Crab Orchard

National Wildlife Refuge

Comprehensive Conservation Plan Approval

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Many people have contributed to this plan over the last seven years. Several key staff positions, including mine, have been filled by different people during the planning period. Tom Palmer and Neil Vincent of the Refuge staff are notable for having been active in the planning for the entire extent. Tom and Neil kept the details straight and the rest of us on track throughout. Mike Brown joined the staff in the midst of the process and contributed new insights, analysis, and enthusiasm that kept us moving forward. Beth Kerley and John Magera provided valuable input on the industrial and public use aspects of the plan. Although this is a refuge plan, we received notable support from our regional office planning staff. John Schomaker provided exceptional service coordinating among the multiple interests and requirements within the Service. Jane Hodgins edited and prepared the many documents that were a part of the process. Jane also kept everyone informed by keeping the planning website current and packed with information. Her touch is most visible to you, the reader, and we appreciate her efforts. Jane Lardy-Nelson handled well the many detailed and technical requirements of submissions to the Service, the Environmental Protection Agency, and the *Federal Register*. Jon Kauffeld's and Nita Fuller's leadership and oversight were invaluable. We benefited from close collaboration and cooperation with staff of the Illinois Department of Natural Resources. Their staff participated from the early days of scoping through reviews and re-writes. We appreciate their persistence, professional expertise, and commitment to our natural resources. Finally, we value the tremendous involvement of citizens throughout the planning process. We heard from visitors to the Refuge and from people who care about the Refuge without ever having visited. Their input demonstrated a level of caring and thought that constantly reminded us of our responsibility as land stewards. We sincerely thank the individuals and groups that were involved and contributed ideas to make this a better plan.

Dan Frisk
Refuge Manager
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Preface

This Comprehensive Conservation Plan (CCP) emerged from a 7-year planning process that included the preparation of Draft and Final Environmental Impact Statements (EIS). In theory we should have been able simply to extract portions of the Final Environmental Impact Statement and assemble them into this stand-alone plan. In reality we had to introduce minor edits to the content of the EIS to make a concise, accurate, and up-to-date CCP that reads well. None of the edits introduce new content. "Chapter 4: Management Direction" consists of rearranged selections from Chapter 2 and Appendix A of the EIS. The rearrangement was needed because of cross-references in the alternatives and features that were common to all alternatives in the EIS. We have also changed verb tenses from the conditional form "would" in the EIS to a definitive "will" in the plan. New U.S. Fish and Wildlife Service policies for the National Wildlife Refuge System were issued in June 2006, late in the planning process. These new policies set forth new goals for the System, which we have substituted for earlier goals in the background description in the first chapter. In order to make the CCP a more complete reference document, we have included the Record of Decision and the memo that transmitted the Service's Programmatic Biological Opinion as appendices. We have also included a map that displays the Refuge's approved boundary, which was established during the planning process and approved by the Regional Director who has authority to approve expansions that are less than 10 percent of the Refuge area.

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Chapter 1: Introduction and Background

The U.S. Fish and Wildlife Service is required to prepare and implement a Comprehensive Conservation Plan (CCP) for each unit in the National Wildlife Refuge System. This document is the Comprehensive Conservation Plan for Crab Orchard National Wildlife Refuge (Figure 1). The CCP will guide the administration and management of the Refuge for 15 years.

Located in southern Illinois, Crab Orchard National Wildlife Refuge (NWR) was established in 1947 for wildlife, agriculture, recreation and industry. The Refuge consists of 43,888 acres. Figure 2 shows the location of the Refuge.

National Wildlife Refuge System Mission, Goals and Principles

The U.S. Fish and Wildlife Service is the principal federal agency responsible for conserving, protecting and enhancing fish, wildlife and plants and their habitats for the continuing benefit of the American people. The Service manages the 95-million-acre National Wildlife Refuge System of more than 540 national wildlife refuges, thousands of small wetlands and other special management areas. It also operates 66 national fish hatcheries, 64 fishery resource offices and 78 ecological services field stations. The agency enforces Federal wildlife laws, administers the Endangered Species Act, manages migratory bird populations, restores nationally significant fisheries, conserves and restores wildlife habitat such as wetlands, and helps foreign governments with their conservation efforts. It also oversees the Federal Aid program

U.S. Fish & Wildlife Service

that distributes hundreds of millions of dollars in excise taxes on fishing and hunting equipment to state fish and wildlife agencies.

The U.S. Fish and Wildlife Service's mission is: “working with others, to conserve, protect and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people.”

Mission of the National Wildlife Refuge System

By law, the mission of the National Wildlife Refuge System 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.”

Figure 1: Crab Orchard NWR

Figure 2: Location of Crab Orchard NWR

Goals of the National Wildlife Refuge System

The development of comprehensive conservation plans and the administration, management, and growth of the System are guided by the following goals:

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.

Guiding Principles of the National Wildlife Refuge System

We are land stewards, guided by Aldo Leopold's teachings that land is a community of life and that love and respect for the land is an extension of ethics.
We seek to reflect that land ethic in our stewardship and to instill it in others.
Wild lands and the perpetuation of diverse and abundant wildlife are essential to the quality of the American life.
We are public servants. We owe our employers, the American people, hard work, integrity, fairness, and a voice in the protection of their trust resources.
Management, ranging from preservation to active manipulation of habitats and populations, is necessary to achieve Refuge System and U.S. Fish and Wildlife Service missions.
Wildlife-dependent uses involving hunting, fishing, wildlife observation, photography, interpretation, and education, when compatible, are legitimate and appropriate uses of the Refuge System.
Partnerships with those who want to help us meet our mission are welcome and indeed essential.
Employees are our most valuable resource. They are respected and deserve an empowering, mentoring, and caring work environment.
We respect the rights, beliefs, and opinions of our neighbors.

Brief History of Refuge Establishment, Acquisition, and Management

President Franklin D. Roosevelt authorized the Crab Orchard Creek Project in 1936 as a Works Progress Administration (WPA) project. The project was "proposed largely as a recreational and conservation program for water, soil and forestry conservation." Several benefits were envisioned for the project: "(1) it will materially aid in eliminating economic and social distress, (2) create the largest recreational area in the state of Illinois, (3) conserve a large water supply and eliminate flooding of privately-owned lands, (4) conserve existing forests, (5) control soil erosion." (Preliminary Plan for Land Acquisition, Crab Orchard Creek Project, 1936)

In late 1937, the U.S. Department of Agriculture Soil Conservation Service assumed administration of the Project. From 1937 to 1942, the federal government purchased 32,000 acres within the Project area from private landowners. Over 80 percent of the acquired land had been cleared and used for agricultural crops and grazing. Civilian Conservation Corps (CCC) workers planted more than 4.6 million trees in the area from 1938 to 1941. The Crab Orchard Lake dam was completed in 1941. Crab Orchard Lake was the largest lake in Illinois at that time. In 1942 the Department of War appropriated 10,223 acres of the Crab Orchard Creek Project land and purchased an additional 12,352 acres to build the Illinois Ordnance Plant. Between 5,000 and 8,000 people worked at the plant, known as Ordill, manufacturing bombs and anti-tank mines during World War II.

Crab Orchard National Wildlife Refuge was established on August 5, 1947, by Public Law 80-361. This Act of Congress transferred 22,575 acres from the Department of War (Illinois Ordnance Plant) and 21,425 acres from the Soil Conservation Service (Crab Orchard Creek Project) to the Secretary of the Interior.

The Crab Orchard Creek Project proposed dams for Little Grassy Creek and Grassy Creek to store water and prevent siltation of Crab Orchard Lake. The dam that created Little Grassy Lake was completed in 1950. The dam that created Devils Kitchen Lake was completed in 1959.

Congress designated a 4,050-acre portion of the Refuge as the Crab Orchard Wilderness in 1976.

Since the Refuge was established, the Service has acquired and divested several parcels of land. In 1959, the Refuge transferred 921 acres of land located in its southeast corner to the U.S. Department of Justice for construction of a maximum security prison. In 1969, the Refuge acquired several scattered tracts of land in exchange for 160 acres that is now the site of the John A. Logan College. In a 1974 exchange, the Refuge acquired 15 acres of State of Illinois land in the vicinity of Little Grassy Fish Hatchery. In a 1979 exchange, Southern Illinois University acquired the current site of Touch of Nature Environmental Center and the Refuge

Figure 3: Protected Lands in Southern Illinois

acquired land south of Little Grassy Lake. Through the years the Refuge has purchased a few scattered parcels. In 2000, the Refuge used Natural Resource Damage Assessment funds to purchase 216 acres on its western edge. Several small land exchanges are pending.

In addition to Crab Orchard NWR, a variety of other state and federal agencies manage land in the vicinity of the Refuge. Figure 3 illustrates these protected lands.

Recent Refuge Management Activities

Wildlife and Fish Habitat

Refuge biologists use various techniques to maintain and enhance wildlife habitat. They manipulate water levels in moist soil management units and seed tallgrass prairie species to reestablish native grasslands. Silvicultural treatments such as thinning, regeneration cutting, and improvement cutting are used in forest habitats to alter species composition and increase growing space. Trees are also planted to reduce forest fragmentation. Biologists use prescribed fire in pine and hardwood forests and grasslands. Biologists monitor wildlife populations and, in cooperation with the Illinois Department of Natural Resources staff, monitor fish populations in the lakes and ponds, stock game and prey fish, and enhance fishing opportunities by placing discarded Christmas trees to increase underwater structure. Trapping nuisance beavers in the closed area is authorized by special use permit. Biologists monitor and apply treatments for control of invasive plants and animals.

Agriculture

The Refuge agriculture program includes about 4,500 acres of row crops (rotation of corn, soybeans, clover) tended by cooperative farmers, about 800 acres of hay fields harvested under special use permits, and about 1,000 acres of pasture grazed under

special use permits. The principal goal of the agriculture program is to provide habitat for wintering Canada geese.

Recreation

The Refuge receives an estimated 1.1 million recreational visits annually. To accommodate the wide variety of recreational uses, the Refuge operates a visitor information center, environmental education sites, hiking trails, four campgrounds, five marinas, boat launch ramps, picnic areas, swimming beaches, auto tour route, and observation deck. The Refuge offers many opportunities for fishing, hunting, environmental education, interpretation, and wildlife observation and photography. In addition, the Refuge permits camps under cooperative agreements to Girl Scouts, Boy Scouts of America, United Methodist Church and Southeastern Illinois Presbytery. Law enforcement officers provide safety and security for visitors and Refuge resources.

Industry

The Refuge leases 1.2 million square feet of facilities that are used for manufacturing, cold storage, and explosives storage. In support of the industrial operations, the Refuge also maintains extensive transportation and utility infrastructure. The Refuge provides water and waste water services to an adjacent college campus and water service to the federal prison.

Wilderness

The Refuge staff disseminates wilderness use information to visitors, controls vehicle access and patrols and conducts informal monitoring to protect the resources of the 4,050-acre Crab Orchard Wilderness.

Contaminants

The Service's Ecological Services branch has Environmental Contaminants staff co-located at the Refuge who manage the investigation, monitoring, and remediation activities associated with sites contaminated with hazardous chemicals. The Refuge is on the U.S. Environmental Protection Agency's National Priority List of hazardous waste sites.

Archaeological and Cultural Resources

The Refuge Manager ensures historic properties are identified and protected as much as possible while achieving Refuge purposes and the Refuge System mission. The manager is guided by several historic preservation laws and regulations. Early in the planning of all projects, the Refuge Manager asks the Regional Historic Preservation Officer (RHPO) to initiate the Section 106 process, which is a set of procedures specified in the National Historic Preservation Act. Then the manager informs the public about the project and its cultural issues through presentations, meetings, and media notices. The manager asks for comments from the public and local officials. Any comments relevant to cultural issues are reported to the RHPO.

Archeological investigations and collecting on the Refuge are performed only in the public interest. Qualified archeologists perform the work under an Archaeological Resources Protection Act permit issued by the Regional Director. Refuge personnel take steps to prevent unauthorized collecting. If unauthorized collecting is detected, Refuge officers cite violators or take other appropriate action and report the violations to the RHPO.

Guided by a Scope of Collection Statement dated November 1992, the Refuge manages museum collections that contain archeological artifacts, art work, historical items and documents, and zoological specimens. To date, twelve archeological investigations have produced in excess of 55,400 artifacts from Refuge lands. The artifacts are stored at 7 repositories, although most are kept at the Center for Archaeological Investigations at Southern Illinois University, Carbondale, under a cooperative agreement.

Refuge Purposes

Public Law 80-361 mandated that the lands transferred from the Department of War and Soil Conservation Service be administered by the Secretary of the Interior through the Fish and Wildlife

Service "for the conservation of wildlife, and for the development of the agricultural, recreational, industrial, and related purposes specified in this Act."

An additional purpose was acquired when Congress designated the 4,050-acre Crab Orchard Wilderness in 1976. The establishing legislation for the Wilderness (Public Law 94-557) states that "wilderness areas designated by this Act shall be administered in accordance with the applicable provisions of the Wilderness Act...". The purposes of the Wilderness Act (Public Law 88-577) are additional purposes of that part of the Refuge that is within the Crab Orchard Wilderness. The purposes of the Wilderness Act are to secure an enduring resource of wilderness, to protect and preserve the wilderness character of areas within the National Wilderness Preservation System (NWPS), and to administer the NWPS for the use and enjoyment of the American people in a way that will leave these areas unimpaired for future use and enjoyment as wilderness.

Refuge Vision Statement

The planning team considered the past vision statement and emerging issues and drafted the following vision statement as the desired future state of the Refuge:

> The citizens of Southern Illinois recognize the staff of Crab Orchard National Wildlife Refuge as government employees who listen and care and who meet significant management challenges in a sensible way. Within the Fish and Wildlife Service, Crab Orchard National Wildlife Refuge is recognized not for its exceptions, but for its exceptional management. The Refuge is held as an example of an area once contaminated that is now clean and safe for humans and wildlife. The viewer of a satellite photograph can easily distinguish the Refuge with its large blocks of habitat and its clean water lakes from the surrounding fragmented and developed landscape. Wildlife thrives. Farmers take pride in their operations on the Refuge because they use model conservation practices, benefit wildlife, and make money. The Refuge and the community are proud to contribute to the Nation's defense through the industry that is hosted on the Refuge. In Southern Illinois where a spectrum of outdoor recreation opportunities ranges from the highly developed to the primitive, the Refuge is known for high quality wildlife-dependent opportunities.

Refuge Goals

Based on the purposes of the Refuge, the mission of the National Wildlife Refuge System and ecosystem considerations, the planning team established the following Refuge goals for the next 15 years.

Wildlife Conservation Goals

Canada Geese:

Provide enough food for wintering Canada geese to support 6.4 million goose-use-days annually, in support of the Mississippi Valley Population Canada Goose Management Plan.

Forest, Early Successional and Grassland Birds:

Maintain or enhance populations of forest, early successional and grassland birds, with emphasis on priority species, as identified in Partners in Flight Physiographic Area Bird Conservation Plans.

Ducks, Shorebirds, and Other Waterbirds:

Maintain or enhance populations of ducks, shorebirds, and other waterbirds, with emphasis on priority species, as identified in the North American Waterfowl Management Plan, U.S. Shorebird Conservation Plan, and North American Waterbird Conservation Plan.

Threatened and Endangered Species:

Maintain or enhance populations of federal and, where compatible, state threatened and endangered species that occur at or near Crab Orchard National Wildlife Refuge.

Water Quality:

Maintain or enhance quality of water in streams and lakes at Crab Orchard National Wildlife Refuge.

Resident Fish and Wildlife:

Maintain or enhance resident fish and wildlife populations consistent with management activities for federal trust resources in cooperation with the Illinois Department of Natural Resources (DNR). Maintain a mixed-species, warm-water sport fishery in cooperation with the Illinois DNR.

Recreation/Public Use Goals

Hunting, Fishing, Wildlife Observation and Photography, Interpretation and Environmental Education:

Hunters, anglers, viewers and photographers of wildlife, general visitors and students will enjoy

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high quality experiences through a variety of opportunities that promote an understanding and appreciation of natural and cultural resources and their management.

Customer Service:

Visitors of all abilities will feel welcome and enjoy a safe visit to an area that they recognize as a national wildlife refuge.

Volunteers and Support Groups:

Volunteers and Refuge support groups will be stewardship partners and strong advocates for the Refuge.

Other Land and Water-based Recreation:

Visitors will enjoy high quality, land- and water-based activities that fulfill the recreation purpose of the Refuge.

Agricultural Goal

Provide opportunities for agricultural uses on Refuge lands that help attain wildlife conservation goals.

Industrial Goal

Provide an industrial complex and attendant utility and transportation infrastructure, which conform to prescribed safety, health, environmental and maintenance standards.

Wilderness Goal

Protect the ecological integrity, preserve the wilderness character, restore natural conditions to the extent practicable and provide opportunities for solitude and primitive recreation within the Crab Orchard Wilderness.

Protection Goal

Protect the integrity of Refuge biological and cultural resources and the health and safety of visitors, industrial workers, farmers, and Service staff.

Outreach Goal

Visitors, cooperators, tenants, and local residents will understand Refuge goals, issues and activities. Service personnel will understand the expectations and concerns of the general public by being receptive to their feedback.

Ecosystem Goals

Upper Mississippi River/Tallgrass Prairie Ecosystem

The Service has adopted an ecosystem approach to conservation and designated 53 ecosystem units (Figure 4). The ecosystem units delineate portions of the landscape where the Service and its partners can set ecosystem-wide resource goals and work together to achieve these goals.

The Refuge is located in the Upper Mississippi River/Tallgrass Prairie Ecosystem (Number 23), an ecologically diverse area encompassing 186,133 square miles in Illinois, Iowa, Minnesota, Missouri and Wisconsin. An ecosystem team has identified the following goals in response to resource management challenges and opportunities:

Goal 1: Protect, restore, and enhance populations of native and trust species and their habitats.

Goal 2: Restore natural ecosystem processes, including hydrology and sediment transport to maintain species and habitat diversity.

Goal 3: Promote environmental awareness of the ecosystem and its needs with emphasis on sustainable land use management.

Goal 4: Identify water quality problems affecting native biodiversity and habitat of trust species.

Goal 5: Reduce conflicts between fish and wildlife needs and other uses.

Figure 4: U.S. Fish & Wildlife Service Ecosystem Units

Goals and Objectives for Other Landscape Level Plans

Migratory Bird Conservation Initiatives

Over the last decade, bird conservation planning has evolved from a largely local, site-based focus to a more regional, landscape-oriented perspective. Significant challenges include locating areas of high-quality habitat for the conservation of particular guilds and priority bird species, making sure no species are inadvertently left out of the regional planning process, avoiding unnecessary duplication of effort, and identifying unique landscape and habitat elements of particular tracts targeted for protection, management and restoration. Several migratory bird conservation initiatives have emerged to help guide the planning and implementation process. Collectively, they comprise a tremendous resource as Crab Orchard NWR engages in comprehensive conservation planning and its translation into effective on-the-ground management.

The North American Waterfowl Management Plan

Signed in 1986, the North American Waterfowl Management Plan (NAWMP) outlines a broad framework for waterfowl management strategies and conservation efforts in the United States, Canada, and Mexico. The goal of the NAWMP is to restore waterfowl populations to historic levels. The NAWMP is designed to reach its objectives through key joint venture areas, species joint ventures, and state implementation plans within these joint ventures.

The Refuge is in the Upper Mississippi River-Great Lakes Region Joint Venture. One of 12 habitat-based joint ventures, this Joint Venture encompasses the states of Michigan and Wisconsin in their entirety, plus portions of Minnesota, Iowa, Nebraska, Kansas, Missouri, Illinois, Indiana and Ohio. The goal of this Joint Venture is to increase populations of waterfowl and other wetland wildlife by protecting, restoring and enhancing wetland and associated upland habitats within the Joint Venture region.

The objectives of this Joint Venture are:

1. Conserve 9,118,884 acres of habitat capable of supporting an annual breeding duck population of 1,542,000, under average environmental conditions, by the year 2013.

   The breeding duck population objective for Illinois is 20,000, which is a 365 percent increase over the average breeding population of 4,300 birds.

2. Conserve 532,711 acres of habitat on migration focus areas capable of supporting 266 million duck use days during annual fall migration, under average environmental conditions, by the year 2013.

   The migration habitat objective (acres of managed wetland habitat) for the Southern Illinois Focus Area is 77,950 acres, which is a 34 percent increase over the 58,171 acres available in 1998.

3. When consistent with Objectives 1 and 2, contribute to the protection and/or increase of habitats for wetland and associated upland wildlife species in the Joint Venture, with emphasis on declining non-waterfowl migratory birds.

Partners In Flight

Formed in 1990, Partners in Flight (PIF) is concerned with most landbirds and other species requiring terrestrial habitats. Partners in Flight has developed Bird Conservation Plans for numerous Physiographic Areas across the U.S. (see http://www.partnersinflight.org). These plans include priority species lists, associated habitats, and management strategies. Reflecting the local physiography, the northern portion of Crab Orchard NWR lies within PIF Physiographic Area 31, the Prairie Peninsula Physiographic Area. The southern portion of the Refuge lies within PIF Physiographic Area 14, the Interior Low Plateaus Physiographic Area.

U. S. Shorebird Conservation Plan and the North American Waterbird Conservation Plan

The U. S. Shorebird Conservation Plan and the North American Waterbird Conservation Plan are plans that address the concerns for shorebird and waterbirds. These plans have corresponding regional plans that cover the Upper Mississippi Valley/Great Lakes Region, which includes the Refuge. These regional plans contain more specific information about the species priorities and habitat conservation needs of birds using the Refuge. These plans are available at http://www.shorebirdplan.fws.gov and http://www.nacwcp.org.

North American Bird Conservation Initiative

In a continental effort, the Partners in Flight, North American Waterfowl Management, U. S. Shorebird Conservation, and the North American Waterbird Conservation plans are being integrated under the umbrella of the North American Bird Conservation Initiative (NABCI) (http://www.nabci-us.org). The goal of NABCI is to facilitate the delivery of the full spectrum of bird conservation through regionally-based, biologically-driven, landscape-oriented partnerships (see http://www.dodpif.org/nabci/index.htm). The NABCI strives to integrate the conservation objectives for all birds in order to optimize the effectiveness of management strategies. NABCI uses Bird Conservation Regions as its planning units. Bird Conservation Regions are becoming increasingly common as the unit of choice for regional bird conservation efforts; Crab Orchard NWR lies within Bird Conservation Region 24, Central Hardwoods.

Each of the four bird conservation initiatives has a process for designating conservation priority species, modeled to a large extent on the PIF method of calculating scores based on independent assessments of global relative abundance, breeding and wintering distribution, vulnerability to threats, area importance (at a particular scale, e.g. Physiographic Areas or Bird Conservation Regions), and population trend. These scores are often used by agencies in developing lists of bird species of concern; e.g., the U. S. Fish and Wildlife Service based its assessments for its 2002 list of nongame Birds of Conservation Concern primarily on the PIF, shorebird, and waterbird status assessment scores.

Region 3 Fish and Wildlife Resource Conservation Priorities (January 2002)

The Resource Conservation Priorities list is a subset of all species that occur in the Region and was derived from an objective synthesis of information on their status. The list includes all federally listed threatened and endangered species and proposed and candidate species that occur in the Region; migratory bird species derived from Service-wide and international conservation planning efforts; and rare and declining terrestrial and aquatic plants and animals that represent an abbreviation of the Endangered Species program's preliminary draft "Species of Concern" list for the Region.

Although many species are not included in the priority list, this does not mean that we consider them unimportant.

The list includes 99 species or populations for the Service's Upper Mississippi River/Tallgrass Prairie Ecosystem. Approximately 45 of the listed species inhabit the Refuge or immediate vicinity.

Legal and Policy Guidelines

In addition to the Refuge's establishing legislation (Appendix G), several laws, executive orders, and regulations govern its administration. See Appendix C for a list and discussion of the guiding laws and orders.

Chapter 2: The Planning Process

Overview of the Planning Process

Our planning process followed eight basic steps described in the Service's planning policy. The steps are:

Preplanning: Planning the Plan
Initiate Public Involvement and Scoping
Review Vision Statement and Goals and Determine Significant Issues
Develop and Analyze Alternatives, Including the Proposed Action
Prepare Draft Plan and NEPA Document
Prepare and Adopt Final Plan
Implement Plan, Monitor, and Evaluate
Review and Revise Plan

The Refuge began pre-planning for the CCP in 1999. There were initial discussions among the staff on issues to be addressed and data that would be necessary during planning. A planning team was formed that consisted of Refuge staff, regional office planning staff, representatives from other programs within the Fish and Wildlife Service, and representatives from the Illinois Department of Natural Resources. Geographic Information System (GIS) data were assembled and organized.

The Service first began soliciting public comment regarding the Comprehensive Conservation Plan in October 2000. Three public meetings were held using the "open house" format. The Service invited people to drop in at their convenience to talk informally with Refuge staff, view exhibits, and fill out comment forms. The dates, times and locations of the meetings were announced in local papers and special mailings. The first meeting was held Thursday, October 19, 2000, at Southwestern Illinois College, Redbud, Illinois. Twenty-two members of the public and two news media representatives attended. The second meeting was held Friday, October 20, 2000, at the Marion Hotel & Conference Center, Marion, Illinois. One-hundred and thirty five members of the public plus seven members of the media attended. The third meeting was held Saturday, October 21, 2000, at the Crab Orchard Refuge Visitor Center. One-hundred and fifty-nine people attended.

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At the open houses, on the Service's Region 3 website, and via the media, people were encouraged to provide written comments on how they wanted the Refuge to be managed. Hundreds of letters and comments were received. Some letters covered one specific interest, others spoke to several interests (Mangi Environmental Group, 2001).

Three focus group meetings were held at the Refuge Visitor Center on January 24 and 25, 2001. Invitations were extended to about 60 stakeholders that had demonstrated a long-standing interest in the Refuge. Additionally, some people were contacted by the invited participants and attended the meetings. In all, 39 people attended the focus group meetings. Each focus group generated and prioritized a list of issues (Mangi Environmental Group, 2001).

