

Appendix A: Environmental Assessment

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

ENVIRONMENTAL ASSESSMENT FOR IMPLEMENTATION OF COMPREHENSIVE CONSERVATION PLAN FOR SWAN LAKE NATIONAL WILDLIFE REFUGE

Abstract: The U.S. Fish and Wildlife Service is proposing to implement a Comprehensive Conservation Plan (CCP) for the Swan Lake National Wildlife Refuge (NWR) in Missouri. This Environmental Assessment (EA) considers the biological, environmental, and socioeconomic effects that implementing the CCP (the preferred alternative is the proposed action) or one of the two 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 Refuge 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.

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Swan Lake

National Wildlife Refuge

Environmental Assessment

Table of Contents

| | |
|---|-----------|
| Chapter 1: Purpose and Need for the Proposed Action | 55 |
| 1.1 Purpose and Need for Action | 55 |
| 1.1.1 Purpose | 55 |
| 1.1.2 Need for Action | 56 |
| 1.2 Decision Framework | 56 |
| 1.3 Background | 57 |
| 1.3.1 The United States Fish and Wildlife Service | 57 |
| 1.3.2 The National Wildlife Refuge System | 57 |
| 1.3.3 Swan Lake National Wildlife Refuge | 58 |
| 1.3.4 Swan Lake NWR Vision Statement for Desired Future Condition | 58 |
| 1.3.4.1 Vision Statement | 58 |
| 1.3.5 Refuge Goals | 58 |
| 1.4 Scoping and Public Involvement | 59 |
| 1.4.1 Issues and Concerns | 60 |
| 1.5 Legal, Policy, and Administrative Guidelines | 60 |
| 1.5.1 Legal Mandates | 60 |
| Chapter 2: Description of Alternatives | 61 |
| 2.1 Rationale for Alternative Designs | 61 |
| 2.2 Alternatives Considered But Not Analyzed in Detail | 61 |
| 2.2.1 Visitor Services Focus | 61 |
| 2.3 Description of Alternatives | 61 |
| 2.3.1 Elements Common to All Alternatives | 62 |
| 2.3.1.1 Habitat | 62 |
| 2.3.1.2 Wildlife | 62 |
| 2.3.1.3 People | 62 |
| 2.3.1.4 Listed Species and Other Species of Interest | 62 |
| 2.3.1.5 Archaeological and Cultural Resource Values | 62 |
| 2.3.2 Alternative 1: Current Management Direction (No Action) | 62 |
| 2.3.3 Alternative 2 | 63 |
| 2.3.4 Alternative 3: Preferred Alternative | 63 |
| Chapter 3: Affected Environment | 67 |
| 3.1 Description of Swan Lake National Wildlife Refuge | 67 |
| 3.2 Habitat Overview | 67 |
| 3.2.1 Forested Resources | 67 |
| 3.2.2 Wetland Resources | 67 |
| 3.2.3 Grassland Resources | 67 |
| 3.2.4 Invasive Species | 68 |
| 3.2.5 Sedimentation and Water Quality | 68 |
| 3.2.6 Geomorphology and Soils | 68 |

| | | |
|-------------------|---|-----------|
| 3.2.6.1 | Geomorphology | 68 |
| 3.2.6.2 | Soils | 68 |
| 3.3 | Wildlife | 69 |
| 3.3.1 | Migratory Bird Species | 69 |
| 3.3.2 | Fish Species | 69 |
| 3.3.3 | Freshwater Mussels | 69 |
| 3.3.4 | Mammals | 69 |
| 3.3.5 | Upland Game Birds | 69 |
| 3.3.6 | Amphibians and Reptiles | 69 |
| 3.3.7 | Federally Listed Threatened and Endangered Species and Other Species of Concern | 69 |
| 3.3.7.1 | Mammals | 69 |
| 3.3.7.2 | Birds | 69 |
| 3.3.7.3 | Reptiles | 70 |
| 3.3.7.4 | Plants | 71 |
| 3.4 | Public Use | 71 |
| 3.5 | Socioeconomics | 71 |
| 3.6 | Archeological and Cultural Values | 72 |
| Chapter 4: | Environmental Consequences | 74 |
| 4.1 | Effects Common to All Alternatives | 74 |
| 4.1.1 | Environmental Justice | 74 |
| 4.1.2 | Archeological and Cultural Values | 74 |
| 4.1.3 | Climate Change Impacts | 75 |
| 4.1.4 | Prescribed Fire as a Management Tool | 75 |
| 4.1.4.1 | Social Implications | 75 |
| 4.1.4.2 | Archeological and Cultural Values | 76 |
| 4.1.4.3 | Flora | 76 |
| 4.1.4.4 | Listed Species | 76 |
| 4.1.4.5 | Soils | 77 |
| 4.1.4.6 | Escaped Fire | 77 |
| 4.1.5 | Trapping | 77 |
| 4.2 | Summary of Effects by Resource and Alternative | 77 |
| 4.2.1 | Waterfowl | 78 |
| 4.2.1.1 | Alternative 1: Current Management Direction (No-Action Alternative) | 79 |
| 4.2.1.2 | Alternative 2 | 79 |
| 4.2.1.3 | Alternative 3: Preferred Alternative | 79 |
| 4.2.2 | Shorebirds | 79 |
| 4.2.2.1 | Alternative 1: Current Management Direction (No-Action Alternative) | 80 |
| 4.2.2.2 | Alternative 2 | 80 |
| 4.2.2.3 | Alternative 3: Preferred Alternative | 80 |
| 4.2.3 | Marsh Birds and Wading Birds | 81 |
| 4.2.3.1 | Alternative 1: Current Management Direction (No-Action Alternative) | 81 |
| 4.2.3.2 | Alternative 2 | 81 |
| 4.2.3.3 | Alternative 3: Preferred Alternative | 81 |
| 4.2.4 | Eastern Massasauga Rattlesnake | 82 |
| 4.2.4.1 | Alternative 1: Current Management Direction (No-Action Alternative) | 82 |

| | |
|--|-----------|
| 4.2.4.2 Alternative 2 | 82 |
| 4.2.4.3 Alternative 3: Preferred Alternative | 82 |
| 4.2.5 Wildlife Dependent Recreation | 82 |
| 4.2.5.1 Alternative 1: Current Management Direction (No-Action Alternative) | 82 |
| 4.2.5.2 Alternative 2 | 82 |
| 4.2.5.3 Alternative 3: Preferred Alternative | 83 |
| 4.2.6 Wildlife Disturbance | 83 |
| 4.2.6.1 Alternative 1: Current Management Direction (No-Action Alternative) | 83 |
| 4.2.6.2 Alternative 2 | 84 |
| 4.2.6.3 Alternative 3: Preferred Alternative | 84 |
| 4.2.7 Hydrology and Water Quality | 84 |
| 4.2.7.1 Effects Alternative 1 | 85 |
| 4.2.7.2 Effects Alternative 2 | 85 |
| 4.2.7.3 Effects Alternative 3 | 85 |
| 4.3 Cumulative Impacts | 85 |
| 4.3.1 Biological Resources | 86 |
| 4.3.1.1 Listed Species and Other Species of Special Interest | 86 |
| 4.3.1.2 Wildlife and Habitat Resource Management | 86 |
| 4.3.1.3 Impacts of Alternatives to Biological Resources | 87 |
| 4.3.2 Sedimentation and Water Quality | 87 |
| 4.3.3 Cultural and Human Resources | 88 |
| Chapter 5: List of Agencies, Organizations, and Persons Contacted | 93 |
| Chapter 6: References and Literature Cited | 94 |
| Figure 1: Location of Swan Lake NWR | 56 |
| Figure 2: Concept Diagram Depicting Stream/Floodplain Relationship | 84 |
| Table 1: Comparison of Alternatives | 64 |
| Table 2: Soil Types, Swan Lake NWR | 69 |
| Table 3: Acres and Potential Energy in Millions of Kilojoules for Three Refuge Habitats, Swan Lake NWR | 78 |
| Table 4: Acres and Shorebird Forage in Grams for Refuge Mudflat Habitat Within Moist Soil Management Units ... | 80 |
| Table 5: Comparison of Impacts by Issue and Alternative | 89 |

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 (Service) is proposing to prepare and implement a Comprehensive Conservation Plan (CCP) for Swan Lake National Wildlife Refuge (Refuge). The Refuge is located in north-central Missouri near Sumner and approximately 30 miles east of Chillicothe, Missouri (Figure 1).

The purpose of the proposed action is to establish the management direction of the Refuge for the next 15 years. This 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 as detailed in the set of goals, objectives, and strategies described in the CCP.

Refuge Purpose Statements are primary to the management of each refuge within the National Wildlife Refuge System (NWRS). The Purpose Statement is derived from the legislative authority used to acquire specific refuge lands and is, along with NWRS 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.”

Executive Order 7563 established Swan Lake National Wildlife Refuge (NWR) on February 27, 1937. The purchase of Refuge lands began at that time with money from the “N.I.R., Agriculture, and Wildlife Refuges Funds.” Following purchase of the land, the Civilian Conservation Corps began work on the Refuge creating wetlands, constructing roads and buildings, and initiating the Refuge farming program. The purpose of the Refuge derived from the Executive Order and other legislative authorities is to provide for the needs of migratory birds and other wildlife.

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 ref-



Swan Lake NWR. Photo credit: USFWS

uges such as Swan Lake NWR 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 Swan Lake NWR include providing opportunities for the public to enjoy wildlife-dependent recreation and 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.

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 (NEPA). NEPA requires federal agencies to examine the effects of proposed actions on the natural and human environment. This EA describes three 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

Figure 1: Location of Swan Lake NWR

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 Swan Lake 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 provide a clear statement of Refuge management direction.
- There is a need to address the siltation of Refuge lakes.
- There is a need to provide Refuge neighbors, visitors, and government officials with an understanding of Service management actions on and around the Refuge.
- 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 massasauga rattlesnakes and bald eagles, two species of particular concern on the Refuge.
- There is a need to ensure that Service management actions, including land protection and

recreation/education programs, are consistent with the mandates of the NWRs.

- There is a need to specify how the mandate to facilitate wildlife-dependent recreation can be fulfilled on the Refuge.
- There is a need to provide a basis for the development of budget requests for operations, maintenance, and capital improvement needs.
- A CCP 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 CCP 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 Region 3-the Midwest Region of the U.S. Fish and Wildlife Service 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 NEPA. If it is determined not to be a major federal action that would significantly affect

the quality of the human environment, 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 (EIS).

1.3. Background

1.3.1. The United States Fish and Wildlife Service

The 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 (NWRS) is an integral component of the Service. The mission of the NWRS, as defined by the National Wildlife Refuge System Improvement Act of 1997 (Act) is: “...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.”

As part of its mission, the Service manages more than 540 national wildlife refuges covering over 95 million acres. These areas comprise the National Wildlife Refuge System, the world's largest collection of lands set aside specifically for fish and wildlife. The majority of these lands, 77 million acres, are in Alaska. The remaining acres are spread across the other 49 states and several United States territories. In addition to refuges, the Service manages thousands of small wetlands, national fish hatcheries, 64 fishery resource offices, and 78 ecological services field stations. The Service enforces federal wildlife laws, administers the Endangered Species Act, manages migratory bird populations, restores nationally significant fisheries, conserves and restores wildlife habitat, and helps foreign governments with their conservation efforts. It also oversees the Federal Aid program that distributes hundreds of millions of dollars in excise taxes on fishing and hunting equipment to state fish and wildlife agencies.

The Act established, for the first time, a clear legislative mission of wildlife conservation for the NWRS. Actions were initiated in 1997 to comply with the direction of this new legislation including an effort to complete CCPs for all refuges. These plans, which are completed with full public involvement, help guide the future management of refuges by establishing natural resources and recreation/education programs. Consistent with this Act, approved plans will serve as the guidelines for refuge management for the next 15 years. The Act states that each refuge shall be managed to:

- Fulfill the mission of the NWRS;
- Fulfill the individual purposes of each refuge;
- Consider the needs of wildlife first;
- Fulfill requirements of CCPs that are prepared for each unit of the NWRS;
- Maintain the biological integrity, diversity, and environmental health of the NWRS;
- Recognize that wildlife-dependent recreation activities including hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation are legitimate and priority public uses; and
- Allow refuge managers authority to determine compatible public uses.



Swan Lake NWR. Photo credit: USFWS

The currently proposed goals of the NWRS are to:

- Conserve a diversity of fish, wildlife, and plants and their habitats, including species that are endangered or threatened with becoming endangered.
- Develop and maintain a network of habitats for migratory birds, anadromous and interjurisdictional fish, and marine mammal populations that is strategically distributed and carefully managed to meet important life history needs of these species across their ranges.
- Conserve those ecosystems, plant communities, wetlands of national or international significance, and landscapes and seascapes that are unique, rare, declining, or underrepresented in existing protection efforts.
- Provide and enhance opportunities to participate in compatible wildlife-dependent recreation (hunting, fishing, wildlife observation and photography, and environmental education and interpretation).
- Foster understanding and instill appreciation of the diversity and interconnectedness of fish, wildlife, and plants and their habitats.

1.3.3. Swan Lake National Wildlife Refuge

The Refuge lies in the floodplain of the Grand River near its confluence with the Missouri River and is bordered on the south by Yellow Creek. Flooding is common, especially during spring and summer periods.

The Refuge acreage is divided into five major habitat types: 3,100 acres of bottomland hardwoods; 3,050 acres of wetlands and moist soil units; 1,365 acres of croplands; 2,100 acres of open water; and 1,250 acres of grasslands.

Silver Lake serves as the Refuge's reservoir pool. Flowage ditches and water control structures can easily transfer the water from the lake to smaller but more manageable wetland units.

Moist soil management, or the production of natural waterfowl foods through water manipulation, is practiced extensively. Water management schemes are aimed at benefiting not only waterfowl but also wading birds, shorebirds, and a variety of wetland plants.

About 1,365 acres of the Refuge are farmed to some degree periodically. The goals of the farming program are to provide waterfowl food, habitat diversity for both migratory and resident wildlife, and complement other Refuge management programs for the benefit of wildlife and people.

Grassland management practices include controlled burning, mowing, planting of native grass varieties, and other measures used to maintain a dynamic upland grass ecosystem. As with grasslands, existing forested tracts are managed to mimic what was here historically. Regardless of the management techniques used, each is designed to help meet the needs of various Refuge plants and animals.

1.3.4. Swan Lake NWR Vision Statement for Desired Future Condition

1.3.4.1. Vision Statement

Diverse and abundant wildlife flourishes within a mosaic of grass, trees, and wetlands recalling an earlier era when the Grand River meandered across its broad, open floodplain. Visitors enjoy recreation dependent on wildlife and show their appreciation by supporting conservation and Swan Lake NWR.

1.3.5. Refuge Goals

The goals presented below are the Service's response to the issues, concerns, and needs expressed by the planning team, the Refuge staff and partners, and the public. These goals, objectives, and strategies reflect the Service's commitment to achieve the mandates of the National Wildlife Refuge System Improvement Act of 1997, the mission of the NWRS, and the purposes and vision of Swan Lake NWR.

