle – Maintain the bottomland cottonwood forest areas and isolated mature cottonwood stands that provide roosting and nesting sites and that exist in 2005 and continue to provide habitat that maximizes Bald Eagle use days during fall and winter migration periods. Strategies: Manage riparian cottonwood forests to ensure sustained stands of mature roost and nest trees; develop designated regeneration sites that will favor seedling development; manage public access to assure adequate habitat is provided.	2.6 Objective: Bald Eagle – Same as Alternative A. Strategies: Same as Alternative A.	2.6 Objective: Bald Eagle – Same as Alternative A. Strategies: Same as Alternative A.	2.6 Objective: Bald Eagle – Same as Alternative A. Strategies: Same as Alternative A.	2.6 Objective: Bald Eagle – Same as Alternative A. Strategies: Same as Alternative A.
2.7 Objective: Eastern Massasauga Rattlesnake – Maintain existing wet prairie habitat of 1,077 acres existing in 2003 to maintain the habitat used by eastern Massassauga rattlesnakes on Squaw Creek NWR (see Object 1.2 regarding habitat acreage). The population numbers and habitat use will be monitored to assess the response to the habitat manipulation. Strategies: Continue to participate in research efforts; continue to monitor local population status; participate in cooperative studies.	2.7 Objective: Eastern Massasauga Rattesnake – Increase wet prairie habitat from 1,077 acres existing in 2003 to 3,259 acres by 2018 will enhance the habitat used by the eastern Massassauga rattlesnake on the Refuge (see objective 1.2 regarding habitat). The population numbers and habitat use will be monitored to assess the response to habitat manipulation. Strategies: Same as Alternative A.	2.7 Objective: Eastern Massasauga Rattlesnake – Same as Alternative A. Strategy: Same as Alternative A.	2.7 Objective: Eastern Massasauga Rattlesnake – Maintain existing wet prairie habitat of 1,077 acres and increase bottomland mesic prairie by 217 acres for a total of 508 acres. Strategies: Same as Alternative A.	2.7 Objective: Eastern Massasauga Rattlesnake – Same as Alternative A. Strategies: Same as Alternative A.

Squaw Creek NWR Objectives and Strategies by Alternative (Continued)

Alternative A: Current Management (No Action)	Alternative B: Restore Historic Wet and Mesic Prairie	Alternative C: Enhance Public Use With Current Resource Management Level	Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation
2.8 Objective: Least Bittern – By providing hemimarsh cattail habitat suitable for nesting, the Refuge will benefit the Least Bittern, which is ranked as an "imperiled" species by the State of Missouri. The population distribution and numbers will be monitored through surveys and research. Strategies: Maintain the presence of cattail stands; continue to monitor nesting activity.	2.8 Objective: Least Bittern – Same as Alternative A but approximately 349 acres of hemi-marsh cattail habitat will be provided. Strategies: Same as Alternative A.	2.8 Objective: Least Bittern – Same as Alternative A. Strategies: Same as Alternative A.	2.8 Objective: Least Bittern – Same as Alternative A. Strategies: Same as Alternative A.	2.8 Objective: Least Bittern – Same as Alternative A. Strategies: Same as Alternative A.
2.9 Objective: Passerine Species – The Refuge will support and follow the recommendations listed in Region 3's Resource Conservation Priorities for the rare and declining passerine species identified in Appendix I. Management interest will focus upon species for which Squaw Creek NWR is or was within their primary range. Strategies: Collect data from routine monitoring; conserve and restore critical habitat; support partners' conservation efforts; encourage and support education efforts.	2.9 Objective: Passerine Species – Same as Alternative A. Strategies: Same as Alternative A.	2.9 Objective: Passerine Species – Same as Alternative A. Strategies: Same as Alternative A.	2.9 Objective: Passerine Species – Same as Alternative A. Strategies: Same as Alternative A.	2.9 Objective: Passerine Species – Same as Alternative A. Strategies: Same as Alternative A.

Squaw Creek NWR Objectives and Strategies by Alternative (Continued)

Alternative A: Current Management (No Action)	Alternative B: Restore Historic Wet and Mesic Prairie	Alternative C: Enhance Public Use With Current Resource Management Level	Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation
2.10 Objective: State Species of Concern – State of Missouri species of concern, such as long-tailed weasels and Franklin's ground squirrels, will be reported to Missouri Department of Conservation staff when observed on or near the Refuge. Strategies: Report observations of state-listed species, including date and location, to the Department of Conservation.	2.10 Objective: State Species of Concern – Same as Alternative A. Strategies: Same as Alternative A.	2.10 Objective: State Species of Concern – Same as Alternative A. Strategies: Same as Alternative A.	2.10 Objective: State Species of Concern – Same as Alternative A. Strategies: Same as Alternative A.	2.10 Objective: State Species of Concern – Same as Alternative A. Strategies: Same as Alternative A.