In early 2001, the planning team formed special topic work groups to deal with the Refuge purposes. The groups included members of the planning team and subject area experts from within the Service and State. The groups reviewed the existing vision and goals for the Refuge and drafted new goals for the next 15 years.

In April 2001, using all of the comments received, considering the goals and all of the rules and regulations that must be followed and considering the given needs, the planning team developed four alternative management concepts. The four concepts were: Existing Management; Land Exchange; Open Land Management; and Forest Land Management. These management concepts were presented to the public in a project update, which was mailed to everyone on the planning mailing list, and people were invited to comment on the concepts. Based on the comments received and land cover data analysis, the alternatives were refined and made more specific.

A Draft Environmental Impact Statement (DEIS) and Comprehensive Conservation Plan was written and released to the public in October 2005. A 90-day period was provided for public comments on the DEIS. The DEIS was distributed in hard copy and compact disk formats. The document was also available for viewing or downloading from the planning web site. We received 1,983 comments via letters, emails, public meeting comment forms, petition, and oral comments. We responded to all comments in the Final Environmental Impact Statement and made changes to the document based on comments received. The changes included modification to the alternatives, including the proposed action, and typographical and factual corrections. The edited document was issued as a Final Environmental Impact Statement and Comprehensive Conservation Plan in August 2006. After a 30 day waiting period, the Regional Director signed the Record of Decision (Appendix A) on October 27, 2006.

Planning Issues

During scoping, many issues or concerns were identified by the public. The issues and concerns ranged from general concerns, the economic effect of the Refuge on the community, for example, to very specific concerns, such as ruts in a gravel road leading to a particular boat ramp. The issues and concerns were classified under major headings. The following paragraphs summarize the issues that were addressed in the Environmental Impact Statement.

Issue 1: Recreation

Recreation was the most frequently mentioned issue by the public. The public was concerned with all facets of recreation, such as concern for loss of recreation; desire to maintain existing recreational facilities; support/maintain/enhance all forms of recreation; and to expand, improve, re-open and/or add new facilities or activities to the Refuge. Comments were made about the poor or inadequate conditions of some of the facilities, including marinas, boat ramps, restrooms, and campgrounds. Comments made to expand, improve, re-open and/or add new facilities or activities to the Refuge covered a wide range of topics. Some people wanted to see the Refuge expand and improve by adding restaurants, marinas, hotels, restrooms, bike trails, hiking trails, disposal containers, roads, shooting range, dog training areas, horse trails, or gas stations. Many others wanted to see the Refuge re-open swimming areas, picnic areas, and sailing facilities. Others wanted to see additional nature walks, environmental education programs, and water quality monitoring.

Issue 2: Wildlife Conservation

Another issue identified by the public was wildlife conservation. The public recognized the need to conserve and protect wildlife populations as well as their habitat. People felt that game and non-game species should be protected, threatened and endangered species should be protected, habitats should be preserved, and restoration efforts should be

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properly employed. The public felt that this is a very important aspect to maintaining the Refuge environment which reflects on how the public uses the Refuge.

Issue 3: Refuge Purposes

A third issue, support for the intended purposes for Refuge management/concern for compatibility of Refuge purposes, was identified as critical to the Refuge. People who wrote or spoke to this concern tended to feel that for some years Refuge management has not properly emphasized or supported the four original purposes for which the Refuge was established. Indeed, some expressed concern that these very purposes may now be considered incompatible with the overall mission of the National Wildlife Refuge System, due to recent legislation and changing policies of the Service.

Issue: Recreational Boating

A fourth issue, support for boating and its proper regulation, was also addressed. There was broad, strong support for the continuation and encouragement of boating at the Refuge. At the same time, the commenting public recognized actual and potential conflicts among boaters and between boaters and other recreational users of the lakes. Comments on regulation of boating included installing speed limits, removing “no wake” signs, and restricting motorized vessels. Many people expressed opposition to jet-skis, or at least expressed the need for more restrictive regulations for their use.

Issue 5: Role in Regional Economy

One issue identified as important in the focus group meetings but not in the letters was the benefits the Refuge provides to the local economy. Focus group participants recognized that the Refuge not only provides tourism dollars, but also agricultural and industrial dollars to the local economy.

Issue 6: Communication between Refuge and Community

Another issue identified as important in the focus group meetings, but not in the letters, was the need for better communication between the Refuge and the community. Some focus group attendees felt that the Refuge could do a better job of informing the local community of current issues facing the Refuge.

Issues Eliminated from Detailed Study

The public identified some additional issues and concerns during scoping. The Service determined that the following issues did not merit detailed study in the EIS.

ATV Use on the Refuge

Some people opposed the use of ATVs on the Refuge.

Rationale: The Refuge was not proposing to expand the public's use of ATVs. The Refuge issues a very limited number of special use permits to people with disabilities authorizing them to use specific roads for specific activities.

Oil and Gas Production, Mining, Road Building, and Quarries

Some people opposed these activities.

Rationale: The Refuge was not proposing to engage in any of these activities, except for possibly building a minor amount of new road (Heron Flats overlook). In fact, the amount of roads likely will decrease as some industrial facilities become obsolete. The federal government owns and controls all but a very small fraction of the mineral rights on Refuge lands. Furthermore, the economics of extracting any minerals appear to be extremely prohibitive for the foreseeable future.

Need for a CCP

Some people opposed the preparation of a CCP.

Rationale: Service policy, which is based on federal law, requires every national wildlife refuge to have a CCP.

Privatization of Refuge Management

Some people supported a privately run Refuge.

Rationale: Public Law 80-361, the legislation that established the Refuge, states: "...all lands herein transferred shall be administered by the Secretary of the Interior through the Fish and Wildlife Service.." As part of the National Wildlife Refuge System, the Service is mandated to administer the Refuge.

Concession Operations

Some people oppose any concessions on the Refuge.

Rationale: Concession contracts are functional tools the Refuge has used for many years to provide certain services to the public that it otherwise could not offer because of budget and personnel constraints.

Changing the Name of the Refuge

Some people would like to see the Refuge name changed from "Refuge" to "Federal Wildlife Management Area."

Rationale: As part of the National Wildlife Refuge System, the name "Crab Orchard National Wildlife Refuge" is appropriate.

Chapter 3: Affected Environment

Introduction

Chapter 3 provides an overview of Crab Orchard National Wildlife Refuge and the resources it provides in terms of habitat, wildlife and people.

Physical Environment

Physiography

The physiography of the northern and southern portions of the Refuge is quite different. The terrain of the northern portion of the Refuge is characterized by low relief, broad valleys, and relatively well-developed drainage systems while the southern portion of the Refuge is uplands with narrow ridges dissected by deep, narrow valleys with steep slopes and numerous sandstone outcrops.

The northern portion of the Refuge is covered with a heterogeneous mixture of rock fragments ranging in size from clay to boulders deposited by glaciers on bedrock. Generally the slopes in the area are less than 3 percent. The southern portion of the Refuge is part of a continuous ridge extending from Battery Rock on the Ohio River to Horseshoe Bluff overlooking the Mississippi River. The hills are highly dissected uplands with little flat land and nearly all of the area has steep slopes, most in excess of 10 percent slope.

The Refuge's elevation ranges from less than 380 feet above mean sea level at Crab Orchard Creek in Jackson County to over 740 feet at the southeast corner of the Refuge in Union County.

The most prominent features of the Refuge landscape are three artificial impoundments: Crab Orchard Lake, Little Grassy Lake, and Devils Kitchen Lake. Together these lakes total about 8,720 surface acres.

Prairie restoration, Crab Orchard NWR

Geology

The bedrock underlying the Refuge is of Pennsylvanian age. In the northern part of the Refuge, the bedrock is covered by a thin layer of glacial till of Illinoian age. During the Wisconsin glacial age, the weathered Illinoian glacial till was covered by the Farmdale and the Peorian loess sheets. The present upland soils developed from these loess sheets. The Loveland loess sheet underlies the Peorian and Farmdale sheets in the unglaciated areas in the southern portion of the Refuge. The Mississippi River valley is the main source of the loess.

Although mining for bituminous coal has occurred over extensive areas to the north of the Refuge, no coal has been mined on Refuge lands. In 1940, an exploratory oil well was drilled in the central portion of the Refuge, but apparently it never produced any oil. The federal government owns the mineral estate on all lands originally transferred to the Department of the Interior in 1947, except for a one-half interest in oil and gas minerals on one 40-acre tract. The government does not own the subsurface rights on several parcels of land acquired since that time. These parcels amount to about 1,350 acres.

Soils

Information on soils is essential for their conservation, development, and productive use. The various soil types have characteristic properties that determine their potential and limitations for specific land uses. Knowledge of soils is important in managing the Refuge's agriculture and wildlife habitat programs, as well as recreational and industrial facilities and activities.

Since the existing soil surveys were published for Williamson County (Fehrenbacher and Odell, 1959) and Jackson County (Herman et al., 1977), many changes and dramatic improvements have been made in soil classification and mapping techniques. The Heartland Geographic Information System Project will create an updated, digitized soil survey of Williamson, Jackson, and Perry counties. The Refuge is co-sponsoring the new soil survey of Williamson County. The soil survey, which will meet current National Cooperative Soil Survey standards, is expected to be completed in 2007.

Climate

The climate of the area is typical of the mid-western region of the United States in which frequent weather changes occur from day-to-day and season-to-season. The weather is governed by cold air moving southward across the plains from Canada, warm, moisture-laden air moving up from the Gulf of Mexico, and dry air from the west and southwest.

Summers are generally hot and humid, with July normally the hottest month. Winters are normally mild with the coldest temperatures recorded in January. The average frost-free dates in spring and fall for the area are April 15 and October 22. The mean annual temperature of the area is about 57 degrees Fahrenheit with mean monthly temperatures ranging from about 35 degrees Fahrenheit in January to 79 degrees Fahrenheit in July. Lake evaporation in the area averages nearly 36 inches a year varying from about 0.7 inch in December to 5.6 in July.

The average annual rainfall for the area is approximately 44 inches. Precipitation is usually highest March through June. Annual snowfall averages from 10 to 15 inches.

Hydrology and Water Quality

The entire Refuge lies within the Crab Orchard Creek watershed. Crab Orchard Creek is a tributary of the Big Muddy River, which drains into the Mississippi River. Major tributaries of Crab Orchard Creek include Drury Creek, Grassy Creek, Little Grassy Creek and Wolf Creek; other tributaries include Prairie Creek, Pin Oak Creek, Pigeon Creek, Rocky Comfort Creek, and numerous smaller, unnamed streams (Figure 5). Surface water on the Refuge exists almost exclusively as man-made reservoirs and ponds. Three large reservoirs cover nearly 9,000 acres of the Refuge (Table 1 on page 18). There are about 60 smaller impoundments covering about 300 acres (range 0.5-100 acres, average = 6 acres). The only natural lake on the Refuge is a 42-acre oxbow of Crab Orchard Creek. The hydrology of this oxbow has been modified by drainage ditches and impoundment of Crab Orchard Lake.

Water quality, drainage modification, shoreline erosion and sedimentation remain ongoing concerns for water bodies on the Refuge. Refuge waters are impacted by agricultural runoff, wastewater treatment effluent, urban runoff, stream channelization, and industrial contaminants. Pollutants from agriculture include sediment, nutrients and pesticides.

Crab Orchard Lake

Crab Orchard Lake is the oldest (1940), largest, and most heavily used lake on the Refuge. Although created for water supply and recreation purposes, it is no longer used as a source for industrial or drinking water. Crab Orchard Lake is eutrophic (high nutrient levels, low oxygen levels) and rarely exhibits thermal stratification. Turbidity can be quite high, especially following rain storms, and the lake supports moderate plankton blooms during warm months. Water surface temperatures reach 88 degrees Fahrenheit in August. The land cover of the Crab Orchard Lake watershed consists of grasslands (34 percent), forests (31 percent), row crops (15 percent), open water (12 percent), urban development (7 percent), and wetlands (2 percent).

Figure 5: Streams and Watersheds of Crab Orchard NWR

Table 1: Crab Orchard NWR Lake Details

Name	Crab Orchard	Little Grassy	Devils Kitchen
Surface Area (acres)	6,910	1,000	810
Capacity (acre feet)	72,525	27,000	29,200
Average Depth (feet)	10.7	27.0	36.0
Shoreline Length (miles)	125	28.3	24.0
Watershed Area (square miles)	215	15	18.3
Creek Dammed	Crab Orchard Creek	Little Grassy Creek	Grassy Creek
Spillway Elevation	405.0	500.0	510.0
Maximum Depth (feet)	24.6	77.0	90.0

Little Grassy Lake

Little Grassy Lake was impounded in 1950 as a recreation resource and today is most commonly used for sport fishing. Little Grassy Lake is relatively clear, has low nutrient levels, and supports light plankton blooms during warm months. The land cover of the Little Grassy Lake watershed consists of forests (65 percent), grasslands (18 percent), row crops (10 percent), open water (6 percent) and wetlands (1 percent).

Devils Kitchen Lake

Devils Kitchen Lake was impounded in 1959 as a recreation resource and today is most commonly used for sport fishing. Devils Kitchen is one of the deepest and clearest lakes in Illinois, has low nutrient levels, and supports minimal plankton blooms

during warm months. Except for the dam area, the lake shoreline consists primarily of oak-hickory forest. The land cover of the Devils Kitchen Lake watershed consists of forests (62 percent), grasslands (25 percent), row crops (7 percent), open water (5 percent), and wetlands (1 percent).

Contaminants

Comprehensive Environmental Response Compensation and Liability Act (CERCLA)

Following World War II and the transfer of the War Department's Illinois Ordnance Plant to the Department of the Interior, explosives production continued to be the principal industry on the property. In addition, new industries moved into buildings formerly used by the wartime contractor. Over the years, approximately 200 tenants have operated a variety of manufacturing plants under lease from the Refuge. In addition to munitions, manufactured products included plated metal parts, ink, electrical components, machined parts, various painted products, and boats.

A number of locations on the Refuge were contaminated with hazardous substances as a result of handling and disposal methods that were once considered acceptable. These methods included placing waste materials in unlined landfills and discharging liquids into surface water bodies and impoundments. These practices contaminated soils, aquatic sediments, and water, which eventually led to the Refuge's designation by the U.S. Environmental Protection Agency (USEPA) in 1987 as a national priority for hazardous waste investigation and cleanup under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA).

In the 1970s, the State of Illinois identified polychlorinated biphenyl (PCB) and cadmium contamination at the Refuge. A fish consumption advisory has been in effect for Crab Orchard Lake since 1988. In 1989, a Refuge-wide investigation was completed on 33 sites. Several sites were remediated and other sites are in different phases of clean-up. A subsequent investigation was conducted in 2001. This investigation identified additional areas of significant contamination where efforts will fully characterize the nature and extent of contamination, evaluate potential cleanup alternatives, and select and implement protective cleanup measures.

The Department of the Interior, the Department of Army, the USEPA, and the Illinois Environmental Protection Agency (IEPA) are actively involved in the site remediation process. The agencies entered into a Federal Facilities Agreement (FFA) in 1991 that defined roles and responsibilities for the contaminants investigations and remediation.

Approximately $85 million has been spent so far for investigation and clean up of contaminated sites. In one cleanup project, approximately 117,000 cubic yards of hazardous PCB contaminated soils were safely treated. The soils, along with other PCB contaminated soils and incinerator ash, were placed in a repository on the site. Other cleanup projects addressed contamination problems associated with unexploded ordnance and lead-contaminated soils around water towers.

Investigation and cleanup are continuing at several sites in existing and former industrial areas within the restricted use portion of the Refuge. These activities are expected to continue into the foreseeable future.

Administrative Facilities

The Service is responsible for maintaining the Refuge headquarters building, visitor information center, maintenance building, a small office building, and three high hazard dams. The visitor information center is described in the discussion of public use in Section on page 32.

The headquarters building consists primarily of office space for four offices – Refuge administrative staff, Ecological Services Marion Field Office, Ecological Services Crab Orchard Superfund Office, and U.S. Environmental Protection Agency. The building has 10,000 square feet and was completed in 1981.

The Refuge maintenance building consists of office areas, supply and equipment storage areas, and a large bay area for various equipment and

Crab Orchard NWR Headquarters, Bot Etzel

Figure 6: Land Cover of Crab Orchard NWR, 1807 and 2000

vehicle maintenance and repair functions. This building has 10,000 square feet and was completed in 1981.

The office building houses the Carterville Fishery Resource Office and the Illinois Department of Natural Resources. This building, built in 1941, has 3,420 square feet.

The three major dams on the Refuge are the Crab Orchard Lake Dam, Devils Kitchen Lake Dam, and Little Grassy Lake Dam.

The Crab Orchard Lake Dam was constructed to provide a reservoir for an industrial and municipal water supply, recreation, and work relief. Construction was authorized in 1936 and completed in 1939, with extensive modifications completed in 1991. The dam is a zoned earth fill embankment dam with a service spillway.

Devils Kitchen Lake Dam was constructed to provide recreation, water storage, habitat and breeding grounds for migratory birds and other wildlife, and conservation. The dam was designed in 1940. Construction began in 1941, but was suspended in 1943 because of World War II. In 1955, the U.S. Army Corps of Engineers reviewed and modified the original designs. Construction was completed in 1959. The dam is concrete with a concrete spillway.

Little Grassy Lake Dam was constructed to provide recreation. Construction was authorized in 1936 and completed in 1942, with modifications in 1991, 1994 and 2003. The dam is a homogeneous earth fill embankment dam with a concrete spillway near the center of the embankment.

Habitat Overview

The purpose of this section is to broadly describe the existing habitats and the changes that have occurred in the last 200 years. The historic framework helps us implement the Fish and Wildlife Service's policy on maintaining the biological integrity, diversity, and environmental health of the National Wildlife Refuge System. The historic perspective is useful to us as a starting point for assessing the condition of the landscape, the potential for restoration of habitats where appropriate, and the recognition of irreversible changes that may preclude or greatly limit restoration.

Background

The habitats of the Refuge area have changed dramatically in the last 200 years. The area that is now the Refuge was 90-95 percent forest prior to European settlement (Anderson and Anderson 1975) (Figure 6). European settlement of southern Illinois began in the early 1800s and by the mid 1800s Native Americans had been pushed out and villages and primitive roads established. Change in the area was greatest in the late 1800s and the first half of the 1900s. Nearly all of the area was either logged for timber or cleared and converted to other uses, particularly agriculture. By the 1930s, the soils in the area were depleted and severely eroded. Starting in 1938, the Resettlement Administration acquired 32,000 acres of the land along Crab Orchard Creek in an effort to prevent further degradation. However, additional clearing and development ensued with the establishment of the Illinois Ordnance Plant during World War II.

The changes in Refuge habitats since 1807 can be summarized as follows: the original hardwood forest (92 percent of aboriginal area) was converted to largely open habitats (agricultural fields and open water) by the 1930s, where forests now exist the mature hardwood forest has been changed to a forest in an earlier seral stage and pine plantations. Savannah (7 percent of aboriginal area) and native prairie (1 percent of aboriginal area) have been completely converted to other habitats. The overall result has been the fragmentation of the hardwood forest and an increase in aquatic habitats with the construction of the lakes. The current land cover for the Refuge is displayed in Figure 7; changes in land cover are displayed in Table 2.

Forests

Before European settlement, the area that is now the Refuge was 92 percent forest. Essentially, all of the original forest was either converted to other habitats, harvested for timber, or otherwise disturbed. The amount of forest reached the lowest point in the first half of the 1900s. Since that time, forests have gradually become reestablished in abandoned farm fields and industrial areas, and some areas were actively replanted with trees. Presently, 56 percent of the Refuge is covered by forest. Examples of wildlife that use Refuge forests are deer, squirrels, raccoons, hawks, owls, and a variety of forest song bird species. A Refuge goal has been to manage for productive oak-hickory forest dominated by native species. Management activities have included tree planting, prescribed burning, thinning, and control of exotic and invasive plants.

Shrubland

Before European settlement, the area that is now the Refuge was about 7 percent savannah. Savannah was probably dominated by prairie grasses interspersed with trees, but some of it was dominated by shrubs. Presently, about 2 percent of the Refuge is covered by shrubland. Examples of wildlife that use shrubland are deer, rabbit, loggerhead shrike, Bell's vireo, and field sparrow. Most Refuge shrubland is the result of abandoning farm fields and industrial areas.

Grassland

Before European settlement, the area that is now the Refuge was 1 percent prairie. All of the prairie was converted to other habitats. Presently, about 4 percent of the Refuge is covered by grassland. Examples of wildlife that use grassland are deer, rabbit, northern bobwhite, grasshopper sparrow, loggerhead shrike, dickcissel, and eastern meadowlark. The majority of Refuge grassland is managed pasture (55 percent) and hay (35 percent) with the remainder (10 percent) represented by planted, native warm-season grasses. Management activities have included planting agricultural and native grasses, prescribed burning, grazing, mowing, control of exotic and invasive plants, and fertilizing.

Wetlands

Before European settlement, there was relatively little wetland habitat on the area that is now the Refuge. Presently, most wetland habitat on the Refuge consists of man-made ponds and lakes, which are discussed in the following paragraphs. Wetlands cover about 6 percent of the Refuge. Examples of wildlife that use wetlands are Canada goose, other waterfowl, herons, raccoons, turtles, frogs, and other amphibians and reptiles. The majority of these wetlands are bottomland hardwood forests (1,900 acres) and moist-soil units (450 acres). During normal years, water levels in moist-soil units are lowered during the summer to encourage the establishment of moist-soil vegetation. Water levels are then raised during the fall to make the seeds produced by moist-soil plants available to waterfowl. Management activities include maintenance of levees and water control structures, water level manipulation, mowing, disking, planting, and control of exotic and invasive plants.

Open Water

Before European settlement, the area that is now the Refuge had little, if any, open water habitat. Presently, about 20 percent of the Refuge is covered by open water, almost all of it in man-made reservoirs. Open water serves as habitat for warm-water sport fish, waterfowl and other waterbirds. Management activities include maintenance of dams, levees, and water control structures, and manipulation of water levels.

Cropland

Row croplands are farmed through cooperative farming agreements with eight farmers. The objectives of the cooperative farming program have been to provide food for wintering Canada geese and other waterfowl, protect and improve Refuge soils, and fulfill the agricultural purpose of the Refuge. Presently, about 10 percent of the Refuge is covered by cropland. Examples of wildlife that use cropland are deer, Canada goose, northern bobwhite, and

Figure 7: Land Cover of Crab Orchard NWR, 2000

Table 2: Area and Percent Cover of Habitats on Crab Orchard NWR, 1807 and 2000

Habitat Type	Acres in 2000	Percent Cover in 2000	Acres in 1807	Percent Cover in 1807
Forest	**25,254**	**56**	**41,820**	**92**
Eastern Red-cedar Forest (old field)	71	<1		
Mixed Hardwood Upland Forest	18,923	42		
Mixed Hardwood Bottomland Forest	1,908	4		
Eastern Red-cedar Mixed Hardwood Forest (old field)	1,006	2		
Pine Plantation/Mixed Hardwood Forest	1,633	4		
Pine Plantation Forest	1,665	4		
Bald-cypress Plantation Swamp Forest	44	<1		
Early Successional Oak Forest (reforested)	5	<1		
Shrubland	**956**	**2**	**3,182**	**7**
Upland Mixed Shrubland (old field)	872	2		
Willow Wet Shrubland	3	<1		
Buttonbush Swamp Shrubland	81	<1		
Herbaceous	**9,026**	**20**	**455**	**1**
Restored Native Grassland	198	<1		
Fallow Herbaceous Field	1,542	3		
Forest Regeneration Herbaceous Land	168	<1		
Perennial Grass Crops	1,752	4		
Wet Herbaceous Meadow	389	1		
Common Reed Marsh	7	<1		
Cattail Marsh	25	<1		
Aquatic Herbaceous Marsh	365	1		
Agricultural Field	4,580	10		
Other Land Cover	**10,220**	**22**	**0**	**0**
Open Water	9,082	20		
Developed Land	1,138	2		
Totals	45,456	100	45,456	100

wild turkey. Management activities include mowing, disking, planting, herbicide and fertilizer application, and harvesting.

Developed Land

Presently, about 2 percent of the Refuge is covered by developed land. This includes: roads and adjacent rights-of-way, and industrial, administrative, and recreational facilities.

Invasive Species

Three categories of undesirable species (invasive, exotic, noxious) are found on the Refuge.

Invasive species are alien species whose introduction causes or is likely to cause economic or environmental harm or harm to human health. Executive Order 13112 requires the Refuge to monitor, prevent, and control the presence of invasive species.

Exotic species are species that are not native to a particular ecosystem. Service policy directs the Refuge to try to maintain habitats free of exotic species.

Noxious weeds are designated by the U.S. Department of Agriculture or the Illinois Department of Agriculture as species which, when established, are destructive, competitive or difficult to control. Principal weed species are shown in Table 3.

Table 3: Principal Weed Species in Agricultural Fields, Crab Orchard NWR

Common Name	Scientific Name
crab grass	*Digitaria sp.*
fall panicum grass	*Panicum sp.*
foxtail grass	*Setaria sp.*
cocklebur	*Xanthium strumarium*
smartweed	*Polygonum sp.*
shattercane	*Sorghum bicolor*
ragweed	*Ambrosia sp.*
pigweed	*Amaranthus sp.*
lamb's quarters	*Chenopodium album*
trumpet-creeper	*Campsis radicans*
morning-glory	*Ipomoea sp.*
nutsedge	*Cyperus esculentus*

Invasive, exotic and noxious weed species are relatively abundant on the Refuge. These species are quite diverse and are found in most Refuge habitats, although some are typically found in agricultural fields or lakes and ponds. Johnsongrass, Canada thistle and giant ragweed are Illinois state-listed noxious weeds that occur on the Refuge. Currently, most Refuge control efforts focus on Johnsongrass, autumn olive, teasel, garlic mustard and common reed. The principal invasive and exotic plant species on Crab Orchard NWR are shown in Table 4.