Based on the purposes of the Refuge, the mission of the NWRS, and ecosystem considerations as well as 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: Wetlands, grasslands, and bottomland forests providing habitat for migratory birds, threatened and endangered species, and other wildlife within the Grand River floodplain

Goal 2 Wildlife: Diverse wildlife teeming within native habitats of the Grand River floodplain

Goal 3 People: Visitors enjoy wildlife-dependent recreation and understand the natural and cultural resources of the Refuge and its role in their conservation.

1.4. Scoping and Public Involvement

In accordance with Service guidelines and NEPA recommendations, public involvement has been a crucial factor throughout the development of the Draft CCP and EA for Swan Lake NWR. This Plan has been written with input and assistance from interested citizens, conservation organizations, and employees of local and state agencies. The Service, as a whole, and the Refuge staff, in particular, are very grateful to each one who has contributed time, expertise, and ideas to the planning process. The staff remains impressed by the passion and commitment of so many individuals for the lands and waters administered by the Refuge.

Generally speaking, scoping refers to the process by which the planning team gathers input from a variety of internal and external sources as to what the key issues, concerns, and opportunities are that need to be addressed in this CCP and EA. Internal scoping sources include the Refuge staff itself, other Service biologists, and professionals in the region. External scoping sources include concerned private citizens; research and educational institutions; members of conservation, outdoors enthusiasts, and civic groups; Refuge neighbors; members of the community; and state, Tribal, and local agencies. These various interests are sometimes referred to collectively as stakeholders, which means those individuals and groups that have a stake in how the Refuge is (and will be) managed. The participation of these stakeholders and their ideas has been of great value in setting the management direction for the Swan Lake NWR.

The planning process for this CCP/EA began with a “kick-off” meeting on October 23-26, 2006, for a tour of the Refuge and an overview of its habitat and wildlife resources and public use programs, facilities, and opportunities. At this time, the planning team also conducted additional internal scoping and prepared a preliminary schedule and plans for public involvement. The nucleus of the CCP planning team itself was comprised of the Refuge Man-

ager, a wildlife biologist, a Service natural resource planner from the Regional Office, and a contractor with experience in preparing CCPs.

A Visitor Services Review was also conducted in 2007 as part of the CCP/EA preparation process. A review team met with Refuge staff to discuss the visitor services program. The staff explained what the visitor services program is currently doing to provide recreational, educational, and interpretive opportunities on the Refuge. The Refuge Manager then took the review team to all the different public use areas on the Refuge. After discussions with some of the staff, the review team met to discuss the current status of the programs and to make recommendations. On the final day of the review, the team presented the recommendations to the staff and had an open discussion of the pros and cons of the various recommendations. Later, the team prepared a report with a number of recommendations for improving and expanding upon visitor services facilities and operations.

Scoping continued with a public meeting on January 11, 2007, at the Refuge headquarters facility. Approximately 95 members of the public attended the scoping meeting. The Refuge Manager was on hand to answer any questions by the public, as was Contractor Randy Williams, a consultant with the Mangi Environmental Group, tasked to assist the Service on the Swan Lake CCP/EA. During this period, meeting participants had the opportunity to express their concerns about the Refuge and ideas and suggestions for its future management. In addition, a comment form was distributed for attendees and sent to other interested parties to submit their written comments. Written comments could be submitted at the meeting, mailed subsequently, or sent via email.

A wide range of issues, concerns, and opportunities were identified and addressed during the planning process. Many issues that are very impor-



Swan Lake NWR. Photo credit: USFWS

tant to the public often fall outside the scope of the decision to be made within this planning process. In some instances, the Service cannot resolve issues some people have communicated to us. We have considered all issues throughout our planning process and have developed plans that attempt to balance the competing opinions regarding important issues

1.4.1. Issues and Concerns

The following issues were presented by the public and are addressed in Table 5, “Comparison of Impacts by Issue and Alternative,” on page 89.

Issue 1: Wildlife Management

There are diverse and sometimes conflicting expectations regarding the presence, variety, and abundance of Refuge wildlife. How should this apparent conflict be addressed?

Issue 2: Wildlife Management

Should hunting opportunities be expanded on the Refuge?

Issue 3: Wildlife Management

The decline in Canada Goose use of the Refuge in recent decades has decreased the quality of goose hunting, drawn fewer hunters and wildlife watchers, and changed the cultural identity of local communities – can this trend be reversed?

Issue 4: Habitat Management

Should the Refuge increase the amount of wet prairie habitat?

Issue 5: Habitat Management

Should the Refuge consider, where possible, restoring the natural hydrology across the Refuge to allow for periodic flooding and increased sheet flow?

Issue 6: Habitat Management

What role should cropland play in Refuge management?

Issue 7: Habitat Management

What can be done to improve shorebird habitat?

Issue 8: Habitat Management

What can be done to improve bottomland hardwood habitat on the Refuge?

Issue 9: Habitat Management

What can be done to address the management of parcels and easements assigned to the Refuge but well beyond the contiguous Refuge Boundary?

Issue 10: Habitat Management

What can be done to reduce the impact of severe flooding on the Refuge and adjoining lands?

Issue 11: Habitat Management

What can be done to reverse the trend in sedimentation accumulation that is filling in Silver Lake?

Issue 12: Visitor Services

What can be done to improve public access throughout the Refuge?

Issue 13: Visitor Services

What can be done to improve wildlife observation?

Issue 14: Visitor Services

What can be done to improve hunting opportunity and variety on the Refuge?

Issue 15: Visitor Services

How will the Refuge address an increased demand for wildlife-dependent recreation opportunities and facilities beyond what is presently available?

Issue 16: Environmental Education

What can be done to improve environmental education?

1.5. Legal, Policy, and Administrative Guidelines

1.5.1. Legal Mandates

Laws, Executive Orders, and Service policy guide administration of refuges. A list of pertinent statutes and policy guidance can be found in Appendix E of the CCP, “Relevant Legal Mandates and Executive Orders.”

Chapter 2: Description of Alternatives

This chapter describes the three alternatives for the Swan Lake NWR, including Alternative 3, the proposed action.

2.1. Rationale for Alternative Designs

Alternatives are different approaches or combinations of management objectives and strategies designed to achieve the Refuge's purpose and vision; the goals identified in the CCP; the priorities and goals of the Refuge System; and the mission of the U.S. Fish and Wildlife Service. Alternatives are formulated to address the significant issues, concerns, and problems identified by the Service and the public during public scoping.

The three alternatives identified and evaluated represent different approaches to provide permanent protection, restoration, and management of the Refuge's fish, wildlife, plants, habitats, and other resources as well as compatible wildlife-dependent recreation. Refuge staff assessed the biological conditions and analyzed the external relationships affecting the Refuge. This information contributed to the development of Refuge goals and, in turn, helped to formulate the alternatives. Thus, each alternative presents different sets of objectives for reaching Refuge goals. Each alternative was evaluated based on how much progress it would make and how it would address the identified issues related to fish and wildlife populations, habitat management, resource protection and conservation, visitor services, and Refuge administration. A comparison of each alternative is provided in Table 1 on page 64.

Serving as a basis for each alternative, a number of goals were developed to help achieve the Refuge's purpose and the mission of the NWRS. Objectives are desired conditions or outcomes that are grouped into sets and, for this planning effort, consolidated into three alternatives. These alternatives represent different management approaches for managing the Refuge over a 15-year time frame while still meeting the Refuge's purposes and goals. The three alternatives are summarized at Section 2.3.

2.2. Alternatives Considered But Not Analyzed in Detail

The alternatives development process under the National Environmental Policy Act and the Refuge Improvement Act, as amended by the National Wildlife Refuge System Improvement Act as 1997, are designed to allow consideration of the widest possible range of issues and potential management approaches. During the alternatives development process, many different solutions were considered. The following alternative component was considered but not selected for detailed study in this CCP/EA for the reasons described.

2.2.1. Visitor Services Focus

This alternative was considered in response to requests from citizens for more access to the Refuge and expanded hunting and fishing opportunities. Promoting visitor enjoyment is an important aspect of Refuge management when it does not conflict with the "wildlife first" priority established by the Refuge System. This alternative would have emphasized improving public access to the Refuge, opening areas to visitors, and expanding times of access in order to promote visitor use. In the analysis of such an effort, it was determined that such a focus would ultimately conflict with the priority of the Service to protect the natural environment and focus on wildlife first.

Expanding Refuge access can be done within the framework of the preferred alternative without conflicting with the "wildlife first" mandate. Many of the ideas and efforts to expand visitor access were incorporated into the preferred action alternative without compromising the needs of wildlife. Because key elements could be incorporated into another alternative and because this alternative is not consistent with Refuge purposes, a "Visitor Services Focus" alternative was not developed for evaluation.

2.3. Description of Alternatives

The three alternatives are summarized in this section and compared in Table 1. Appendix 1 contains additional details on the alternatives.

2.3.1. Elements Common to All Alternatives

Although the alternatives differ in many ways, there are similarities among them as well. These common features are listed below to reduce the length and redundancy of the individual alternative descriptions. Each of the three alternatives described above would have the following features in common for the issues targeted for review in this Environmental Assessment:

2.3.1.1. Habitat

Within 5 years of Plan approval, quantify water needs and available water sources necessary to meet Refuge management objectives and over the life of the Plan maintain or improve water quality.

2.3.1.2. Wildlife

Within 10 years of Plan approval, provide habitat suitable to support a viable population of the eastern massasauga rattlesnake.

2.3.1.3. People

Within 5 years of Plan approval, develop an environmental education site that includes an outdoor classroom.

Over the life of the Plan, provide compatible opportunities for gathering mushrooms, berries, and antlers for personal use.

Over the life of the Plan, avoid and protect, or mitigate against disturbance of all known cultural, historic, or archeological sites.

2.3.1.4. 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 species of interest described in Chapter 3. In all alternatives, the current acreage of wet prairie, which benefits eastern massasauga rattlesnakes, is maintained except Alternative 3 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.

2.3.1.5. Archeological 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 NWRS 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 Archeological Resources Protection Act (ARPA) 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.

2.3.2. Alternative 1: Current Management Direction (No Action)

Current management and public use practices would continue under this alternative. Refuge management programs would continue to be developed and implemented with limited baseline biological information and limited monitoring. Wildlife surveys would still be completed for the presence and absence of species and to alert Refuge staff to large-scale changes in population trends. Cooperation with partners for monitoring waterfowl, eagle, fish, and deer herd health surveys would continue. The Refuge would continue to provide habitat for and monitor the progress on the eastern massasauga rattlesnake. It would also maintain the current habitat mix for the benefit of other migratory birds, shorebirds, marshbirds, and landbirds. Staff would continue existing surveys to monitor long-term population trends and health of resident species.

Hunting, fishing, and environmental education programs would continue to be the priority focus of public use on Swan Lake NWR with no expansion of current opportunities. Current restrictions or prohi-

bitions would remain. Environmental education and wildlife observation and photography would be accommodated at present levels with a few interpretive sites added. Staffing would remain at its current level with no new positions added.

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, fish and wildlife populations, public use, resource conservation, facilities, work force, and administration. This alternative does not fully address long-term needs and issues.

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

2.3.3. Alternative 2

Under this alternative, Refuge streams that are now impounded would be restored as free flowing streams. Existing levees and dikes would be removed, breached, or otherwise modified to allow water movement across the Refuge. The amount of stream flow and open water within the Refuge would be closely linked to runoff within the watershed, meaning streams and wetlands would undergo seasonal and annual periods with little or no water. The habitats within the Silver Lake basin would convert from open water to varying amounts of emergent wetland, wet meadow, and bottomland forest. None of the estimated 1,200 acres of emergent wetland would be managed using moist soil management practices. All cropland would be converted to prairie, wet meadow, or other native habitats. Wildlife monitoring would focus on threatened and endangered species, waterfowl, shorebirds, and the eastern massasauga rattlesnake.

Goose hunting and deer hunting would continue under this alternative, but the Refuge would also formally propose the addition of duck and small game hunting and emphasize opportunities for youth and people with disabilities. Stream fishing opportunities would continue, but fishing opportunities within Silver Lake would not be available because it would no longer be managed as a year-round reservoir. Seasonal access to some portions of the Refuge would be extended, increasing opportunities for wildlife observation and photography. There would be an increased emphasis on welcoming and orienting visitors and on interpretation. There would be continued emphasis on developing the Refuge Friends group.

2.3.4. Alternative 3: Preferred Alternative

Under Alternative 3, Silver Lake would no longer serve as a year-round reservoir to provide source water for wetland management across the Refuge. Most of the year Refuge streams would rise and fall along with stream flow, creating seasonal and annual variations in water levels within the Silver Lake and Swan Lake basins. One departure would be that the basins would typically be flooded in the fall to accommodate migratory birds. The habitats within the Silver Lake and Swan Lake basins would convert from open water to varying amounts of wet meadow and emergent wetland dominated by bulrush and cattails. Other emergent wetlands would be managed using moist soil management practices. All cropland would be converted to prairie, wet meadow, or other native habitats. Wildlife monitoring would be closely linked to management information needs.

Goose hunting and deer hunting would continue under this alternative, but the Refuge would also formally propose the addition of duck and small game hunting and emphasize opportunities for youth and people with disabilities. Stream fishing opportunities would continue, but fishing opportunities within Silver Lake would be dependent on seasonal and annual water levels. Seasonal access to some portions of the Refuge would be extended, increasing opportunities for wildlife observation and photography. There would be an increased emphasis on welcoming and orienting visitors and on interpretation above that included in Alternative 2. There would be continued emphasis on developing the Refuge Friends group and on providing an increase in the amount of volunteer opportunities.