Squaw Creek NWR Objectives and Strategies by Alternative (Continued)

Alternative A: Current Management (No Action)	Alternative B: Restore Historic Wet and Mesic Prairie	Alternative C: Enhance Public Use With Current Resource Management Level	Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation
Goal 3 People: Visitors, nearby residents and other stakeholders will appreciate the natural resources and ecological processes and cultural resources of Squaw Creek NWR, will help achieve the objectives of the Refuge, and will support the Service's mission.				
3.1 Objective: Interpretation – Design, fund and implement interpretive programs and facilities that meet Service standards and that will attract and accommodate up to 130,000 visitors annually. Strategies: Continue to offer interpretive programs, tours and demonstrations as time and staffing allow.	3.1 Objective: Interpretation – Same as Alternative A. Strategies: Same as Alternative A.	3.1 Objective: Interpretation – Design, fund and implement interpretive programs and facilities that meet Service standards and that will attract and accommodate up to 175,000 visitors annually by 2013 with a subsequent annual increase of 2 percent throughout the life of this plan. Strategies: Develop clear Refuge themes related to key resource issues; replace the auto tour leaflet with signs and sound posts; develop interpretive aids for Callow Memorial Trail; explore potential for extending Loess Bluff Trail; prepare new interpretive leaflets for species groups and Refuge resources and history; update existing leaflets; initiate contract for concept plan for a visitor center; remove picnic tables and grill from headquarters and replace with amphitheater; update the orientation video.	3.1 Objective: Interpretation – Same as Alternative A. Strategies: Same as Alternative C.	3.1 Objective: Interpretation – Same as Alternative A. Strategies: Same as Alternative A.

Squaw Creek NWR Objectives and Strategies by Alternative (Continued)

Alternative A: Current Management (No Action)	Alternative B: Restore Historic Wet and Mesic Prairie	Alternative C: Enhance Public Use With Current Resource Management Level	Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation
3.2 Objective: Environmental Education – Offer environmental education programs, materials and facilities that meet Service standards and accommodate visitation consistent with 2004 environmental education levels. Strategies: Continue to offer interpretive programs, tours and demonstrations at current level.	3.2 Objective: Environmental Education – Same as Alternative A. Strategies: Same as Alternative A.	3.2 Objective: Environmental Education – Offer environmental education programs, materials and facilities that meet Service standards and accommodate up to 6,000 students annually by 2013. Evaluate the effectiveness of the environmental education program by 2013. Strategies: Alert schools to Refuge resources; conduct an annual teacher workshop; develop accessible EE activities linked to local and state education standards; expand the outdoor classroom facilities by adding a boardwalk with a learning station into a marsh area; add a seasonal clerk to staff the visitor contact station during peak public use periods; recruit and train volunteers to conduct activities.	3.2 Objective: Environmental Education – (Same as Alternative C) Strategies: Same as Alternative C.	3.2 Objective: Environmental Education – Same as Alternative A. Strategies: Same as Alternative A.

Squaw Creek NWR Objectives and Strategies by Alternative (Continued)

Alternative A: Current Management (No Action)	Alternative B: Restore Historic Wet and Mesic Prairie	Alternative C: Enhance Public Use With Current Resource Management Level	Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation
3.3 Objective: Wildlife Observation and Photography – Maintain, improve and develop to Service standards facilities and programs to encourage more interactive visitor participation resulting in a higher quality outdoor experience, including an existing 10-mile circular auto tour route, the 2-mile Mallard Marsh Road and three walking trails. Strategies: Continue to participate in Eagle Days; maintain auto tour route.	3.3 Objective: Wildlife Observation and Photography – Same as Alternative A. Strategies: Same as Alternative A.	3.3 Objective: Wildlife Observation and Photography – Maintain, improve and develop to Service standards facilities and programs to encourage more interactive visitor participation resulting in a higher quality outdoor experience, including an existing 10-mile circular auto tour route, the 2-mile Mallard Marsh road and the three walking trails and, by 2013, an extension of the Callow Memorial Trail to form a looped trail with the Loess Bluff Trail and a one-quarter-mile boardwalk to a marsh. Strategies: Improve facilities, including upgrading the surface of the auto tour route and improving walking trail surfaces; develop one or more accessible wildlife observation blinds for photographers and the general public; construct an accessible boardwalk into a marsh; maintain walking tours free of debris; create a two-way road between the start of the auto tour route and the Eagle Pool hiking trail; create pull-off areas on the auto tour route; post maps on kiosks.	3.3 Objective: Wildlife Observation and Photography – Same as Alternative C. Strategies: Same as Alternative C.	3.3 Objective: Wildlife Observation and Photography – Same as Alternative A. Strategies: Same as Alternative A.

Squaw Creek NWR Objectives and Strategies by Alternative (Continued)

Alternative A: Current Management (No Action)	Alternative B: Restore Historic Wet and Mesic Prairie	Alternative C: Enhance Public Use With Current Resource Management Level	Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation
3.4 Objective: Hunting and Fishing – Provide quality recreational hunting opportunities for up to 135 deer hunters per season to help maintain healthy populations. Continue to allow bank fishing at legal public access points throughout the Refuge. Strategies: Continue muzzle-loading-only antlerless deer hunt; continue to allow fishing of limited fishery resource.	3.4 Objective: Hunting and Fishing – Same as Alternative A. Strategies: Same as Alternative A.	3.4 Objective: Hunting and Fishing – Same as Alternative A, with the addition of the spring goose hunt. Strategies: Continue monitoring the deer hunt; manage deer hunt to avoid conflicts with other uses and resources. Continue working with MDOC regarding deer hunt regulations. Continue to permit fishing at legal public access points. A managed spring Snow Goose hunt will be offered. Inform public when snagging of rough fish is permitted. Provide at least one accessible deer hunting blind with signage and parking space and develop reservation system.	3.4 Objective: Hunting and Fishing – Same as Alternative C. Strategies: Same as Alternative C.	3.4 Objective: Hunting and Fishing – Same as Alternative A. Strategies: Same as Alternative A.
3.5 Objective: Mushroom Gathering – Allow opportunities for mushroom gathering in selected areas. Strategies: Allow morel mushroom gathering in the Loess Bluffs by special permit; patrol areas closed to mushroom picking during gathering season.	3.5 Objective: Mushroom Gathering – Same as Alternative A. Strategies: Same as Alternative A.	3.5 Objective: Mushroom Gathering – Same as Alternative A. Strategies: Same as Alternative A.	3.5 Objective: Mushroom Gathering – Same as Alternative A. Strategies: Same as Alternative A.	3.5 Objective: Mushroom Gathering – Same as Alternative A. Strategies: Same as Alternative A.