Exotic and invasive plant species pose one of the greatest threats to the maintenance and restoration of the diverse habitats found on the Refuge. They threaten biological diversity by causing population declines of native species and by altering key ecosystem processes like hydrology, nitrogen fixation, and fire regimes. Left unchecked, these plants have come to dominate many areas on the Refuge and reduced the value of the land as wildlife habitat. There is a bountiful seed source of many of these exotic/invasive species on the lands surrounding the Refuge, thus in order to be effective in our management plans, we must bring together a complex set of interests including private landowner, commercial, and public agencies.

Natural and Current Role of Fire

Prior to European settlement, fire assuredly was an influence on the structure and function of the small patches of prairie and savannah in the area that is now the Refuge. Fire was less of a factor in open forests, and even less in closed forests. Now, the natural process of fire has been replaced by fire management that includes suppression and prescribed burning.

Table 4: Principal Invasive and Exotic Plant Species, Crab Orchard NWR

Common Name	Scientific Name
autumn olive	*Elaeagnus umbellata*
multiflora rose	*Rosa multiflora*
kudzu	*Pueraria montana*
purple loosestrife	*Lythrum salicaria*
common reed	*Phragmites australis*
Johnsongrass	*Sorghum halepense*
reed canary grass	*Phalaris arundinacea*
fescue grass	*Festuca pratensis*
tall fescue	*Festuca arundinacea*
garlic mustard	*Alliaria petiolata*
Japanese honeysuckle	*Lonicera japonica*
Amur honeysuckle	*Lonicera maackii*
Oriental bittersweet	*Celastrus orbiculatus*
Canada thistle	*Cirsium arvense*
bull thistle	*Cirsium vulgare lanceolatum*
black-locust	*Robinia pseudoacacia*
white poplar	*Populus alba*
mimosa	*Albizia julibrissin*
tree-of-heaven	*Ailanthus altissima*
wintercreeper	*Euonymus fortunei*
Chinese yam	*Dioscorea oppositifolia*
crown vetch	*Coronilla varia*
white sweet clover	*Melilotus alba*
yellow sweet clover	*Melilotus officinalis*
sericea lespedeza	*Lespedeza cuneata*
bush clover	*Lespedeza bicolor*
Japanese stiltgrass	*Microstegium vimineum*
dodder	*Cuscuta spp.*
shortleaf pine	*Pinus echinata*
loblolly pine	*Pinus taeda*
Virginia pine	*Pinus virginiana*
ponderosa pine	*Pinus ponderosa*
coontail	*Ceratophyllum demersum (aquatic)*
Eurasian watermilfoil	*Myriophyllum spicatum (aquatic)*
common teasel	*Dipsacus fullonum*
cut-leaved teasel	*Dipsacus laciniatus*

Prescribed burn on Crab Orchard NWR

We have fire records for the Refuge from 1947 to the present, but information prior to 1986 is incomplete. Records indicate that the area has an average of 2.3 wildland fires annually, with a total of 127 wildland fires recorded from 1947 to 2001. Fires are most likely to occur in the spring from March 1 to May 15 and in the fall from October 15 to December 1.

We use prescribed fire to manipulate vegetation in a safe and cost-effective manner. Our principal purpose is to improve the wildlife habitat conditions in the southern pine plantations. Prescribed burning also reduces hazardous fuels, encourages oak and hickory and discourages sugar maple. Burning improves the condition of the understory. And, although burning is not specifically undertaken for these purposes, burning enhances the aesthetics of the forest by making the understory more open and improves access for both habitat management and recreation.

Southern pine plantations are burned to reduce fuels on the forest floor and to keep understory low to better provide for wildlife. By burning, we keep the understory vegetation in a young, vigorous condition, increasing seeds and fruit that are available to wildlife near the ground. As a result of fire, more light reaches the ground, which favors less shade-tolerant species. We conduct inventories to determine if there are enough young hardwoods in the understory of pine stands to permit succession to a native hardwood forest. If succession is likely, we will terminate prescribed burning.

Areas identified as "fallow herbaceous fields" (Figure 7 on page 22) are old fields that have been invaded by low, woody vegetation and vines. If we want to maintain these lands in an early seral stage, fire helps maintain the openings and habitat diversity. Burning also enhances conditions for deer and upland game hunting and wildlife observation and photography.

Fire is essential for proper management of native, warm-season grasses and associated forbs. Prescribed fire stimulates growth of the grasses, increases seed germination and growth of forbs, creates open ground for wildlife, retards encroachment of woody vegetation, and reduces the fuel load. Tallgrass prairie has been established on several areas on the Refuge. Fire will play a significant role in maintaining this habitat type, which benefits prairie bird species.

Wildlife

Information on wildlife in the area before European settlement is limited. We do know that some mammals that were in the area are no longer found in Illinois (Hoffmeister 1989): bison (*Bison bison*), elk (*Cervus elaphus*), black bear (*Ursus americanus*), and mountain lion (*Felis concolor*). The Passenger Pigeon (*Ectopistes migratorius*) and Carolina Parakeet (*Conuropsis carolinensis*) inhabited the area but are now extinct. The Greater Prairie Chicken (*Tympanuchus cupido*) has a greatly reduced range (Bohlen 1989). We know little about how amphibians, reptiles, and invertebrates in the area may have changed through the years.

The Refuge provides habitat for many species that occur in Illinois (Table 5). See Appendix D for a complete list of wildlife species known to inhabit the Refuge.

Mammals

Forty-three species of mammals have been recorded in or near the Refuge (Appendix D). White-tailed deer, Virginia opossum, raccoon, rabbits, squirrels, beaver, and coyote are commonly observed species on the Refuge.

White-tailed deer numbers on the Refuge have shown a pattern similar to the rest of Illinois. By the early 1900s, deer had either been extirpated from the Refuge, or occurred in very low numbers. Refuge records mention a release of deer in 1942, but no numbers are provided. The number of deer on the Refuge is estimated at 10 in 1947, 30 in 1949 and 70 in 1950. By 1953, deer were no longer an oddity on the Refuge. The population increased and attained such high levels that deer damage to crops and forest began to become an issue in the early 1960s. The first Refuge deer hunt in the restricted use area

Table 5: Number of Wildlife Species Found in Illinois and at Crab Orchard NWR

Taxonomic Group	Number of Species Found in Illinois	Number of Species Found at Crab Orchard NWR	Percent of Illinois Species Found at Crab Orchard NWR
Amphibians	41	22	54
Reptiles	61	28	46
Mammals	62	43	69
Birds	327	269	82
Terrestrial Vertebrates	491	362	74

occurred in 1966. The average annual harvest in the restricted use area since then has been about 600 per year.

Birds

Two-hundred sixty-nine species of birds have been recorded in or near the Refuge (Appendix D). Herons, Canada goose and other waterfowl, raptors, wild turkey, and songbirds are commonly observed species on the Refuge.

Canada Goose

Prior to European settlement, Canada geese probably rarely used the Refuge area. The Refuge was dominated by forest (more than 90 percent) and had little habitat to attract geese. Refuge records indicate that there were only about 2,200 Canada geese on the Refuge in 1947. Establishing a large, wintering population was a Refuge priority. Refuge staff kept pinioned or penned geese as a decoy flock to attract migrating geese and emphasized production of corn and other grains in the Refuge farm program to provide food for wintering geese. The response by Canada geese was relatively quick; in 1948 the peak count on the Refuge was 24,000 and peak counts generally increased through the middle 1990s (Figure 8). The average peak count (1947-2001) is 82,000.

Overall, Canada Goose use of the Refuge, as measured in goose-use-days, has been more variable and shows less of a trend than peak counts (Figure 9). The average (1952-2002) has been 5.4 million goose-use-days. The Refuge goal is to provide food for 6.4 million goose-use-days each year.

Since the Refuge was created in 1947, attracting and providing food for migratory Canada Geese has been a primary focus of activities on the Refuge. Early efforts to attract geese included maintaining a captive flock of pinioned geese, increasing the production of desirable agricultural crops, and, sometimes, directly feeding geese by placing large quantities of grain in open areas of the Refuge. Current efforts to supply food for geese emphasize providing sufficient quantities of diverse food-producing habitats. Much of this food is provided by the Refuge agriculture program. Row crops provide corn, winter wheat, and clover. Hay fields and pastures provide grasses and legumes. Food is also provided in natural wetlands, managed moist soil wetlands, lakes and ponds, and miscellaneous sites such as mowed industrial areas and rights-of-way. Other goose management activities include seasonal closure to boating on the east end of Crab Orchard Lake and fall mowing around selected ponds.

In 1998, Service and Illinois DNR biologists completed a report that set a specific Refuge goal of providing food for 6.4 million goose-use days annually. This goal was derived using over 40 years of Refuge Canada Goose data (unpublished Crab Orchard NWR report, 1998). This report also calculated that the minimum amount of agricultural row crops required to potentially provide for 6.4 million GUDs is 1,500 acres, but this requires several critical assumptions. These assumptions are: 1) geese have unrestricted use of all fields, 2) average crop yields, 3) average winter temperatures, 4) average snow fall, and 5) crops are not consumed by other animals. In practice, we know these assumptions are not met and goose food availability is influenced by the following factors: 1) geese do not use some fields because they are too small to fly into or they are in the portion of the Refuge open to the public and disturbance levels are higher, 2) crop yields can vary substantially (winter wheat production was low in fall 2001 because of late and wet planting conditions, corn and clover production in 2002 was low because of drought conditions, etc.), 3) lower than average winter temperatures result in greater calorie demand by Canada Geese, 4) some crops are unavailable because of occasionally heavy snow

Figure 8: Peak Counts of Wintering Canada Geese on Crab Orchard NWR, 1947 to 2001

Figure 9: Canada Goose-use Days on Crab Orchard NWR, 1952 to 1999

cover, and 5) other animals (deer, raccoons, blackbirds, etc.) also consume crops. In order to compensate for factors that regularly decrease food availability (ex., consumption by other species and non-use of certain fields) and factors that occasionally decrease food availability (ex., low crop production due to drought, deep snow conditions) more than 1,500 acres of crops are required. For example, if each of these five factors reduced food availability by just 10 percent, over 2,500 acres of row crops would be required to provide 6.4 million goose-use-days. However, we know that in some instances these factors can cause larger reductions. For example, in 2002 corn production was reduced by 50 percent or more.

Wild Turkey

Wild turkeys were not known to occur on the Refuge until 122 were released by the Illinois Department of Conservation in 1958. Occasional turkey sightings were made on the Refuge through 1965. In 1966, Refuge records estimate a population of seven wild turkeys and state that several observations were made during the year. Wild turkey numbers continued to increase enough that by 1989, the Illinois DNR trapped 14 hen turkeys for stocking off the Refuge. The Refuge held its first wild turkey hunting season in the restricted use area in the spring of 2001, when 39 wild turkeys were harvested by 52 hunters.

Table 6: Nongame Species of Management Concern, Crab Orchard NWR

Common Name	Scientific Name
Common Loon	*Gavia immer*
Northern Harrier	*Circus cyaneus*
Red-shouldered Hawk	*Buteo lineatus*
Greater Yellowlegs	*Tringa flavipes*
Black-billed Cuckoo	*Coccyzus erythropthalmus*
Chuck-will's-widow	*Caprimulgus carolinensis*
Whip-poor-will	*Caprimulgus vociferus*
Red-headed Woodpecker	*Melanerpes erythrocepalus*
Northern Flicker	*Colaptes auratus*
Acadian Flycatcher	*Empidonax virescens*
Loggerhead Shrike	*Lanius ludovicianus*
Bell's Vireo	*Vireo belli*
Wood Thrush	*Hylocichla mustelina*
Blue-winged Warbler	*Vermivora pinus*
Prairie Warbler	*Dendroica discolor*
Prothonotary Warbler	*Protonotaria citrea*
Worm-eating Warbler	*Helmitheros vermivorus*
Louisiana Waterthrush	*Seiurus motacilla*
Kentucky Warbler	*Oporomis formosus*
Field Sparrow	*Spizella pusilla*
Grasshopper Sparrow	*Ammordramus savannarum*
Dickcissel	*Spiza americana*
Eastern Meadowlark	*Sturnella neglecta*
Orchard Oriole	*Icterus spurius*

USFWS Nongame Bird Species of Management Concern

The Fish and Wildlife Conservation Act, 1980, requires that the Service identify "all migratory nongame birds that, without additional conservation action, are likely to become candidates for listing under the Endangered Species Act of 1973." Additionally, the Act further underscores the need to develop actions to assure the conservation of these species with the underlying philosophy that "an ounce of prevention is worth a pound of cure." Species of management concern in Region 3 have been identified in a Resource Conservation Priorities report (USFWS 2002). Nongame species of management concern known to regularly occur on the Refuge are shown in Table 6.

Amphibians and Reptiles

Twenty species of amphibians and 28 species of reptiles have been recorded on the Refuge (Appendix D). Cricket frog, Fowler's toad, bullfrog, painted turtle, eastern box turtle, racer, and diamondback water snake are commonly observed species on the Refuge.

Fish[1]

Prior to dam construction, fish habitat in the area consisted primarily of the larger, named streams. No fish community survey data from streams from before dam construction exists, and only one cursory survey has been completed since. Over the last 50-60 years, most fish habitat has been provided by the three large lakes and eight smaller impoundments. Fish management on the Refuge has emphasized mixed-species, warm-water sport fish. Since 1998, the fisheries on the Refuge have been managed cooperatively by IDNR and the Refuge.

Crab Orchard Lake

The fish community of Crab Orchard Lake is dominated by carp and gizzard shad, which comprise 75 percent of the biomass. However, a popular recreational fishery exists for largemouth bass, bluegill, crappie, channel catfish and white bass. The Lake's aquatic habitat has been affected by shoreline erosion, sedimentation, excessive nutrient loading from discharges of municipal wastewater and nonpoint source pollution, and contamination by PCBs and other contaminants. Sediments contaminated by PCBs were dredged from a bay of the lake in 1996.

The fish management goals for Crab Orchard Lake are to:

maintain and/or improve the existing bluegill and redear fisheries,
maintain and/or improve the existing largemouth bass fishery,
maintain the existing channel catfish fishery,
maintain the existing white bass and hybrid striped bass fishery,

1. *Information for this section comes primarily from: 1) Refuge records; 2) IDNR records and 3) an unpublished report by the Carterville Fisheries Resource Office (Surprenant 1994).*

maintain the existing white and black crappie fishery, and
monitor PCB concentrations in fish flesh.

Species abundance and body condition, which are monitored by annual surveys, determine population objectives for bluegill, redear, largemouth bass, black and white crappie, white and hybrid striped bass, and channel catfish.

Although initial stocking records are not available, if USDA Soil Conservation Service recommendations were followed, largemouth bass, bluegill, channel catfish, and bullheads were stocked. Other species now occurring were present in the watershed or have since been introduced. Following the pattern of large impoundments in the 1940s and 1950s, the largemouth bass fishery flourished initially then declined through the late 1940s as carp, gizzard shad, white crappie and yellow bass became dominant. Supplemental stocking of game species began with 1.5 million largemouth bass 2-inch fingerlings in the 1950s. Since then, millions of fry and fingerlings of several species have been released into Crab Orchard Lake.

Commercial fishing was permitted on Crab Orchard Lake during the 1960s and 1970s and discontinued in 1979. There are no plans to resume commercial fishing on Crab Orchard Lake.

Contaminant levels in Crab Orchard Lake fish have been studied by the Illinois Environmental Protection Agency, Fish and Wildlife Service and Illinois Department of Natural Resources since 1975. PCBs in fish flesh have exceeded FDA safety levels, especially in fish east of Route 148 (Hite and King 1977, Ruelle 1983, Kohler and Heidinger 1990, Kohler and Heidinger 1994).

Based on analysis of PCB data, the first fish consumption advisory was issued in 1988. People were advised that certain fish had high contamination and should not be eaten. This advisory applied to channel catfish longer than 15 inches and to carp longer than 15 inches caught east of Route 148. People were advised that bluegill and largemouth bass caught east of Route 148 had moderate contamination and should not be eaten by children and nursing mothers. This advisory has since been modified and covers largemouth bass, channel catfish, and carp. Consumption advisory information is published annually by IDNR in the Illinois Fishing Information booklet.

Devils Kitchen Lake

Devils Kitchen Lake is most commonly used for sport fishing and is known for its quality-sized bluegill and redear, occasional trophy bass, and year-round rainbow trout. The fish management goals for Devils Kitchen Lake are to: 1) maintain and/or improve the existing bluegill and redear fisheries, 2) maintain and/or improve the existing largemouth bass fishery, and 3) maintain the existing rainbow trout fishery through annual stockings.

The forage base at Devils Kitchen Lake is augmented with annual stockings of threadfin shad, if available. Population objectives for bluegill, redear, and largemouth bass are based on species abundance and body condition, which are monitored by annual surveys. Low lake fertility results in minimal plankton blooms and limited food for fish leading to lower fish numbers and growth rates. In 2004, the Illinois Department of Public Health issued a fish consumption advisory for largemouth bass caught in Devils Kitchen Lake because of elevated levels of methyl mercury.

Little Grassy Lake

Little Grassy Lake is most commonly used for sport fishing and is known for quality-sized bluegill, redear, and largemouth bass. The fish management goals for Little Grassy Lake are to: 1) maintain and/or improve the existing bluegill and redear fisheries, 2) maintain and/or improve the existing largemouth bass fishery, and 3) maintain the existing channel catfish fishery through annual stockings.

The forage base at Little Grassy Lake is augmented with annual stockings of threadfin shad, when available. Population objectives for bluegill, redear, and largemouth bass are based on species abundance and body condition, which are monitored by annual surveys. Like Devils Kitchen Lake, low fertility limits fish management. Light plankton blooms and limited food leads to lower fish numbers and growth rates.

Small Impoundments

Sport fisheries management also occurs on eight small impoundments (Table 7). The IDNR attempts to control algae blooms in some of the smaller impoundments. Two ponds were treated in 1999 and 2001 with an aquatic herbicide. These impoundments are managed for warm-water, mixed species sport fisheries.

Table 7: Small Fishing Ponds on Crab Orchard NWR

Name	Surface Area (Acres)	Shoreline Length (miles)
A-41 Pond	37	2.0
Bluegill Pond	6	0.6
Blue Heron Pond	10	0.6
Honker's Corner Pond	6	0.5
Mann's Pond	9	0.7
Manager's Pond	2	0.3
North Prairie Pond	6	0.6
Visitor's Center Pond	40	2.3

Monitoring

Refuge staff, staff from the IDNR, and volunteers survey wildlife use. The surveys provide information for Refuge management and support state and national conservation efforts. The following paragraphs describe current monitoring programs.

Canada Goose Surveys: Aerial surveys of Canada Geese are conducted by the IDNR, generally from mid-October to mid-March. The data are used to estimate goose-use-days. Refuge biologists also conduct an informal survey of goose use of agricultural fields.

Weekly Waterfowl Survey: Refuge biologists survey waterfowl weekly from mid-August through mid-April, traveling over 70 miles and covering 50 points to view large areas of Crab Orchard Lake and several smaller impoundments and moist-soil units. Survey data are entered into a database, which can produce 16 types of reports. Gulls, shore, wading, and predacious birds are also counted throughout the route. Goose collar observations are also recorded and reported to the Office of Migratory Bird Management.

Bald Eagle Monitoring: Biologists monitor Bald Eagle nests for use and productivity. As part of a nation-wide effort, the Refuge has participated in the mid-winter Bald Eagle survey since 1961.

Heron Rookeries: Biologists periodically check the known heron rookeries for use and productivity.

Wild Turkeys: Biologists monitor wild turkeys to keep track of their population. The data are used in establishing harvest permits.

Bluebirds: Since 1992, a group of volunteers has maintained and monitored bluebird boxes. In 2000, nine volunteers monitored 220 boxes.

Christmas Bird Count: The Refuge participates in the Christmas Bird Count, a national survey organized by the National Audubon Society.

Spring Bird Count: The Refuge participates in the Spring Bird Count, another national survey organized by the National Audubon Society.

Mourning Dove Count: The Mourning Dove Count is conducted off the Refuge as part of a nation-wide survey coordinated by the Office of Migratory Bird Management. The survey has been conducted every year since 1964.

American Woodcock Singing Ground Survey: The North American Woodcock Singing Ground Survey is a cooperative effort conducted on and off the Refuge in conjunction with the Office of Migratory Bird Management.

White-tailed Deer: The Refuge uses a fall deer count to establish a deer population index. The population index is used, in turn, to determine the number of available hunting permits. A 20-mile survey route was developed by Southern Illinois University in 1966 and the Refuge has conducted the survey every year since then.

Indiana Bat Surveys: The Indiana bat is a federally listed endangered species. Biologists have conducted limited mist-netting to determine if and where the Indiana bat might be using the Refuge.

Amphibian Surveys: Biologists have used a variety of techniques (searching, song counts and drift fences) to determine what species of amphibians, and to a lesser extent reptiles, inhabit the Refuge. In a one-time effort, biologists surveyed for deformed frogs as part of a nation-wide cooperative

Barn Owl, U.S. Fish & Wildlife Service

effort. In an effort to evaluate certain CERCLA sites, surveys for the absence or presence of amphibians and deformed frogs are ongoing.

Gypsy Moth: The Refuge cooperates with the U.S. Forest Service by installing gypsy moth traps each summer as part of a nation-wide effort to monitor this pest's distribution and population.

Exotic and Invasive Plants: Biologists informally monitor exotic and invasive plants. Some of the species monitored are autumn-olive, Johnsongrass, common reed, purple loosestrife, Canada thistle, musk thistle, kudzu, and reed canary grass.

Forest Watch: Forest Watch is a volunteer cooperative effort organized by the Illinois DNR. Volunteers conduct biological monitoring in order to identify long-term changes in the health of forest ecosystems. Two permanent monitoring plots are located on the Refuge.

River Watch: River Watch, like Forest Watch, is a volunteer cooperative effort organized by the Illinois Department of Natural Resources. Each spring citizen scientists evaluate two streams on the Refuge. The data and results are reported to the state for an evaluation of stream quality.

Fish Surveys: Refuge fish management is conducted by IDNR in conjunction with the Service's Carterville Fishery Resource Office. The IDNR uses electrofishing on the lakes and several of the smaller ponds each year to determine population diversity, structure and overall health. The IDNR also collects fish for contaminant analysis as dictated by the State fish consumption advisory group and studies delayed bass mortality associated with fishing tournaments as appropriate. Creel surveys were conducted in 1976, 1978 and 2000.

Lotus Surveys: The American lotus (*Nelumbo lutea*) that grows in Grassy Bay is in apparent decline and is being studied. The IDNR has done some seeding and planting in the bay. The Refuge is monitoring several new patches of lotus in Crab Orchard Lake east of Route 148.

Shoreline Surveys: Shoreline and island erosion has been shown to be a contributor of sediment to the lakes, especially Crab Orchard Lake. Over the years various surveys and control efforts have been tried. The last effort was in 2001.

Federal Threatened and Endangered Species

Mammals

The endangered Indiana bat (*Myotis sodalis*) is not known to occur on the Refuge, but it has been observed in areas nearby. In winter, Indiana bats hibernate in caves and mines. There are no known caves or mines on the Refuge, but Indiana bats are known to hibernate in caves in Jackson County adjacent to the Refuge. Summer maternity roosts and colonies are found in well-developed riparian woods and upland forests.

The first surveys for Indiana bats on the Refuge occurred in 1989. During two nights of netting, none were captured. However, Illinois DNR biologists thought that some of the Refuge habitat looked suitable. There have been several attempts to capture Indiana bats on the Refuge to determine if the species is present. A 1999 survey was unsuccessful in capturing any Indiana bats.

Birds

The Bald Eagle (*Haliaeetus leucocephalus*) occurs as a winter migrant and a summer breeder on the Refuge (Figure 10). The Bald Eagle is currently listed as a threatened species that has been proposed to be delisted. Bald Eagles are probably much more common in the area than they were before construction of Crab Orchard Lake in 1940. The Refuge estimated 10-14 wintering birds in 1961. The history of eagles nesting can be summarized as: 1974-construction of the first nest; 1979-the first nesting attempt; 1980-first nestling; 1981-first fledglings. Generally, each year 10 to 30 bald eagles winter on the Refuge; there are two or three active nests and two to six fledglings (Figure 11).

Plants

There are no known federally listed threatened or endangered plants on the Refuge.

Figure 10: Bald Eagle Winter Survey Counts on Crab Orchard NWR, 1993-2002

Figure 11: Bald Eagle Fledgling Counts on Crab Orchard NWR, 1993-2000

Public Use Resources and Trends

Swimming, boating, picnicking, dog field trials, camping, hunting and fishing were a part of the Crab Orchard Creek Project before the establishment of Crab Orchard National Wildlife Refuge. When Congress transferred the lands to the Department of the Interior, they directed the Secretary to classify the lands for the most beneficial use. Subsequently, the Secretary designated Area I and Area III of the Refuge for recreational use, including hunting, fishing, picnicking, boating, swimming and similar activities. In Area III group recreation and camps were to take precedence over other public uses. Area II was classified as "closed refuge." (Figure 12)

When the Department of the Interior assumed management of the lands, Area I was under a single concession permit issued by the Soil Conservation Service. The concessionaire operated two government owned bathing beaches, a boat docking concession (Playport) and a skeet and trap facility. The Crab Orchard Boat & Yacht Club, an incorporated group of individuals, leased property and paid concession royalties to the main concessionaire.

In 1956, the Refuge reached a milestone of 1 million annual visitors. Nine years later visitation surpassed 2 million annual visits. Visitation fell as additional State and federal recreational areas were constructed in Southern Illinois. Today the annual visitation averages 1 million.

A wide spectrum of recreational activities continues to occur on and around Crab Orchard, Devils Kitchen and Little Grassy lakes. The activities include boating, water-skiing, swimming, camping, picnicking, hunting, fishing, wildlife observation, environmental education, environmental interpretation, horseback riding, and photography. Public use facilities include campgrounds, marinas, boat ramps, fishing piers, beaches, picnic areas, hiking trails, auto tour, visitor center, environmental education complex, observation decks, and photo blinds.