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

Table 1: Comparison of Alternatives

| | Alternative 1 (No Action Alternative) | Alternative 2 | Alternative 3 (Preferred Alternative) |
|--|--|---|---|
| <u>Streams and Water Bodies</u> | Continue to impound Refuge streams and use Silver Lake as a reservoir to provide water for wetland management across the Refuge. | Restore Refuge streams to free flowing streams with seasonally fluctuating water levels. | Mimic components of historic hydrologic function along reaches of Refuge streams. Allow for seasonal and annual variations in water levels within Swan Lake and Silver Lake basins to increase the amount and variety of native vegetation |
| <u>Emergent Wetland and Moist Soil Management</u> | Maintain at least 500 acres and up to 1,000 acres of emergent wetland with a mixture of bulrush and cattails, and additionally manage about 800 acres using moist soil management techniques ensuring at least 10 percent is available as mud flat habitat for migrating shorebirds. | Maintain approximately 1,200 acres as emergent wetland habitat primarily within the Swan Lake basin. | Maintain at least 1,200 acres and up to 1,800 acres of emergent wetland habitat. Use moist soil techniques to manage emergent wetlands at locations and an amount to be determined after the completion of an ongoing hydrogeomorphic evaluation. Ensure that up to 25 percent of the acreage is available as mud flat or shallow water unvegetated habitat in the spring and up to 10 percent is available in the fall for migrating shorebirds. |
| <u>Shrub Swamp</u> | Maintain 300 to 500 acres of shrub swamp dominated by buttonbush and willow. | Maintain up to 70 acres of shrub swamp dominated by buttonbush and willow. | Same as Alternative 1. |
| <u>Wet Meadow</u> | Maintain wet meadow habitat at present levels (110 acres). | Convert approximately 4,000 acres of existing cropland, open water, emergent wetland and other habitats to wet meadow and | Convert approximately 530 acres of existing cropland, food plots, areas of dense young forest, and areas dominated by reed canary grass to wet meadow. |
| <u>Native Prairie</u> | Maintain existing grasslands at present levels (1,000 acres) and species mix. | Convert approximately 950 acres of existing cropland to native prairie, and maintain a diverse floral community within converted and existing grasslands. | Convert approximately 835 acres of existing cropland or food plots to native prairie, and maintain a diverse floral community within converted and existing grasslands. |
| <u>Cropland</u> | Maintain existing amount (1,365 acres) of cropland annually leaving at least 30 percent and up to 100 percent of planted crops as food and cover for wildlife. | Convert all existing cropland (1,365 acres) to native habitats. | Convert all existing cropland (1,365 acres) to native habitats. |
| <u>Bottomland Forest</u> | Maintain existing bottomland forest (3,100 acres) and ensure that 20 percent of stands are comprised of selected oak species. | Increase the amount of bottomland forest from 3,100 acres to 3,800 acres | Same as Alternative 1. |
| <u>Watershed Conservation</u> | Quantify water needs and available water sources necessary to meet Refuge management objectives and improve water quality within Refuge source waters. | Same as Alternative 1. | Same as Alternative 1. |
| <u>Outlying Fee Title Properties and Easements</u> | Maintain existing methods for managing or monitoring outlying fee title properties and easements. | Develop a strategy for ensuring the condition and management of outlying fee title properties and easements. | Develop a strategy for ensuring the condition and management of outlying fee title properties and easements. |

Table 1: Comparison of Alternatives

| | Alternative 1 (No Action Alternative) | Alternative 2 | Alternative 3 (Preferred Alternative) |
|---|---|--|---|
| <u>Threatened and Endangered Species</u> | Continue monitoring Bald Eagle numbers via Missouri Department of Conservation surveys. | Implement a program to monitor all federally listed threatened and endangered species on the Refuge and assist with monitoring of state-listed threatened and endangered species. | Implement a monitoring program to track abundance, population trends, and/or habitat associations of selected species. |
| <u>Migratory and Resident Birds</u> | Monitor waterfowl numbers bi-weekly during duck hunting season via Missouri Department of Conservation bi-weekly waterfowl counts. | Conduct weekly counts of waterfowl and shorebirds during migration. | Monitor migratory bird species with emphasis on waterfowl and shorebirds. |
| <u>Eastern Massasauga Rattlesnake</u> | Provide habitat suitable to support a viable population of the Eastern Massasauga Rattlesnake | Same as alternative 1 | Same as alternative 1 |
| <u>Welcoming and Orienting Visitors</u> | Provide an unstaffed point of contact 7 days a week year-round. | Provide a staffed point of contact most business days during normal working hours year-round. | Provide a staffed point of contact during normal working hours year-round on business days and seasonally on holidays and weekends. |
| <u>Hunting</u> | Continue to offer goose hunting and managed deer hunts (including opportunities for disabled hunters). | Same as Alternative 1, but also within 2 years of CCP approval, propose changes to Refuge regulations (as part of a formal opening package) that includes introducing duck hunting and small game hunting, and emphasize opportunities for youth and disabled hunters. | Same as Alternative 2 . |
| <u>Fishing</u> | Continue to provide existing facilities for shore and boat fishing. | Stream fishing only in accordance with state and Refuge regulations. Silver Lake basin is restored as a stream channel. | Fishing opportunities within Silver Lake basin are dependent on seasonal and annual water levels. |
| <u>Wildlife Observation and Photography</u> | Continue to provide existing opportunities for wildlife observation and photography by allowing access to the entire Refuge from mid March through mid October. | Same as Alternative 1, but also allow visitors limited access to selected portions of the Refuge from mid October through the end of February. | Same as Alternative 2. |
| <u>Interpretation</u> | Provide unstaffed interpretive facilities 7 days a week year-round. | Provide staffed interpretation facilities most business days during normal working hours year-round. | Provide staffed interpretive facilities during normal working hours year-round on business days, and seasonally on holidays and weekends. |
| <u>Environmental Education</u> | Develop an environmental education site that includes an outdoor classroom. | Same as Alternative 1. | Same as Alternative 1. |
| <u>Other Compatible Recreation and Uses</u> | Provide compatible opportunities for gathering mushrooms, berries, and antlers for personal use. | Same as Alternative 1. | Same as Alternative 1. |
| <u>Friends and Volunteers</u> | Continue to provide current level of volunteer opportunities (approximately 625 hours annually). | Continue to develop the Refuge Friends group and maintain existing level of volunteer opportunities (625 hours annually). | Continue to develop the Refuge Friends group and provide volunteer opportunities that total at least 1,000 hours annually. |

Table 1: Comparison of Alternatives

| | Alternative 1 (No Action Alternative) | Alternative 2 | Alternative 3 (Preferred Alternative) |
|---|---|---|---|
| <u>Outreach</u> | Continue to speak to local groups upon request (up to 2-3 times per year), provide information and interviews for local and outdoors media and distribute news releases 2-3 times annually. | Continue to speak to local groups upon request (up to 4-6 times per year), provide information and interviews for local and outdoors media and distribute news releases 4-6 times annually. | Increase local community support and appreciation for fish and wildlife conservation and endorse the Refuge's role in conservation. |
| <u>Archeological, Cultural, and Historic Protection</u> | Avoid and protect or mitigate against disturbance of all known cultural, historic, or archeological sites. | Same as Alternative 1. | Same as Alternative 1. |

Chapter 3: Affected Environment

3.1. Description of Swan Lake National Wildlife Refuge

This chapter provides a brief introduction to the existing physical and social environment of Swan Lake National Wildlife Refuge (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 (CCP).

The Refuge lies in the glacial till plain of North-central Missouri in Chariton County near the town of Sumner. It is located near the confluence of the Grand and Missouri Rivers and is bordered in the south by Yellow Creek. The Refuge acreage is divided into five major habitat types: 3,100 acres of bottomland hardwoods; 3,050 acres of wetlands and moist soil units; 1,365 acres of croplands; 2,100 acres of open water; and 1,250 acres of grasslands.

3.2. Habitat Overview

Along with the five habitat types noted above, there are a number of areas in transition between habitat types. These transition areas are often in a state of flux, succeeding from one seral stage to the next. Enhancement measures undertaken for wildlife diversity include moist soil units. Enhancement measures undertaken for wildlife diversity include the conversion of cropland to moist soil units. These units are managed for high invertebrate populations and a variety of plant species that are attractive to a mix of wetland dependent wildlife species. Prairie areas are burned periodically to maintain and rejuvenate native grass stands. The Yellow Creek Research Natural Area provides 1,000 acres of old growth bottomland hardwood forest habitat.

3.2.1. Forested Resources

The Refuge has 3,100 acres of bottomland hardwoods primarily in the Yellow Creek Research Natural Area. These forestlands are dominated by pin oak, hickory, silver maple, eastern cottonwood, American elm, American plum, black cherry, and river birch.



Beaver activity, Swan Lake NWR. Photo Credit: FWS

3.2.2. Wetland Resources

More than 800 acres of Refuge land are managed annually for moist soil plant production. Fall tillage, partial flooding, various drawdown schemes, and planting are all used as management tools. There are 12 individual wetland management units ranging in size from 8 to 1,850 acres.

Management strategies are designed to increase waterfowl maintenance levels in addition to meeting the objectives for endangered species, other migrant species, and resident wildlife. Silver Lake is used as a reservoir to supply water, as needed, for the Refuge moist soil units through annual manipulation of water levels in these units. Water level is also manipulated to maintain wetland food productivity and limit encroachment of brush and undesirable vegetation.

3.2.3. Grassland Resources

Warm season grasses native to Missouri have disappeared from much of their natural range as a result of farming, overgrazing, and invasions of woody plants. The original Refuge objective to preserve a remnant flock of Prairie Chickens is no longer feasible, and current management objectives are to restore and maintain representative native grasslands for habitat diversity.

Currently, the preferred land management technique to restore and maintain grasslands and curtail invasion by undesirable species is prescribed fire. Prescribed fire can help restore native warm season

grasses as the dominant species in the Refuge grasslands ecosystem. Haying can also be beneficial and should be considered as an alternative management technique when there is a demand for hay in the local area.

3.2.4. Invasive Species

Non-native mammals, birds, insects, mollusks, fish, and plants have been introduced to the Refuge over the 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 Swan Lake 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

With its 7,900 square mile watershed extending into Iowa, the Grand River has been a constant source of floodwater and debris entering Swan Lake NWR. Agricultural runoff flows into the streams of the Grand River watershed, four of which flow through or adjacent to the Refuge. This agricultural runoff contains whatever residue from pesticides and fertilizers that have been used on the fields in the watershed. Hundreds of levees have increased velocity and frequency of flooding, impacting Refuge water management, facilities, and habitat. This alteration of hydrology is of major concern. Silver Lake, the main reservoir pool for the Refuge and the source of water for nearly 3,000 acres of seasonally flooded moist soil and other wetland management units, is silting in.

The 1993 Swan Lake National Wildlife Refuge Contaminants Survey documented potential contamination problems from dieldrin, chlordane, copper, chromium, manganese, and zinc on the Refuge. The major source of these compounds was speculated to be agricultural runoff from the area surrounding the Refuge. It was recommended that if there were concern that populations of fish and wildlife using the Refuge were decreasing or did not seem healthy, there should be further investigations into the abovementioned compounds.

There have been changes in agricultural practices in the watershed since that 1993 contaminants survey. Confined animal facility operations have become more prevalent in the watershed. The effects of these changes should be monitored. Eutrophication from increased nutrients from non-point source pollution has become a cause for concern on many natural areas throughout the nation. It is recommended that at least a water quality monitoring plan be developed and implemented for the Refuge, including monitoring sites on the main streams flowing into the Refuge (Molitor, 2006).

3.2.6. Geomorphology and Soils

3.2.6.1. Geomorphology

The Refuge lies in the glacial till plain of North-central Missouri. Most of the Refuge is relatively flat with elevations ranging from a minimum of 653 feet MSL to a maximum of 741 feet MSL. The Refuge is subject to flooding from local intermittent streams, the Grand River, and Yellow Creek. As a result, external water sources greatly influence water management capabilities, and although conditions vary widely, excess water is generally the greatest hindrance to water management efforts.

3.2.6.2. Soils

Approximately 61 percent of the Refuge soils are classified as Darwin Silty Clay. This very poorly drained soil has a surface layer of very dark gray with a light silty clay layer approximately 14 inches thick and a 46 inch subsoil layer. Permeability and surface runoff are very slow. The pH ranges from slightly acidic to mildly alkaline. Natural fertility and organic matter content is high.

The other major soil type is Kennebec Silt Loam. Covering about 16 percent of the Refuge, this moderately well drained soil has a 26-inch-thick surface layer and a 35-inch substratum. Permeability is moderate, pH ranges from neutral to medium acidic, and natural fertility and organic matter is high.

A complete list of soil types with Refuge acreage is shown in Table 2.

Table 2: Soil Types, Swan Lake NWR

| Soil Type | Acreage |
|-----------------------------|---------|
| Ankeny fine sandy loam | 27 |
| Bremer silt loam | 576 |
| Chariton silt loam | 616 |
| Darwin silty clay | 3,736 |
| Edina silt loam | 80 |
| Grundy silt loam | 103 |
| Haynie very fine sandy loam | 5 |
| Kennebec silt loam | 977 |
| Submerged soil | 4,550 |

3.3. Wildlife

3.3.1. Migratory Bird Species

The Refuge bird list (see Appendix C of the Draft CCP) contains species that have been recorded on the Refuge. Another 17 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. Birdwatching, a non-consumptive use of bird resources, is another important activity on the Refuge.

3.3.2. Fish Species

The Refuge lies within the floodplain of the Missouri River. The Refuge’s temporary wetlands do not typically hold enough water to support fisheries, but Silver Lake does have a resident population of game and other fish species. Beyond those fish found in Silver Lake, species found at Swan Lake NWR come mostly from Elk Creek and Yellow Creek. There are at least 10 species of fish present on the Refuge.

Species commonly 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

Freshwater mussels are one of the most imperiled groups of animals in North America. Currently 70 mussel species are listed as endangered or threatened under the Endangered Species Act, and a number of others are candidates or potential candidates for protection. The Yellow Creek has historically supported a variety of freshwater mussels.

Today, the Refuge continues to support assemblages of mussels and provides an important refuge for maintaining mussel biodiversity. While no threatened or endangered freshwater mussel species are currently known to inhabit the Refuge, current residents may be reclassified as such. The potential also exists to introduce species in peril to suitable habitat on the Refuge.

Freshwater mussels are typically found buried in the substrate in beds often 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

Swan Lake NWR is home to many resident mammal species that have been observed on the Refuge by Refuge personnel and visiting mammalogists (see Appendix C). White-tailed deer are the only big game on the Refuge. Furbearers found on the Refuge include Virginia opossum, raccoon, striped skunk, river otter, beaver, mink, nutria, and muskrat. Gray fox, red fox, coyote, and bobcats are also present. Both eastern cottontail and swamp rabbits inhabit the Refuge. Fox and gray squirrels are found on the Refuge with fox squirrels in the more open woods and gray squirrels inhabiting the dense forests.

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

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 and Other Species of Concern

3.3.7.1. Mammals

No federally listed endangered or threatened mammal species occur on the Refuge.

3.3.7.2. Birds

Federally listed threatened and endangered species sighted in the recent past have included the Piping Plover and Least Tern.

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. Interior populations of the Least Tern, formerly well distributed in the Missouri Basin, now survive only in scattered remnants. Habitat has been decimated by extensive water management projects. 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 Swan Lake 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.

Both the formerly listed Peregrine Falcon and Bald Eagle use the Refuge as well.

The Peregrine Falcon is an occasional visitor to the Refuge. They are most often seen during the winter months. They feed almost exclusively on birds such as doves, waterfowl, and songbirds, but occasionally they hunt small mammals including bats, rats, voles, and rabbits.

The Bald Eagle breeds throughout the United States and winters throughout the southern portion of its breeding range. The Bald Eagle was recently delisted from the federal Threatened and Endangered Species List but is still a species of interest at the Refuge. Bald Eagles will use the Refuge during the winter to feed on fish, waterfowl, coots, muskrats, and nutria.

Other bird species of interest found on the Refuge and listed on the Missouri Department of Conservation's Rare and Endangered Species List include the Black Tern, King Rail, and American Bittern.

The Black Tern (*Chlidonias niger*) usually nests in small groups and in shallow water throughout Canada and the Northern United States. Their colonies occur in freshwater marshes and wetlands with

emergent vegetation found along lake margins and occasionally in rivers (Dunn and Argo, 1995). Unlike other terns, these birds frequently fly over land areas as they hunt for insects. Black Terns also eat small fish and crustaceans, which they pick from the water. Populations have decreased markedly since the mid-1960s due to habitat loss and human disturbance.

A large rail of freshwater marshes, the King Rail (*Rallus elegans*) has declined alarmingly in much of its range over the last 40 years. The King Rail usually gets its food in aquatic habitats but will feed on insects away from water. When it catches food on land, it often takes the item to water and dunks it before eating it. King Rails usually place nests above water in shallow parts of marsh in tussock or clump of aquatic vegetation, i.e. grasses, sedges, or rushes of uniform height (Terres, 1980).