Squaw Creek NWR Objectives and Strategies by Alternative (Continued)

Alternative A: Current Management (No Action)	Alternative B: Restore Historic Wet and Mesic Prairie	Alternative C: Enhance Public Use With Current Resource Management Level	Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation
3.6 Objective: Public Information – Refuge programs will continue to serve the traditional Refuge users as of 2004. Strategies: Continue existing use of news releases to advertise events like Eagle Days and hunting program.	3.6 Objective: Public Information – Same as Alternative A. Strategies: Same as Alternative A.	3.6 Objective: Public Information – By 2025, 60 percent of people within 100 miles of the Refuge will be aware of the Refuge, its mission, its facilities and scheduled events. Emphasize reaching diverse groups of people who are not part of the traditional Refuge audience. Strategies: Expand means of publicizing Refuge events to include electronic technologies and the Internet; ask visitors how they heard about events; provide a 24-hour telephone line with Refuge information; create and maintain an accessible website; maintain and update Refuge information at the I-29 rest stop; maintain current media list and distribute 35 news releases annually; continue coordination with St. Joseph Visitors and Convention Bureau; reinstate a public service slide show; explore use of highway billboards; develop informational brochures; participate in youth-oriented activities; work with Regional Office external affairs.	3.6 Objective: Public Information – Same as Alternative C. Strategies: Same as Alternative C.	3.6 Objective: Public Information – Same as Alternative A. Strategies: Same as Alternative A.

Squaw Creek NWR Objectives and Strategies by Alternative (Continued)

Alternative A: Current Management (No Action)	Alternative B: Restore Historic Wet and Mesic Prairie	Alternative C: Enhance Public Use With Current Resource Management Level	Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation
3.7 Objective: Volunteers – Maintain volunteer program at 2004 level. Strategies: Continue to recruit volunteers for help with hand cutting invasive species and greeting visitors during Eagle Days at 2003 level.	3.7 Objective: Volunteers – 20 percent decrease in volunteer hours. Strategies:	3.7 Objective: Volunteers – Increase the number of volunteer hours to 7,500 by 2013, with a 5 percent annual increase, to serve both in the Visitor Contact Station and around the Refuge as interpretive and educational guides and in supervised habitat management projects. Strategies: Increase volunteer recruitment efforts through web sites, news releases, public service ads, and work with civic groups; be actively involved in local Audubon chapters; provide temporary housing for volunteers when it's available.	3.7 Objective: Volunteers – Same as Alternative C. Strategies: Same as Alternative C.	3.7 Objective: Volunteers – Same as Alternative A. Strategies: Same as Alternative A.
3.8 Objective: Friends of Squaw Creek NWR – Maintain and enhance a close working relationship with Friends of Squaw Creek NWR that helps foster common goals supporting the Refuge mission. Strategies: Continue to support Friends of Squaw Creek NWR and be actively involved by attending board meetings and providing advice and assistance.	3.8 Objective: Friends of Squaw Creek NWR – Same as Alternative A. Strategies: Same as Alternative A.	3.8 Objective: Friends of Squaw Creek NWR – Same as Alternative A. Strategies: Same as Alternative A.	3.8 Objective: Friends of Squaw Creek NWR – Same as Alternative A. Strategies: Same as Alternative A.	3.8 Objective: Friends of Squaw Creek NWR – Same as Alternative A. Strategies: Same as Alternative A.

Squaw Creek NWR Objectives and Strategies by Alternative (Continued)

Alternative A: Current Management (No Action)	Alternative B: Restore Historic Wet and Mesic Prairie	Alternative C: Enhance Public Use With Current Resource Management Level	Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation
3.9 Objective: Government Agencies & Non-government Organizations – The 2004 level of involvement with NGOs and government agencies (see Chapter 5, Partnerships) will be maintained. Strategies: Continue existing work with Natural Resources Conservation Service, Holt County Soil and Water Conservation District, and the U.S. Geological Survey to reduce sedimentation in the Refuge's watershed.	3.9 Objective: Government Agencies & Non-government Organizations – Same as Alternative A. Strategies: Same as Alternative A.	3.9 Objective: Government Agencies & Non-government Organizations – To increase awareness of and support for the Refuge, increase level of active cooperation with non-governmental organizations and governmental agencies on different aspects of on-Refuge and off-Refuge management and educational efforts, both in terms of the number of NGOs and the level of effort. The 2004 level of involvement with NGOs will be maintained, but additional efforts will be made to share Refuge information with these agencies and organizations during routine interactions with them. Strategies: Continue work with traditional NGOs; continue to work with local Audubon societies; increase activity with the St. Joseph Visitor and Convention Bureau in promoting the Refuge and its activities; increase work with the Mound City Chamber of Commerce and local groups; actively look for partnering opportunities with other regional conservation groups, service organizations and educational institutions.	3.9 Objective: Government Agencies & Non-government Organizations – Same as Alternative C. Strategies: Same as Alternative C.	3.9 Objective: Government Agencies & Non-government Organizations – Same as Alternative A. Strategies: Same as Alternative A.