Hunting

Several species of small game, big game, and migratory waterfowl are hunted on the Refuge. Federal and State hunting regulations apply. Recreational trapping requires a special use permit. Refuge records show only a few trappers setting traps on the Refuge in the last few years.

Figure 12: 1948 Area Designations, Crab Orchard NWR

Most hunting occurs outside the restricted use area. The public use area of the Refuge makes up approximately 23,000 acres and is open to all hunting activities in accordance with State hunting seasons. Hunting includes muzzleloader, archery, shotgun and pistol deer hunting, waterfowl hunting, archery and shotgun wild turkey hunting, small game hunting (rabbit, squirrel, quail, and woodchuck), game bird hunting (dove, woodcock, snipe and crow) and furbearer hunting (raccoon, opossum, fox and coyote).

A controlled white-tailed deer and wild turkey hunt occur in the restricted use area. Other hunting programs include controlled goose hunting, youth deer hunting and deer hunting for people with physical disabilities. Hunting is prohibited in zones around the youth camps on Little Grassy Lake and industrial areas in the restricted use area.

Restricted Use Area Deer Hunt: Since 1973, white-tailed deer hunting in the restricted use area has been an important management tool and a popular recreational activity. The Refuge conducts two hunts that coincide with State seasons. Five hundred permits are issued each season for a total of 1,000 permits.

From 1973 through 1994, hunters could take either sex of deer. They were encouraged to take antlerless deer with the intent of keeping the Refuge's deer population strong and healthy by limiting the herd size and balancing the sex ratio. However, the Refuge did not achieve this goal. Therefore, in 1995, the first gun deer hunting season was designated antlerless only.

Restricted Use Area Spring Wild Turkey Hunt: In the spring of 2001, the Refuge implemented a spring turkey hunt in the restricted use area. The Refuge requested 15 State-issued permits for each of four seasons for a total of 60 permits. When the State went to five seasons in 2002, the Refuge chose to keep the same total number of permits (60) so 12 permits were issued for each season. The State also added a youth season, so 12 additional restricted use area permits were added in 2002. A total of 72 permits are currently offered. The public use area portion of the Refuge is open to all turkey hunters who have an appropriate permit from the State. This can result in hunter competition for prime hunting areas and lower success rates. The Refuge goal for the restricted use area hunt has been to offer an experience that focuses on lower numbers of hunters and higher success rates. Hunter success rates in the restricted use area during 2001-2004 have been 75 percent, 43 percent, 52 percent, and 35 percent, respectively. The State-wide hunter success rate is about 20 percent.

Controlled Goose Hunting: The area for this hunt is within the portion of the Refuge open to public hunting. The controlled goose hunting areas, contain 18 land blinds and 15 water blinds. Two of the blinds are accessible to people with disabilities and can be reserved daily.

Youth and Disabled Persons Deer Hunt: In 1991, volunteers constructed blinds and implemented the hunts, which have been very successful. The hunts coincide with the first shotgun deer hunt season. The Refuge reserves permits for 25 disabled hunters and 25 youth hunters and a portion of the restricted use area is designated for these hunts. Hunters are required to have an aide or adult with them in the field.

Fishing

Fishing is one of the more popular visitor pastimes on the Refuge. Crab Orchard, Little Grassy and Devils Kitchen Lakes are available for fishing year-round with one exception. The eastern portion of Crab Orchard Lake is closed to boating from October 1 to March 14 to provide resting area for wintering waterfowl. The main species of fish sought by the anglers are largemouth bass, crappie, bluegill and channel catfish.

There are several bank fishing areas on the Refuge (see Figure 13). Although there are many other good fishing areas, the areas described in the following paragraphs receive the highest visitation and the most noticeable resource impacts.

Visitor's Pond is a popular fishing site on the Refuge. It is located in the restricted use area behind the visitor information center. The pond is open from March 15 to September 30. A universally accessible asphalt trail leading to a fishing pier allows easy access to the pond.

Wolf Creek Recreation Area consists of a causeway and a peninsula where pan fishing is popular year-round. There are two gravel parking areas, a restroom, fish attractors, and six accessible fishing platforms along the causeway. Picnic tables and benches are provided for day use.

Blue Heron Pond is located in the restricted use area. The pond is open from March 15 to September 30. Because it is out of the way, the pond receives far fewer visits than other ponds in the restricted use area.

Figure 13: Bank Fishing Sites on Crab Orchard NWR

A-41 Pond is located in the restricted use area. People walk from a gravel parking area approximately one-half mile to the pond. The pond is open from March 15 to September 30. The opening coincides with cattle pasturing in the same area.

Manager's Pond is accessible from Old Route 13 near Carterville. The pond receives light use, possibly due to the scarcity of parking facilities and the heavy algae growth covering the pond during most of the summer.

Honker's Corner Pond is located on Old Route 13 approximately 1 mile west of Route 148. There is ample roadside parking. The pond is used consistently in early spring, but slows as algae growth covers the pond during most of the summer months.

Route 148 North is located on the northeast end of the Route 148 causeway. There is a large gravel parking lot and kiosk. The area receives moderate use from spring to fall. Mostly anglers fish for pan fish and channel catfish in Crab Orchard Lake.

Route 148 South is located on the southeast end of the Route 148 causeway. There is a small gravel parking lot. The area usually has one or more cars in the parking lot during fishing season.

Cambria Neck Area is located on a peninsula off Cambria Road. The area is used by anglers often during the height of fishing season. There are picnic facilities, a restroom, a parking lot and a grassy recreation area. The area is visible from New Route 13, which may account for a lot of first-time visitors.

Ann Manns Pond is located on Spillway Road, 2 miles south of the Crab Orchard Lake Dam. Bank fishing and fishing from non-motorized boats is permitted year around. There is a small parking area.

Bluegill Pond is located along the southern boundary of the restricted use area. People walk from a gravel parking area approximately one-half mile to the pond. The pond is open from March 15 to September 30. The opening coincides with cattle pasturing in the same area.

Fishing Tournaments

Five fishing tournaments are held annually on the Refuge's three lakes under special use permits. The tournaments are well established and require minimal assistance from Refuge staff, although the Refuge's law enforcement staff and Illinois DNR officers do run spot checks during the tournaments. Approximately 500 anglers participate in these events. Anglers and biologists have expressed concern over the lack of vegetation for spawning bass and, with respect to tournaments, to post-release mortality.

Fish-Offs

The three major lakes receive many visits from fishing clubs hosting club events called “fish-offs.” A fish-off is defined as an organized club fishing event of 20 boats or fewer. The Refuge registered over 130 fish-offs in 2001 and more occur without being registered. The Refuge recently instituted new rules restricting fish-offs to one per club, per lake, per year. All fish caught must be returned to the lake and aerated live wells are required for all boats.

Camping

At one time camping was allowed throughout open areas of the Refuge. Because of litter and trash problems, camping was restricted to a concession-operated campground on each of the three major lakes. Campground locations are shown in Figure 1 on page 2.

Crab Orchard Campground began operation in 1964 under a concession contract. In 1969, the Refuge assumed operation of the campground and upgraded electric service, restrooms and showers. The campground returned to a concession contract in 1972.

Today Crab Orchard Campground is the largest of the four campgrounds with 250 electric and non-electric sites. Restroom and shower facilities are located on each of the six loops. In addition, there is a fish cleaning area, a store and a swimming beach. The campground is open from April 1 through October 31. With management approval, campsites may be made available during the off-season. There is no limit on campground stays.

Little Grassy Campground is a concession-operated campground and marina that has 130 electric and non-electric campsites. There is a restroom and shower facility. A store offers bait, food items and boat rental. The campground is open from April 1 through October 31 with limited campsites available during the off season.

Devils Kitchen Campground is a concession-operated campground and marina that has 45 electric and non-electric campsites. The campsites are tiered, because they are located on a steep hill. There is a restroom and shower facility. A store offers bait, food items and boat rental. The campground is open from April 1 through October 31 with limited campsites during the off season.

Figure 14: Crab Orchard NWR Campground Visits Per Year

Crab Orchard Boat & Yacht Club, a private organization, operates a marina and a campground with 40 electric campsites under a lease contract. Membership is required to use any part the facility. Camping is permitted with an annual membership.

Figure 14 summarizes campground visits to the Refuge.

Wildlife Observation

Wildlife observation is the most popular activity occurring on the Refuge, and there are many good observation areas on the Refuge. Points of interest, trails, auto tours and viewing blinds have been developed in an effort to encourage and enhance wildlife viewing. Figure 15 identifies existing observation blinds and decks.

The Route 148 observation platform is located approximately 2 miles south of the Visitor Center. The platform has interpretive signs and offers a good view of an open field, but only adequate viewing of a pond area. There is a large, paved parking lot.

Wolf Creek Causeway is a very popular location when wintering waterfowl are present. The parking lot is used to view birds from automobiles.

Waterfowl Display Pond is located on Wolf Creek Road about one-half mile north of the causeway. There is a roadside pull-off area from which visitors can view waterfowl at the 1-acre pond, which is about 100 yards west of the road.

Bald Eagle Lane is located off Spillway Road and offers a view of Grassy Bay and an occasional Bald Eagle sighting. There is a Bald Eagle nest not too far from this site.

The Devils Kitchen Dam observation area offers good viewing of the lake. The area has a restroom, parking lot, picnic table, grassy area and trail leading to the bottom of the dam.

Devils Kitchen Line No. 11 offers a good view of the lake.

Little Grassy Lake Dam overlook offers an excellent view of the lake. The area has enough room for a few automobiles and is occasionally congested when anglers use it as a parking lot.

Hiking Trails

Hiking is permitted throughout the public use area of the Refuge. Refuge volunteers maintain seven trails that are open to the general public and one trail that is provided for educational purposes only. Numerous fire trails have served as hiking trails on the Refuge. The following is a list of maintained trails.

Harmony Trail: The trail is about 1 mile long and is a self-guided, non-interpretive trail. The trail has an A-frame structure with interpretive panels at the trailhead. There is an observation blind on this trail at the edge of a moist-soil unit. The trail receives heavy use, especially during the spring and fall.

Prairie Trail: Located across from the Harmony Trail, this trail makes a circle through a 7-acre prairie restoration area. Currently the trail is used very little, because it is not well defined or interpreted.

Figure 15: Observation Areas on Crab Orchard NWR

Wild Turkey Trail: Located across from Devils Kitchen Line No. 12 on Tacoma Lake Road, the 2-mile trail zigzags through a pine plantation and continues along a ridge top, ending at a gravel parking lot on Grassy Road. The trail has been signed at the trailheads and throughout the trail.

Devils Kitchen Line No. 17: This loop trail is an asphalt road that has been closed to automobile traffic. It borders and offers access to the Crab Orchard Wilderness. There is a large, paved parking lot at the trailhead.

Visitor Center Trail: The trail is located next to the Visitor Center. The first quarter mile is universally accessible and has three benches and four interpretive signs. A new half-mile section completes the loop trail. The new section awaits an asphalt surface.

Homestead Trail: The gravel, 1-mile loop trail next to Refuge Headquarters is designed as an environmental education trail. It has an observation deck and a study platform.

Rocky Bluff Trail: The trail is the most popular trail on the Refuge. Located across from Devils Kitchen Line No. 11, the trail offers a magnificent view of a unique part of the Refuge. The 1.9 mile loop trail crosses the Wild Turkey Trail at mid-point. During the spring, volunteers lead wildflower walks along the trail.

The National Trail System Act of 1968 (Public Law 90-543) authorized creation of a national trail system comprised of National Recreation Trails, National Scenic Trails and National Historic Trails. Legislation is pending in Congress to add National Discovery Trails as a new category of long-distance trails and designate the American Discovery Trail as the first National Discovery Trail. The proposed American Discovery Trail covers more than 6,000 miles from Delaware to California. The Southern Midwest Route of the American Discovery Trail crossing Illinois would overlay most of the River to River Trail, which runs about 146 miles from Battery Rock on the Ohio River to Grand Tower on the Mississippi River for a distance of about 176 miles (River to River Trail Society, 1995).

In late 1997, the Shawnee National Forest drafted a memorandum of understanding (MOU) between the Shawnee National Forest, the Refuge, and the River to River Trail Society to formalize maintenance responsibilities and alignment of the River to River Trail along a tentative route through the Crab Orchard Wilderness. The parties have not agreed to or signed the MOU.

Boating

Boating has long been a popular activity on the Refuge. When Crab Orchard Lake was completed in 1940, it was the largest man-made lake in Illinois. Crab Orchard Lake hosted professional outboard motor races in 1947. In 1953, the Southern Illinois Sailing Club moved from St. Louis to Crab Orchard Lake. Over the past 50 years boating on Crab Orchard Lake has changed with the times, from 25 hp outboards in the 1940s to jet skis and house boats today.

The Refuge offers boating on Crab Orchard, Devils Kitchen, and Little Grassy lakes. Crab Orchard Lake has 13 improved boat launching facilities; three ramps are provided on Devils Kitchen Lake; four are provided at Little Grassy Lake (see Figure 16). The lakes and boating facilities are described in the following paragraphs.

Crab Orchard Lake

Crab Orchard Lake is the largest of the three main lakes and covers approximately 7,000 acres. The area west of Wolf Creek Road is open all year and serves as a multi-recreation area for pleasure boating of all types (jet skis, house boats, runabouts, sail boats, and pontoons) and fishing. The area east of Wolf Creek Road is open March 15 to September 30. Thirteen boat ramps offer access to the lake.

Three marinas are operated on Crab Orchard Lake. The Refuge operates Playport Marina and the former Images Marina. Crab Orchard Boat & Yacht Club offers docks, slips, a picnic area and campsites to members only.

Devils Kitchen Lake

The smallest and most scenic of the three lakes, Devils Kitchen Lake covers approximately 800 acres. Care must be used when boating in the lake because numerous trees lie just under the water's surface. The lake is used for boating, canoeing, and fishing. Outboard motors on the lake are limited to 10 horsepower. There are three public boat ramps and one marina on the lake.

Figure 16: Boat Launches on Crab Orchard NWR

Little Grassy Lake

Little Grassy Lake covers approximately 1,000 acres. The lake is heavily used by the public, four group camps and Southern Illinois University's Touch of Nature Environmental Center for fishing, boating, swimming and canoeing. The lake is scenic and has some underwater hazards from trees. Outboard motors on the lake are limited to 10 horsepower. There are four public boat ramps and one marina on the lake.

Swimming

Swimming has long been a popular activity on the Refuge. At one time the Refuge supported six public beaches – four on Crab Orchard Lake and one each on Devils Kitchen Lake and Little Grassy Lake.

The Soil Conservation Service ran two concession-operated beaches on Crab Orchard Lake at the time the area was transferred to the Department of the Interior. Each beach had a beach house with showers, changing area, and vending area. Subsequently, the Fish and Wildlife Service ran these beaches (Hogan's Point and Crab Orchard) as fee areas. The Service also created beaches at Carterville and Lookout Point. In 1973, the Crab Orchard Beach and Hogan's Point Beach were closed and Carterville and Lookout Point were placed under concession contracts.

Today swimming is allowed in Crab Orchard and Little Grassy lakes and prohibited in Devils Kitchen Lake. In 1994, Carterville and Lookout Point beaches were removed from concession contract. The Service then ran Carterville Beach as a recreational area and Lookout Point was closed. Because the Refuge was not able to meet public health standards at Carterville Beach, the beach was closed in 1998. The Refuge expanded the beach at the Crab Orchard Campground and the concessionaire opened the beach to the general public. The Little Grassy Campground also operates a beach that is open only to campers.

Picnicking

From the late 1940s through the 1960s, picnicking was a very popular activity on the Refuge. In 1961 there were 20 designated picnic areas with more than 200 picnic tables. When the Refuge experienced a $75,000 budget cut in non-program uses in 1973, several picnic areas were closed. Today picnicking is encouraged in four locations on the Refuge. The areas vary in size, character and type of use (see Figure 17).

Cambria Neck: This is the largest of the picnic areas. The area has several picnic tables with grills, a restroom, a gravel boat ramp and parking lot. The area is open during warm season months for picknicking and fishing.

Greenbriar: This area has a parking lot, a restroom, an accessible fishing dock and three picnic tables and grills. The area is used mostly by anglers fishing along the bank.

Harmony Trail: The area has a heated restroom, a large parking lot and two concrete picnic tables. The area is used mainly by school groups and trail visitors.

Wolf Creek Recreation Area: This area is mostly used by anglers fishing from the bank. The area has five picnic tables and grills, a restroom, and fishing access.

Horseback Riding

Regulations controlling horseback riding on Crab Orchard NWR have seen several changes over the years. During the 1960s and up to 1979, horseback riding was permitted only in areas designated by signs or on marked horseback trails. In 1979, the regulation permitted horseback riding only on existing paved or graveled roads in the open area (public use area) of the Refuge. In 1984, the regulation prohibited horses in concession, agriculture and grazing areas.

Even though the 1984 regulation allowed horseback riding in most of the public use area, this activity is concentrated in the more wild and scenic southern portion of the Refuge. In 1976, much of

Marion Boat Club, 1945

Figure 17: Picnic Areas on Crab Orchard NWR

Figure 18: Annual Group Camp Attendance at Crab Orchard NWR, 1997-2001

this southern portion was designated as the Crab Orchard Wilderness and horseback riding was not allowed. In the past two decades, probably as a result of lax enforcement, horseback riding in the Wilderness has become increasingly common. Equestrians typically ride on old abandoned roads and user-defined trails within the Wilderness and adjacent lands. Recently there has been a marked increase in the development of unauthorized trails in the Wilderness.

Several organizations have proposed developing trails in the Wilderness for hiking and horseback riding. In 1980 the Shawnee Trails Conference, Inc. proposed the 130-mile MISHIO trail traversing southern Illinois from Grand Tower on the Mississippi River to Cave-in-Rock on the Ohio River. The Refuge Manager decided not to authorize any trail construction in the Wilderness based on the unsuitable soil and steep slopes. The Refuge's Master Plan, finalized in 1979, also recommended that no trails be developed for these same reasons. The Crab Orchard Wilderness Management Plan (1985) states: "No trail construction will be undertaken in the future …" In 1993 The River to River Trail Society sought permission to realign the River to River Trail from public, paved roads to a route through the Wilderness. The Refuge Manager requested more details from the Society regarding design criteria, layout, construction and maintenance, as well as modes of travel and expected levels of public use, to assess the impacts on the Wilderness and the Refuge in general. In 1997 volunteers laid out and cleared a tentative route, but the proposal has not been formally evaluated. Later that year a formal Memorandum of Understanding between the Society, the Refuge and the U.S. Forest Service was drafted to define trail alignment and maintenance responsibilities, but it has not been signed.

Group Camps

Four group camps are located on Little Grassy Lake. The camps operate under a cooperative agreement with the Refuge.

Annually, approximately 5,700 people attend the United Methodist Church Camp and 1,200 attend Camp Carew, a Presbyterian Church camp.

The Boy Scouts of America camp, Pine Ridge, is primarily a day use facility that is active throughout the year. Approximately 6,000 Scouts attend the camp each year.

The Girl Scouts camp, Camp Cedar Point, is recognized as one of the oldest Girl Scout camps in the nation. The camp is active throughout the year. Approximately 7,000 Scouts attend this camp.

Almost 20,000 campers participate in group camping activities on the Refuge every year (Figure 18).

Environmental Education

The Refuge provides educational assistance to area teachers, educators, and Refuge group camps. Refuge staff, interns, and volunteers present both on-site and off-site educational programs to area school groups, Boy Scout groups, and other organizations upon request. In addition, each group camp is required to provide a minimum of 1 hour of environmental education each day to campers. The Refuge provides camp instructors with workshops and lesson plans prior to each camping season.

Educational materials (books, posters, videos, and other supplies) are maintained by the Refuge and are available for loan to area educators. Educational kits focusing on key concepts and resources are also available for loan. In addition, Refuge staff provide assistance with curriculum development and with special event programs conducted by other agencies and organizations.

Interpretation

Interpretive programs are given by Refuge staff and volunteers to school, civic and other groups. The programs are presented through automobile tours, talks and walks. Some of the better attended programs include Bald Eagle tours, wildflower walks and owl prowls. The Refuge also presents its interpretive message through bulletin boards, signs and wayside exhibits. Visitor services staff presented 114 programs to more than 3,400 individuals in 2001.

Visitor Center

The Visitor Center contains an information and exhibit area, auditorium/conference room, book store and office space for visitor services staff. Built in 1941, the building originally housed a fire station. The building was renovated in 1993 and has 3,455 square feet. Approximately 1 million people visit the Refuge every year, and the Center receives approximately 40,000 of those visitors. Visitor Center staff answer questions, issue user passes, host workshops and conferences, present interpretive programs, and check-in deer and turkey hunters.

Existing Transportation Patterns and Visitor Facilities

Crab Orchard NWR is located in southern Illinois relatively close to Arkansas, Indiana, Kentucky, Missouri and Tennessee. Interstate highways 24, 55, 57, and 64 provide high speed routes to southern Illinois. Several state and county roads provide access to and within Refuge boundaries.

State Route 148 passes through the Refuge from north to south, passes the Visitor Center and has an average daily traffic count of 5,800. New State Route 13 crosses the northern portion of the Refuge and has an average daily traffic count of 25,000. New State Route 13 provides the primary access to the developed recreation sites in the northwestern portion of the Refuge. Interstate 57 passes through the eastern portion of the Refuge and has an average daily traffic count of 26,900.

The Refuge also maintains an extensive system of roads within its boundaries. According to a 2001 survey of Refuge roads completed by the U.S. Department of Transportation, Crab Orchard National Wildlife Refuge maintains 38 miles of paved surface roads and 17 miles of gravel roadway for a total of 56 roadway miles. And additionally, 1.1 million square feet of parking area, 21 boat launch ramps, and three universally accessible areas are also maintained by Refuge personnel.

Special Management Areas

Wilderness

Congress designated the Crab Orchard Wilderness as a unit of the National Wilderness Preservation System on October 19, 1976, when it enacted Public Law 94-557. The 4,050-acre Wilderness was the first in the State of Illinois; seven additional wilderness areas have since been established on the Shawnee National Forest. The Crab Orchard Wilderness is located in the extreme southern portion of the Refuge bordering the shores of Devils Kitchen and Little Grassy lakes. (See Figure 1 on page 2.) A Wilderness Management Plan was approved for the Crab Orchard Wilderness in 1985.

The rugged terrain of this unglaciated land is interlaced with numerous creeks. The vegetation cover in the Crab Orchard Wilderness is predominantly second growth deciduous forest on slopes and typical old-fields with scattered trees, brush and small grassy openings along ridges. There are more than 700 acres of plantations, including 400 acres of hardwood (mostly black-locust) and 325 acres of non-native pine and pine-hardwood. Invasive species, such as autumn-olive, multiflora rose, Japanese honeysuckle, Amur honeysuckle and Oriental bittersweet, are common throughout the Wilderness, and likely to become more problematic. The Wilderness contains numerous old house sites with relic exotic ornamental plants, sandstone pillars, open wells, ponds and trash. There is one known cemetery (Baker) located in the north central portion. Rocky Comfort Road, which is maintained by Williamson County, runs north and south through the area.

The Wilderness Act of 1964 permits certain activities within designated wilderness areas that do not alter natural processes. Wilderness values are preserved through a “minimum tool” approach that requires the Refuge to use the least intrusive methods, equipment and facilities necessary for adminis-

Crab Orchard Wilderness Area

tering the areas. The Refuge staff maintains boundary signs and barricades to prevent vehicle trespass and occasionally patrols in the area. There are no research projects presently being conducted within the Wilderness.

Visitor activities in the Crab Orchard Wilderness include hunting, hiking, horseback riding, nature study, and mushroom picking. Although horseback riding was prohibited when the Wilderness was designated, this use has become increasingly common in the years since then, likely as a result of lax enforcement. Hikers and horseback riders generally follow old roads and user-defined trails, which have become eroded in some places especially on the steeper slopes. Horse traffic, though generally light, has disturbed the fragile soils along the trails. Most damage occurs during winter and spring when the ground is wet and soft.

The Crab Orchard Wilderness is located near the population center of southern Illinois and is readily accessible to visitors who seek solitude in a natural setting. The primary access points are along Rocky Comfort Road, Devils Kitchen Lines #9 and #17, Antioch Cemetery Road, and West Liberty Cemetery Road. The Wilderness is also accessible by boat from Little Grassy and Devils Kitchen lakes. The number and distribution of visitors in the Wilderness are not well documented. A study was conducted by Reeder (1977) soon after Wilderness designation to characterize public use by surveying 128 visitors. A more detailed study by McCurdy and others (1994) described the demographics and recreation use patterns of visitors to five wilderness areas on the Shawnee National Forest, one of which was Panther Den Wilderness which is adjacent to the Crab Orchard Wilderness.

Inholdings and Lands Contiguous to the Crab Orchard Wilderness

The entire northern boundary and almost all of the western boundary of the Wilderness border other Refuge land (see Figure 1 on page 2). Much of the northern boundary is formed by the Little Grassy and Devils Kitchen lakes, which are man-made reservoirs. At the time of designation, the Wilderness designation excluded an inholding and another parcel surrounded by Wilderness on three sides, both owned by Southern Illinois University. Through a land exchange in 1979, the Refuge acquired these tracts, which together constitute about 120 acres. An additional 558-acre tract contiguous with the southern boundary of the Crab Orchard Wilderness was acquired in the same land exchange. Rocky Comfort Road runs north-south through this tract.

Lands on the southern boundary of the Wilderness include the 779-acre Panther Den Wilderness, managed by the USDA Forest Service. Additional lands are owned by Southern Illinois University and private individuals. Neighboring lands are primarily second growth forest with a few fields making up the rest of the boundary. Lands adjacent to the eastern boundary of the Wilderness are primarily fields in private ownership. .