Although common in much of its range, the American Bittern (*Botaurus lentiginosus*) is usually well hidden in bogs, marshes, and wet meadows. Usually solitary, it walks stealthily among cattails or bulrushes. If it senses that it has been seen, the American Bittern becomes motionless with its bill pointed upward, causing it to blend into the reeds. It is most active at dusk. More often heard than seen, this bittern has a call that resembles a congested pump (Gibbs, et al., 1992).

3.3.7.3. Reptiles

Swan Lake NWR is home to one of the last viable breeding populations of the eastern massasauga rattlesnake, 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 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 Endangered Species Act protection.

Candidate species receive no statutory protection under the Endangered Species Act. 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 Endangered Species Act.

3.3.7.4. Plants

No federally listed endangered or threatened plant species occur on the Refuge.

3.4. Public Use

The 1997 National Wildlife 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, and environmental education and interpretation.

Wildlife observation remains the primary visitor activity throughout the year. The Refuge also has strong local support and traditional ties to waterfowl hunting, and each year large portions of the Refuge are closed to all public use except hunting. This closure limits user conflicts but also reduces access for wildlife observation, photography, fishing, interpretation, and other activities during a popular time of year to visit the Refuge. To reduce user conflicts between hunters and other visitors, the Refuge may consider zoning areas or expanding pedestrian access for non-hunting activities in other ways.

Current visitation for the Refuge averages an estimated 17,000 visitors annually. The nearest Refuge with visitor services staff is Squaw Creek NWR, which is more than two hours at 127 miles away. The potential for expanding the volunteer program or creating a Friends group to support the Refuge visitor services program is also limited by the demographics of the area, lack of volunteer facilities, and distance to urban centers.



Swan Lake NWR. Photo credit: USFWS

3.5. Socioeconomics

The National Environmental Policy Act 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 more recent census data as indicated, Chariton County can be characterized by the following statistics (United States Census Bureau, 2009; Indiana Business Research Center, 2009):

- The estimated population in 2008 was 7,740. This was a decrease of minus 8.3 percent from the 2000 Census.
- In 2007, the per capita personal income in Chariton County was \$27,795. This was an increase of 7.6 percent from 1997. The 2007 figure was 72 percent of the national per capita income, which was \$38,615.
- In 2008, 95.1 percent of the population was white, not of Hispanic or Latino origin, with the balance being other races.
- 79.6 percent were high school graduates and 11.4 percent had graduate degrees.
- In 2008, there were 4,373 housing units in the county.
- Mean travel time to work was 23.4 minutes.
- 80.2 percent of the county residents worked in the county.

The Service produced “Banking on Nature: The Economic Benefits to Local Communities of National Wildlife Refuge Visitation” in 1997. The report, which was updated in 2002 and 2006, 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 2006, people visited refuges in the lower 48 states more than 34.8 million times for recreation and environmental education. Their spending generated \$1.7 billion of sales to regional economies. As this spending flowed through the economy, more than 27,000 people were employed, and \$542.8 million in employment income was generated.

3.6. Archeological and Cultural Values

Archeological and historical information on Chariton County and Swan Lake NWR is limited mainly from the lack of professional studies, excavations, and inventories (Bray, 1980; Boyd, 1982; Dobrovolny, 2008). Native American Oneota sites represent most of the known prehistoric sites in Chariton County and the surrounding area. Other Indian tribes in the area with records are the Missouri and Osage (Bray, 1980). It is believed that property related to the Civilian Conservation Corps (CCC) and other early materials exist on the Refuge. These items would need to be inventoried so that they can be managed appropriately (Dobrovolny, 2008).

Many prehistoric sites have been located on the Refuge. They include Lithic scatter, burned clay fragments, and habitation sites. None of these have been evaluated for their qualification for nomination to historical registers (Dobrovolny, 2008). Based on the evidence found in the drainages that Chariton County is a part of, the potential exists for additional prehistoric and historical sites in Chariton County that are worthy of study and could represent most of the prehistoric and historic periods (Bray, 1980; Boyd, 1982). Further investigation may result in the discovery of more sites, and the Refuge's marshy conditions would aid in the preservation of archeological remains (Dobrovolny, 2008; Boyd, 1982; Bray, 1980).

The earliest generally accepted human culture in North America is termed PaleoIndian, which began approximately 12000 B.C. Kill sites are typically the evidence from this period (Boyd, 1982). While the characteristic fluted points of weapons and tools have been discovered in the nearby counties of Saline, Howard, and Randolph, none have been found in Chariton County (Bray, 1980; Boyd, 1982). The lack of field investigations, rather than lack of existence, is the probable reason (Boyd, 1982).

The next period is the Archaic period, which ranges approximately from 7000 B.C. to 1000 B.C. (Boyd, 1982). Some Archaic period habitation sites have been located on the Refuge (Dobrovolny, 2008). Known sites from this period exist near Chariton

County (Boyd, 1982). Two well-known sites in nearby counties include Graham Cave and Arnold Research Cave (Boyd, 1982; NPS, No date).

The Woodland period is from 1000 B.C. to 900 A.D. This period includes the transition to agricultural societies (Boyd, 1982). Currently, the evidence is mostly pottery fragments from this period. Further investigations may reveal additional sites (Bray, 1980; Boyd, 1982).

The Mississippian period is from 900 to 1600 A.D. During this period, there were semi-sedentary villages as well as smaller special activity sites that were dispersed upriver. Hunting camps would be expected near or in the Refuge. There is one Utz site in Saline County from this period. The lack of other sites is not understood (Boyd, 1982).

The Historical Aboriginal period is from 1600 to 1830 A.D. This period begins the European influence and the displacement of eastern tribes. Some Oneota sites have been located in the area around Chariton County. Burial sites have been found in Adair County (Boyd, 1982).

French influenced the area with miners and visitors. In particular, as the earliest and furthest west French outpost on the Missouri, Fort Orleans influenced the lives of the Native Americans. It symbolized the French presence in the area, which affected the Kansas, Osages, and Missouri tribes. By the time of statehood in 1820, many white settlements existed in the Chariton area including several trading posts, forts, and houses (Bray, 1980). These people included French, Germans, and other Anglo-Americans. They were craftsmen and farmers, and they brought livestock (Bray, 1980; Boyd, 1982). Records, if they existed, of more settlements were possibly lost. Chariton did not have as much slavery as the neighboring counties. During the Civil War, the state was one of the most severely divided between some people favoring the South and others favoring the Union (Bray, 1980).

Executive Order 7563 on February 27, 1937, established Swan Lake NWR, which began with the purchase of 10,670 acres. Following the purchase of land, the CCC began work on the Refuge creating wetlands, constructing roads and buildings, and initiating the Refuge farming program (USFWS, No date). A couple of sites exist on the Refuge related to the CCC including the service building and a storage building (Dobrovolny, 2008).

No National Register of Historic Places properties are located on the Refuge (Dobrovolny, 2008; NPS, 2007). However, Chariton County has six sites, Carroll County has five, Livingston County has three, and Linn County has five (NPS, 2007). Additionally, Chariton County has no sites on the

National Historic Landmarks Program (NPS, No date). No state historic sites or parks exist in Chariton County, but Perishing State Park is to the north within 10 miles of the Refuge (MODNR, 2006). The Refuge may contain properties and items worthy of nomination once evaluated.

Certain public groups may become interested in the Refuge's cultural resources once identified. The Otoe-Missouria Tribe, Choctaw Nation of Oklahoma, Delaware Tribe of Indians, Osage Nation of Oklahoma, Iowa Tribe of Kansas and Nebraska, Iowa Tribe of Oklahoma, and Winnebago Tribe of Nebraska are Native American tribes that could have an interest in sites on the Refuge for traditional cultural resources reasons, sacred sites, and cultural hunting and gathering areas. Communication has not yet been established with these tribes regarding these potential matters. The archeological studies, to date, were performed before reporting to tribes was required. Nothing since has triggered the need to report to these tribes. The current sites found have not been of interest, but further investigations may discover sites of interest (Dobrovolny, 2008). 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.

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 management alternatives described in this Environmental Assessment (EA) will disproportionately place any adverse environmental, economic, social, or health impacts on minority and low-income populations. Implementation of any action alternative that includes public use and environmental education is anticipated to provide benefits equally to all residents residing in the surrounding communities.

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. All the alternatives presented in this EA envision low levels of development, thereby producing little negative effect on the Refuge’s cultural and historic resources. Potentially negative effects could include construction of new trails or facilities and further development of water impoundments. In most cases, these management actions would require review by the Service’s Regional Archaeologist in consultation with the State of Missouri Historic Preservation Office, as mandated by Section 106 of the National Historic Preservation Act. Therefore, the determination of whether a particular action within an alternative has



Mourning Dove. Photo credit: FWS

the potential to affect cultural resources is an ongoing process that would occur during the planning stages of every project.

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. 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 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."

Perhaps no subject relevant to managers of public lands and waters is as complex and multi-faceted as climate change. According to the "Fourth Assessment Report" of the Intergovernmental Panel on Climate Change (IPCC), climate change manifests itself primarily as increased temperature, changes in precipitation patterns, and sea-level rise. A changing climate is expected to affect precipitation patterns, vegetation types and distribution, wildlife habitat and behavior, fire frequency, sea levels, and disease trajectories as well as a broad range of human activities.

Climate change impacts will vary due to the different nature of the ecosystems on Refuge managed lands. Anthropogenic stressors, such as chemical pollution, over-fishing, land-use changes, habitat fragmentation, population growth, and elevated ultraviolet radiation, are likely to interact synergistically and sometimes unpredictably with climate change, and together are likely to affect various Refuge lands in different ways.

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 dioxide. 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 by reference 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 had prescribed burning previously 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 nearby communities and/or Refuge neighbors 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 that 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 Missouri 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 manage-

ment problems. This will include identified problems that not forecasted wind changes might 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, because all artifacts are buried well beneath the surface and no above ground evidence exists. Therefore, 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 one 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 three days after the burn, the grasses and forbs will begin to grow. The enriched soil will promote rapid growth such that after two or three 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 two or three 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. Vehi-

cle 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

If there is any impact at all, the potential impacts of fire on listed species are likely to be positive. Of the federally listed threatened and endangered species on or near the Refuge, two are birds (interior Least Tern and Piping Plover). 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.

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. 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 Piping Plovers would be avoided.

Swan Lake NWR is within the historical range of the eastern massasauga rattlesnake, which is a candidate species for listing. While it is positive that the eastern massasauga 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.

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 nitrification 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 that 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 firefighting equipment will be immediately available at the scene with all nearby water sources previously located. The applicable Department of Natural Resources (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 beavers that are plugging water control structures and muskrats, beavers, 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 are negligible due to the small number of animals taken and the restricted areas trapped.

4.2. Summary of Effects by Resource and Alternative

Key analysis factors are defined as habitat requirements or limiting factors important to each of the resources analyzed below. The analysis that follows focuses on the effects of each alternative on these factors. In all of the alternative analysis, it is important to remember that precise quantification of impacts was not possible given the necessary flexibility for long-term planning and the unknowns inherent with long-term planning, such as variability in precipitation patterns, effects of climate change, increases in scientific knowledge/management practices, and offsite influences. Consequently, the conclusions are focused on projected significance. For example, a major unknown of the implementation of the action alternatives (Alternatives 2 and 3) is the ability of the Refuge to provide shoreline and wetland habitat with reduced on-site water control capability given offsite water level

Table 3: Acres and Potential Energy in Millions of Kilojoules for Three Refuge Habitats, Swan Lake NWR

| | Alternative 1 | Alternative 2 | Alternative 3 |
|---------------------------|---------------|---------------|------------------|
| Emergent Wetland Acres | 500-1,000 | 1,200 | 1,200-1,800 |
| --Potential Energy | 199-399 | 479 | 479-718 |
| Moist Soil Acres | 830 | 0 | 830 ¹ |
| --Potential Energy | 1,220 | 0 | 1,220 |
| Cropland | 1,365 | 0 | 0 |
| --Potential Energy (corn) | 280 | 0 | 0 |
| | | | |
| Total Potential Energy | 1,699-1,899 | 479 | 1,699-1,938 |

1. Final acreage to be determined after completion of hydrogeomorphic evaluation

management and natural variability of weather patterns, which was the reason to create these on-site water control structures.

4.2.1. Waterfowl

Factors considered in this analysis include:

- Seasonal availability of high energy foods
- Seasonally available open water
- Disturbance

Spring migrating waterfowl use Swan Lake NWR for feeding and courtship. Moist soil units provide seeds, rhizomes, and tubers – foods with high energy content – as well as invertebrates. Vertical structure of the bottomland forest, largely related to tree density and diameter, creates isolated areas favorable for waterfowl courtship behavior. Hard mast production of bottomland forests also provides food for waterfowl during fall migration. Migrating waterfowl require loafing habitat, areas largely free of disturbance with adequate hiding cover and water depth.

Many types of waterfowl use the Refuge, but Canada Geese at one time wintered there in high numbers. Beginning in the 1950s, use of Swan Lake NWR by wintering Canada Geese of the Eastern Prairie Population (EPP) steadily increased until it peaked in 1977 at 181,000 birds. The decades following the peak saw a steady decline in the number of geese wintering on the Refuge despite a steady increase in Canada Goose numbers (EPP geese and others) within the Mississippi Flyway (Missouri Department of Conservation, 1995). Studies of the Canada Goose population show a variety of factors interact to affect their distribution. These include

increased availability of habitats across the landscape, fall and winter weather conditions, and variations in hunting pressure along the migratory flyway (Sheaffer et al., 2004), which are all factors outside the influence of Refuge management. Canada Geese that do winter on the Refuge, with peak numbers of about 20,000 to 40,000 in recent years, require high energy foods, open water, and low levels of disturbance. This analysis considers the effects of each alternative on these factors, but it is important to note that they are not thought to be primary determinants in the number of Canada Geese that winter on the Refuge.

High energy foods (those high in calories) to meet the needs of migrating and wintering Canada Geese and other waterfowl primarily are provided on the Refuge: 1) within emergent wetlands, especially those managed using moist soil techniques, and 2) through planted crops. Moist soil foods consisting of a mixture of seeds, roots, tubers, and green browse from naturally occurring wetland plants are known to contain high energy and are preferred by wintering Canada Geese when available (Austin 1998). As moist soil foods are depleted or made unavailable because of ice, geese shift to agricultural and other foods both within and beyond the Refuge. As spring nears and wetlands are again available, geese shift back to moist soil foods in preparation for migration.

Table 3 compares wetland and cropland acreages, and available energy, across all alternatives. Energy estimates for each habitat are derived from values provided in the Upper Mississippi River and Great Lakes Region Joint Venture Waterfowl Conservation Strategy (2007).

In addition to high energy foods, waterfowl also need areas where they can loaf and rest undisturbed. Although goose hunting has long occurred at designated locations on the perimeter of the Refuge, the opposite is the case for the interior of the Refuge where all public uses are prohibited during the wintering period. In this way the Refuge provides for the daily energy requirements of waterfowl in an area largely free of human disturbance.