Squaw Creek NWR Objectives and Strategies by Alternative (Continued)

Alternative A: Current Management (No Action)	Alternative B: Restore Historic Wet and Mesic Prairie	Alternative C: Enhance Public Use With Current Resource Management Level	Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation
3.10 Objective: Research Support – Actively encourage and provide technical assistance and logistical support to qualified researchers to support ongoing cooperative investigations of long-term management importance to the Refuge or that supports other compatible projects. Strategies: Cooperate with the U.S. Geological Survey on a project studying stream flow and sedimentation; solicit assistance from additional partners; continue work with Missouri Western State College staff; continue research on the Eastern Massassauga rattlesnake; promote potential research opportunities in other forums and media; provide temporary housing to researchers when it is available.	3.10 Objective: Research Support – Same as Alternative A. Strategies: Same as Alternative A.	3.10 Objective: Research Support – Same as Alternative A. Strategies: Same as Alternative A.	3.10 Objective: Research Support – Same as Alternative A. Strategies: Same as Alternative A.	3.10 Objective: Research Support – Same as Alternative A. Strategies: Same as Alternative A.
3.11 Objective: Cultural Resources – Evaluate and preserve archaeologic and historic resources. Strategies: contract a survey to identify Native American sites; determine the status of farmstead buildings on Munkres tract.	3.11 Objective: Cultural Resources – Same as Alternative A. Strategies: Same as Alternative A.	3.11 Objective: Cultural Resources – Same as Alternative A. Strategies: Same as Alternative A.	3.11 Objective: Cultural Resources – Same as Alternative A. Strategies: Same as Alternative A.	3.11 Objective: Cultural Resources – Same as Alternative A. Strategies: Same as Alternative A.

Squaw Creek NWR Objectives and Strategies by Alternative (Continued)

Alternative A: Current Management (No Action)	Alternative B: Restore Historic Wet and Mesic Prairie	Alternative C: Enhance Public Use With Current Resource Management Level	Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation
3.12 Objective: Health and Safety – Ensure the health and safety of visitors, volunteers, and employees and protect the natural resources and physical property of the Refuge. Strive for zero accidents for visitors and no accidents resulting in loss of work for employees. Strategies: Work with zone officers and state conservation agents to provide adequate law enforcement presence; add a new electric gate at the Refuge entrance; complete a boundary survey on Munkre's tract; provide routine maintenance and an annual inspection of all Refuge facilities; replace or close facilities that compromise public safety; review permit, licenses and inspections annually; revise the station safety plan; conduct regular safety meetings; refresh staff in CPR and first aid techniques every 2 years.	3.12 Objective: Health and Safety – Same as Alternative A. Strategies: Same as Alternative A.	3.12 Objective: Health and Safety – Same as Alternative A. Strategies: Same as Alternative A.	3.12 Objective: Health and Safety – Same as Alternative A. Strategies: Same as Alternative A.	3.12 Objective: Health and Safety – Same as Alternative A. Strategies: Same as Alternative A.

Squaw Creek NWR Objectives and Strategies by Alternative (Continued)

Alternative A: Current Management (No Action)	Alternative B: Restore Historic Wet and Mesic Prairie	Alternative C: Enhance Public Use With Current Resource Management Level	Alternative D: Optimize Resource Management With Enhanced Public Use (Preferred Alternative)	Alternative E: Intensive Wetland Management With Extreme Measures to Combat Sedimentation
3.13 Objective: Welcome and Orient Visitors – Provide visitors with welcoming, comfortable experience through adequate guidance that does not detract from appreciating nature. Strategies: Enhance brochures and kiosks to include information relevant to a Refuge visit; revise and implement the station sign plan; indicate restrooms on Refuge location maps; install information and wayfinding signs per FWS Sign Handbook; enhance information provided in wayfinding signs; include information on sites and when and where sites can viewed on kiosks and maps; upgrade all orientation to be accessible to visitors with visual disabilities; identify and remove items that detract from naturalness; build pedestrian spaces at start of and along auto tour route; expand information provided along auto tour route; develop an accessible web site for the Refuge.	3.13 Objective: Welcome and Orient Visitors – Same as Alternative A. Strategies: Same as Alternative A.	3.13 Objective: Welcome and Orient Visitors – Same as Alternative A. Strategies: Same as Alternative A.	3.13 Objective: Welcome and Orient Visitors – Same as Alternative A. Strategies: Same as Alternative A.	3.13 Objective: Welcome and Orient Visitors – Same as Alternative A. Strategies: Same as Alternative A.

Appendix L: Response to Comments on the Draft Comprehensive Conservation Plan and Environmental Assessment