Research Natural Areas

The Service administratively designates research natural areas (RNA), which are part of a national network of reserved areas under various ownerships. RNAs are intended to assist in the preservation of examples of all significant natural ecosystems for comparison with those influenced by man, to provide educational and research areas for scientists to study the ecology, successional trends, and other aspects of the natural environment, and to serve as gene pools and preserves for rare and endangered species of plants and animals. In RNAs, as in designated Wilderness, natural processes are allowed to predominate without human intervention. Under certain circumstances, deliberate manipulation may be used to maintain the unique features for which the RNA was established. Activities such as hiking, bird watching, hunting, fishing, wildlife observation, and photography are permissi-

Figure 19: Research Natural Areas on Crab Orchard NWR

Table 8: Research Natural Areas on Crab Orchard NWR

Name	Area (Acres)	Date Established
Crab Orchard Creek Bottoms	105	1970
Devils Kitchen Dam	130	1970
Post Oak Flats	22	1970
Area 10	40	1972
Big Grassy Creek	210	1972
Crab Orchard Cemetery	70	1972
Devils Kitchen Lake	136	1972
Little Grassy Creek	20	1972
Pigeon Creek	40	1972
Post Oak Flats Addition	50	1972
The Oxbow	160	1972
Wolf Creek Bay	40	1972
Wolf Creek East Tributaries	330	1972
Total	1,353	

ble, but not mandated, in RNAs. Thirteen RNAs totaling 1,353 acres have been established on the Refuge (Figure 19 and Table 8).

Conservation Easements

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

The Refuge manages 24 conservation easement areas totaling 490 acres located within the Crab Orchard Fish and Wildlife Management District, a 21-county area in southern Illinois (see Figure 20). Inadequate staffing levels have impeded proper management of the widely dispersed easements. Some of the easements have not been surveyed or marked on the ground. The easements should be inspected regularly, but some have not been inspected in over ten years. Without appropriate monitoring the easements and their resources can not be protected from the myriad forms of encroachment.

Industrial Use Status and Trends

In 1942, the eastern portion of the Crab Orchard Creek Project was transferred to the War Department for construction of the Illinois Ordnance Plant. The War Department acquired additional lands for its purposes. The Illinois Ordnance Plant was built during 1942 as a loading site for high explosive shells, land mines, bombs and components.

Initially, the Illinois Ordnance Plant contained 536 buildings with approximately 2.3 million square feet of space, water and sewage treatment plants and distribution systems, power and telephone utility systems, 88 miles of railroad track, 93 miles of access and service roads, parking for 6,900 vehicles, nine steam generating plants and a peak wartime employment of approximately 10,000 workers. The Illinois Ordnance Plant ceased ordnance operations in 1945 with the end of World War II.

When the War Department and Soil Conservation Service lands were transferred to the Department of the Interior in 1947, approximately 1.6 million square feet of space suitable for industrial leasing were included in the transfer.

From 1947 to 1978, the Refuge leased buildings to a variety of tenants. Conventional buildings were used for the manufacture of munitions, boats, stencil board, marking machines, mobile homes, inks and brushes. A vocational training school also operated in the buildings. Cold storage warehouses were used for washer/dryer parts storage, beverage distributorship, freight terminal and office space, among other things. Igloo type buildings were leased primarily by munitions manufacturers, fireworks distributors, and coal mining companies for storage of explosives or explosive components.

In 1978, in a master planning process, the Service considered divesting the industrial operations on the Refuge. A 250-acre tract of land was identified on the north boundary of the Refuge as an industrial park for the relocation of existing indus-

Figure 20: Conservation Easements Administered by Crab Orchard NWR

trial tenants. The industrial park concept failed due to distance requirements of munitions manufacturing, costs related to relocation of industrial operations, and the industrial purpose specified in the public law that created the Refuge.

In 1981, in a cooperative effort with the Industrial Tenant Association, the Service implemented a new industrial policy and new lease contracts. The policy and leases have served as guidelines in the administration of the industrial complex since 1981. The industrial complex currently consists of about 1.2 million square feet. The Refuge collects about $500,000 in rental receipts each year. Rental receipts are returned to the Refuge and are used as part of its operation and maintenance budget.

Agriculture

The Refuge began farm management in 1948. The original focus of management was to:

- reclaim farmland that had been fallow during ordnance plant operations,
- improve soil fertility,
- improve farm practices,
- emphasize establishment of pasture, and
- use crops to help establish a wintering flock of Canada Geese.

The Refuge started with 35 cooperative and 18 cash farmers in 1948. By 1952, there were 60 cooperative farmers and no cash farmers. Common crops included corn, soybeans, wheat, sudan grass, oats, rye, and barley. Crop fields were in a 5-year rotation that included 2-3 years of grass or legumes. Pastures of cheat (*Bromus tectorum*) and bluegrass (*Poa* sp.) were grazed by cattle along with some horses and sheep. There were no permanent hay fields.

Hay crops were red clover (*Trifolium pratense*), lespedeza, red top (*Agrostis alba*), and timothy (*Phleum pratense*). The number of cooperators was high and the number of acres allocated to each coop-

Figure 21: Number of Agricultural Cooperators at Crab Orchard NWR, 1953, 1979, and 2001

Figure 22: Total Area of Agricultural Fields on Crab Orchard NWR, 1947-2001

erator was relatively small. In 1953, there were 99 cooperators with an average of 110 acres per cooperator (Figure 21). By 1979, there were 28 cooperators with an average of 280 acres per cooperator. In 2001, there were 20 cooperators with an average of 315 acres per cooperator

Efforts to reclaim farmland continued through the 1950s and 1960s (Figure 22). Some bottomland forest was converted to farmland. In 1963, for example, 170 acres of bottomland forest were cleared and converted to crop production. During this period, the common rotation was: corn, soybeans, winter grain, hay, hay. In 1966, 2,500 geese died from impaction of soybeans in their crops. In 1967, soybeans were dropped from the rotation and replaced with milo, and 1967 was the first year in 10 with no impaction mortality of geese on the Refuge. Soybeans were added back into the rotation in 1992. More has been learned about crop impaction in geese and there has been no subsequent impaction-related mortality.

Current row crop management emphasizes soil protection and integrated pest management. Management consists of crop rotation, no-till planting, higher weed tolerance, restricted use of herbicides, and no insecticide use.

The current rotation, which was implemented in 2005, is:

Year 1 – corn followed by rye

Figure 23: Area of Row Crop Fields, Pastures and Hay Fields in 1953, 1979, and 2001

Year 2 – soybeans (drilled) followed by winter wheat (drilled)
Year 3 – corn
Year 4 – soybeans (drilled) followed by winter wheat (drilled)
Year 5 – clover
Year 6 – clover

Approximately 300 acres are in a continuous rotation of corn and soybeans, because these areas are too wet to produce clover.

Until recently, cooperators signed 5-year agreements. In anticipation of comprehensive conservation planning, the agreements were changed to 1-year agreements until a management direction for the Refuge is specified within a plan. Cooperators bear the expense of all planting and harvesting costs. Cooperators receive 75 percent of the corn, 100 percent of the soybean harvest, and 100 percent of any second year clover they cut for hay. Crab Orchard NWR receives 25 percent of the corn and 100 percent of the winter wheat. The Refuge's share of corn and wheat are left unharvested to be used by geese and other wildlife. In 2001, approximately 4,464 acres were planted in corn, beans or clover (Figure 23). There were 244 fields with an average size of 18 acres.

The current grazing program consists exclusively of cattle grazing on fescue pastures. The grazing period runs from April 15 to November 15. To make pastures more attractive to geese, cooperators are required to have their pastures grazed or mowed to 6 inches or lower in height by October. The Refuge's pastures are in relatively poor condition with low soil fertility. Cooperators currently sign a 1-year special use permit. The grazing fee is $8.95 per animal unit month (AUM). Cooperators pay the fee through a mowing credit of $9/acre and by fertilizing the pasture. In 2001, there were 10 pastures with an average size of 108 acres – approximately 863 acres were grazed and 220 acres were cut for hay.

The current hay program consists of improved timothy fields and unimproved fields that are mostly old fescue pastures. Cooperators are allowed as many cuttings as a field will produce each year, and they are required to cut their field to 6 inches or shorter by October. The Refuge's hay fields currently have low soil fertility. In 2001, cooperators paid $8.50 per ton of hay. Payment is made by fertilizing their field. In 2001, approximately 767 acres were cut for hay. There were 22 fields with an average size of 34 acres.

Archaeological and Cultural Values[2]

Several investigations have shown that humans have exploited southern Illinois, with its great variations in topography, geology, and vegetation, for over 10,000 years. People of the nomadic hunter-gatherer PaleoIndian (10,000 to 8,000 BC) and

2. *This section is derived from the report, "Cultural Resource Management Plan for Cultural Resources Within the Crab Orchard NWR" (3 vols.) by Anthony Godfrey and Donna Stubbs, dated August 2001, as well as other cultural resources reports of studies at the Refuge from 1951 to the present.*

Archaic (8000 to 600 BC) cultures found rich lithic resources for tools, rock overhangs for shelter, and animals and plants from both forests and prairies for subsistence. Late Archaic people began farming the prairies to supplement their hunting and gathering procurement. People of the Woodland culture (600 BC to AD 1000) acquired pottery and the bow and arrow and increased reliance on farming, with cultural influences that came from the west via the Mississippi River and from the east via the Ohio and Illinois rivers. The Refuge area was the center for the Woodland Crab Orchard Tradition, the archeological site type now flooded by Crab Orchard Lake. Woodland people were further influenced by the flowering of the Hopewellian and Mississippian culture (AD 1000 to 1500), resulting in the establishment of small agricultural communities in the Refuge area. Southern Illinois essentially became depopulated from about AD 1500 until after the first European contact in AD 1673, although groups of displaced eastern tribes intermittently settled the area.

Euro-American settlers began arriving in the early 19th century, primarily from Kentucky, Tennessee, and the Carolinas. Even earlier, George Rogers Clark passed through Williamson County and possibly the Refuge area in 1788 while taking Illinois from British control. Subsequent settlers constructed fortifications for protection; three blockhouses were located on or near the Refuge.

Settlements established before the mid-1800s near what is now the Refuge were Russell Corners on Eight Mile Prairie, Bainbridge and Phelps Prairie on Phelps Prairie, Cottage Home and Fredonia. One settlement located on what is now Refuge land was the village of Chamnesstown (later known as Mousertown), which became a center for agricultural trade.

By the 1930s farmsteads and small towns covered the Refuge area. Documents indicate at least 28 farmsteads and habitations, 34 cemeteries, three churches, 12 schools, and two towns within the Refuge boundaries.

About 1,000 acres of the Refuge have been subjected to controlled and reported archeological survey and investigation. One hundred and thirty-six prehistoric sites have been reported on the Refuge, and human remains have been identified for at least 98 persons. Moreau Maxwell conducted the important excavation of the Sugar Camp Hill site 11-WM-1 in 1939 and identified the Crab Orchard Tradition before the site was covered by Crab Orchard Lake.

Peithman Collection, Crab Orchard NWR

The artifacts from this work have been dispersed to various museums; many artifacts can no longer be located.

Some subsequent investigations at the Refuge in the 1950s and 1960s have had similar or worse problems. Reyman reported a survey from which artifacts, field notes and other documents have all been lost. The Refuge contracted, as part of its 1978 master planning, for an inventory of 28 recorded and reported sites on the Refuge, but documentation was still incomplete. During the 1980s and 1990s several investigations have occurred on the Refuge for which reports have been completed and collections are curated at appropriate repositories. Recent studies indicate settlement patterns in the Crab Orchard Creek basin may be more complex than previously thought.

As of October 1, 2001, there were no National Register properties on or in the vicinity of the Refuge.

The area of the Refuge having been vacated of most human occupancy from approximately 1500 and resettled by historic period tribes from the 17th to 19th centuries, modern descendants of prehistoric cultures have not been identified. Three historic period tribes have legal or occupancy claims to the Refuge area. The Kaskaskia (part of the Illiniwek or Illinois, now part of the Peoria Tribe) were declared by the Indian Claims Commission as having jurisdiction over most of southern Illinois. The Piankashaw, a sub-group of the Miami tribe, historically were in southern Indiana, then in southeastern Illinois with a short-term reservation 75 miles northeast of the Refuge, but actual occupation there was historically late, brief, and tenuous. The Indian Claims Commission determined the Piankashaw to

Table 9: Most Frequently Cited Offences on Crab Orchard NWR, 1997-2001

Offence	1997	1998	1999	2000	2001	Totals
Trespass	73	109	118	93	68	461
No Entrance Pass	57	103	91	73	49	373
State Vehicle Code	9	15	11	10	9	54
State Hunting Law	8	10	13	9	6	48
No Fishing License	25	21	14	19	17	96
Underage Drinking	16	21	29	20	10	96
Under Influence	3	11	14	8	5	41
Unauthorized Fire	7	5	12	9	6	39
Violate Posted Sign	4	6	9	7	8	34
Illegal Transport Alcohol	33	41	54	19	21	168
Special Regulations	17	15	29	12	28	101
Public Indecency	15	11	7	14	6	53
Possession of Controlled Substance	43	52	39	31	24	189
Off-road Vehicle	6	9	6	10	4	35
Total	316	429	446	334	261	1,788

be legally part of the Peoria tribe and later became the United Peoria and Miami. The third tribe was the Shawnee, who had homes in Ohio and Missouri and used southern Illinois as transient travelers. The Indian Claims Commission identified Shawnee villages in the 18th century in Illinois south of the Kaskaskia on the Mississippi, south of Grayville on the Wabash, and along the Ohio River.

Although Indian tribes are generally considered to have concerns about traditional cultural properties, the several church groups (and possibly other groups) formerly within the Refuge boundaries could also have similar concerns.

The Refuge archeological collections contain prehistoric artifacts currently not associated with any modern tribe. Furthermore, the collections contain human remains but no funerary objects, sacred objects or objects of cultural patrimony as defined in the Native American Graves Protection and Repatriation Act. Although sites of historic period Indian occupation have not been identified on the Refuge, they may exist and contain cultural items.

Law Enforcement

Enforcement of Federal wildlife laws, regulations specific to the Refuge System, and State laws is an essential part of Refuge operation. Law enforcement plays a crucial role in ensuring that natural and cultural resources are protected and that visitors have a safe environment. The Refuge currently has five employees, three full-time and two collateral duty, who conduct law enforcement duties on the Refuge. Cooperative relationships exist with state conservation officers and all county sheriff departments in the area. Table 9 displays the most frequently cited offences between 1997 and 2001.

Socioeconomic Environment

Economic Setting

The study area for estimating the economic effects of the recreational, agricultural and commercial use of the Refuge is defined as Williamson and Jackson counties. Most visitors to the Refuge (about 89 percent) come from within a 50-mile radius of the Refuge, and about 90 percent of these visitors come from Williamson and Jackson counties. Since most visitors come from these two counties, most of the economic impact of Refuge visitation occurs within these counties. All of the commercial activities that take place on the Refuge are within these counties.

Williamson County contains almost all of the Refuge lands. Williamson County was established in 1839 with Marion as the county seat. Major communities include Marion, Herrin, Carterville, Johnston City, Pittsburg and Creal Springs.

Jackson County contains portions of Little Grassy Lake. The county was established in 1816. Most of the county's residents live in one of three cities: Carbondale, DeSoto, and Murphysboro, which is the county seat.

Table 10: Williamson County and Jackson County, Illinois and the United States Population, Percentage Change 1980, 1990, 2000

				Percent Change		
	1980	1990	2000	1980-1990	1990-2000	1980-2000
Williamson County	56,846	57,717	61,296	1.5	6.20	7.8
Jackson County	61,846	61,055	59,612	-1.30	-2.40	-3.60
Illinois	11,434,702	11,446,979	12,419,293	0.10	8.50	8.60
United States	227,224,719	249,464,396	281,421,906	9.80	12.80	23.90

Table 11: Demographic Profile of Jackson County, Williamson County, Illinois and the United States

	Jackson County	Williamson County	Illinois	USA
Population, percent change 1990-2000	-2.40	6.20	8.60	13.10
White, percent	80.80	95.30	73.50	75.10
Black or African American, percent	13.00	2.50	15.10	12.30
American Indian and Alaska Native, percent	0.30	0.30	0.20	0.90
Asian, percent	3.00	0.50	3.40	3.60
Hispanic or Latino origin, percent	2.40	1.20	12.30	12.50
Home ownership rate, percent	53.3.	73.60	67.30	66.20
Persons per household	2.21	2.35	2.63	2.59
Persons below poverty level, percent	21.00	14.90	11.30	13.30

Population

Table 10 compares the population growth of Williamson and Jackson counties, Illinois, and the United States from 1980 to 2000. Williamson County population grew at a slower rate than the state but substantially less than the U.S. from 1980 to 2000. The 1990s was a period of significantly increased growth for both Williamson County and the state, but both lagged behind national population growth.

Jackson County population declined while the State and U.S. population grew from 1980 to 2000. From 1990 to 2000, Jackson County lost population compared with significant increases in the state and U.S. population.

Demographic information for Williamson and Jackson counties is provided in Table 11.

Employment

Table 12 shows full- and part-time employment by major business sector in Williamson County in 1980 and 2000. The majority (68 percent) of county employment in 1980 was in four sectors: services, retail trade, government and manufacturing. These four sectors accounted for 75 percent of county employment in 2000.

Employment growth in Williamson County generally outpaced state growth from 1980 to 2000. Williamson County has had a substantially higher unemployment rate than either the state or the U.S. However, since 1983, Williamson County unemployment rates have slowly declined so that they more closely resemble state and national unemployment rates.

Table 13 shows the major employment sectors in Jackson County for 1980 and 2000. In 1980, the major sectors – government, services and retail trade – totaled 73 percent of county employment. In 2000, government, services and retail trade accounted for 80 percent of county employment.

Table 12: Employment by Major Business Sector, Williamson County, 1980 and 2000

Sector	1980	Percent of Total Employment	2000	Percent of Total Employment	Percent Change in Employment, 1980-2000
Farming	788	3.80	591	1.90	-25.00
Mining	1,046	5.00	124	0.40	-88.10
Construction	1,443	6.90	2,105	6.80	45.90
Manufacturing	3,440	16.50	3,119	10.10	-9.30
Transportation/Public Utilities	1,293	6.20	1,681	9.50	30.00
Wholesale Trade	942	4.50	837	2.70	-11.10
Retail Trade	3,541	16.90	6,174	20.10	74.40
Finance, Insurance, and Real Estate	1,226	5.90	2,414	7.90	96.90
Services	3,615	17.30	8,166	26.60	125.90
Government	3,488	16.70	5,534	18.00	58.70
Total Employment	20,909	100.00	30,745	100.00	47.00
Illinois Total Employment	5,688,059	100.00	7,442,406	100.00	30.80

Table 13: Employment by Major Business Sector, Jackson County, 1980 and 2000

Sector	1980	Percent of Total Employment	2000	Percent of Total Employment	Percent Change in Employment 1980-2000
Farming	1,061[1]	3.50	973	2.50	-12.70
Mining	662	2.20	89	0.20	-86.60
Construction	1,119	3.70	1,729	4.50	54.50
Manufacturing	1,742	5.70	1,469	3.80	-15.70
Transportation/Public Utilities	1,473	4.90	1,062	2.70	-27.90
Wholesale Trade	488	1.60	460	1.20	-5.70
Retail Trade	5,548	18.30	7,285	18.80	31.30
Finance, Insurance and Real Estate	1,663	5.50	2,056	5.30	23.60
Services	5,828	19.20	9,920	25.50	70.20
Government	10,783	35.50	13,784	35.50	27.80
Total Employment	30,367	100.00	38,827	100.00	27.90
Illinois Total Employment	5,688,054	100.00	7,442,406	100.00	30.80

1.Equals 5-year average 1980-84.

Employment Earnings and Personal Income[3]

Employment earnings in Williamson County totaled $604 million in 1980 and $789 million in 2000, an increase of 31 percent. This compares with a 51 percent statewide increase. Table 14 shows employment earnings for Williamson County by major employment sectors for 1980 and 2000.

Employment earnings in Jackson County totaled just under $750 million in 1980 and about $985 million in 2000, an increase of 32 percent. Table 15 shows employment earnings for the major employment sectors in Jackson County.

3. All dollar figures have been adjusted for inflation for year 2000 dollars.

Table 14: Employment Earnings by Major Business Sector, Williamson County, 1980 and 2000

Sector	1980 (thousands)	Percent of Total Employment	2000 (thousands)	Percent of Total Employment	Percent Change in Employment, 1980-2000
Farming	$1,985	0.30	$3,418	0.40	72.20
Mining	$75,082	12.40	$2,655	0.30	-96.50
Construction	$59,209	9.80	$56,674	7.20	-4.30
Manufacturing	$111,770	18.50	$102,425	13.00	-8.40
Transportation/ Public Utilities	$56,286	9.30	$75,755	9.60	34.60
Wholesale Trade	$29,358	4.90	$28,209	3.60	-3.90
Retail Trade	$72,557	12.00	$92,471	11.70	27.40
Finance, Insurance and Real Estate	$16,200	2.70	$41,944	5.30	158.90
Services	$77,965	12.90	$166,231	21.10	113.20
Government	$103,644	17.20	$219,532	27.80	111.80
Total Employment Earnings	$604,056	100.00	$789,314	100.00	30.70
Illinois Total Employment Earnings	$194,155,230	100.00	$293,692,287	100.00	51.30

Table 15: Employment Earnings by Major Business Sector, Jackson County, 1980 and 2000

Sector	1980 (thousands)	Percent of Total Employment	2000 (thousands)	Percent of Total Employment	Percent Change in Employment, 1980-2000
Farming	$5,420	0.70	$12,347	1.30	127.80
Mining	$51,687	6.90	$3,342	0.30	-93.50
Construction	$43,395	5.80	$51,886	5.30	19.60
Manufacturing	$45,965	6.20	$41,334	4.20	-10.10
Transportation/Public Utilities	$57,067	7.60	$47,429	4.80	-16.90
Wholesale Trade	$13,131	1.80	$11,373	1.20	-13.40
Retail Trade	$93,030	12.50	$98,023	9.90	5.40
Finance, Insurance and Real Estate	$23,438	3.10	$30,692	3.10	30.90
Services	$12,253	16.10	$234,441	23.80	95.00
Government	$297,359	39.80	$454,432	46.10	52.80
Total Employment Earnings	$749,284	100.00	$985,299	100.00	32.00
Illinois Total Employment Earnings	$194,155,230	100.00	$293,692,287	100.00	51.30

Table 16 shows per capita personal income (PCPI) for Williamson and Jackson counties, Illinois, and the U.S. for 1980, 1990 and 2000. During the 1980s, PCPI growth in Williamson County was significantly lower than both the state and the U.S. However, in the 1990s county PCPI growth was fairly even with state growth and much higher than national growth. While growth rates were similar for Jackson County and the state, 2000 PCPI is almost 55 percent higher for the state than Jackson County (Table 16). Overall, from 1980 to 2000, Williamson County PCPI grew at a substantially lower rate than the state and national economies.

Table 16: Williamson County and Jackson County Per Capita Income, 1980, 1990 and 2000

				Percent Change		
	1980	**1990**	**2000**	**1980-90**	**1990-2000**	**1980-2000**
Williamson County	$18,109	$19,698	$22,641	8.80	14.90	25.00
Jackson County	$15,092	$17,559	$21,676	16.30	23.50	43.80
Illinois	$22,625	$27,419	$31,856	21.20	16.20	40.10
United States	$20,799	$27,127	$29,469	30.40	8.60	41.70

Table 17: Annual Economic Impact of Refuge Budget Expenditures

	Expenditures	**Economic Output**	**Jobs**	**Labor Income**
Salary Impacts				
Two-county Study Area	$1,212,390	$1,625,313	25.2	$547,998
Illinois	$166,888	$288,957	3.4	$106,369
United States	$18,793	$32,539	0.4	$11,978
Total Salary Impacts	$1,398,071	$1,946,809	29	$666,345
Non-salary Impacts				
Two-county Study Area	$525,030	$691,622	7.8	$213,173
Illinois	$61,605	$98,776	0.8	$33,718
United States	$184,302	$295,457	2.5	$100,864
Total Non-salary Impacts	$770,937	$1,085,855	11.1	$347,755
Total Impacts	$2,169,008	$3,032,664	40.1	$1,014,100

Table 18: Annual Tax Impacts of Refuge Expenditures

	Federal Taxes	**State and Local Taxes**	**Total Taxes**
Salary Tax Impacts			
Two-county Area	$144,950	$114,805	$259,755
Illinois	$30,631	$19,885	$50,516
United States	$3,449	$2,239	$5,688
Total Salary Tax Impacts	$179,030	$136,929	$315,959
Non-salary Tax Impacts			
Two-county Area	$52,359	$27,325	$79,684
Illinois	$9,352	$4,373	$13,725
United States	$27,376	$13,802	$41,178
Total Non-salary Tax Impacts	$89,087	$45,500	$134,587
Total Tax Impacts	$268,117	$182,429	$450,546

Table 19: Economic Impacts of Refuge Recreation in Two-county Study Area

Activity	Total Expenditures	Economic Output	Employment	Labor Income
Big game hunting	$451,620	$581,414	11	$238,742
Small game hunting	$168,260	$205,545	4	$75,604
Migratory waterfowl hunting	$1,163,229	$1,480,497	27	$624,816
Fishing	$7,347,787	$9,260,444	181	$3,972,468
Boating	$2,757,469	$3,459,091	84	$2,068,264
Wildlife observation	$4,923,785	$6,088,532	118	$2,477,711
Camping	$2,901,000	$3,655,260	72	$1,569,180
Refuge Total	$19,713,150	$24,730,783	497	$11,026,785

Impact of the Refuge Budget

Refuge budget expenditures contribute to local and regional economies. Table 17 summarizes the economic impact of both salary and non-salary budget expenditures. Separate input-output models were used to estimate the impacts of local spending, regional (in-state but not local), and out-of-state spending for both salary and non-salary expenditures. These estimates are based on the annual average Refuge budget from 1996 to 2000.

Table 18 shows the tax revenues generated by budget expenditures for each of the three spending areas and by salary and non-salary expenditures.