4.2.1.1. Alternative 1: Current Management Direction (No-Action Alternative)

Migratory waterfowl are expected to continue using the Refuge at present levels over the life of the CCP, barring changes in waterfowl numbers or migration patterns influenced by conditions beyond the Refuge. Under Alternative 1, the amount of high energy foods provided in emergent wetlands and cropland would remain at present levels. Silver Lake would be held at its present level providing more than 2,000 acres of open water throughout each year. Impounding water within the Silver Lake basin would provide a reliable water source for moist soil management across the Refuge but would do so by flooding an area that might otherwise provide additional high energy wetland habitat. Goose hunting would continue at designated sites along the perimeter of the Refuge, but the interior would serve as a sanctuary largely free of human disturbance. See Section 4.2.6. “Wildlife Disturbance” on page 83 for additional discussion of wildlife disturbance.

4.2.1.2. Alternative 2

Under this alternative the amount of high energy foods for waterfowl would decrease compared to existing amounts within two of the three habitats analyzed (Table 3). Without impounded water, the Silver Lake and Swan Lake basins would likely convert to wet meadow, emergent wetland, or bottomland forest. The availability of open water would become more variable because it would be closely linked to the amount of runoff within the watershed (see Section 4.2.7. “Hydrology and Water Quality” on page 84). Increased amounts of wildlife-dependent recreation would increase the amount of disturbance along the perimeter of the Refuge, but disturbance within the interior of the Refuge would likely decrease without much of the existing infrastructure especially roads and levees. Migratory waterfowl are expected to continue using the Refuge but the amount and frequency of use would be linked to water availability.

4.2.1.3. Alternative 3: Preferred Alternative

Under this alternative the amount of high energy foods for waterfowl would remain the same or increase compared to existing amounts within the

three habitats analyzed (Table 3 on page 78). The availability of open water would become more variable because it would be closely linked to the amount of runoff within the watershed (see Section 4.2.7. “Hydrology and Water Quality” on page 84), but Refuge wetlands including the Silver Lake basin would be seasonally flooded to accommodate migrating waterfowl and shorebirds. Increased opportunities for wildlife-dependent recreation, especially duck hunting, would likely increase the amount of disturbance in some locations, but the interior of the Refuge would remain closed seasonally to reduce disturbance to wintering and migrating waterfowl. See Section 4.2.6. “Wildlife Disturbance” on page 83 for additional discussion of wildlife disturbance. Migratory waterfowl are expected to continue using the Refuge at present levels over the life of the plan barring changes in waterfowl numbers or migration patterns influenced by conditions beyond the Refuge.

4.2.2. Shorebirds

Factors considered in this analysis include:

- Amount and seasonal availability of mud flats with hiding cover and abundant and diverse invertebrates
- Suitable water depths
- Disturbance

Presently, migrating shorebirds primarily utilize Swan Lake NWR for stopover feeding habitat. Most migration occurs from March through May and again from July through November. Invertebrates found in seasonally exposed mud flats within some moist soil units provide a high energy food source. Shorebirds require low levels of disturbance as well as specific amounts of hiding cover and water depths ranging from 0 to 8 inches, depending on the species.

The Upper Mississippi and Great Lakes Region Joint Venture Shorebird Habitat Conservation Strategy (Potter et al. 2007) identifies five shorebird foraging guilds. According to the Refuge bird list, the most commonly occurring migrant shorebirds are clustered in two foraging guilds: Wet Mudflat/moist soil plants and Shallow Water (<5cm). This analysis focuses on the amount of Wet Mudflat/moist soil plants habitat (hereafter mudflats) likely to occur under each of the alternatives and how well the amounts provide for the needs of the estimated numbers of migrating shorebirds. The amount of shallow water habitat is dependent on subtle variations in topography and is difficult to quantify, but in all but drought years it is reasonable to conclude that the amount of shallow water habitat would rise and fall along with the amount of mudflats within moist soil units. Using information provided in Pot-

Table 4: Acres and Shorebird Forage in Grams for Refuge Mudflat Habitat Within Moist Soil Management Units

| | Alternative 1 | | Alternative 2 | | Alternative 3 | |
|-----------------|---------------|---------|---------------|------|------------------|-----------------|
| | Spring | Fall | Spring | Fall | Spring | Fall |
| Mudflat (acres) | 80 | 80 | 0 | 0 | 200 ¹ | 80 ² |
| Forage (grams) | 648,000 | 648,000 | 0 | 0 | 1,620,000 | 648,000 |

1. Final acreage to be determined after completion of hydrogeomorphic evaluation.
2. Final acreage to be determined after completion of hydrogeomorphic evaluation.

ter et al. (2007) shows that the daily forage energy requirement for members of the Wet Mudflat guild ranges from 5.80 grams to 14.84 grams with an average of 8.79 grams per day, and that most migrants within this guild stay 5-10 days at a site.

In 2003, the Refuge was designated as a regional site of importance under the Western Hemisphere Shorebird Reserve Network. This means that at least 20,000 shorebirds use the Refuge annually, but only a portion of these feed in mudflat habitat. Table 4 shows the estimated amount of shorebird forage for mudflat habitat within moist soil units for each alternative. Alternatives 1 and 3 both provide sufficient forage to meet the needs of the estimated number of migrant shorebirds using the Refuge.

4.2.2.1. Alternative 1: Current Management Direction (No-Action Alternative)

Under Alternative 1, approximately 10 percent (about 80 acres) of the total area managed using moist soil practices would be seasonally exposed as mud flats to provide feeding habitat for migrating shorebirds. This is expected to provide sufficient forage to meet the needs of migrant shorebirds within the mudflat foraging guild that use the Refuge as stopover habitat.

The relatively shallow and flat Refuge wetlands would provide a range of water depths to meet the needs of other shorebird foraging guilds. Silver Lake would continue to function as a reservoir with relatively constant water depths and would provide little or no shorebird feeding habitat.

Under Alternative 1, public uses that occur on the Refuge would be segregated by location and time of year to minimize disturbance in these areas during peak migration activity. See Section 4.2.6. "Wildlife Disturbance" on page 83 for additional discussion of wildlife disturbance.

4.2.2.2. Alternative 2

Under this alternative none of the emergent wetland would be managed using moist soil practices and there would be no mudflat habitat associated with these areas. The amount of forage available to shorebirds would increase greatly at first as the sediments of the Silver Lake basin are exposed, but eventually these would convert to vegetative cover and there would be little mudflat habitat on the Refuge. Use of the Refuge by the shorebird foraging guild dependent on this habitat (currently one of the most common) would decrease along with the habitat. The availability of shallow water habitat would become more variable because it would be closely linked to the amount of runoff within the watershed (see Section 4.2.7. "Hydrology and Water Quality" on page 84). Increased amounts of wildlife-dependent recreation would increase the amount of disturbance along the perimeter of the Refuge but disturbance within the interior of the Refuge would likely decrease without much of the existing infrastructure especially roads and levees.

4.2.2.3. Alternative 3: Preferred Alternative

Under Alternative 3, approximately 25 percent (about 200 acres) of the total area currently managed using moist soil practices would be seasonally exposed as mud flats in the spring and 10 percent (80 acres) in the fall. These acreages may vary because the final amount and location of moist soil managements are not yet determined. This alternative would provide the most forage for shorebirds associated with mudflats. Increasing the amount of mudflat habitat in the spring would benefit migrating shorebirds because some species use the Refuge in larger numbers during the spring, and it would provide migrants additional resources leading into the breeding season. Seasonal variations of water levels within the Silver Lake basin may also increase the amount of mudflat habitat.

The availability of shallow water habitat would become more variable because it would be closely linked to the amount of runoff within the watershed (see Section 4.2.7. “Hydrology and Water Quality” on page 84), but Refuge wetlands including the Silver Lake basin would be seasonally flooded to accommodate migrating shorebirds and waterfowl. Increased opportunities for wildlife-dependent recreation, especially duck hunting, would likely increase the amount of disturbance in some locations, but the interior of the Refuge would remain closed seasonally to reduce disturbance to wintering and migrating waterfowl. See Section 4.2.6. “Wildlife Disturbance” on page 83 for additional discussion. Migratory shorebirds are expected to continue using the Refuge at or above present levels over the life of the Plan barring changes in numbers or migration patterns influenced by conditions beyond the Refuge.

4.2.3. Marsh Birds and Wading Birds

Factors considered in this analysis:

- Dense marsh vegetation
- Stable water levels during breeding season (marsh birds)
- Variety of water depths (wading birds)
- Wetlands with abundant food resources (fish, reptiles, amphibians, seeds)
- Disturbance

Swan Lake NWR provides habitat for both migrating and nesting marsh birds and wading birds. Marsh birds, including bitterns, rails, grebes, and coots, are often secretive and difficult to survey. Many nesting marsh birds require dense vertical cover, often of a single plant species, along with stable water levels. The type of vegetation and water levels varies by marsh bird species. Wading birds, which include herons and egrets, primarily feed by wading in shallow waters. They require wetlands with abundant prey and various water depths to accommodate a range of species. Both marsh birds and wading birds are sensitive to disturbance by humans. See Section 4.2.6. “Wildlife Disturbance” on page 83 for additional discussion.

4.2.3.1. Alternative 1: Current Management Direction (No-Action Alternative)

Under Alternative 1, the amount of wetlands and dense marsh vegetation would remain at present levels. Exposure of mudflats in the spring and fall (see Section 4.2.2. “Shorebirds” on page 79) would provide a variety of water depths for wading birds. Use of the Refuge by marsh and wading birds would continue at present rates. Periodic catastrophic flooding worsened in part by changes within the

watershed (see Section 4.2.7. “Hydrology and Water Quality” on page 84) would continue to adversely affect nesting marsh birds. Marsh birds initially attracted to Refuge wetlands, with seemingly stable water levels, would continue to lose nests, eggs, or young to later flooding when it occurs. The interior of the Refuge, where most marsh and wading bird habitat is located, would continue to serve as sanctuary free from human disturbance much of the year. See Section 4.2.6. “Wildlife Disturbance” on page 83 for additional discussion.

4.2.3.2. Alternative 2

Under Alternative 2, the amount of dense marsh vegetation would decrease, especially within former moist soil units, but there would be a large increase in the amount of wet meadow habitat. The amount of forage available to wading birds and marsh birds would increase greatly as the sediments of the Silver Lake basin are exposed. The amount of foraging habit would vary along with water levels, but would be greater than present amounts. Periodic catastrophic flooding would continue to be a problem for nesting marsh birds as described in Alternative 1. The amount of disturbance would increase along the perimeter of the Refuge, but the interior of the Refuge, where most marsh and wading bird habitat is located, would continue to serve as a sanctuary free from human disturbance much of the year. See Section 4.2.6. “Wildlife Disturbance” on page 83 for additional discussion.

4.2.3.3. Alternative 3: Preferred Alternative

Under this alternative, the amount of dense marsh vegetation would increase, especially within the Swan Lake and Silver Lake basins. The amount of wet meadow habitat also would increase, but much less than under Alternative 2. These changes would increase the amount of foraging habitat for all wetland associated birds. Reestablishing the relationship between water surface elevation and stream flow throughout much of the year would provide a variety of water depths, conditions favorable to wading birds. The amount of nesting habitat for marsh birds would increase, but periodic catastrophic flooding would continue to be a problem as described in Alternative 1. Locating some moist soil units at higher elevations within the Refuge may allow some nesting marsh birds to avoid flooding. The amount of disturbance would increase along the perimeter of the Refuge, but the interior of the Refuge, where most marsh and wading bird habitat is located, would continue to serve as a sanctuary free from human disturbance much of the year. See Section 4.2.6. “Wildlife Disturbance” on page 83 for additional discussion.

4.2.4. Eastern Massasauga Rattlesnake

Factors considered in this analysis:

- Contiguous mosaic of early successional uplands and lowlands at least 250 acres largely free of woody vegetation, and in close proximity to known hibernation sites
- Wetlands especially wet meadow and wet prairie

Swan Lake NWR harbors a population of the eastern massasauga rattlesnake, a candidate species for listing under the Endangered Species Act. The existing amount of habitat is thought to be the minimum necessary to meet the needs of the population (Durbian et al. 2008).

4.2.4.1. Alternative 1: Current Management Direction (No-Action Alternative)

Under this alternative, the amount of contiguous habitat for the eastern massasauga rattlesnake would remain at present levels. If the habitats are regularly disturbed to retard succession it would maintain the minimum amount of habitat required to sustain a viable population. Recurrent flooding would continue to be a threat and restricting the population to one minimally sized patch of habitat potentially threatens the long-term viability of the population.

4.2.4.2. Alternative 2

Under Alternative 2, the amount of prairie would increase by nearly 1,000 acres and the amount of wet meadow habitat by about 4,000 acres. This would increase the size of the existing contiguous habitat and create additional separate patches of contiguous habitat. The elimination of Sliver Lake would increase the opportunities for the population to expand westward within the Refuge. If the habitats are regularly disturbed to retard succession it would improve habitat conditions for the snake as well as the probability of maintaining a viable population. Recurrent flooding would continue to have an adverse effect, especially when it coincides with the hibernation period, a time when the snakes are unable to move away from flood waters.

4.2.4.3. Alternative 3: Preferred Alternative

Under Alternative 3, the amount of prairie would increase by more than 800 acres and the amount of wet meadow habitat by more than 500 acres. This would increase the size of the existing contiguous habitat and create additional patches. If the habitats are regularly disturbed to retard succession it would improve habitat conditions for the snake as well as the probability of maintaining a viable population. Reestablishing the relationship between stream flow and water surface elevation may provide oppor-

tunities for westward dispersal during periods when the Sliver Lake basin contains little or no water, but existing infrastructure would continue to serve as barriers to dispersal.

4.2.5. Wildlife Dependent Recreation

4.2.5.1. Alternative 1: Current Management Direction (No-Action Alternative)

Despite the desire to increase Refuge access by the public, there would only be an unstaffed point of contact 7 days a week year-round under this alternative to provide information on such access due to staffing considerations. Because this alternative would allow for the continued impoundment of Refuge streams and use Silver Lake as a reservoir to provide water for wetland management across the Refuge, there would continue to be opportunities for fishing at existing facilities for shore and boat fishing. With regard to hunting, there would be an effort to provide a quality hunting experience for participants of managed deer hunts (including disabled hunters) and the annual goose hunt.

Other wildlife-dependent recreational and educational opportunities would be addressed under this alternative. There would be an effort to provide quality wildlife observation and photography opportunities by continuing to allow visitors access to the entire Refuge from mid March through mid October. This alternative also calls for the development of an environmental education site that includes an outdoor classroom. As another example of providing recreational opportunities, this alternative would provide compatible opportunities for gathering mushrooms, berries, and antlers for personal use.

With regard to public outreach and educational opportunities, this alternative would continue to provide volunteer opportunities that total approximately 625 hours annually and call for Refuge personnel to continue to speak to local civic and sportsmen's groups and special events upon request approximately two to three times per year.