Response to Comments for EA and Draft CCP

Comment 1	*Public outreach and community education provided by the Refuge is lacking, and the preferred alternative does not adequately address current or future needs. It is not clear how the Refuge will recruit and train volunteers to accomplish environmental education objectives.*
Response 1	Under the preferred alternative, objectives 3.*2 Environmental Education* (pg. 58 dccp), *3.6 Public Information* (pg. 61 dccp), *3.7 Volunteers* (pg. 62 dccp), and *3.8 Friends of Squaw Creek NWR* (pg. 63 dccp) represent an increase above current levels described in *Section 3.3.3 Public Use* (pg. 37 dccp). This modest but reasonable increase seeks to balance these programs with others under expected funding levels, and is consistent with the potential market as described in *Section 3.2.6.1 Potential Refuge Visitors* (pg. 30 dccp). The existing staff includes a Park Ranger position that is largely devoted to delivering visitor services. The Park Ranger as well as other Refuge staff will assist in implementing these objectives and strategies including training volunteers.
Comment 2	*Control, but do not destroy American lotus on the Refuge.*
Response 2	Strategy 2 under *Objective 1.1 Wetlands* (pg. 41 Draft CCP) is directed at controlling American lotus and other pest plant species. American lotus will continue to exist on the Refuge.
Comment 3	*American lotus could be the focus of a summer festival or workshop that helps with public outreach and environmental education.*
Response 3	The environmental education and public outreach services described in *Objective 3.2 Environmental Education* (pg. 58 Draft CCP) and *Objective 3.6 Public Information* (pgs. 61 Draft CCP) do not preclude a festival or workshop focused on American lotus. Nevertheless, American lotus is not the focus of these programs because it provides little value for wildlife, especially for migratory birds that use the wetlands where the plant is found. American lotus also reaches nuisance levels if not carefully managed.
Comment 4	*Allowing hunting of Snow Geese is contradictory to the purpose of the refuge*
Response 4	Hunting is consistent with the purpose of the Refuge described in *Section 1.2 Refuge Purpose* (pg. 4 Draft CCP). The purpose is derived from Executive Order 7156 which references the Migratory Bird Conservation Act, neither of which precludes hunting. In 1949 Congress amended the Migratory Bird Conservation Act to allow waterfowl hunting on 25 percent of areas acquired under its authority. Congress increased the figure to the present level of 40 percent in 1958. In 1978 Congress added a provision granting the Secretary of Interior discretion to exceed the 40 percent standard by an unlimited extent when it is beneficial to the species. The area on which Snow Goose hunting would take place is 3 percent of the Refuge. Strategy 1 of *Objective 2.4 Reduction of Snow Geese* (pg. 54 Draft CCP) has been modified to better describe the extent and duration of the Snow Goose hunt.

Comment 5	*Allowing hunting of Snow Geese will have negative effects on the geese and other creatures.*
Response 5	As noted in *Section 4.1.6 Snow Goose Management* (pg. 114 Draft CCP) the intent of the Snow Goose hunt is to contribute to the reduction of the mid-continent population of Snow Geese. It would have an adverse effect on individual geese, but would benefit the population overall. At present numbers Snow Geese exceed the carrying capacity of their nesting grounds in Canada and are adversely affecting the habitat. The hunt is not anticipated to have negative effects on other wildlife species.
Comment 6	*A number of comments oppose allowing Snow Goose hunting on the Refuge.*
Response 6	The 1997 National Wildlife Refuge Improvement Act identifies hunting as one of six priority public uses to be facilitated on Refuges. Hunting Snow Geese and/or other game species is allowed on many National Wildlife Refuges, in some cases for decades, without adverse effect on wildlife populations. Hunting is a compatible use and consistent with the purposes of Squaw Creek NWR. *Section 2.1.3 Snow Goose Management* (pg. 10 Draft CCP) discusses Snow Goose over abundance and the need to reduce the population. See also Responses 4 and 5 above for more on Snow Goose hunting and its anticipated impacts.
Comment 7	*The plan is comprehensive and well written*
Response 7	Comment noted
Comment 8	*A number of comments support the selection of the preferred alternative.*
Response 8	Comments noted
Comment 9	*I support managed hunts for white-tailed deer and Snow Geese, but oppose hunting of other waterfowl on the Refuge.*
Response 9	None of the alternatives contain a proposal to expand hunting beyond the two species mentioned.
Comment 10	*The term "refuge" implies a safe place for wildlife where hunting does not occur.*
Response 10	While National Wildlife Refuges are managed first and foremost for wildlife, hunting is allowed when it will not negatively impact the population being hunted. Some wildlife populations, such as those of deer and Snow Geese at Squaw Creek NWR, reach levels that do harm to the habitat. In the case of deer the problem is local, while for Snow Geese the problem is greatest on the northern breeding grounds. It is consistent with wildlife management principles to lower the numbers of these species before they cause harm to the habitat and in turn negatively affect other forms of wildlife. Also see Response 6 above.
Comment 11	*Hunting will conflict with other public uses of the Refuge.*
Response 11	Hunting is not anticipated to conflict with other public uses. Deer hunting occurs 3 days per year on 41 percent of the Refuge usually during December or January. The area is closed to the public during this time to minimize conflicts. Conflicts with other public uses will be minimized since the Snow Goose hunt would occur on only 3 percent of the Refuge (about 200 acres) and will not be permitted within one-quarter mile of the auto tour route. Hunting is one of the priority wildlife-dependent public uses on refuges as well as being a useful population management tool in this instance.

Comment 12	*Allowing hunting on the Refuge will cause Snow Geese to avoid the Refuge along with Bald Eagles that follow the flocks. Fewer geese would make the annual migration less of a spectacle and cause fewer people to visit the Refuge.*
Response 12	We do not anticipate any adverse effects of the Snow Goose hunt on Bald Eagles or wildlife viewing during the annual migration. The Refuge provides important migratory habitat in an area where migrating waterfowl have few alternative stopover sites. Allowing hunting on 3 percent of the Refuge is not anticipated to disrupt Snow Goose use. Snow Geese primarily use the Refuge for roosting, and the areas where this occurs are within the 97 percent of the Refuge that will not be open to Snow Goose hunting. We expect large numbers of Snow Geese to continue to use the Refuge. The reaction of light geese (Snow Geese and Ross's Geese) to this hunt will be closely monitored by Refuge staff and appropriate measures will be implemented if necessary to minimize any unintended impacts.
Comment 13	*Convert croplands (specifically corn) to native grasslands to attract fewer Snow Geese.*
Response 13	As noted in *Section 4.5.2 Wildlife and Habitat Resource Management* (pg. 121 Draft CCP) under the Preferred Alternative, 279 acres of cropland would be converted to grassland or prairie, but this is not likely to affect the number of Snow Geese using the Refuge. Snow Geese predominantly use the Refuge for roosting and feed in cropland outside the Refuge.
Comment 14	*Construct a boardwalk from bone yard to bluff pool.*
Response 14	This was not considered as a part of this analysis because the proposed boardwalk would be long (more than 1 ½ miles in length), costly to build, and travel a narrow strip between Davis Creek and private property. It would also present a potential safety hazard during hunting seasons since hunting occurs on private property adjacent to the refuge boundary along this location.
Comment 15	*Buy as much land as possible to add to the Refuge.*
Response 15	All of the alternatives include a provision to acquire up to 400 acres from willing sellers within the existing authorized boundary (*Objective 1.9 Land Acquisition*, pg. 49; Table 1, pg 90). We considered Refuge expansion, but chose not to pursue it at this time. See *Appendix A, Section 2.2 Alternatives Considered But Not Analyzed in Detail* (pg. 88 Draft CCP) for more information.