Economic Impacts of Refuge Recreation

The Refuge has averaged between 1.1 and 1.2 million visits per year during the 1990s. During this period, four major recreational activities – hunting, fishing, boating and wildlife observation – comprised from 37 to 89 percent of total Refuge visits. From 1995 to 2000, these activities averaged about 44 percent of all Refuge visits. Activities making up the remaining Refuge visits include Visitor Center visits, environmental education and tours.

Based on the average annual visitation over the 5-year span between 1996-2000, 66 percent of all visits were made by residents of the study area and 34 percent were made by non-residents (people residing outside the two-county study area). About 80 percent of Refuge visitors reside within 20 miles of the Refuge. A significant portion of non-resident visitors come from the St. Louis and Chicago metropolitan areas.

From 1996 to 2000, hunting visits averaged close to 44,000 annually. Most of the hunting on the Refuge is migratory waterfowl hunting (62 percent), followed by deer hunting (26 percent) and small game hunting (12 percent). Overall, about 74 percent of annual hunting visits are made by non-residents. Annually, non-residents make up about 85 percent of deer hunters, 15 percent of small game hunters and 80 percent of migratory waterfowl hunters.

During the period from 1996 to 2000, annual fishing visits to the Refuge have averaged over 210,000. Residents of the two-county area account for about 70 percent of total Refuge fishing visits.

Boating use on the Refuge has increased from 73,334 visits in 1996 to 109,420 in 2000, an increase of 49 percent. Residents make up about 60 percent of annual boating use on the Refuge.

Wildlife observation has increased from 93,692 annual visits in 1996 to 154,869 visits in 2000, an increase of over 65 percent. Most of the wildlife observation visits come from residents, comprising 80 percent of annual Refuge wildlife observation visitation.

Camping and picnicking on the Refuge averages 193,400 visits annually. Residents comprise about 80 percent of annual camping and picnicking visitation.

Recreation on the Refuge results in significant expenditures for both travel-related goods and services and activity-related equipment purchases. Table 19 shows expenditures by recreational activity along with estimates of the economic output, employment and income associated with these expenditures. The impacts were estimated using regional input-output models[4] for each of the six recreational activities.

4. *The economic impacts of recreational spending were derived using IMPLAN, a regional input-output modeling and software system. For additional information, see MIG, Inc., IMPLAN System and Olson and Lindall, IMPLAN Professional Software, Analysis and Guide.*

Table 20: Recreation Expenditures and Economic Impacts for Non-resident Visitors to the Refuge

Activity	Total Expenditures	Economic Output	Employment	Labor Income
Big game hunting	$383,877	$494,202	9	$202,931
Small game hunting	$33,652	$41,109	1	$15,121
Migratory waterfowl hunting	$930,583	$1,184,398	21	$499,853
Fishing	$2,204,336	$2,778,133	54	$1,191,740
Boating	$1,102,988	$1,383,636	33	$827,306
Wildlife Observation	$984,757	$1,217,706	24	$495,542
Camping	$580,200	$731,052	14	$313,836
Refuge Total	$6,220,393	$7,830,236	156	$3,546,329

Total expenditures shows the total annual expenditures associated with the indicated recreational activity. The figures include spending by both residents and non-residents in the two-county study area.

Economic output shows the total industrial output generated by recreation-related expenditures. Total output is the production value (alternatively, the value of all sales plus or minus inventory) of all output generated by recreation expenditures. Total output includes the direct, indirect and induced effects of these expenditures. Direct effects are simply the initial effects or impacts of spending money; spending money in a grocery store for a fishing trip or purchasing ammunition or a pair of binoculars are examples of direct effects. The purchase of the ammunition by a sporting goods retailer from the manufacturer or the purchase of canned goods by a grocery from a food wholesaler are examples of indirect effects. Finally, induced effects refer to the changes in production associated with changes in household income (and spending) caused by changes in employment related to both direct and indirect effects. More simply, people who are employed by the grocery, by the food wholesaler, and by the ammunition manufacturer spend their income on various goods and services which in turn generate a given level of output. The dollar value of this output is the induced effect of the initial (or direct) recreation expenditures. [5]

5. *More technically, direct effects are production changes associated with the immediate effects ofchanges in final demand (in this case, changes in recreation expenditures); indirect effects are production changes in those industries directly affected by final demand; induced effects are changes in regional household spending patterns caused by changes in regional employment (generated from the direct and indirect effects).*

The economic impact of a given level of expenditures depends, in part, on the degree of self-sufficiency of the area under consideration. For example, a county with a high degree of self-sufficiency (out-of-county imports are comparatively small) will generally have a higher level of impact associated with a given level of expenditures than a county with significantly higher imports (a comparatively lower level of self-sufficiency). Consequently, the economic impact of a given level of expenditures will generally be less for rural and other less economically integrated areas compared with other, more economically diverse areas or regions.

Employment and labor income include direct, indirect and induced effects in a manner similar to total industrial output. Employment includes both full-time and part-time jobs, with a job defined as one person working for at least part of the calendar year, whether one day or the entire year. Labor income in the IMPLAN system consists of both employee compensation and proprietor income (Minnesota IMPLAN Group, Inc. 1999).

Table 20 shows recreation expenditures and economic impacts for non-resident visitors to the Refuge.

The economic impacts from recreation expenditures estimated in this report are gross area-wide (two-county area) impacts. Information on where expenditures may occur locally and the magnitude and location of resident and non-resident expenditures is not currently available. Generally speaking, non-resident expenditures bring “outside” money into the area and thus generate increases in real income or wealth. Spending by residents is simply a transfer of expenditures on one set of goods and services to a different set within the same area. In order to calculate “net” economic impacts within a given area derived from resident expenditures,

Table 21: Federal, State and Local Tax Revenue Derived From Refuge-related Recreational Spending by Residents and Non-residents

	Federal Taxes	State and Local Taxes	Total Tax Revenue
Big game hunting	$46,672	$42,306	$89,043
Small game hunting	$13,013	$11,893	$24,924
Migratory waterfowl hunting	$115,180	$106,828	$222,171
Fishing	$665,325	$604,459	$1,270,722
Boating	$248,213	$175,679	$424,259
Wildlife Observation	$393,536	$375,150	$769,244
Camping	$232,080	$212,785	$444,865
Totals	$1,714,019	$1,529,100	$3,243,119

Table 22: Tax Revenue Generated by Non-resident Refuge Recreation Spending

	Federal Taxes	State and Local Taxes	Total Tax Revenue
Big game hunting	$39,671	$35,960	$75,687
Small game hunting	$2,602	$2,378	$4,984
Migratory waterfowl hunting	$92,144	$85,462	$177,736
Fishing	$199,598	$181,338	$381,217
Boating	$99,285	$70,272	$169,704
Wildlife Observation	$78,707	$75,030	$153,849
Camping	$46,416	$42,557	$88,973
Totals	$558,423	$492,997	$1,051,420

much more detailed information would be necessary on expenditure patterns and visitor characteristics. Since this information is not currently available, the gross area-wide estimates are used as an upper-bound for the net economic impacts of total resident and non-resident spending in the two-county area. The economic impacts of non-resident spending in Table 17 represents a real increase in wealth and income for the two-county area (for additional information, see Loomis p. 191 and U.S. Department of Commerce pp. 7-9).

Tax Impacts of Refuge Recreation Spending

Table 21 shows Federal, state and local tax revenue derived from Refuge-related recreational spending in the two-county area by both residents and non-residents. These estimates are based on tax regulations and policies in effect in 1998.

Table 22 shows tax revenue generated by non-resident recreation spending in the two-county area.

Economic Impacts of Refuge Agriculture, Grazing, Timber Harvesting and Commercial Use

Several different types of commercial activities take place on the Refuge. Commercial uses include: (1) the leasing of Refuge land for an industrial park and storage facilities; (2) the use of lakes within the Refuge for boat docks and marina concessions; (3) timber harvesting; (4) grazing; and (5) farming.

The industrial park currently has 14 firms leasing space. These 14 firms employ 551 people. Annual rental receipts total $506,051. Eleven buildings are currently vacant, which if leased would employ about 20 people and bring in about $55,000 in rental revenue.

The Refuge has three boat docks, four campgrounds and two marinas. Table 23 shows annual concession revenue and fees paid for each of these facilities.

The Refuge's forests are managed strictly for wildlife conservation. Forest habitat management activities, such as thinning, sometimes generate merchantable timber as a by-product. Some types of timber the Refuge has sold include pine pulpwood,

Table 23: Annual Concession Revenue and Fees Paid for Crab Orchard NWR Recreational Facilities

Recreational Facility	Revenue	Fees Paid
Devils Kitchen Marina and Campground	$53,805	$1,076
Boat & Yacht Club	$94,547	$9,454
Crab Orchard Campground	$148,553	$14,682
Little Grassy Marina and Campground	$97,582	$11,210
Playport Marina	$97,625	NA
Images Marina	$43,255	NA
Total	$535,367	$36,422

Table 24: Recreation and Refuge Budget Expenditures Compared with Study Area

Area	Industrial Output	Employment	Employment Income
Williamson County	$2,280 million	30,745	$789 million
Jackson County	$2,070 million	38,827	$985 million
Study Area Total	$4,350 million	69,572	$1,770 million
Refuge Impacts	$27.8 million	537	$12.0 million
Refuge Impacts as Percent of Study Area Total	0.64%	0.77%	0.68%

pine sawtimber, and hardwood pulpwood. Since 1989, there have been about 35 timber sales which produced $264,266 in stumpage receipts. Most of the timber harvested has been pine pulpwood, amounting to over 10,000 tons. About 2,800 tons of pine sawtimber and 425 tons of hardwood pulpwood have been harvested over the same period. On average about 1,927 tons are harvested annually with a value of $6,641.

The Refuge currently allocates 863 acres to support 375 head of cattle and 1,726 animal unit months 3 (AUM) with a value of $172,500. We assume that all cattle are yearlings, and are thus sold at the end of each grazing period. The period for cattle grazing on the fescue pastures runs from April 15 to September 30. Also, the grazing fee is $8.95 per AUM, and is paid through a mowing credit of $2.53 per AUM and by fertilizing the pasture.

In recent years, about 5,200 acres annually have been farmed on the Refuge. Crops include corn (1,877 acres with a market value of $507,000), clover (1,484 acres with a value of $320,000), soybeans (1,179 acres with a value of $212,000) and hay (767 acres with a value of $164,905). Total market value of crops grown on the Refuge is $1.2 million.

Comparison of Refuge-Related Economic Impacts to Study Area Economy

Current recreational and commercial use of the Refuge generates a considerable amount of economic effects. However, compared with either of the two counties individually or in total, the economic effects generated by the Refuge are comparatively minor. This is not to say that businesses in certain sectors in specific locations may not be significantly affected by major changes in Refuge management policy; however, in general the Refuge plays a relatively minor role in the study area economy as whole.

Tables 24 to 27 compare Refuge-related impacts to the study area economy. Table 24 compares the two major sources of Refuge economic impacts, recreation and Refuge budget expenditures, with the two-county study area. Annual industrial output for the study area (based on 1998 data) totals $4.35 billion. Refuge recreation and budget impacts total $27.8 million, 0.64 percent of the study area total. Similarly, Refuge recreation and budget impacts account for 0.77 percent of total study area employment and 0.68 percent of study area employment income.

Table 25 shows the annual number of acres farmed on the Refuge and production value compared with the study area. Farming on the Refuge typically accounts for less than 2 percent of total

Table 25: Annual Number of Refuge Acres Farmed and Production Value Compared with the Study Area

Area	Acres[1]	Value[2]
Williamson County	92,289	$10.1 million
Jackson County	202,558	$32.6 million
Study Area Total	294,847	$42.7 million
Refuge Impacts	5,231	$1.2 million
Refuge Impacts as a Percent of Study Area Total	1.8%	3.00%

1. *County data source: U.S. Department of Agriculture, 1999.*
2. *Value is based on statewide average market prices.*

Table 26: Annual Refuge Grazing and Value Compared with the Study Area

Area	Total Head[1]	Value[2]
Williamson County	5,185	$2.2 million
Jackson County	7,900	3.9 million
Study Area Total	13,085	$6.1 million
Refuge Impacts	375	$172,500
Refuge Impacts as Percent of Study Area Total	2.90%	2.80%

1. *County data source: U.S. Department of Agriculture, 1999.*
2. *Value is total county sales based on 1997 Census of Agriculture.*

Table 27: Annual Amount of Timber Harvest on the Refuge Compared with the Study Area[1]

Area	Tons Harvested	Value
Williamson County	6,090	$97,440
Jackson County	49,778	$796,448
Study Area Total	55,868	$893,888
Refuge Impacts	1,927	$6,641
Refuge Impacts as Percent of Study Area Total	3.45%	

1. *Value for Williamson and Jackson counties is based on the average price received for hardwood stumpage ($140/mbf in Illinois, November 1999 to August 2000. Value for the Refuge is based upon average stumpage receipts received by the Refuge.*

acres farmed in the study area. If only Williamson County is considered, the Refuge accounts for 5.7 percent of total acres farmed in the county. Farming on the Refuge comprises about 3 percent of total crop value in the study area. Compared with Williamson County only, Refuge crop value is 12 percent of total county crop value.

Table 26 shows Refuge grazing and value compared with the study area. The 375 head of cattle on the Refuge constitute 2.9 percent of all cattle grazed in the study area and 7.2 percent of all cattle grazed in Williamson County. Grazing value on the Refuge is 2.8 percent of the study area total and is 7.8 percent of total grazing value for Williamson County.

Table 27 shows the amount of timber harvested on the Refuge compared with the study area. Average annual tons harvested on the Refuge is 1,927, which is 3.4 percent of total tons harvested in the study area and about 32 percent of total tons harvested in Williamson County. Williamson and Jack-

son counties harvest approximately 56,000 tons of hardwoods annually, receiving about $900,000 annually. Timber value on the Refuge is 1 percent of the study area total and 7 percent of total timber value for Williamson County.

Currently, the Refuge leases about 1.2 million square feet of commercial and industrial building space. As of March 2001, the Greater Marion, Illinois, area had industrial parks and sites that included 2,231 acres (Regional Economic Development Corporation, 2002).

Current Staff and Budget

Staff

The Refuge's staffing as of January 2003 is illustrated in Figure 24.

Budget

Based on the annual average Refuge budget between 1996 and 2000, the Refuge budget includes $1.4 million in salaries and $770,937 in non-salary expenditures.

Partnerships

The Refuge has many partnerships with local, state, and national organizations. These partnerships benefit the Refuge in many ways, including fostering good community relations and enhancing Refuge habitats and wildlife populations. The Refuge intends to continue partnerships such as the following:

Southern Illinois Hunting and Fishing Days, Inc. is a non-profit organization that partners with the Refuge to promote hunting and fishing in the area. The Refuge initiated this program in the early 1980s. SI Hunting and Fishing Days assumed the lead for this activity in the early 1990s. Several thousand people now attend an annual weekend event, which is held at John A. Logan College.

Take Pride in America has been organized and worked with the Refuge since 1988. Take Pride in America has built courtesy docks for boat landings at all three lakes. Take Pride in America organized the construction of bass-rearing ponds and maintains Take Pride in America Point (formerly known as Hogan's Point) for fish-offs.

The Crab Orchard Waterfowl Association has provided funds for the construction of moist soil units on the Refuge. Quail Unlimited has provided native grass seed for Refuge prairie restoration.

Southern Illinois University, Touch of Nature, the Friends of Crab Orchard NWR and the Refuge's Visitor Services Program have partnered to provided environmental education opportunities for local schools.

With the help of the following partners, the Refuge has been able to provide one of the most successful Kids Fishing Derby events in the area:

University of Illinois Extension
Illinois DNR
Southern Illinois National Hunting and Fishing Days
Timberline Fisheries
Zimmer Radio Group
WalMart
Silkworm Inc.
Marion Pepsi-Cola
Crab Orchard Boat & Yacht Club

The Refuge has many dedicated groups and volunteers who assist with a variety of tasks. The Friends of Crab Orchard National Wildlife Refuge, John A. Logan College, University of Southern Illinois, Southern Illinois Audubon Society, Williamson County Tourism Bureau, and Marion U.S. Penitentiary are just a few of the organizations that contribute time to the Refuge.

Figure 24: Crab Orchard NWR Current Staffing Chart

Chapter 4: Management Direction

Operational Policies

Area Designations

Background: Twice since the establishment of the Refuge, the Service has published its land use policy in the Federal Register. These documents used the concept of dividing the Refuge into three areas and describing the types of use that would be considered within a particular area. This policy was last published in the Federal Register on September 6, 1961. It called for using Area I for "various forms of recreation, including public hunting and fishing in accordance with State laws, picnicking, boating, swimming, and similar activities;" Area II for "industrial purposes;" and Area III "for use and administration as a public recreation area on which group recreation, group camps and private cabin or cottage site developments on lands zoned for those purposes."

Since the publication of the policy described above, Congress has passed several laws governing the management of the National Wildlife Refuge System. The most recent, the National Wildlife Refuge System Improvement Act of 1997 (Act) sets forth guiding principles for management of all national wildlife refuges, such as wildlife-dependent recreation having priority over non-wildlife-dependent recreation. It challenges the managers of Crab Orchard National Wildlife Refuge to balance Refuge purposes, which are "...conservation of wildlife and for the development of agriculture, recreation, industrial and related purposes...," with the Refuge System mission of "administering a national network of lands and waters for the conservation, management, and where appropriate, restoration of fish, wildlife and plant resources and their habitats..." The Act states that: "... if a conflict exists between the purposes of a refuge and the mission of the System, the conflict shall be resolved in a manner that first protects the purposes of the refuge, and, to the extent practicable, that also achieves the mission of the System."

U.S. Fish & Wildlife Service

Policy: With this comprehensive conservation plan, the Service is attempting to balance its management responsibilities across all portions of the Refuge. The concept of classifying uses of the Refuge into Areas I, II and III will be dropped. Only the industrial area of the Refuge, formerly known as either Area II or the Closed Area, will retain the designation of "restricted use area" because of safety and security concerns.

The safety and security concerns are associated with property protection, contaminants and the storage of explosive materials. The warehouse area on the east end of Ogden Road (Area 7) will be closed to the general public, thereby precluding access to Blue Heron Pond for recreational fishing.

U.S.Fish & Wildlife Service

Wildlife management is a major focus for all lands encompassed by the boundaries of Crab Orchard NWR.

Camping Length of Stay

Background: People camped near Crab Orchard Lake before the Refuge was established. In the early days of the Refuge, camping was allowed throughout the open areas of the Refuge. However, the dispersed camping caused unacceptable litter and resource damage. In order to minimize the problems, four concession-operated campgrounds were constructed and camping was permitted only in the campgrounds. Crab Orchard Lake Campground began operation in 1964. Since then, the Refuge campgrounds have been operated by both concessionaires and the Service at different times.

Refuge regulations have not limited the length of stay for campers. By not limiting the length of stay, campers have been able to occupy a site for an entire season. The result is that sometimes families on a short vacation or a weekend visit have limited opportunity to camp in the most desirable sites near the water. Some people who have occupied sites for the entire season have brought in equipment and material that have created an atmosphere more typical of a permanent trailer park than a campground. The lack of a length of stay regulation is unusual in public campgrounds. In order to provide a more equitable opportunity to stay in desirable camping sites, we will establish a maximum length of stay at all Refuge campgrounds.

Policy: We will limit the length of stay at Refuge campgrounds to 14 nights comparable with other Federal and State campgrounds in the area. For the first 2 years, approximately one-half of the campsites will remain available for long-term camping and the other half for stays up to 14 days maximum. The second 2-year period will permit up to one-third of campsites to be available for 28 days and the remaining two-thirds will be limited to 14-day maximum stays. Finally, beginning in the fifth year, a 14-day maximum stay will apply to all campsites. At the end of a camping stay, we will require persons to remove all camping equipment from the campground for a minimum of 48 hours. Personal property such as trailers or recreational vehicles may not be stored in the campground during this 48-hour period. In addition, a reservation system will be phased in for Refuge campgrounds.

Group Camps

Background: Refuge policy that immediately followed establishment of the Refuge had provisions that permitted group recreation, group camps and private cabin or cottage site development on lands zoned for that purpose. The areas chosen for group camps were along the shoreline of the proposed Little Grassy Lake. Interest from organizations on how to establish a group camp in this area was shown as early as December 1947.

The Service prioritized the availability of this opportunity for planned group camping with the policy of first serving strictly youth camping groups, second youth/adult church camp educational programs and last fraternal organizations. In 1950, the Refuge began reviewing applications for group camping from a number of organizations. The Service issued several group camping leases to organizations such as: The Boy Scouts of America, the Girl Scouts, the Educational Council of 100 Inc., Pioneer Communications Club, Independent Order of Odd Fellows, The United Methodist Church, The Presbyterian Church and others. Many of these organizations began using the area in 1952. Today there are four group camps still operating on the Refuge: Pine Ridge Camp (Boy Scouts), Camp Cedar Point (Girl Scouts), Camp Carew (Presbyterian Church), and the United Methodist Church Camp.

Policy: Group camps will continue with the requirement that they provide environmental education as specified in current agreements. The infrastructure associated with the existing camps will not expand beyond current square footage occupied by

Table 28: Recreational Entrance Fees and Federal Passes That Will Permit Entry

Fee Option	Cost	Eligibility	Allows Entry to...	Validation Period
Daily Fee	$2/vehicle	Anyone	Crab Orchard NWR	1 day
Weekly Fee	$5/vehicle	Anyone	Crab Orchard NWR	7 consecutive days
Commercial bus	$20	For buses up to 20 passengers	Crab Orchard NWR	1 day
Refuge Annual[1]	$15/vehicle	Anyone	Crab Orchard NWR	1 year (July 1 - June 30)
Duck Stamp	$15	Anyone	Any national wildlife refuge	1 year (July 1 - June 30)
Golden Eagle	$65	Anyone	Any federal fee area	1 year from month of purchase
Golden Age	$10	Persons 62 years or older	Any federal fee area	Lifetime
Golden Access	Free	Anyone who is permanently disabled	Any federal fee area	Lifetime
Hologram[2]	$15	Anyone holding a National Park Pass	Any federal fee area	1 year from month of purchase
Daily boat launch fee	$2/boat	Anyone	Crab Orchard NWR	1 day
Daily boat launch fee	$2/boat	Anyone	Crab Orchard NWR	1 day
Weekly boat launch fee	$5/boat	Anyone	Crab Orchard NWR	7 consecutive days
Annual boat launch[1]	$10/boat	Anyone	Crab Orchard NWR	1 year (July 1 to June 30)

1. *Additional passes for vehicles and boats may be purchased for $5.*
2. *The National Park Pass ($50) can be upgraded through the purchase of a $15 Golden Eagle hologram. The Golden Eagle hologram can be affixed to the Park pass to allow for entrance into all federal fee areas. The National Park pass will not be available at the Refuge, but the hologram can be made available.*

the camps. The camps will be assessed a fee for use of federal lands. Because the use authorized under the agreements includes environmental education with no profit gained by the camps, the fees will be minimal administrative and use fees. If an organization decides to no longer operate their camp, the Refuge will determine if the site should be closed or leased to another organization based on Refuge's environmental education goals, the purpose and mission of the organization wishing to occupy the camp, the condition of the facilities and existing National Wildlife Refuge System policies.

Recreational Fees

Background: Entrance fees were implemented in 1988 under the authorization of the Emergency Wetland Resource Act of 1986. The entrance fee program admitted anyone holding a permit and accompanying passengers in their vehicle to the Refuge. In 1997, under authorization of the Omnibus Consolidated Rescissions and Appropriations Act of 1996, the entrance fee program was modified to a recreation use fee program. The user fee program requires all vehicles and boats using the Refuge to have a valid fee decal. In evaluating the use fee program as part of the comprehensive conservation planning process, we recognized that the current program does not fairly implement the intent of the Federal Demonstration Fee Program.

Policy: We will implement a recreational fee program that is comparable to other fee programs within the Service. These changes will be consistent with the new Federal Lands Recreation Enhancement Act and increase convenience for the visiting public. The Refuge will have an entrance fee as well as an expanded amenity recreation fee. Federal Duck Stamps, America the Beautiful Passes, and Crab Orchard Refuge annual, weekly and daily passes will permit entry to the Refuge. An expanded amenity recreation fee will be charged in addition to the entrance fee for using boat launching facilities and participating in quota hunts. Table 28 summarizes recreational fees.

Fishing Tournaments

Background: Five fishing tournaments are held each year on the Refuge's three lakes under special use permits. Devils Kitchen Lake and Little Grassy Lake each host one tournament. Crab Orchard Lake hosts three tournaments. The tournaments are well established and require minimal assistance from Refuge staff, although Refuge and Illinois Department of Natural Resources officers do conduct spot checks for violations during the tournaments. Anglers and biologists have expressed concern over reduced fish populations because of post-release mortality and the lack of vegetation for spawning bass.

Policy: The five current fishing tournaments will continue on the Refuge's three lakes. However, if any of these five organizations decide to discontinue a tournament, the event will be eliminated and not replaced in the future. We will continue to work with tournament organizers to reduce post-release mortality.

Fish-offs

Background: The three lakes receive many visits from fishing clubs hosting events called "fish-offs." A fish-off is defined as an organized club fishing event having 20 boats or fewer. Recreational anglers and biologists have expressed concern over reduced fish populations and catch rates as a result of fishing pressure on Refuge lakes. In the past, the total number of fish-offs has not been limited, and as many as 95 Refuge-authorized fish-offs have been held in a single year, in addition to unauthorized events.

Policy: Organizers of fishing events must obtain a fish-off use permit. The permit allows the organizer to have one fish-off per lake, per year. The total number of fish-offs allowed on the Refuge will be determined annually by the Refuge Manager. There is a $35 charge for the permit and the organizer must follow terms and conditions of the permit.