4.2.5.2. Alternative 2

Under this alternative, the response to the growing demand for greater access to the Refuge by the public would be to provide a staffed point of contact and interpretation facilities most business days during normal working hours year-round to accommodate up to 17,000 visitors annually. Because under this alternative there would be an effort to return hydrology on the Refuge to historic patterns prior to the installation of the present water control structures on the Refuge, open water fishing opportunities may be reduced. However, over the life of the plan, the Refuge would continue to provide access

for fishing in accordance with state and Refuge regulations. With regard to hunting, there would be an effort to develop a hunting plan that introduces duck hunting and small game hunting and emphasizes opportunities for youth and disabled hunters.

Other wildlife-dependent recreational and educational opportunities would be addressed under this alternative. While still making an effort to protect sensitive wildlife from disturbance, this alternative would provide quality wildlife observation and photography opportunities by continuing to allow visitors access to the entire Refuge from mid March through mid October, and by allowing visitors limited access to selected portions of the Refuge from mid October through the end of February. As another example of providing recreational opportunities, this alternative would provide compatible opportunities for gathering mushrooms, berries, and antlers for personal use. Under this alternative, Refuge personnel would continue to develop the Friends group and maintain the existing level of volunteer opportunities (625 hours annually). With regard to outreach, over the life of the plan there would be an effort to continue to speak to local civic and outdoors enthusiasts groups and special events upon request approximately four to six times per year. There would also be an effort to continue to provide information and interviews for local news media and outdoors writers as well as distribute news releases four to five times annually.

Implementing Alternative 2 would enhance wildlife-dependent recreation on the Refuge by increasing wildlife recreation over current opportunities and would be more beneficial than Alternative 1 by increasing public outreach, interpretation, and access to the Refuge. Therefore, Alternative 2 would be beneficial to wildlife-dependent recreation.

4.2.5.3. Alternative 3: Preferred Alternative

Under this alternative, the response to the growing demand for greater access to the Refuge by the public would be to provide a staffed point of contact and interpretation facilities during normal working hours year-round on business days and seasonally on holidays and weekends to accommodate up to 50,000 visitors annually. Alternative 3 would be the same as Alternative 2 with regard to hunting. Because under this alternative there would be an effort to replicate some of the historic water hydrology patterns prior to the installation of the present water control structures on the Refuge, open water fishing opportunities may be reduced. However, over the life of the plan, the Refuge would continue to provide access for fishing in accordance with state and Refuge regulations.

Other wildlife-dependent recreational and educational opportunities would be addressed under this alternative. While still making an effort to protect sensitive wildlife from disturbance, this alternative would provide quality wildlife observation and photography opportunities by continuing to allow visitors access to the entire Refuge from mid March through mid October, and by allowing visitors limited access to selected portions of the Refuge from mid October through the end of February. As another example of providing recreational opportunities, this alternative would provide compatible opportunities for gathering mushrooms, berries, and antlers for personal use. Under this alternative, Refuge personnel would continue to develop the Friends group and increase the amount of volunteer opportunities (1,000 hours annually). With regard to outreach, over the life of the plan, there would be an effort to continue to speak to local civic and outdoors enthusiasts groups and special events upon request approximately four to six times per year. There would also be an effort to continue to provide information and interviews for local news media and outdoors writers as well as distribute news releases four to five times annually. These outreach efforts should result in an increase in local community support and appreciation for fish and wildlife conservation and the public's endorsement of the Refuge's role in conservation.

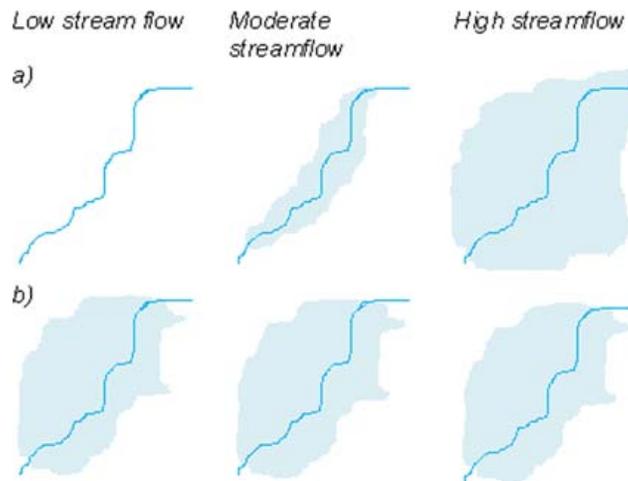
Implementing this alternative would be beneficial to the Refuge's wildlife dependent recreation through increasing access to the Refuge and hunting opportunities over current. Alternative 3 would be more beneficial than the other alternatives by increasing volunteer opportunities and interpretation.

4.2.6. Wildlife Disturbance

Swan Lake NWR offers opportunities for six priority wildlife-dependent public uses: hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation. In addition, the Refuge also offers opportunities for the following uses: hiking, jogging, boating, canoeing, kayaking, wild edibles gathering for personal use, and picnicking. The potential to disturb wildlife is an element common to all uses occurring on the Refuge. This analysis discusses the amount of potential wildlife disturbance from these uses for all alternatives.

4.2.6.1. Alternative 1: Current Management Direction (No-Action Alternative)

Under this alternative, current management practices that support wildlife disturbance will continue to be supported. These include sanctuary areas for waterfowl during hunting season and Ref-

Figure 2: Concept Diagram Depicting Stream/Floodplain Relationship

use “No-Access” areas during nesting season. Continuing current practices represents no change, which would be less than significant as these measures are designed to protect the species from disturbance during sensitive/critical times.

4.2.6.2. Alternative 2

As discussed within this EA, there are certain species that are especially sensitive to disturbance including shorebirds, wading birds, and marsh birds. Restoration of historic water hydrology patterns and conversion of all current cropland to other native habitats called for under this alternative should provide additional habitat for these sensitive species. Implementation of that Refuge change combined with efforts to reduce wildlife disturbance of these species will benefit these wildlife species. Therefore, these additional protective measures and increased habitat would represent a beneficial impact.

4.2.6.3. Alternative 3: Preferred Alternative

Under Alternative 3 water management on the Refuge would change. This change would allow for the creation of more diverse habitat that would attract a greater variety of species to utilize the Refuge. This alternative also calls for the greatest use of the Refuge by visitors. This alternative would establish periods of access by the public along with “No-Access” areas that should provide needed sanctuary for many sensitive species.

4.2.7. Hydrology and Water Quality

- Factors considered in this analysis
- Water surface elevation relative to stream flow

■ Sedimentation

Hydrology within the Grand River Watershed has been dramatically altered over the past 150 years through land use changes, levee and dam construction, and stream channelization. This includes the construction of levees and water control structures within the Refuge to impound water. One consequence to Refuge waters is a change in the relationship between water surface elevation (water depth and distribution) and stream flow (volume of water moving past a given point). Historically (prior to watershed alterations), water elevation and distribution would rise and fall along with stream flow. Today, there is little relationship between these two hydrologic variables; Figure 2 depicts the relationship between a stream and its floodplain under (a) historic hydrologic conditions and (b) with existing impoundments and levees.

The absence of this relationship has contributed to a number of effects within the Silver Lake basin including a decrease in the amount of aquatic vegetation and an increase in sedimentation, turbidity, and carp, a fish species that thrives in slow moving or standing water and that has behavior that increases turbidity and decreases aquatic vegetation. Sedimentation is also a factor affecting water quality and quantity within the Refuge, especially the Silver Lake basin. Comparing the original capacity of the Silver Lake basin to estimates derived from bathymetric data collected in 2007 shows that the volume of the basin is decreasing. Such sedimentation is typical of impoundments like Silver Lake and although the present rate of sedimentation is not known, the trend is expected to continue.

4.2.7.1. Effects Alternative 1

Under this alternative the relationship between water surface elevation and stream flow would remain unchanged. Silver Lake would continue to serve as a reservoir to provide source water for management of other wetlands within the Refuge. Sedimentation would likely continue within the Silver Lake basin, but a Refuge emphasis on enhancing land and water conservation practices within the watershed would help decrease erosion and sedimentation. Despite such efforts, the water holding capacity of the basin would likely continue to decrease which could hamper wetland management across the Refuge.

4.2.7.2. Effects Alternative 2

Under this alternative water no longer would be impounded on the Refuge in an attempt to restore the relationship between water surface elevation and stream flow. This means that water elevation and distribution would rise and fall along with stream flow and that Refuge streams and wetlands would undergo seasonal and annual periods with little or no water.

Stream restoration would occur gradually. Initially, sheet flow would increase as water flowing into the Refuge spread across the flat, exposed sediments within the Silver Lake basin. As the sediments compact, flows would first scour a braided channel and eventually form a meandering main channel. This would create a stretch of riverine habitat, something that presently does not exist within the Refuge or throughout much of the Grand River Watershed.

Water and land use changes across the Grand River Watershed described above preclude full restoration of hydrologic function within the Refuge. Today runoff reaches the Refuge more quickly and in greater amounts than in the time prior to the watershed changes. It is likely that the magnitude and frequency of high flow events would increase and overbank flooding along with it once Silver Lake is no longer serving as a buffer. The lower portion of the Silver Lake basin would receive floodwaters from both the Grand River and Yellow Creek and is expected to be inundated more frequently than the upper basin. Habitat within the Silver Lake basin would begin to convert to wet meadow, emergent wetland, or bottomland forest.

Refuge streams, especially Elk Creek and Turkey Creek, would continue to carry sediment, but a Refuge emphasis on enhancing land and water conservation practices within the watershed would help decrease erosion and sedimentation. The elimination of Silver Lake and restoration of riverine habi-

tat would increase the amount of aquatic vegetation and create conditions less favorable to carp, both of which would help reduce stream turbidity.

4.2.7.3. Effects Alternative 3

This alternative would mimic components of historic hydrologic function within Refuge streams by restoring the relationship between water surface elevation and stream flow throughout much of the year. This means water elevation and distribution would rise and fall along with stream flow creating seasonal and annual variations in water levels within the Silver Lake and Swan Lake basins. One departure would be that the basins would typically be flooded in fall to accommodate migratory birds. It is expected that partial or total flooding of both basins in fall would be possible in all but drought years.

Refuge streams, especially Elk Creek and Turkey Creek, would continue to carry sediment, but a Refuge emphasis on enhancing land and water conservation practices within the watershed would help decrease erosion and sedimentation. Within the Silver Lake basin the variations in water levels are expected to help flush sediment, increase the amount of aquatic vegetation, and create conditions less favorable for carp. It is expected that an increase in aquatic vegetation and lower carp numbers would also help lower turbidity.

4.3. Cumulative Impacts

A cumulative impact is defined as an impact on the natural or human environment, which results from the incremental impact of the [proposed] action when added to other past, present, and reasonably foreseeable future actions regardless of which agency (Federal or nonfederal) or person undertakes such other actions (40 Code of Federal Regulations 1508.7).

Cumulative impacts are the overall net effects on a resource that arise from multiple actions. Impacts can “accumulate” spatially when different actions affect different areas of the same resource. They can also accumulate over the course of time from actions in the past, in the present, and in the future. Occasionally, different actions counterbalance one another, which cause them to partially cancel out each other’s effect on a resource. Nevertheless, more typically, multiple effects add up with each additional action contributing an incremental impact on the resource. In addition, sometimes the overall effect is greater than merely the sum of the individual effects, such as when one more reduction in a population crosses a threshold of reproductive sustainability and threatens to extinguish the population.

A thorough analysis of impacts always considers their cumulative aspects. Because actions do not take place in a vacuum, there are virtually always some other actions that have affected that resource in some way in the past, are affecting it in the present, or will affect it in the reasonably foreseeable future. Thus, any assessment of a specific action's effects must in fact be made with consideration of what else has happened to that resource, what else is happening, or what else will likely happen to it.

The Refuge is not aware of any past, present, or future planned actions that would result in a significant cumulative impact when added to the Refuge's proposed actions as outlined in the preferred alternative.

4.3.1. Biological Resources

4.3.1.1. 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 massasauga rattlesnake and Least Bittern have special classifications and occur on the Refuge. Another species of interest on the Refuge is the Bald Eagle.

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 (no longer are present). Of the remaining three populations, one is secure and two are vulnerable. Threats to the massasauga 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 massasauga rattlesnake.

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 NWR, Swan Lake NWR, Mingo NWR, and the refuges that were formerly part of the Mark Twain National Wildlife Refuge Complex (Port Louisa NWR, Great River NWR, Clarence Cannon NWR, Two Rivers NWR and Middle Mississippi NWR) 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 but dramatic recovery. There are now more than 6,000 nesting eagle pairs and more than 20,000 individual birds in the lower 48 states; the Bald Eagle has been delisted from the Endangered Species Act.

4.3.1.2. Wildlife and Habitat Resource Management

Prairies once occurred in every part of Missouri, including extensive prairies in the Ozarks. Of the remaining 90,000 acres of native prairie in Missouri, about 68,000 acres are in private ownership. Missouri Department of Conservation, the Missouri Department of Natural Resources, The Nature Conservancy, the Missouri Prairie Foundation, the University of Missouri, and the Ozark Regional Land Trust own an estimated 22,000 acres of native prairie. 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 floodplains, 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. In addition to these dams, levees such as the Garden of Eden levee add to the severity of flooding events within the Swan Lake watershed.

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.

4.3.1.3. Impacts of Alternatives to Biological Resources

All of the alternatives are intended to maintain or improve biological resources on the Refuge. The biological integrity of the Refuge and achievement of Refuge purposes would be enhanced best under the preferred alternative (Alternative 3). The combination of our proposed management actions with those of other organizations could result in substantial, beneficial cumulative effects by:

- Increasing protection and management for federally and state-listed threatened or endangered species.
- Protecting habitats that are regionally declining.
- Reducing invasive plants and animals.

However, these beneficial impacts are dependent on the success of the proposed actions.

We used regional bird conservation plans, Partners in Flight, shorebird, waterbird, and waterfowl plans as well as cooperation with the Missouri DNR in determining the highest resource priorities for the Refuge to protect and manage. This process allows the Refuge to focus its conservation and management actions on those resources of concern that are internationally, nationally, regionally, and locally important. We expect positive cumulative impacts on neotropical migratory birds, waterfowl, waterbirds, species of special concern, fish, and other resident wildlife and their habitats from Refuge actions.

Alternative 1 (No Action)

Alternative 1 does not call for major changes in Refuge goals, objectives, and strategies. Over time, wetland habitat could be expected to decline under Alternative 1, and a corresponding decline in wildlife health and populations could be expected. This would be due primarily to the loss of capacity in Silver Lake due to sedimentation. Because Silver Lake is used as a reservoir to supply water used to manipulate wetland habitat throughout the Refuge, any loss of water capacity will eventually reduce Refuge ability to manage these wetland areas effectively. Efforts would be made to conserve habitat as it is today but would not fully address long-term issues such as sedimentation in the wetland management units. This alternative does not contribute to reversing the dramatic loss of habitat, including prairies and wetlands, which the state of Missouri has experienced. However, as the Refuge is not the only site of these habitats and Refuge would still implement measures to provide for these habitats under this

alternative, the cumulative impact of implementing Alternative 1 to other past, present, and reasonably foreseeable future actions should be less than significant.