Comment 16	*There is no need to add a law enforcement officer, fire specialist, and part-time clerk. The present staff does a wonderful job with burns and law enforcement.*
Response 16	Presently, no one on the Refuge has law enforcement credentials, but there is a need for law enforcement. In the past law enforcement activities were included as part of a wider range of duties for some of the Refuge staff. The role of law enforcement officers has grown more complex, and maintaining law enforcement credentials has become more demanding in terms of time and training. In response to these changes the agency is shifting towards full time law enforcement officers. The law enforcement strategies included under *Objective 3.12 Health and Safety* (pg. 65 Draft CCP) of the preferred alternative reflect this trend. Likewise, the knowledge, skills, and abilities required to carry out a safe and legally compliant prescribed fire program have become more demanding, and require a position largely dedicated to these tasks. The prescribed fire specialist position referenced under *Objective 1.2 Wet Prairie* (pg. 45 Draft CCP), *Objective 1.3 Bottomland Mesic Prairie* (pg. 46 Draft CCP), and *Objective 1.4 Loess Hills Prairie* (pg. 47 Draft CCP) is necessary to carry out management of these habitats. Finally, more than 130,000 people visit the Refuge annually, most during the spring and fall migrations. During these peak times we are unable to meet the demand with present staffing. The seasonal clerk position noted under *Objective 3.2 Environmental Education* (pg. 59 Draft CCP) would help meet this demand and also help implement the other strategies described under this objective.
Comment 17	*Maintaining a small bison herd on the Refuge would provide a unique wildlife viewing opportunity that would draw visitors.*
Response 17	Although within the historic range of the bison, most of the grasslands within the Refuge are in the loess bluffs adjacent to wetlands and are not suitable for bison. Presently, five National Wildlife Refuges in the United States are authorized to preserve and propagate remnant herds of nationally and/or historically significant animals such as bison. Squaw Creek NWR is not one of the five.
Comment 18	*Convert the ditches to a more natural state.*
Response 18	This was considered under Alternative B Restore Historic Wet and Mesic Prairie. See *Appendix A Section 2.3.2* (pg. 89 Draft CCP), *Section 4.3* (pg. 118 Draft CCP), and *Section 4.7.2* (pg. 123 Draft CCP).
Comment 19	*It would be good to see more management of invasive plants including use of herbicides.*
Response 19	Prescribed burning, mechanical, and chemical (which includes the use of herbicides) measures to slow the spread of invasive plants are included under all alternatives. Numerous strategies throughout *Section 4.2* (pg. 41-52 Draft CCP) address control of invasive species.

Comment 20	*Allow some harvest of American lotus by the public as part of the control measures.*
Response 20	American lotus blooms in July and produces seed pods thereafter. The pods are generally ready to harvest in the fall. However, this coincides with the fall waterfowl migration. Harvesting the pods during the fall would cause a disturbance factor to waterfowl and other marsh and water birds that are present since lotus is found in the deeper water areas that are used by waterfowl, particularly Snow Geese. The only efficient way to harvest any large number of pods that would be an effective control measure would require the use of a boat or canoe. Hence, a greater amount of disturbance.
Comment 21	*Perhaps the trees accumulating by the bridge on Squaw Creek can be removed from the water and placed in the woods to decay.*
Response 21	Removing and transporting trees and other woody debris that accumulates at the Squaw Creek water control structure would be time intensive and unnecessary. There is no shortage of woody debris in the surrounding uplands and eventually it will provide habitat for fish and other aquatic wildlife somewhere downstream. Trees, trash, and other debris from upstream sources is a concern that we will address in our work within the Davis and Squaw Creek watersheds. See *Objective 1.10 Watershed Improvement* (pg. 49 Draft CCP) for more information.
Comment 22	*Consumptive use of the Refuge should be kept to a minimum.*
Response 22	Presently, consumptive uses on the refuge include white-tailed deer hunting, cooperative farming, haying, fishing and mushroom picking. Snow Goose hunting is the only consumptive use being added. White-tailed deer hunting is an important management tool to reduce an over-population of deer that continue to cause damage to woodlands and cropland. Haying is on a very limited scale and is used as a supplement to our prescribed burning program and for grassland management and brush control. The refuge has little viable fish habitat and fishing is limited to ditches and creeks or snagging of non-game fish when excess water is released from Eagle Pool. Mushroom picking season is limited to 40 days in the spring and generates very little interest most years.
Comment 23	*Landowners depend on the income from hunters. Offering hunting on the Refuge would hurt the local community by drawing hunters away from private lands.*
Response 23	Conflicts with landowners renting out hunting rights will be minimized since the Snow Goose hunt would occur on only 3 percent of the Refuge (about 200 acres). The limited duration and extent of the Snow Goose hunt is not expected to draw hunters from nearby private lands. Hunting is one of the priority wildlife-dependent public uses on refuges as well as being a useful population management tool in this instance.
Comment 24	*If hunters abandon surrounding private lands in favor of the Refuge landowners may convert their lands to other uses, eliminating wildlife habitat.*
Response 24	See Response 23.