Recreational and Technical Rock Climbing

Background: Crab Orchard NWR is not typically considered a climber's destination, but some demanding and varied rock climbs can be found in the southern portions of the Refuge. Over the years Refuge visitors have inquired about climbing, but climbing has never been officially permitted. Rock climbing has occurred in the Devils Kitchen and Little Grassy areas. The Refuge has in the past discouraged rock climbing activities such as jumping and diving from the rocks of Devils Kitchen Lake by not permitting swimming in the lake and by closing the area below the Crab Orchard Dam spillway to public access. Climbing opportunities can be found at nearby Giant City State Park.

Policy: Recreational and technical rock climbing will not be permitted on the Refuge. This includes free-style rock climbing, rappelling and technical rock climbing. (Also see the rock climbing discussion in the Record of Decision, Appendix A.)

Scuba Diving

Background: Limited opportunities for scuba diving do exist on Crab Orchard NWR, however this activity has never explicitly been permitted. Some visitors have participated in this activity under the assumption that it was allowed. Due to the relatively shallow and turbid condition of Crab Orchard Lake and the fact that swimming is prohibited on Devils Kitchen Lake, Little Grassy Lake is the only location where a visitor could reasonably expect to participate in this activity.

Policy: Due to the fact that swimming is already allowed in Little Grassy Lake, the lake is already heavily used by youth camps, and it is a popular fishing destination, we will prohibit scuba diving on the Refuge to reduce conflicts between these user groups.

Trapping

Background: Opportunities for trapping do exist on Crab Orchard NWR. In the past, trapping has been loosely regulated through special use permits in areas designated by the refuge biologist. A maximum number of 50 recreational trapping permits had been determined, but due to changes in culture and markets, that number does not reflect actual demand.

Policy: Limited trapping will be allowed in designated areas of the Refuge through special use permits. Carefully controlled trapping is considered a management tool, and contributes to the habitat and wildlife management goals of the Refuge. In some cases it is the only means by which nuisance wildlife can be removed. The activity will be limited in scope to areas of the Refuge that are identified by the Refuge biologist, and carefully regulated through the use of special use permits.

Dog Training

Background: Dog field trials were a part of the Crab Orchard Creek Project before the establishment of Crab Orchard National Wildlife Refuge. Training of dogs has occurred sporadically on the Refuge, and is regulated through special use permits. In addition, dogs are allowed on the Refuge, provided they are leashed. Hunting is a priority public use and supports the recreation purpose for which the Refuge was established, and well trained hunting dogs contribute to this activity by locating and retrieving game that may otherwise be lost.

Policy: The training of dogs that are to be used for hunting will be allowed in designated areas of the Refuge through special use permits. This use does not include field trials or commercial/professional dog training, which remains prohibited. This use also does not include training of dogs from sunset to sunrise, also known as "running" furbearers with dogs, which will also be prohibited.

Boundary Modification

Expand authorized Refuge boundary to include additional lands contiguous with the current Refuge boundary.

Background: The Washington Office of the Service approved the study of potential additional Refuge lands in 1990. The Refuge did not pursue the study of additional lands until the CCP process. The CCP planning effort was the logical time to re-examine all management and land protection issues related to the Refuge. So, during the CCP effort we again looked at the possible need to adjust the boundary of the Refuge. Land acquisition and subsequent habitat management will enhance the purposes of the Refuge and offer additional protection to existing lands as development accelerates along Refuge boundaries.

The boundary modification, which was approved as part of the EIS/CCP, is depicted in Figure 25.

Wildlife Conservation Goals

Several of the objecctives under these goals refer to changing acreages of land cover on the Refuge. Figure 26 and Figure 27 show projected land cover in 15 years and 100 years. Table 29 on page 70 compares the land cover in 2000 with the projected land cover in 2021 and 2106. Given the uncertainties in future conditions, the acreages are approximate.

U.S. Fish & Wildlife Service

Canada Geese Goal

Provide enough food for wintering Canada geese to support 6.4 million goose-use-days annually, in support of the Mississippi Valley Population Canada Goose Management Plan.

Background: When established, the Refuge was recognized as being important to providing habitat for wintering Canada Geese. The Refuge was also established with an agricultural purpose. The agricultural purpose and supporting wintering Canada Geese are interrelated. The importance of wintering refuge habitat to the Mississippi Valley population of Canada Geese has been recognized in population management plans. The Refuge's approach to meeting the goal of 6.4 million goose-use-days is to provide relatively large amounts of a diverse array of food-producing habitats. This approach provides relatively high assurance that even if a major habitat fails to provide, sufficient foods will be available in other habitats. The Refuge has about 4,500 acres of cropland, 1,000 acres of pasture, 700 acres of hay fields, and 450 acres of moist-soil units commonly used by geese (see Figure 7 on page 22). Other goose management activities include seasonal closure to boating on the east end of Crab Orchard Lake and fall mowing around selected ponds.

Objective 1

Provide enough food for wintering Canada Geese to support 6.4 million goose-use-days.

Strategy

Contributing Refuge Operating Needs System (RONS) projects: 02006, 020007, 02008, 02009

1. Maintain 4,300 acres of cropland in agricultural production (see Figure 26). Manage 450 acres of moist-soil units. Continue fall mowing

Figure 25: Crab Orchard NWR Approved Boundary Modification and Adjacent Public Lands

Table 29: Areas of Land Cover at Crab Orchard NWR in 2000 and Acres Projected for 2021 and 2106, With Change from 2000 Shown in Parentheses

Land Cover	2000	2021	2106
Agricultural Field	4,540	4,412 (-128)	4,412 (-128)
Aquatic Herbaceous Marsh	365	365 (0)	365 (0)
Bald-cypress Plantation, Swamp Forest	44	44 (0)	44 (0)
Buttonbush Swamp Shrubland	81	81 (0)	81 (0)
Cattail Marsh	25	25 (0)	25 (0)
Common Reed Marsh	7	7 (0)	7 (0)
Developed Land	1,138	1,138 (0)	1,138 (0)
Early Successional Oak Forest (reforested)	5	0 (-5)	0 (-5)
Eastern Red-cedar, Mixed Hardwood Forest (old field)	1,006	1,006 (0)	0 (-1,006)
Eastern Red-cedar Forest (old field)	71	71 (0)	0 (-71)
Fallow Herbaceous Field	1,567	172 (-1,395)	172 (-1,394)
Forest Regeneration Herbaceous Land	168	0 (-168)	0 (-168)
Mixed Hardwood Bottomland Forest	1,907	2,042 (+135)	2,042 (+135)
Mixed Hardwood Upland Forest	18,923	21,148 (+2,225)	25,869 (+6,946)
Open Water	9,082	9,082 (0)	9,082 (0)
Perennial Grass Crops	1,725	1,564 (-161)	1,564 (-160)
Pine Plantation / Mixed Hardwood Forest	1,633	1,633 (0)	0 (-1,633)
Pine Plantation Forest	1,665	1,665 (0)	0 (-1,665)
Restored native Grassland	240	261 (+21)	261 (+21)
Upland Mixed Shrubland (old field)	872	347 (-525)	0 (-872)
Wet Herbaceous Meadow	389	389 (0)	389 (0)
Willow Wet Shrubland	3	3 (0)	3 (0)

around selected ponds. Maintain seasonal closure to boating on the east end of Crab Orchard Lake.

Forest, Early Successional and Grassland Birds Goal

Maintain or enhance populations of forest, early successional and grassland birds, with emphasis on priority species, as identified in Partners in Flight Physiographic Area Bird Conservation Plans.

Background: The Refuge has about 25,000 acres of forest habitat. Most of this acreage is in old-field or second-growth hardwood forest cover on upland and bottomland sites. Oaks are keystone species that are essential to a healthy, diverse forest ecosystem in this region. Typically with a lack of disturbance shade-tolerant trees increase in dominance while oaks steadily decrease, and understory diversity is greatly diminished. On many sites timber harvesting, prescribed burning, and other methods of disturbance must occur for oaks to flourish. Past forest management activities have included prescribed burning and the thinning of hardwood stands to maintain tree health, promote mast production and control species composition. Our management actions will apply these same treatments in order to provide habitat for the full spectrum of native plants and animals with an emphasis on the habitat needs of the resource conservation priority species. No commercial timber harvesting will take place in the Crab Orchard Wilderness or any research natural area.

Studies have shown that forest fragmentation reduces nesting success of migratory birds because of increased nest predation and parasitism. The Refuge has carried out reforestation activities in recent years to reduce fragmentation of forested habitats and retire former agricultural fields and pastures.

Table 30: Forest, Grassland and Shrubland Bird Species of Conservation Priority

Forest Birds	Grassland Birds	Shrubland Birds
Acadian Flycatcher	Dickcissel	Bell's Vireo
Cerulean Warbler	Eastern Meadowlark	Blue-winged Warbler
Chuck-will's-widow	Field Sparrow	Field Sparrow
Kentucky Warbler	Grasshopper Sparrow	Loggerhead Shrike
Louisiana Waterthrush		Prairie Warbler
Red-shouldered Hawk		
Whip-poor-will		
Wood Thrush		
Worm-eating Warbler		

The Refuge has about 3,300 acres of pine plantations. Most of the pine plantations were established between 1938 and 1941 by the USDA Soil Conservation Service for the purpose of controlling soil erosion. Pines, which are not native to the Refuge, generally provide lower quality wildlife habitat than native hardwoods. The existing plans call for thinning and prescribed burning pine plantations to encourage the growth of desirable, mast-producing hardwoods.

The Refuge has about 2,500 acres of early successional habitat. Some migratory birds primarily use early successional habitats, such as shrubland and fallow herbaceous fields. Without active management, these habitat types will succeed to forest. These habitat types are identified in Figure 7 on page 22.

Refuge grasslands include pastures (1,000 acres), hay fields (700 acres), and native grasslands (240 acres). Pastures and hay fields provide the majority of the grassland habitat for migratory birds. However, the pastures are relatively poor quality habitat for many migratory birds because they are dominated by fescue, a non-native grass. Prior to 2005, Refuge hay fields were mowed in spring and summer when migratory birds are nesting, which reduces nesting success. The presence of woody vegetation along fence rows and roadsides tends to reduce the value of grasslands for some birds. .

The Refuge has 4,500 acres in the row crop program. The crop rotation is generally corn/soybeans/corn/clover/clover. Grassland birds, such as the dickcissel and eastern meadowlark, use clover fields for nesting habitat. Cooperative farmers commonly mow second year clover to make hay during the nesting season of migratory birds, which reduces nesting success.

The forest, shrubland and grassland resource conservation priority bird species that are expected to benefit from our habitat management are listed in Table 30. These priority bird species are a regional subset of the priority species found in Partners in Flight plans.

Objective 1

Manage forest land to favor oak-hickory forest types on suitable sites with all age classes from seedling stage to old-growth represented. Manage native, shade-tolerant tree species (such as sugar maple) to prevent wide-spread succession to climax forest cover types.

Strategies

1. Write and implement a *Habitat Management Plan* following policy in the Fish and Wildlife Service Manual (620 FW 1).
2. Apply appropriate silvicultural treatments to manage forest health, species composition, and age structure. Treatments may include non-commercial forest stand improvement treatments (girdling, cutting, and/or applying herbicide to individual stems), commercial timber cutting (thinnings, improvement cuttings, and regeneration cuttings) and prescribed burning. Forest stand improvement treatments may occur in any forest type (up to 25,000 acres). Commercial timber cutting may occur in any forest type outside the Crab Orchard Wilderness and research natural areas (up to 19,700 acres). Commercial harvest operations are not likely to take place on more than 400 acres annually on average, half of which will be considered regeneration cuttings. Our preferred regeneration technique is the shelterwood method. More specifically, the shelterwood method with reserves will be used in hardwood (and

Figure 26: Land Cover of Crab Orchard NWR, Projected Conditions 2021

Figure 27: Land Cover of Crab Orchard NWR, Projected Conditions 2106

pine) stands where some hardwoods will be left standing following the final removal cutting. Prescribed fire may be applied in upland forest (up to 23,000 acres of hardwood and pine types), but not in bottomland forest.

3. Reforest available open sites located outside of the two large forest blocks (see Objective 2 below) by planting native hardwoods, with preference given to oaks and hickories, to reduce forest fragmentation. Examples of such sites would be small agricultural fields (or portions thereof) no longer being farmed, abandoned industrial areas, abandoned rights-of-way (roads, powerlines, and pipelines), and remediated contaminant areas.
4. Control exotic, invasive plants through integrated pest management practices.

Objective 2

Manage two portions of the Refuge as large forest blocks to benefit area-sensitive forest birds. The first area (about 13,000 acres) extends from the southern end of Grassy Bay east to Caney Creek, and south including the wilderness area. The second area (about 1,700 acres) extends from the federal prison north and includes the Crab Orchard Creek bottomlands. This will include about 490 acres of reforestation of open habitat to consolidate large blocks of forest habitat.

Strategy

Contributing RONS projects: 02001, 97001, 97009, 97008, 98027

1. Reforest about 290 acres of crop fields, 130 acres of fallow fields, and 90 acres of perennial grasslands. This may include site preparation, planting a cover crop, planting tree seedlings, and weed control treatments.

Objective 3

Accelerate succession of all (about 3,300 acres) pine plantations to native hardwood forest.

Strategy

Contributing RONS projects: 97001, 97008, 02001, 98027

1. Thin pine plantations to promote establishment and growth of native hardwoods. In some cases, remove pine overstory to release young hardwoods. Most silvicultural treatments will be conducted under contract by commercial timber harvesting firms. Conduct prescribed burning during the dormant season (November through March) on a 3- to 5-year cycle to enhance habitat conditions and promote desirable hardwood regeneration.

Objective 4

Maintain about 300 acres in early successional habitat.

Strategy

Contributing RONS projects: 02005, 97001.

1. Use prescribed fire or mechanical treatment (mowing, discing) to disturb about 200 acres every 3 to 5 years. Add about 100 acres of 30-foot-wide borders of native warm-season grasses in row crop fields in the open portion of the Refuge.

Objective 5

Maintain 260 acres of native warm-season grassland.

Strategy

Contributing RONS projects: 02008, 97001.

1. Prescribed burn all native warm-season grasslands on a 2- to 3-year cycle to favor grassland vegetation and control undesirable plants. Apply mechanical or herbicide treatments to control vegetation, when needed.

Glenn Smart

Objective 6

Maintain 1,000 acres of pasture, 700 acres of hay fields, and about 1,600 acres of clover fields with increased emphasis on habitat quality for grassland birds.

Strategy

Contributing RONS projects: 02008, 02002, 97001, 02007, 02009.

1. Remove 124 acres of linear forest habitat and 8 miles of hedge rows. Install fences to create paddocks within pastures to enable greater control of grazing intensity. Convert fescue pastures to other cool-season and native warm-season grasses by preparing the site and reseeding. The typical Refuge pasture will become three or four paddocks with a paddock of cool-season grass and two or three paddocks of native warm-season grasses. Cattle will enter the cool-season grass paddock in the spring switch to the warm season grasses in the summer, and move back to the cool season grass in the fall. The native warm season grass will provide the grassland birds with nesting, migration, and winter habitat. Vegetation structure will be managed by the amount of grazing applied to each paddock. Most of the pasture grass will not require fall mowing and will be taller than 6 inches during the winter. All mowing of hay fields, pastures, and clover fields will take place after August 1.

   Rationale for converting pasture fescue: Tall fescue (*Festuca arundinacea*) is a cool-season, perennial grass native to Europe that is invasive in many natural communities in the U.S. Tall fescue has been planted for forage and soil conservation and now covers more than 35 million acres in the U.S. (Ball et al. 1993). It has become the most abundant or dominant plant in many areas, including the Refuge's grasslands. Most (75-80 percent) tall fescue in the U.S. is infected with a fungus (*Neotyphodium coenophialum*) that produces compounds that are toxic to insects (Breen 1994), small mammals (Coley et al. 1995, Conover 1998), and birds (Conover and Messmer 1996, Madej and Clay 1991). Tall fescue often results in loss of plant diversity (Clay and Holah 1999). Livestock losses related to tall fescue in the U.S. have been estimated between $500 million and $1 billion annually (Ball et al. 1993).

   Conversion of tall fescue pastures to native warm-season grasses and cool-season grasses with higher wildlife values will provide several benefits: 1) reduce the abundance of an invasive, non-native species, 2) increase plant diversity, 3) increase plant productivity, 4) improve forage for cattle production, and 5) improve pastures for wildlife production.

U.S. Fish & Wildlife Service

Ducks, Shorebirds, and Other Waterbirds Goal

Maintain or enhance populations of ducks, shorebirds, and other waterbirds, with emphasis on priority species, as identified in the North American Waterfowl Management Plan, U.S. Shorebird Conservation Plan, and North American Waterbird Conservation Plan.

Background: The Refuge has several types of habitat that support ducks, shorebirds, and other waterbirds: 9,100 acres of open water in artificial lakes and ponds, 1,900 acres of bottomland forest, and 500 acres of swamps, marshes, and wet meadows. The Refuge manages about 450 acres of these wetlands to encourage the growth of moist-soil plants and aquatic invertebrates to provide food for waterfowl, shorebirds, and other waterbirds.

Objective 1

Provide 450 to 500 acres of moist-soil habitat during fall, winter and spring for migrating shorebirds, waterfowl, and other waterbirds.

Strategy

Contributing RONS projects: 02006, 97001.

1. Construct 150-200 acres of new moist-soil habitat. Maintain dikes and water control structures. Manipulate water levels and vegetation to encourage production of waterfowl foods.

Threatened and Endangered Species Goal

Maintain or enhance populations of federal and, where compatible, state threatened and endangered species that occur at or near Crab Orchard National Wildlife Refuge.

Background: The Bald Eagle is the only federally designated threatened species known to occur on the Refuge. The Indiana bat, which is federally classified as endangered, is known to occur in proximity to the Refuge. Thirty-one state-listed threatened and endangered species inhabit, or have inhabited, the Refuge (see Appendix E). Chapter 3 describes the threatened and endangered species on the Refuge. 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 preparation of the EIS. The memo accompanying the Service's Programmatic Biological Opinion is included as Appendix J.

Objective 1

Assure that federally listed species, state-listed species and federally proposed species and their habitats are protected.

Strategies:

1. No disturbance of bald eagles will take place during critical periods within protective zones as described in the Northern States Bald Eagle Recovery Plan (USFWS, 1983). Areas are designated closed through signing and brochures.
2. Forest management activities, such as thinning and prescribed burning, will require close coordination with U.S. Fish and Wildlife Service, Ecological Services personnel. These activities may require standard surveys to determine whether Indiana bats are present in a given forest unit or the activities may be scheduled outside of the season when Indiana bats are likely to use Refuge forests.

Water Quality Goal

Provide and manage for quality of water in streams and lakes at Crab Orchard National Wildlife Refuge.

Background: Natural processes along with various human activities occurring in the watershed affect water quality on the Refuge. Since the Refuge controls only a portion of the watershed, increased efforts to protect water quality both on the Refuge and beyond its boundaries are essential. Urbanization of lands adjacent to the Refuge is likely to have even greater impacts on water quality in the future.

Objective 1

Improve the quality of water within the watershed of the Refuge.

Strategies

1. Cooperate with Illinois Environmental Protection Agency to monitor water quality. Identify landowners and land uses in the watershed. Provide education and technical assistance to landowners with particularly sensitive riparian areas. Work with municipalities and developers to enhance on-site storm water retention.
2. Work with farmers to establish buffer strips and keep livestock away from streams and ponds. Continue using current soil and water protection measures in the Refuge farm program: use no insecticides, use only Service-approved herbicides, use minimum tillage practices, and use winter cover crops.
3. Continue clean-up of contaminated sites. Ensure Refuge industrial operations conform to prescribed environmental standards.

Resident Fish and Wildlife Goal

Maintain or enhance resident fish and wildlife populations consistent with management activities for federal trust resources in cooperation with the Illinois DNR.

Background: There is a long history of public fishing, public hunting, and management of resident fish and wildlife species on the Refuge.

Objective 1

Manage Refuge fisheries with emphasis on mixed-species, warm-water sport fishing.

Strategy

1. Continue cooperative management of Refuge fisheries with Illinois DNR. Continue managing fish populations and habitat through activities such as: setting length and creel limits,

seasonal closures of spawning bed areas, habitat enhancements, annual surveys, and fish stocking.

Objective 2

Manage Refuge resident wildlife populations at levels that allow opportunities for sport hunting of game species.

Strategies

1. Continue managing the Refuge agriculture program with methods that benefit resident game species, such as: leave up to 25 percent of the corn crop unharvested, plant winter wheat in soybean fields each fall, use low tillage planting techniques, keep fields in clover 2 years out of the 6-year rotation, delay mowing until after August 1, and use no insecticides.
2. Incorporate beneficial practices such as those suggested in the Northern Bobwhite Conservation Initiative: convert cool-season to warm-season grasses and burn and thin pine plantations.
3. Continue controlled hunting for turkey and deer in the restricted use portion of the Refuge.

Recreation/Public Use Goals

Hunting, Fishing, Wildlife Observation and Photography, Interpretation and Environmental Education Goal

Hunters, anglers, viewers and photographers of wildlife, general visitors, and students enjoy high-quality experiences through a variety of opportunities that promote an understanding and appreciation of the Refuge's natural and cultural resources and their management.

Background: The Refuge System Improvement Act of 1997 identified six wildlife-dependent, priority public uses that should be facilitated on national wildlife refuges if compatible with the purposes of the Refuge. These priority uses, which include hunting, fishing, wildlife observation and photography, interpretation, and environmental education, are compatible and can be facilitated at the Refuge. While all of these uses are provided at the Refuge to an extent, support for some of these uses has been inconsistent and the quality of the experience has been variable. The Refuge can provide high-quality experiences for these priority wildlife-dependent uses through improvement of supporting facilities, programs, and materials over the next 15 years. A high-quality experience includes uncrowded conditions, no conflicts with other users, a reasonable opportunity, and overall satisfaction. Understanding and appreciation of Refuge resources, management strategies, and purposes also contribute to quality of experience and influence visitor enjoyment.

Objective 1

Increase the quality of hunting opportunities to a level where 75 percent of hunters experience uncrowded conditions, no conflicts with other users, a reasonable harvest opportunity, and satisfaction with their overall experience. Instill a sense of awareness among hunters of the Refuge as a component of the National Wildlife Refuge System and of hunting as a wildlife management tool.

Strategies

1. In the public hunting area of the Refuge, continue the policy of providing hunting opportunities based on state hunting seasons and state and federal regulations.
2. In the restricted use area of the Refuge, maintain hunting opportunities, by permit, during shotgun deer and spring shotgun turkey seasons. Areas with high concentrations of waterfowl may occasionally be closed during the restricted use area shotgun hunts. Maintain shotgun deer season hunting opportunities for youth and persons with disabilities and, within 3 years of the plan's approval, provide these groups with opportunities for spring shotgun turkey season hunting when populations warrant.
3. Administer goose hunts in the controlled area through an agreement with a partner organization.
4. Over the life of the plan, promote ethical hunting behavior and increase hunter adherence to federal and state regulations through effective informational brochures and signs. Increase the visibility of Refuge law enforcement.
5. Over the life of the plan, enhance public understanding of Refuge hunting opportunities, ethical behaviors, the role of hunting in wildlife management, and the Refuge as a component of the National Wildlife Refuge System by increasing the quality of maps, signs, and brochures.

Bob Etzel

Objective 2

Increase the quality of fishing opportunities to a level where 75 percent of anglers experience uncrowded conditions, no conflicts with other users, a reasonable harvest opportunity, and satisfaction with their overall experience. At least 75 percent of anglers understand the issues, strategies, and policies involved in Refuge fisheries management and conservation.

Strategies

1. In the public fishing areas, continue the policy of providing fishing opportunities based on state and federal regulations.
2. Continue to allow tournaments and fish-offs on the Refuge. Continue current policies on limited closures of Refuge waters east of Wolf Creek Road.
3. Continue to provide bank and boat fishing opportunities in accordance with state and federal regulations. Maintain Refuge boat ramps, fishing piers, and parking facilities. Study the feasibility for and construct accessible fishing facilities at Little Grassy and Devils Kitchen lakes within 4 years of the plan's approval.
4. Over the life of the plan, promote Refuge fishing opportunities and encourage conservation practices, such as catch-and-release fishing, through the development and maintenance of high-quality maps, signs, brochures and the Refuge web page.
5. Ensure that the fishing public clearly understands the fish consumption advisories for Crab Orchard Lake through signs and brochures.
6. Over the life of the plan, provide insight to anglers regarding Refuge strategies, issues, and policies for fisheries management and conservation by redesigning and developing more effective informational signs and brochures. Increase angler awareness of the Refuge as a component of the National Wildlife Refuge System by improving the quality and content of maps, signs, and brochures.

Objective 3

Ensure that viewing and photography opportunities meet the needs of 95 percent of participants. Establish and maintain viewing and photography opportunities for all major Refuge habitat types and optimum seasons.

Strategies

1. Within 2 years of the plan's approval, develop an annual observation/photography fact sheet for the Refuge that will include a calendar of established tours, programs, and events; information on identified and recommended viewing and photography areas; guidelines to enhance viewing enjoyment; and a Refuge map delineating trails, blinds, platforms, and identified viewing areas.
2. Continue popular, established programs and tours like the October Discovery Auto Tours, January Eagle Tours, and Spring Wildflower Walks that enhance visitor experience, bring visitors in closer proximity to resources, and provide optimum seasonal opportunities for observation and photography and continually evaluate these programs for effectiveness.
3. Within 2 years of the plan's approval, improve the existing photography/observation blinds and platforms by adding camouflage as needed to enhance viewing opportunities. Evaluate location of existing blinds and platforms and move as needed. Position interpretive and identification panels in or near blinds and platforms to promote understanding and appreciation of Refuge resources. Enhance panels to promote awareness of the Refuge as a component of the National Wildlife Refuge System.
4. Within 5 years of the plan's approval, evaluate need for and add additional blinds/platforms, including interpretive and identification panels, where and if needed to ensure observation and photography oppor-

tunities in all major Refuge habitat types. Maintain all identified viewing and photography sites.

5. Over the life of the plan and in cooperation with other partners, encourage utilization of the Refuge for birding and other wildlife observation through development of informational materials, programs, trails, tours, and special events. Promote the Refuge as a site for quality wildlife observation and photography through participation in selected community and regional birding, nature, and photography festivals and events.