Alternative 2

Restoring historic hydrologic patterns and increasing the amount of native prairie habitat would be the focus of Alternative 2. Species depending on these habitats, such as the eastern massasauga rattlesnake, would benefit greatly while species that depend on other habitat types would see no benefit over current management or even a negative impact due to decrease in habitat availability driven by less water control level management by the Refuge. The magnitude of impacts to these wetland-dependent species depends on the Refuge's ability to provide these water-dependent habitats without on-site water control structures and in the presence of anthropogenic offsite-caused fluctuations in water levels and natural variations. However, as long as the habitats are provided at quantities and qualities necessary for the species, cumulative impacts would be less than significant.

Alternative 3

Of the three alternatives, the preferred alternative (Alternative 3) would generate the greatest benefits for wildlife, habitat, and people by optimizing resource management while increasing 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. However, with less water level control under this alternative, Alternative 3 has the same risks discussed in Alternative 2. Therefore, while Alternative 3 has a greater opportunity for beneficial impacts, implementing this alternative would still have less than significant cumulative impacts as long as the habitats are provided at quantities and qualities necessary for the species.

4.3.2. Sedimentation and Water Quality

Factors influencing sedimentation and water quality near and in the Refuge include:

- Swan Lake 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. Non-point source pollu-

tion 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 North-central region of Missouri have suffered extensive channelization, unrestricted livestock access, and sedimentation.
- Levee systems downstream of the Refuge prolong the negative impacts of flooding events.

All three alternatives would benefit the watershed and alleviate sedimentation by encouraging conservation practices and fostering improved soil and water uses. The incremental impact of any of the alternatives to past, present, and reasonable foreseeable future activities would likely be less than significant to sedimentation and water quality given the contribution of the Refuge to any water pollution and sedimentation.

4.3.3. Cultural and Human Resources

Factors related to the cumulative impacts on cultural and human resources include:

- Swan Lake NWR receives an estimated 17,000 visitors annually.
- The Service has identified six priority wildlife-dependent public uses: hunting, fishing, wildlife observation and photography, and environmental education and interpretation.
- Swan Lake NWR was recognized historically as a premiere hunting location for geese. Declines in populations of these birds have had an impact on the economy of the local area.
- Efforts to diversify habitat and expand hunting opportunities on the Refuge should attract greater utilization and improve the local economy.

We expect none of the alternatives to have cumulative impacts on cultural resources on the Refuge. Beneficial impacts would accrue at various levels, depending on the alternative, because of our proposed expansion of environmental education and interpretation programs as well as increased field surveys to identify and protect any sites discovered.

The lack of cumulative impacts is partially due to the fact that cultural resource impacts are generally localized, such as crushing of artifacts with heavy machines. Accordingly, under all of the alternatives, management practices on the Refuge would consider potential impacts to historical resources. Projects requiring excavation would be sampled using test pits in the affected area before work begins. Our regional archaeologist reviews annual prescribed burn plans before we implement them and, even then, we select methods to avoid impacts on any resources, which reduces the risk of negative impacts.

We expect none of the alternatives to have significant, adverse, and/or negative cumulative impacts on the economy of the local area. With Alternatives 2 and 3, we expect increased Refuge visitation and increased tourism to bring additional revenues to local communities, but we do not predict a significant increase in overall revenue in any area.

Table 5: Comparison of Impacts by Issue and Alternative

| Issue | Alternative 1 Current Management Direction (No Action) | Alternative 2 | Alternative 3 (Preferred Alternative) |
|--|---|--|---|
| <i>Issue No. 1: Wildlife Management:</i> There are diverse and sometimes conflicting expectations regarding the presence, variety, and abundance of Refuge wildlife. How should this apparent conflict be addressed? | The FWS focus is always “Wildlife First” in any management decision. If a refuge has the opportunity to address the needs of a species of interest, it will weigh that opportunity against potential impacts to populations of other species. This will be done before and in preference to any actions that impact public use. | Same as Alternative 1. | Same as Alternative 1. |
| <i>Issue No. 2: Wildlife Management:</i> Should hunting opportunities be expanded on the Refuge? | This alternative would provide a quality hunting experience for managed deer hunts (including hunters with disabilities) and the annual goose hunt. | This alternative would add to Alternative 1 by proposing duck hunting and small game hunting and emphasize opportunities for youth and hunters with disabilities. | Same as Alternative 2. |
| <i>Issue No. 3: Wildlife Management:</i> The decline in Canada Goose use of the Refuge in recent decades has decreased the quality of goose hunting, drawn fewer hunters and wildlife watchers, and changed the cultural identity of local communities – can this trend be reversed? | Studies indicate that the trend in a reduction of Canada Geese at the Refuge is more a reflection of changes in land use throughout the watershed than it is with changes in Refuge management. Under this alternative, the trend is likely to continue. | Efforts will be made under this alternative to expand hunting options on the Refuge as noted in Issue No. 2. | This alternative will expand on Alternative 2. |
| <i>Issue No. 4: Habitat Management:</i> Should the Refuge increase the amount of wet meadow habitat? | This alternative would maintain wet meadow habitat at present levels. | Under this alternative, about 4,000 acres of existing cropland, open water, emergent wetland and other habitats would be converted to wet meadow comprised of sedges, prairie cordgrass, and forbs. | Implementation of this alternative would convert approximately 530 acres of existing cropland, food plots, and areas of dense early successional forest to wet meadow. |
| <i>Issue No. 5: Habitat Management:</i> Should the Refuge consider, where possible, restoring the natural hydrology across the Refuge to allow for periodic flooding and increased sheet flow? | Current management practice relies on gravity flow through control structures to manage the time, duration, and flooding depth of most moist soil units on the Refuge. | Under this alternative, the restoration of a more natural hydrology regime on the Refuge would be considered because it would reduce Refuge management costs and could allow for a more natural ebb and flow of waters seasonally. | Over the long term, this alternative would mimic components of historic hydrologic function along reaches of Elk Creek, Turkey Creek, Tough Branch, and Yellow Creek that are within the Refuge. Over the life of the plan, allow for seasonal and annual variations in water levels within Swan Lake and Silver Lake basins to increase the amount and variety of native vegetation. |

Table 5: Comparison of Impacts by Issue and Alternative

| Issue | Alternative 1 Current Management Direction (No Action) | Alternative 2 | Alternative 3 (Preferred Alternative) |
|--|--|---|--|
| <i>Issue No. 6: Habitat Management: What role should cropland play on the Refuge?</i> | Co-op farming practices would continue to be reviewed annually to measure impacts to Refuge habitat and wildlife health, and the Refuge would maintain the existing amount of cropland (1,365 acres) annually leaving at least 30 percent and up to 100 percent of planted crops as food and cover for wildlife. | Over the life of the plan, this alternative would convert all existing cropland to native habitats, which could benefit wildlife by providing more natural habitat. | Same as Alternative 2. |
| <i>Issue No. 7: Habitat Management: What can be done to improve shorebird habitat?</i> | Current management practices call for a review of water management in the moist soil units to try to manipulate flooding levels to leave more shoreline during certain times of the year to benefit migrating shorebirds. | This alternative would restore Refuge streams to free flowing streams with seasonally fluctuating water levels. In the short term this could potentially increase seasonal availability of shoreline and mudflats that are the preferred habitat of shorebirds. | This alternative would ensure that at least 25 percent of moist soil acreage is available as mud flat habitat for migrating shorebirds in the spring and 10 percent in the fall. |
| <i>Issue No. 8: Habitat Management: What can be done to improve bottomland hardwood habitat on the Refuge?</i> | Over the long term, this alternative would maintain the existing bottomland hardwood stands and ensure that approximately 20 percent of the Refuge hardwood stands are converting to red oak species, willow oak, and their associates based on regeneration surveys. | This alternative would maintain approximately 3,800 acres of bottomland hardwood stands with a mosaic of age and structural classes distributed across a narrow elevation gradient with species listed in Table 1 on page 64. | Same as Alternative 1. |
| <i>Issue No. 9: Habitat Management: What can be done to address the management of parcels and easements assigned to the Refuge but well beyond the contiguous Refuge Boundary?</i> | Some of the easement and title parcels have potential for habitat restoration and wildlife-dependent recreation opportunities that would help fulfill Refuge purposes and support the mission of the NWRS. But few staff and long distances mean these properties currently receive little attention; this situation will not change under this alternative. | Within 5 years of Plan approval, this alternative calls for the development of a strategy for ensuring that the condition and management of outlying fee title properties and easements are in compliance with Service direction. | Same as Alternative 2. |
| <i>Issue No. 10: Habitat Management: What can be done to reduce the impact of flooding on the Refuge and adjoining lands?</i> | There will be no effort to modify this impact under this alternative. | This alternative would eliminate much of the infrastructure subject to flood damage. Wildlife, especially nesting marsh birds, would continue to be adversely affected by periodic catastrophic floods. | This Refuge would participate as a partner in the Lower Grand River Conservation Opportunity Area to work on watershed issues including the magnitude and frequency of flooding. |

Table 5: Comparison of Impacts by Issue and Alternative

| Issue | Alternative 1 Current Management Direction (No Action) | Alternative 2 | Alternative 3 (Preferred Alternative) |
|---|---|--|--|
| Issue No. 11: Habitat Management: What can be done to reverse the trend in sedimentation accumulation that is filling in Silver Lake? | Under this alternative, Refuge personnel will try to work with land owners within the watershed to modify land management practices that may be contributing to this problem. | Same as Alternative 1, but this alternative also calls for the restoration of Refuge streams to free flowing streams with seasonally fluctuating water levels. Silver Lake basin would no longer be used as a reservoir. | Same as Alternative 1, but this alternative also would allow for seasonal and annual variations in water levels within the Silver Lake basin reducing its role as a reservoir and diminishing concerns about sedimentation filling in the basin. |
| <i>Issue No. 12: Visitor Services:</i> What can be done to improve public access throughout the Refuge? | The Refuge is currently reviewing how to improve Refuge access. Two important factors control that debate: controlling access to easily disturbed critical habitat and obtaining manpower. | While addressing the issue of easily disturbed habitat, this alternative would provide a staffed point of contact most business days during normal working hours year-round to accommodate up to 17,000 visitors annually and certain portions of the Refuge would be opened from mid October 15 through the end of February. | In addition to Alternative 2, Alternative 3 calls for a staffed point of contact seasonally on holidays and weekends to accommodate up to 50,000 visitors annually. |
| <i>Issue No. 13: Visitor Services:</i> What can be done to improve wildlife observation? | The Refuge is currently reviewing improvements to Refuge wildlife observation opportunities through improvements in Refuge walking tours and allow visitors access to the entire Refuge from mid March through mid October. | This alternative would go beyond Alternative 1 by additionally allowing visitors limited access to selected portions of the Refuge from mid October through the end of February. | Same as Alternative 2. |
| <i>Issue No. 14: Visitor Services:</i> What can be done to improve hunting opportunity and variety on the Refuge? | Over the life of the CCP, this alternative would provide a quality hunting experience for participants of managed deer hunts (including disabled hunters) and the annual goose hunt but would not expand beyond that. | Within 2 years of CCP approval, this alternative would propose changes to Refuge regulations that include introducing duck hunting and small game hunting, emphasizing opportunities for youth and hunters with disabilities. It would also make efforts to reliably determine the number of hunting visits to the Refuge and assure that at least 85 percent of hunters judge that they are being provided a quality opportunity. | Same as Alternative 2. |

Table 5: Comparison of Impacts by Issue and Alternative

| Issue | Alternative 1 Current Management Direction (No Action) | Alternative 2 | Alternative 3 (Preferred Alternative) |
|---|---|---|--|
| <i>Issue No. 15: Visitor Services:</i> How will the Refuge address an increased demand for wildlife-dependent recreation opportunities and facilities beyond what is presently available? | Under this alternative, Refuge personnel will maintain the current level of Public Use activities. | This alternative will expand on Alternative 1 by developing and implementing Public Outreach programs designed to increase use of the Refuge. | This alternative will expand on Alternative 2 by improving and expanding Refuge facilities designed for Public Use and explore opening the Refuge to greater access by the public. |
| <i>Issue No. 16: Environmental Education:</i> What can be done to improve environmental education? | Within 5 years of CCP approval, this alternative would call for the development of an environmental education site that includes an outdoor classroom. Once the site is developed, efforts would be made to ensure that 80 percent of educators using the site annually would report that its use supported their curriculum and helped in promoting resource stewardship and conservation. | Same as Alternative 1. | Same as Alternative 1. |

Chapter 5: List of Agencies, Organizations, and Persons Contacted

Elected Federal Officials

- U.S. Senator Christopher Bond
- U.S. Senator Claire McCaskill
- U.S. Representative Ike Skelton
- U.S. Representative Sam Graves
- U.S. Representative Blaine Luetkemeyer

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
- U.S. Department of Agriculture/NRCS, Columbia, Missouri
- Environmental Protection Agency, Chicago, Illinois; Kansas City, Kansas
- Columbia Environmental Research Center, Columbia, Missouri
- Upper Midwest Science Center, LaCrosse, Wisconsin
- Squaw Creek 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 Jay Nixon

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
- The Advisory Council on Historic Preservation

City/County/Local Governments

- Chariton County

Organizations:

- Archaeological and historic preservation state-wide groups
- The Sierra Club, Washington, D.C.
- Ducks Unlimited
- Pheasants Forever
- Wild Turkey Federation
- The American Fisheries Society, Columbia, Missouri
- The Missouri Prairie Foundation, Columbia, Missouri
- The Wildlife Society, Missouri Chapter, Missouri Dept. of Conservation
- Missouri Wildlife Society, Hannibal, Missouri
- Missouri Conservation Foundation, Jefferson, Missouri
- The Conservation Federation of Missouri, Jefferson City, Missouri
- The Missouri Audubon Council, Jefferson City, Missouri
- Missouri State Chapter, Soil and Water Conservation Society
- The Audubon Society of Missouri, St. Louis, Missouri
- Wildlife Management Institute, Washington, D.C.
- National Wildlife Foundation
- Defenders of Wildlife, 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 planning mailing list.

Chapter 6: References and Literature Cited

Please see Appendix F of the CCP. Also, please see Appendix B for the acronyms and abbreviations used in the Environmental Assessment.

Appendix 1: Objectives Grouped by Alternative

Alternative 1 No Action

Objective 1-1: Streams and Water Bodies

Over the life of the Plan, continue to impound Refuge streams and use Silver Lake as a reservoir to provide water for wetland management across the Refuge.

Objective 1-2: Emergent Wetland

Over the life of the Plan, maintain at least 500 acres and up to 1,000 acres of emergent wetland habitat primarily within the Silver Lake and Swan Lake basins where bulrush and cattails comprise 25-50 percent of areal coverage and narrow-leaved cattail, bur reed, lotus, and arrowhead comprise less than 5 percent of areal coverage. Within one year of CCP approval, develop a water management regime that helps maintain the plant species mix described above. Additionally, manage approximately 800 acres of emergent wetland using moist soil management techniques to provide a diversity of native herbaceous plant foods such as wild millet (*Echinochloa* spp.); panic grass (*Panicum* spp.); sedges (*Cyperus* spp. and *Carex* spp.); and beggarticks (*Bidens* spp.). Ensure that at least 10 percent of the acreage is available as mud flat habitat for migrating shorebirds.

Objective 1-3 Shrub Swamp

Over the life of the Plan, maintain 300 to 500 acres of shrub swamp dominated by at least 50 percent areal coverage of buttonbush and willow.