Comment 25	*Snow Goose hunting would have a negative effect on the spring migrating shorebirds*
Response 25	We do not anticipate a negative impact on migrating shorebirds from the spring Snow Goose hunt. The hunt would be limited to 3 percent of the Refuge and would be at least a quarter mile from any shorebird unit. Hunters would access the hunting area via Highway 118 to further minimize disturbance to shorebirds.
Comment 26	*I have no objection to the managed deer hunt. Hunt more deer.*
Response 26	As stated in *Objective 2.5* (pg. 54) the white-tailed deer population on the Refuge will be managed through controlled hunts to achieve a fall relative density of 20 to 25 deer per square mile.
Comment 27	*Hunting geese on the Refuge will cause them to leave the area. Local hunting clubs and the community would be hurt by the loss of revenue.*
Response 27	See Response 12 and Response 23 above. The reaction of light geese (Snow Geese and Ross's Geese) to this hunt will be closely monitored by Refuge staff and appropriate measures will be implemented if necessary to minimize any unintended impacts.
Comment 28	*It would be nice to have more wildflowers on the Refuge.*
Response 28	Part of the intent of *Objective 1.3, Strategy 11* (pg. 46 Draft CCP) and *Objective 1.4, Strategy 8* (pg. 47 Draft CCP) is to produce more wildflowers on the Refuge.
Comment 29	*Increase the amount of volunteer hours in Objective 3.7 from 7,500 to 10,000.*
Response 29	We agree. Objective 3.7 Volunteers has been changed to reflect this change.
Comment 30	*Prevent siltation of the Refuge by purchasing additional land to protect the watershed.*
Response 30	See Response 15.
Comment 31	*Develop cooperative agreements and conservation easements with watershed landowners to reduce the flow of sediment into creeks.*
Response 31	We intend to do this. See *Objective 1.10* (pg. 49 Draft CCP).
Comment 32	*The muzzleloader hunt is not adequate to manage the deer herd. Consider adding an archery hunt.*
Response 32	*Objective 2.5 White-tailed Deer Management* (pg. 54 Draft CCP) and *Objective 3.4 Hunting and Fishing* (pg. 60 Draft CCP) allow for the expansion of the muzzleloader hunt to help reduce deer numbers. In 1989 and 1990, the first two years of deer hunts at Squaw Creek, hunters were allowed to use muzzleloaders or bows. Hunter success rates were far greater for those using muzzleloaders. Expanding the muzzleloader hunt is a more effective means of reducing deer numbers.
Comment 33	*Any lands added to the existing Refuge should be left open to hunting if feasible.*
Response 33	The 400 acres that are presently approved for acquisition are primarily in cropland at this time. If acquired, they would be converted to either wetlands or grasslands. The sole hunting opportunities on these properties would probably be spring Snow Goose hunting.
Comment 34	*Refuge staff should work in coordination with the Arctic Goose Task Force to decide best measures for controlling the population.*
Response 34	The Snow Goose hunt is being offered in response to recommendations from the Arctic Goose Habitat Working Group as noted in *Section 3.1.2.4 Arctic Goose Management Initiative* (pg. 17 Draft CCP).

Comment 35	*Implement measures to reduce the population of Snow Geese, but attempt to do it in a way that does not drive geese away and detract from the annual migration spectacle.*
Response 35	The spring Snow Goose hunt will limited to 3 percent of the Refuge, leaving most of the Refuge undisturbed. The reaction of light geese (Snow Geese and Ross's Geese) to this hunt will be closely monitored by Refuge staff and appropriate measures will be implemented if necessary to minimize any unintended impacts. See Response 23 and *Section 4.1.6 Snow Goose Management* (pg. 114 Draft CCP) for more on the environmental consequences regarding hunting of Snow Geese.
Comment 36	*Continue support of research of the Eastern massassauga rattlesnake.*
Response 36	We intend to do this. See Strategy 1 under *Objective 2.7 Eastern Massassauga Rattlesnake* (pg. 55 Draft CCP).
Comment 37	*Efforts to expand the Refuge should include potential habitat for the Eastern massassauga rattlesnake.*
Response 37	We considered Refuge expansion, but chose not to pursue it at this time. See *Appendix A, Section 2.2 Alternatives Considered But Not Analyzed in Detail* (pg. 88 Draft CCP) for more information. We do plan to convert 217 acres of cropland to bottomland mesic prairie, a habitat important to the Eastern Massassauga Rattlesnake. See *Objective 1.3 Bottomland Mesic Prairie* (pg. 45 Draft CCP) and *Objective 2.7 Eastern Massassauga Rattlesnake* (pg. 55 Draft CCP) for more information.
Comment 38	*In the areas of the Refuge used most heavily by the Eastern massassauga rattlesnake, habitat management should be directed towards meeting the needs of the snake. Any fires in these areas should be done when they will not harm the snakes.*
Response 38	As stated in *Objective 2.7 Eastern Massassauga Rattlesnake* (pg. 55 Draft CCP) management efforts will emphasize the Eastern massassauga rattlesnake in wet prairie and bottomland mesic prairie. Strategy 5 under *Objective 1.2 Wet Prairie* (pg. 44 Draft CCP) is intended to minimize adverse effects on the snake from prescribed burns.
Comment 39	*Efforts should be made to educate visitors to avoid snakes on Refuge roads. If necessary construct underpasses to allow snake movement and prevent mortality from vehicle traffic.*
Response 39	We have made attempts to educate the public about snakes, particularly the Eastern massassauga rattlesnake. We developed a leaflet that reminds visitors to avoid running over snakes on the road. It would not be feasible to construct underpasses on the auto tour route because snakes can be found crossing the roads throughout the entire 10 mile tour route.