Objective 1-4 Wet Meadow

Maintain wet meadow habitat at present levels.

Objective 1-5 Native Prairie

Maintain existing grasslands at present species mix

Objective 1-6 Cropland

Maintain existing amount (1,365 acres) of cropland annually leaving at least 30 percent and up to 100 percent of planted crops as food and cover for wildlife.

Objective 1-7 Bottomland Forest

Over the long term (100-200 years), maintain the existing amount (approximately 3,100 acres) of bottomland hardwood stands with a mosaic of

age and structural classes distributed across a narrow elevation gradient with lower elevations dominated by black willow, silver maple, and river birch, mid elevations dominated by pin oak, swamp white oak, red maple, green ash, sycamore, and cottonwood, and upper elevations dominated by other oaks, hickory, and pecan. Within 10 years of Plan approval ensure that approximately 20 percent of stands are converting to red oak species, willow oak and their associates based on regeneration surveys.

Objective 1-8 Watershed Conservation

Within 5 years of Plan approval, quantify water needs and available water sources necessary to meet Refuge management objectives. Also, over the life of the Plan, maintain or improve water quality within Refuge source waters to meet Refuge management objectives and comply with current standards of the Environmental Protection Agency and Missouri Department of Natural Resources.

Objective 1-9 Outlying Fee Title Properties and Easements

Maintain existing methods for managing and monitoring outlying fee title properties and easements.

Objective 2-1: Threatened and Endangered Species

Over the life of the Plan, continue monitoring bald eagle numbers via Missouri Department of Conservation surveys.

Objective 2-2 Migratory and Resident Birds

Over the life of the Plan, monitor waterfowl numbers bi-weekly during duck hunting season via Missouri Department of Conservation bi-weekly waterfowl counts.

Objective 2-3: Eastern Massasauga Rattlesnake

Within 10 years of Plan approval, provide habitat suitable to support a viable population of the Eastern Massasauga Rattlesnake and potentially avoid listing the snake under the Endangered Species Act.

Objective 3-1: Welcoming and Orienting Visitors

Throughout the life of the Plan, provide an unstaffed point of contact 7 days a week year round.

Objective 3-2: Hunting

Over the life of the Plan, provide a quality hunting experience for participants of managed deer hunts (including disabled hunters) and the annual goose hunt.

Objective 3-3: Fishing

Over the life of the Plan, continue to provide existing facilities for shore and boat fishing.

Objective 3-4: Wildlife Observation and Photography

Provide quality wildlife observation and photography opportunities by continuing to allow visitors access to the entire Refuge from mid March through mid October.

Objective 3-5: Interpretation

Throughout the life of the Plan, provide unstaffed interpretive facilities 7 days a week year round.

Objective 3-6: Environmental/Conservation Education

Within 5 years of Plan approval, develop an environmental education site that includes an outdoor classroom. Once the site is developed, eighty percent of educators using the site annually report it supports their curriculum and helps in promoting resource stewardship and conservation.

Objective 3-7: Other Compatible Recreation and Uses

Over the life of the Plan, provide compatible opportunities for gathering mushrooms, berries, and antlers for personal use.

Objective 3-8: Friends and Volunteers

Over the life of the Plan, continue to provide volunteer opportunities that total approximately 625 hours annually.

Objective 3-9 Outreach

Over the life of the Plan, continue to speak to local civic and sportsmen's groups and special events upon request approximately 2-3 times per year. Also continue to provide information and interviews for local news media and outdoors writers as well as distribute news releases 2-3 times annually.

Objective 3-10 Archeological, Cultural, and Historic Protec

Over the life of the Plan, avoid and protect or mitigate against disturbance of all known cultural, historic, or archeological sites.

Alternative 2

Objective 1-1: Streams and Water Bodies

Restore Refuge streams to free flowing streams with seasonally fluctuating water levels.

Objective 1-2: Emergent Wetland

Over the life of the Plan, maintain approximately 1,200 acres as emergent wetland habitat primarily within the Swan Lake basin where bulrush and cattails comprise 25-50 percent of areal coverage and narrow-leafed cattail, bur reed, lotus, and arrowhead comprise less than 5 percent of areal coverage.

Objective 1-3 Shrub Swamp

Over the life of the Plan, maintain up to 70 acres of shrub swamp dominated by at least 50 percent areal coverage of buttonbush and willow.

Objective 1-4 Wet Meadow

Over the life of the Plan, convert approximately 4,000 acres of existing cropland, open water, emergent wetland and other habitats to wet meadow comprised of sedges (e.g. *Cyperus* spp. and *Carex* spp.), prairie cordgrass (*Spartina pectinata*), and forbs (e.g. *Asclepias* spp., *Polygonum* spp., *Vernonia* spp., *Solidago* spp., *Bidens* spp., *Ambrosia* spp., *Rudbeckia* spp.).

Objective 1-5 Native Prairie

Within 10 years of Plan approval, convert approximately 950 acres of existing cropland to native prairie, and maintain a diverse floral community within converted and existing grasslands composed of at least 50 percent of native prairie plant species identified for this area.

Objective 1-6 Cropland

Over the life of the Plan, convert all existing cropland (1,365 acres) to native habitats.

Objective 1-7 Bottomland Forest

Over the long term (100-200 years), maintain approximately 3,800 acres of bottomland hardwood stands with a mosaic of age and structural classes distributed across a narrow elevation gradient with lower elevations dominated by black willow, silver maple, and river birch, mid elevations dominated by pin oak, swamp white oak, red maple, green ash, sycamore, and cottonwood, and upper elevations dominated by other oaks, hickory, and pecan.

Objective 1-8 Watershed Conservation

Within 5 years of Plan approval, quantify water needs and available water sources necessary to meet Refuge management objectives. Also, over

the life of the Plan, maintain or improve water quality within Refuge source waters to meet Refuge management objectives and comply with current standards of the Environmental Protection Agency and Missouri Department of Natural Resources.

Objective 1-9 Outlying Fee Title Properties and Easements

Within 5 years of Plan approval, develop a strategy for ensuring that the condition and management of outlying fee title properties and easements are in compliance with Service direction.

Objective 2-1: Threatened and Endangered Species

Within 5 years of Plan approval, implement a program to monitor all federally threatened and endangered species on the Refuge and assist with monitoring of state-listed threatened and endangered species.

Objective 2-2 Migratory and Resident Birds

Over the life of the Plan, conduct weekly counts of waterfowl and shorebirds during migration.

Objective 2-3: Eastern Massasauga Rattlesnake

Within 10 years of Plan approval, provide habitat suitable to support a viable population of the Eastern Massasauga Rattlesnake and potentially avoid listing the snake under the Endangered Species Act.

Objective 3-1: Welcoming and Orienting Visitors

Within 5 years of Plan approval, provide a staffed point of contact most business days during normal working hours year round to accommodate up to 17,000 visitors annually.

Objective 3-2: Hunting

Maintain existing hunting opportunities, and within 2 years of CCP approval, propose changes to Refuge regulations (as part of a formal opening package) that includes introducing duck hunting and small game hunting, and emphasize opportunities for youth and the disabled. Within 7 years of approval of the Plan, reliably determine the number of hunting visits to the Refuge and that at least 85 percent of hunters judge that they are being provided a quality opportunity.

Objective 3-3: Fishing

Over the life of the Plan, provide access for fishing in accordance with state and Refuge regulations.

Objective 3-4: Wildlife Observation and Photography

Provide quality wildlife observation and photography opportunities by continuing to allow visitors access to the entire Refuge from early March through late October, and by allowing visitors limited access to selected portions of the Refuge during closed periods.

Objective 3-5: Interpretation

Within 5 years of Plan approval, provide staffed interpretation facilities most business days during normal working hours year round

Objective 3-6: Environmental/Conservation Education

Within 5 years of Plan approval, develop an environmental education site that includes an outdoor classroom. Once the site is developed, eighty percent of educators using the site annually report it supports their curriculum and helps in promoting resource stewardship and conservation.

Objective 3-7: Other Compatible Recreation and Uses

Over the life of the Plan, provide compatible opportunities for gathering mushrooms, berries, and antlers for personal use.

Objective 3-8: Friends and Volunteers

Over the life of the Plan, continue to develop the Friends group and maintain existing level of volunteer opportunities (625 hours annually).

Objective 3-9 Outreach

Over the life of the Plan, continue to speak to local civic and sportsmen's groups and special events upon request approximately 4-6 times per year. Also continue to provide information and interviews for local news media and outdoors writers as well as distribute news releases 4-5 times annually.

Objective 3-10 Archeological, Cultural, and Historic Protection

Over the life of the Plan, avoid and protect or mitigate against disturbance of all known cultural, historic, or archeological sites.

Alternative 3 (Preferred Alternative)

Objective 1-1: Streams and Water Bodies

Over the long term (50 years), mimic components of historic hydrologic function along reaches of Elk Creek, Turkey Creek, Tough Branch, and Yellow Creek that are within the Refuge. Over the 15 year life of the Plan, allow for seasonal and annual variations in water levels within Swan Lake and Silver Lake basins to increase the amount and variety of native vegetation (see Objective 1-2 Emergent Wetland).

Objective 1-2: Emergent Wetland

Within Wetland Management Units

Over the life of the Plan, maintain at least 1,200 acres and up to 1,800 acres of emergent wetland habitat primarily within the Silver Lake, Swan Lake, and South Pool basins where bulrush and cattails comprise 25-50 percent of areal coverage and narrow-leafed cattail, bur reed, lotus, and arrowhead comprise less than 5 percent of areal coverage. Within one year of CCP approval, develop a water management regime that helps maintain the plant species mix described above.

Within Moist Soil Management Units

Over the life of the Plan, use moist soil techniques (as described on page 24) to manage emergent wetlands at locations and an amount to be determined after the completion of an ongoing hydrogeomorphic evaluation. Manage moist soil areas to provide a diversity of native herbaceous plant foods such as wild millet (*Echinochloa* spp.); panic grass (*Panicum* spp.); smartweed (*Polygonum* spp.); sedges (*Cyperus* spp. and *Carex* spp.); and beggarticks (*Bidens* spp.), and ensure that up to 25 percent of the acreage is available as mud flat or shallow water (6 inches or less) unvegetated habitat in the spring and up to 10 percent of the acreage is available as mud flat or shallow water habitat with less than 50 percent cover in the fall for migrating shorebirds.

Objective 1-3 Shrub Swamp

Over the life of the Plan, maintain 300 to 500 acres of shrub swamp dominated by at least 50 percent areal coverage of buttonbush and willow.

Objective 1-4 Wet Meadow

Within 5 years of Plan approval, convert approximately 530 acres of existing cropland; food plots; areas of dense early successional forest largely comprised of willow; buttonbush, and silver maple; and areas dominated by reed canary grass to wet meadow comprised of sedges (e.g. *Cyperus* spp. and *Carex* spp.), prairie cordgrass (*Spartina pectinata*), and forbs (e.g. *Asclepias* spp., *Polygonum* spp., *Vernonia* spp., *Solidago* spp., *Bidens* spp., *Ambrosia* spp., *Rudbeckia* spp.).

Objective 1-5 Native Prairie

Within 10 years of Plan approval, convert approximately 835 acres of existing cropland or food plots to native prairie, and maintain a diverse floral community within converted and

existing grasslands composed of at least 50 percent of native prairie plant species identified for this area.

Objective 1-6 Cropland

Within 10 years of Plan approval, convert all cropland to other native habitats (see Objectives 1-2, 1-4 and 1-5).

Objective 1-7 Bottomland Forest

Over the long term (100-200 years), maintain the existing amount (approximately 3,100 acres) of bottomland hardwood stands with a mosaic of age and structural classes distributed across a narrow elevation gradient with lower elevations dominated by black willow, silver maple, and river birch, mid elevations dominated by pin oak, swamp white oak, red maple, green ash, sycamore, and cottonwood, and upper elevations dominated by other oaks, hickory, and pecan. Within 10 years of Plan approval ensure that approximately 20 percent of stands are converting to red oak species, willow oak and their associates based on regeneration surveys.

Objective 1-8 Watershed Conservation

Within 5 years of Plan approval, quantify water needs and available water sources necessary to meet Refuge management objectives. Also, over the life of the Plan, maintain or improve water quality within Refuge source waters to meet Refuge management objectives and comply with current standards of the Environmental Protection Agency and Missouri Department of Natural Resources.

Objective 1-9 Outlying Fee Title Properties and Easements

Within 5 years of Plan approval, develop a strategy for ensuring that the condition and management of outlying fee title properties and easements are in compliance with Service direction.

Objective 2-1: Threatened and Endangered Species

Within 5 years of Plan approval, implement a monitoring program to track abundance, population trends, and/or habitat associations of selected species (of present interest is Indiana bat).

Objective 2-2 Migratory and Resident Birds

Within 5 years of Plan approval, implement a monitoring program to track abundance, population trends, and/or habitat associations of migratory bird species with emphasis on waterfowl and shorebirds. Link monitoring to management information needs and to species or habitats of concern or special interest.

Objective 2-3: Eastern Massasauga Rattlesnake

Within 10 years of Plan approval, provide habitat suitable to support a viable population of the Eastern Massasauga Rattlesnake and potentially avoid listing the snake under the Endangered Species Act.

Objective 3-1: Welcoming and Orienting Visitors

Within 10 years of Plan approval, provide a staffed point of contact during normal working hours year round on business days and seasonally on holidays and weekends to accommodate up to 50,000 visitors annually.

Objective 3-2: Hunting

Maintain existing hunting opportunities, and within 2 years of CCP approval, propose changes to Refuge regulations (as part of a formal opening package) that includes introducing duck hunting and small game hunting, and emphasize opportunities for youth and the disabled. Within 7 years of approval of the Plan, reliably determine the number of hunting visits to the Refuge and that at least 85 percent of hunters judge that they are being provided a quality opportunity.

Objective 3-3: Fishing

Over the life of the Plan, provide access for fishing in accordance with state and Refuge regulations.

Objective 3-4: Wildlife Observation and Photography

Provide quality wildlife observation and photography opportunities by continuing to allow visitors access to the entire Refuge from early March through late October, and by allowing visitors limited access to selected portions of the Refuge during closed periods.

Objective 3-5: Interpretation

Within 10 years of Plan approval, provide staffed interpretive facilities during normal working hours year round on business days and seasonally on holidays and weekends.

Objective 3-6: Environmental/Conservation Education

Within 5 years of Plan approval, develop an environmental education site that includes an outdoor classroom. Once the site is developed, eighty percent of educators using the site annually report it supports their curriculum and helps in promoting resource stewardship and conservation.

Objective 3-7: Other Compatible Recreation and Uses

Over the life of the Plan, provide compatible

opportunities for gathering mushrooms, berries, and antlers for personal use.

Objective 3-8: Friends and Volunteers

Over the life of the Plan, continue to develop the Friends group and provide volunteer opportunities that total at least 1,000 hours annually.

Objective 3-9 Outreach

Within 3 years of approval of the Plan increase local community support and appreciation for fish and wildlife conservation and endorse the Refuge's role in conservation.

Objective 3-10 Archeological, Cultural, and Historic Protection

Over the life of the Plan, avoid and protect or mitigate against disturbance of all known cultural, historic, or archeological sites.