Comment 40	*More land should be converted from heavily managed wetlands and crops/old fields to wet prairie and bottomland mesic prairie to meet the requirements of the Refuge Improvement Act's requirement to maintain biological integrity, diversity, and environmental health of the refuge. We agree with Objective 1.1 of alternative B's proposal to increase the acreage of wet prairie habitat well above 1,077 acres and we encourage the FWS to include this in the preferred alternative.*
Response 40	As noted in *Section 1.2 Refuge Purpose* (pg. 4 Draft CCP) the Refuge was established in 1935 as the "Squaw Creek Migratory Waterfowl Refuge" and its purpose is to provide habitat for migratory birds and other wildlife. The Refuge is used by numerous types of migratory birds and other wildlife, but it has a long history as a stopover for migratory waterfowl. Restoration of wet prairie would come at the expense of managed wetlands. Both are rare habitats in the Lower Missouri ecosystem. Converting the managed wetlands to wet prairie would reduce the amount of an important migratory habitat in an area where migrating waterfowl have few alternative stopover sites. Fish and Wildlife Service policy directs us to maintain biological integrity, diversity, and environmental health and where appropriate restore them in a manner consistent with refuge purposes and the Refuge System mission. Converting the managed wetlands does not best meet the purposes of the refuge.
Comment 41	*We recommend that all of the cropland/old fields should be converted to bottomland mesic prairie and Loess Bluff prairie as proposed in Objective 1.7 of alternative B. The preferred alternative does not convert enough cropland/old fields and its timeline is too slow. We believe that removing the refuge's artificial habitats which these two species (white-tailed deer and Snow Geese) have grown accustomed to, should be maximized before increasing and initiating hunting on the refuge. The conversion to bottomland mesic prairie and Loess Bluff will also help by providing more habitats for the candidate Massassauga rattlesnake and for area songbirds which have seen a dramatic decline in numbers.*
Response 41	As noted in *Section 2.3.4 Alternative D* (pg. 94 Draft CCP) the preferred alternative seeks to maximize wildlife habitat and population management without adversely impacting current levels of wildlife-dependent recreation. To do this we chose to convert 279 acres of cropland to other habitats, and maintain 300 acres of cropland to serve as an attractant for wildlife and provide viewing opportunities. We modified the Environmental Assessment (*Appendix A*, pg. 119 Draft CCP) to note we will monitor the impacts of cropland reduction on wildlife viewing opportunities, and eliminated a number of references indicating a link between the amount of cropland and Snow Goose numbers and viewing. Snow Geese predominantly use the Refuge for roosting and feed in cropland outside the Refuge. The amount of cropland on the Refuge is not likely to affect Snow Goose numbers or use of the Refuge. Cropland does attract white-tailed deer and turkey, species popular with wildlife viewers.
Comment 42	*We feel that there should be guidelines in the compatibility determination on white-tailed deer hunting which outline how the refuge will inform hunters of the presence of the Massassauga rattlesnake and Western fox snake and ensure that these snakes are not harassed or killed.*
Response 42	Both of these species are hibernating during the winter months when the deer hunt occurs. This precludes any potential harassment from deer hunters.

Comment 43	*We fail to see how mushroom gathering is compatible with refuge purposes or the Refuge System mission. It has the potential to degrade the ecological integrity of areas where it is allowed especially if it becomes a commercial activity. We feel it should not be authorized on the Refuge.*
Response 43	Mushroom picking is a non-wildlife dependent public use. Such uses can occur on National Wildlife Refuges where they are compatible with the Refuge System mission and the refuge purposes, and do not conflict with wildlife-dependent recreation. Mushroom picking meets these standards. The quantity of mushrooms produced in a given year is closely tied to variations in temperature and moisture. In general, wet years produce more mushrooms and dry years fewer. The temperature and moisture regime of northwest Missouri does not reliably produce conditions favorable to mushroom growth. Mushroom crops plentiful enough to interest pickers occur about once every 3-4 years. These sporadic crops are unlikely to attract those seeking large quantities of mushrooms for commercial use. Much of the concern regarding mushroom picking originated in the Pacific Northwest where climate and vegetative cover favor mushrooms including a number of rare species associated with old growth forests. There collection of large quantities of mushrooms for commercial use is common and has resulted in greater research and regulation to promote sustainable harvesting practices and protection of rare species. The Forest Service's Pacific Northwest Research Station maintains a website regarding research and monitoring of commercially harvested forest mushrooms. They note that initial small scale studies on the impacts of edible mushroom picking show that careful harvesting does not diminish subsequent fruiting (http://mgd.nacse.org/fsl/MonitorPoster/). Commercial use is not anticipated nor is it permitted under the compatibility determination. Mushroom gathering is limited to 10 pounds per year for each individual and is not anticipated to adversely impact the ecological integrity of the Refuge. Archeological evidence from within the Refuge shows it has been inhabited by humans for more than 12,000 years. Many of the early inhabitants relied heavily on wild plants for food. It is reasonable to conclude that they harvested mushrooms when available and that permitting individual gathering today is consistent with the historic conditions of the area. The Missouri Mycological Society is engaged in a study to determine the effects of harvesting on the fungi *Cantherellus*, a species commonly collected within the state. The results of this and any similar studies will be useful in guiding future policy on this matter.