6. Within 8 years of the plan's approval, identify and create a Refuge birding trail that may include enhancement and coordination of existing trails, viewing areas and signs, and creation of a birding trail brochure and map.

7. Over the life of the plan, expand the Refuge web site to promote wildlife observation and photography. Include updates on Refuge and area sightings of rare birds and other wildlife; profiles of selected seasonally-occurring and resident species; suggested optimal viewing times and locations; and current Refuge programs, facilities, tours, and other opportunities for observation and photography.

Objective 4

Increase the effectiveness of the Refuge interpretive program so that 70 percent of visitors gain a better understanding of three primary concepts: (1) the value and unique purposes of the Refuge, (2) the Refuge as a component of the national network of refuges, and (3) the significance and mission of the National Wildlife Refuge System. Heighten awareness of conservation and stewardship concepts. Encourage visitors to adopt ethical behaviors and to take positive actions that support Refuge goals and the Refuge System mission.

Strategies

1. Within 3 years of the plan's approval, develop the interpretation portion of the Visitor Services Plan outlining a comprehensive, multifaceted approach emphasizing selected themes and key Refuge resources. Themes will be selected based on importance to Refuge and System goals and relevance to surrounding communities. All interpretive materials, tours, and programs will focus on one or more of these Refuge themes, along with the three basic concepts of the Refuge and Refuge System. Refuge interpretive themes may be in a storyline form that includes three or more themes. Themes may include: Exploring the Diversity of Wildlife, Understanding the Past, Protecting the Balance, and Communicating Visitor Opportunities.

2. Within 4 years of the plan's approval, renovate and replace damaged and outdated interpretive and information panels on Refuge kiosks, wayside exhibits, trails, ramps, structures and other facilities. Ensure all panels comply with Service standards.

3. In cooperation with Refuge volunteers and other partners, conduct a variety of high quality interpretive programs annually. Continue popular and established interpretive programs and special events, such as the Families Understanding Nature program and National Wildlife Refuge Week. Ensure interpretive programming remains current and dynamic by continually creating new programs, incorporating new ideas, updating information, and revitalizing ongoing programs. Focus each interpretive program on one or more Refuge themes.

4. Over the life of the plan and in cooperation with Friends of Crab Orchard National Wildlife Refuge and other partners, revise Ref-

uge interpretive brochures, handouts, and other written materials as needed to improve consistency and to meet Service standards.

5. Within 1 year of the plan's approval, create a custom audiovisual program that provides visitors with orientation information about the Refuge. Ensure this program and a variety of other wildlife-related audiovisual programs are made available for viewing at the Visitor Center and for use in interpretive programs.
6. Within 3 years of the plan's approval, establish and maintain an interpretive auto tour route, using existing roads, that will facilitate opportunities for wildlife and cultural resource observation and provide visitors with an overview of the Refuge, its resources, and its management. Include identified stations with interpretive panels and corresponding, radio-broadcasted interpretive messages.

Objective 5

Increase the effectiveness of the Refuge environmental education program so that 75 percent of participants gain a better understanding and appreciation of the resources, purposes, and value of the Refuge and the Refuge System. Heighten awareness of conservation and stewardship concepts and encourage participants to take positive actions on the Refuge and in their community that support Refuge goals and the Refuge System mission.

Strategies

1. Within 2 years of the plan's approval, develop the environmental education portion of the Visitor Services Plan, outlining a comprehensive, curriculum-based approach structured to be compatible with state learning standards and national environmental education guidelines. Emphasize key Refuge resources, the Refuge, the National Wildlife Refuge System, and selected Refuge themes. These themes will be based on importance to Refuge and System goals and relevance to surrounding communities. All environmental education materials, facilities, and programs will focus on one or more of these Refuge themes, along with the basic concepts of the Refuge and the Refuge System. Refuge themes may be in a storyline form that incudes three or more themes. Themes may include: Exploring the Diversity of Wildlife, Understanding the Past, Protecting the Balance, and Communicating Visitor Opportunities.
2. Within 3 years of the plan's approval and in cooperation with Friends of Crab Orchard National Wildlife Refuge and other partners, create an array of environmental education kits, each focusing on one or more aspects of Refuge themes. Educational kits will include interactive materials and a detailed instructional and activity guide designed with a clear, consistent format and coordinated with state learning standards. Develop and maintain a multi-faceted environmental education resource library, available for use by educators and in Refuge educational programs, comprised of books, videos, posters, audio tapes, written materials, and environmental education kits.
3. Within 4 years of the plan's approval and in cooperation with other partners, establish an environmental education complex that incorporates an outdoor amphitheater with educational displays, a set of associated trails, the Refuge Visitor Center, and an educator's trail specifically designed to facilitate environmental education activities and function as an outdoor classroom.
4. Within 4 years of the plan's approval and in cooperation with other partners, create an Educator's Guide to Crab Orchard National Wildlife Refuge that provides an orientation, guidelines, grade-level and state learning standards information, maps, and site-specific activities that focus on one or more Refuge themes. Incorporate input from area educators to ensure the Refuge guide meets area teachers' needs.
5. In cooperation with other partners, conduct or host annual teacher workshops that encourage area educators to incorporate environmental education into their curriculum and to utilize Refuge materials, staff, and resources, both in the classroom and during field trips.
6. Continue currently-offered environmental education programs done by request, including on-site and off-site programs, special educational events, group camp programs, and special interest group programs. Over the life of the plan, expand the environmental education program to include additional on-

site and off-site programs, special educational events, group camp programs, and special interest group programs. Develop pre- and post-visit activities in addition to on-site activities.

7. Over the life of the plan, establish partnerships with selected local schools, agencies, and nonprofit organizations to more effectively develop and expand environmental education programs. Involve volunteers in educational programs and explore the potential for environmental education interns through Southern Illinois University and John A. Logan College. Explore the potential for creating a grant program to help area schools with field trip expenses.
8. Conduct an annual review of the Refuge environmental education program. Invite feedback from area educators. Revise as necessary.

U.S. Fish & Wildlife Service

Customer Service Goal

Visitors of all abilities will feel welcome and enjoy a safe visit to an area that they recognize as a national wildlife refuge.

Background: Policy and guidance of the Service directs each refuge to meet basic standards in hosting visitors. The guidance covers signs, kiosks, leaflets, facility and road maintenance, customer service, and opportunities for visitor feedback. Awareness of Crab Orchard NWR as a national wildlife refuge can also influence visitor experience and enjoyment.

Objective 1

Improve Refuge signs, kiosks, and facilities so that 90 percent of visitors feel welcome and secure, enjoy their visit, and recognize the area as a national wildlife refuge.

Strategies

1. Within 3 years of the plan's approval, revise information on existing kiosks, trailhead and other identification markers, boundary signs, and other such signs as necessary to meet Service standards.
2. Within 5 years of the plan's approval, create and install additional kiosks where needed at Refuge access points to ensure that all visitors are greeted and informed that they are entering a national wildlife refuge. Ensure that all structures comply with Service standards.
3. Verify annually that visitors are welcomed and treated courteously by staff and volunteers. Confirm customer service standards during employee and volunteer orientations. Provide visitors with opportunities for feedback through suggestion cards, verbal reports, written mail, and e-mail through the Refuge web page. Address customer service issues promptly and professionally according to Service standards.
4. Within 2 years of the plan's approval, develop a Refuge brochure with detailed information on accessible facilities, trails, programs, and recreational opportunities at the Refuge.
5. Conduct semi-annual safety inspections of all Refuge facilities and reaffirm compliance with Service standards.
6. Maintain recognizable, consistent signs that clearly identify public hunting areas. Increase awareness among non-hunting visitors of hunting areas and seasons through effective signs and brochures.
7. Respond to notification of safety problems and unsafe situations promptly and in accordance with Service standards. Increase visibility of Refuge law enforcement, particularly during periods of heavy visitation.

Volunteers and Support Groups Goal

Volunteers and Refuge support groups will be stewardship partners and strong advocates for the Refuge.

Background: Volunteers, support groups, and other partnerships strengthen Refuge activities and contribute to making the Refuge an integral part of the community.

Objective 1

Improve Refuge support for volunteer and Friends of Crab Orchard NWR activities to a point where at least 95 percent of volunteers and Friends members feel like valued contributors to the success of Refuge programs and endeavors.

Strategies

1. Continue to manage volunteer and support programs in accordance with Service guidelines detailed in "A Guidebook for Working with Volunteers." Maintain an active liaison with support groups and partners.
2. Provide in-depth initial training to Refuge volunteers that will enable them to effectively and efficiently complete projects and responsibilities. Encourage involvement in diverse volunteer activities that match volunteer interests.
3. Continue demonstrating Refuge appreciation for volunteer contributions and Friends support annually through a Volunteer Appreciation Banquet and other appropriate means. Present awards for service hours in accordance with Service guidelines.

Other Land- and Water-based Recreation Goal

Visitors will enjoy high quality, land- and water-based activities that fulfill the recreation purpose of the Refuge when the Refuge was established.

Background: There is a recognized need to improve the facilities at the Refuge. Under current trends of resource allocation, the current facilities can not be maintained at acceptable standards. The intent will be to reduce the facilities so that the quality could be improved.

A conflict has existed between anglers and high speed watercraft. A 150-foot no-wake zone along the shoreline of Crab Orchard Lake will reduce this conflict, as will additional no-wake zones in several necks on the lake and east of Highway 148.

The Haven and the Crab Orchard Boat & Yacht Club are available only to a limited segment of the general population. The facilities and activities at these clubs amount to private use of public land. Our long-term goal is to make these areas available to a broader portion of the public.

The Haven is a 10-acre site located on the north side of Crab Orchard Lake, near the Highway 13 and Cambria Neck Road intersection. This site has been leased to the Egyptian Past Commanders Club of the American Legion since 1948 for the benefit and enjoyment of disabled veterans primarily from the Marion Veterans Hospital and the Anna State Hospital. The Haven includes a one-story lodge building, and several outside picnic sites, that are used for day visits by veterans for recreation and socializing. During the length of the planning period established for this Refuge CCP (next 15 years), the Refuge Staff will work collaboratively with the Egyptian Past Commanders Club to evaluate the effectiveness of this facility in achieving the purpose of Haven's establishment, and to make recommendations for its future use.

We will extend the lease of the Crab Orchard Boat & Yacht Club for 2 years after the approval of the Refuge CCP. After the lease expires, we will convert the operation of the club facilities to a concession contract. This will end what amounts to private use of public land and make the facilities available to a wider portion of the public.

Objective 1

Improve the quality of boat launches, marinas, beaches, picnic areas, and campground to industry standards within the life of the CCP.

Strategies

1. Maintain picnicking at the Refuge recreational areas of Greenbriar, Wolf Creek, and Harmony Trail, and relocate picnic facilities from Cambria Neck and Playport Marina to a day use area at the current Images Marina site. Explore the option of concession-operated picnic shelters at Little Grassy and Crab Orchard campgrounds.
2. Explore the potential for a bicycle route within the restricted use area of the Refuge. The route will run mainly along old railroad beds.
3. Continue current policies on swimming at Devils Kitchen, Little Grassy and Crab Orchard lakes. Prohibit scuba diving.

4. Within 10 years of the plan's approval, upgrade boat ramps and associated parking at Devils Kitchen, Little Grassy and Crab Orchard lakes.
5. Continue current zoning on Crab Orchard Lake with additional no wake zones (see Figure 28). Gas motors will be prohibited in the most southeastern arm of Devils Kitchen Lake, from the mouth of Grassy Creek south to the Refuge boundary, and in ponds within the public use area. The portion of the lake south of Line Road 6 boat ramp will be designated a no-wake zone (see Figure 29).
6. Horseback use on the Refuge will be confined to a designated River to River Trail (see Figure 30 on page 86) and erosion due to trail use will be actively controlled through maintenance and/or seasonal closures.
7. Camping at Devils Kitchen will be reduced to primitive sites only. Crab Orchard and Little Grassy campgrounds will be upgraded to standards comparable to others in the area.
8. Within 2 years of the plan's approval, consolidate Playport and Images marinas on Crab Orchard Lake. Images marina slips will be moved to Playport marina. Within 5 years of the plan's approval, remove the building at Images Marina and develop the area into a large access area to the lake with a comfort station.
9. After 2 years of the completion of the CCP, the Crab Orchard Boat & Yacht Club will be converted to a concession.

Agricultural Goal

Provide opportunities for agricultural uses on Refuge lands that help attain wildlife conservation goals.

Background: Agriculture, one of the specified purposes of the Refuge, has been a part of the landscape since early settlement. After many years of soil depletion and erosion, beginning in the 1930s efforts have been made to implement better farming practices. On the Refuge, agriculture has been used to benefit wildlife, chiefly wintering Canada Geese.

Objective 1

Continue farming operations on about 4,400 acres of row crops with greater emphasis on conservation practices.

Strategy

1. Maintain infrastructure (roads, fences) in support of agricultural operations. Drop small, less profitable fields (less than 5 acres) from row cropping and convert to other cover (about 15 fields totaling 52 acres).Identify and drop farmed wetlands from the farm program. Permit cooperator to harvest corn remaining in the field in the spring. Emphasize Johnsongrass control. Prohibit mowing of clover in the crop rotation until after August 1. Enlist technical oversight from Natural Resource Conservation Service and University of Illinois Extension.

Objective 2

Continue farming operations on about 700 acres of hay fields with greater emphasis on conservation practices.

Strategy

1. Prohibit mowing of hay until after August 1. Maintain an updated rate charge for hay.

Objective 3

Enhance nesting habitat for grassland birds while maintaining or increasing the value for grazing on about 1,000 acres of pastures.

Strategy

1. Convert fescue pastures to other cool-season grasses and native warm season grasses with higher wildlife value. Divide existing pastures into three or four paddocks with a paddock of cool season grass and two or three paddocks of native warm season grasses. Rotate grazing cattle among the paddocks during the season. Enlist technical oversight from Natural Resource Conservation Service and University of Illinois Extension.

Industrial Goal

Provide an industrial complex and attendant utility and transportation infrastructure, which conform to prescribed safety, health, environmental and maintenance standards.

Background: Industry began in the area during World War II. When the Refuge was established it was given an industrial purpose, because industry was seen as a way of improving the economy of the area. The war time industry and some subsequent industrial tenants have contaminated the soils and waters of the Refuge. Providing the water and sewer infrastructure in support of industry has been

Figure 28: Crab Orchard Lake Watercraft Zoning

Figure 29: Devils Kitchen Lake Zoning, Crab Orchard NWR

Figure 30: Horseback Riding Trails on Crab Orchard NWR

difficult for the Refuge to accomplish. Most of the manufacturing and storage buildings are reaching the limits of their expected lifetime. The buildings require a lot of maintenance and refurbishing to meet today's standards. Recently, several industrial parks have been developed in the area that offer amenities not available on the Refuge. Of the industries on the Refuge, the munitions industry is in a unique position of requiring widely spaced facilities for safety. By providing a safe area for munitions manufacture, the Refuge is able to contribute to and support the national defense. The Refuge will continue to provide an area for defense munitions manufacture. The Service will seek not to compete with neighboring industrial parks. The Refuge will maintain roads and provide water and sewer services sufficient for current industrial tenants. Tenants will be expected to bring their facilities up to prescribed safety, health, environmental and maintenance standards under any new leases. If tenants do not renew leases, the Refuge will seek new tenants for facilities that continue to be suitable for occupancy. The intent will be to consolidate the areas occupied by industry.

Objective 1

Consolidate the areas occupied by industry.

Strategies

1. Update Industrial Policy. Maintain the current infrastructure to support existing facilities.
2. Remove buildings that are no longer suitable for occupancy for reasons of contamination, safety or lack of structural integrity and restore to natural habitats.

U.S. Fish & Wildlife Service

Wilderness Goal

Protect the ecological integrity, preserve the wilderness character, restore natural conditions to the extent practicable, and provide opportunities for solitude and primitive recreation within the Crab Orchard Wilderness.

Background: As long as they do not alter natural processes, the Wilderness Act of 1964 permits certain activities within designated wilderness areas. The Crab Orchard Wilderness is a popular area for hunting, hiking, nature study, horseback riding, and mushroom picking. Prohibited activities, such as camping and off-road vehicle use, occasionally occur. Horseback use and trails have developed inconsistent with the existing Wilderness Management Plan. The Wilderness Management Plan, which was approved in 1985, is dated and needs to be revised.

Suitability

The CCP planning included a wilderness review to identify Service-owned lands and waters within the planning unit that may qualify for inclusion in the National Wilderness Preservation System. The Service identified two tracts of land within the planning unit that meet the criteria for Wilderness Study Areas: an 80-acre tract completely surrounded by the existing Crab Orchard Wilderness and a 40-acre tract surrounded on three sides by the Crab Orchard Wilderness. Southern Illinois University owned both tracts when the Crab Orchard Wilderness was designated in 1976. The Refuge subsequently acquired the tracts through a land exchange in 1979. The two tracts are roadless, contiguous to designated wilderness, appear natural, and offer opportunities for solitude and primitive recreation. Both tracts are currently managed as a part of the Crab Orchard Wilderness.

The two parcels should be recommended for wilderness designation. This will add consistency to the protection and management of the Wilderness. The Wilderness will be managed in accordance with Service policy for Wilderness management (6 Refuge Manual 8). All activities in designated Wilderness will be carried out in conformance with the mandates of the Wilderness Act and the establishing legislation for the Crab Orchard Wilderness, Public Law 95-557. The use of motorized vehicles and mechanical transport is prohibited, except in emergency situations.

Objective 1

Recommend the designation of two parcels (120 acres) as Wilderness within 2 years of approval of the CCP.

Strategy

1. Prepare and submit a Wilderness Study Report. Service wilderness policy is currently under revision. The direction of the new policy will be followed when it is adopted.

Objective 2

Revise and implement the Crab Orchard Wilderness Management Plan within 5 years of approval of the CCP.

Strategy

1. Prepare and implement a Wilderness Management Plan. Service wilderness policy is currently under revision. The direction of the new policy will be followed when it is adopted.

Objective 3

Restore native hardwood forest on 325 acres of pine and pine-hardwood forest in the Crab Orchard Wilderness within 15 years of approval of the CCP.

Strategies

1. Thin the pine plantations (229 acres) and pine-hardwood stands (96 acres) in the Wilderness to promote establishment and growth of native hardwoods. Thinning will be conducted in several phases over a 10- to 15-year period to mimic the natural process of succession where pines are gradually replaced by hardwoods. Individual pines will be killed by cutting, girdling or injecting herbicide. No trees will be removed from the site. Treatments will be conducted so that the results will appear natural as much as possible. However, trees along heavily used trails may need to be felled to avoid personal injury to visitors, in which case this zone may appear unnatural for several years. Eventual removal of all the non-native pines will restore the natural vegetative cover of the area and enhance wilderness characteristics.
2. Prescribed burn the pine and pine-hardwood stands during the dormant season (November through March) on a 3- to 5-year cycle to enhance habitat conditions and promote desirable hardwood regeneration. Control lines will be established by hand tools where necessary, using natural firebreaks as much as possible.

Objective 4

Control or eradicate invasive species (especially autumn-olive, multiflora rose, Amur honeysuckle, white poplar, and Oriental bittersweet) over the 15-year life of the CCP.

Strategy

1. Prepare and implement an Integrated Pest Management Plan following guidance developed by the Service's "Promises Invasive Species Team."

Objective 5

Explore ways to increase cooperation with the U.S. Forest Service on management of the Crab Orchard Wilderness and the adjoining Panther Den Wilderness within 2 years of approval of the CCP.

Strategy

1. Contact the Forest Supervisor of the Shawnee National Forest and discuss ways our agencies could work together in managing the adjoining wildernesses.

Objective 6

Provide opportunities for primitive recreation, such as hiking, hunting, nature study and wild food collection, over the 15-year life of the CCP.

Strategies

1. Continue current primitive recreational opportunities.
2. Prepare and distribute a wilderness brochure and conduct interpretive programs to inform the public about primitive recreational opportunities available.

Objective 7

Within 5 years of approval of the CCP, determine an appropriate level of opportunities to offer equestrians based on an evaluation of the current level and extent of horseback riding use and its effects on the Wilderness.

Strategy

1. Evaluate the current, unauthorized River to River route. Cooperate with partners to plan, construct, and maintain an authorized River to River trail route through the Refuge.

Protection Goal

Protect the integrity of Refuge biological and cultural resources and the health and safety of visitors, industrial workers, farmers, and Service staff.

Background: Past industrial practices at the Refuge contaminated some lands and waters. As a result, in 1987 the Refuge was added to the U.S. Environmental Protection Agency's National Priorities List of contaminated sites. Studies have located

many sites of contamination within the former Illinois Ordnance Plant (IOP) resulting from military activities that occurred during World War II or subsequent activities of private industrial tenants. Lands no longer used by industry are converted to habitat for fish and wildlife. Some of these lands have been contaminated. These contaminants may need to be removed so that they do not adversely impact plants, fish, wildlife, or public health and welfare. Refuge visitors should be able to use these habitats for hunting, fishing, wildlife observation and other potential future uses without being exposed to unacceptable levels of contaminants. The Service is seeking remedy for past acts of contamination through the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as "Superfund." The Service believes past acts of contamination should be remedied with the best and most cost effective technologies available. The Service also believes that the Refuge should not be burdened with residual contamination that may impair the ability of the Service to manage the Refuge for appropriate uses in the future.

The Refuge's law enforcement officers serve to protect the natural and cultural resources, as well as the health and safety of visitors, staff, and tenants. The Refuge depends on cooperative relationships with the Illinois DNR and several local sheriff departments.

The Refuge faces a significant challenge of controlling exotic and invasive plants to protect biological diversity, provide high quality habitats for fish and wildlife, and facilitate agriculture, recreation, and industry.

The Refuge contains many documented cultural resources, and other undiscovered sites probably exist.

The Refuge manages 24 conservation easements within a 21-county area in southern Illinois. Inadequate staffing levels have impeded proper management of the widely dispersed easements. Some of the easements have not been surveyed or marked on the ground. The easements should be inspected regularly, but there have been long periods between inspections. Without appropriate monitoring the easements and their resources can not be protected from encroachment.

Objective 1

Refuge lands and waters are safe for fish, wildlife, plants, and people.

Strategy

1. Work with USEPA, Illinois EPA, Departments of Interior and Justice, and responsible parties to remediate contaminated sites. Where contamination is left in place, or where there is potential for undiscovered contamination that may pose a risk from exposure, institutional controls may be formulated. An institutional control plan will be written by the CERCLA staff and made available to Refuge management for implementation.

Objective 2

Visitors will feel safe on the Refuge and illegal harvest of fish and wildlife will be reduced.

Strategy

1. Maintain full-time law enforcement staff.

Objective 3

Manage or eliminate invasive species on the Refuge.

Strategy

1. Write and implement an Integrated Pest Management (IPM) Plan following guidance developed by the Service's "Promises Invasive Species Team." The IPM plan will address target species control methods, mapping and monitoring.

Objective 4

Protect the cultural, historic, and pre-historic resources of federally-owned lands within the Refuge.

Strategies

1. Implement the Cultural Resource Management Plan for Cultural Resources within the Crab Orchard National Wildlife Refuge (Godfrey and Stubbs 2001).
2. Ensure archeological and cultural values are described, identified, and taken into consideration prior to implementing undertakings. Notify the Regional Historic Preservation Officer early in project planning or upon receipt of a request for permitted activities.
3. Develop a step-down plan for surveying lands to identify archeological resources and for developing a preservation program.

4. Complete accessioning, cataloging, inventorying, and preserving the museum collection at the Refuge in accordance with "Survey of Collections at Crab Orchard NWR" by Mayda S. Jensen.

Objective 5

Meet Service policy guidelines ("Administration and Enforcement Procedures for Conservation Easement") for 12 conservation easements by 2007, for all easements by 2010.

1. Complete legal surveys on 50 percent (12 tracts) of all conservation easements by 2007 through contracted services. Complete contracted surveys on the remaining tracts by 2010.
2. Conduct annual inspections of all conservation easements.
3. Develop land use plans for 50 percent (12 tracts) of the conservation easements and restore grassland and wetland habitats on 25 percent of these tracts by 2009.
4. Hire a permanent 6-month law enforcement officer to conduct annual inspections, develop land use plans, and restore wetland and grassland habitat projects.

Outreach Goal

Visitors, cooperators, tenants, and local residents will understand Refuge goals, issues and activities. Service personnel will understand the expectations and concerns of the general public by being receptive to their feedback.

Background: During the scoping process, residents of local communities reported they felt uninformed by the Refuge about activities occurring on the Refuge and about the reasons for certain activities. To resolve this concern, the Refuge will communicate more effectively with local communities and listen more attentively to community concerns.

In keeping with the history of public use on the Refuge, many non-wildlife oriented special events have been permitted on the Refuge. These special events have included organized running, bicycling, and swimming events, use of Refuge for "National Hunting and Fishing Days" activities, and American Red Cross Blood Drives.

The Refuge will continue to support special events that foster good community relations and are organized by nonprofit organizations. To be permitted, these events cannot damage Refuge habitats or facilities, nor can they adversely impact fish and wildlife populations. In addition these events cannot interfere with Refuge visitors and wildlife-dependent activities such as hunting, fishing, and environmental education. Permitted activities will be limited to one-time and annual events.

Glenn Smart

Objective 1

The positive attitude toward Refuge management will increase among visitors, cooperators, tenants, and local residents throughout the life of the plan.

Strategies

1. Issue press releases, hold Refuge open houses and hold regularly scheduled forums.
2. Within 2 years of the Plan's approval, create and maintain a "listening log" of written and verbal public input submitted to the Refuge. Review this log quarterly and address voiced community concerns.
3. Provide annual reports on the "State of the Refuge." Distribute these reports upon request at the Visitor Center and by mail and post the current year's report on the Refuge website.
4. Continue to permit selected annual and special events that are organized by nonprofit organizations, provided they are compatible and do not damage Refuge resources or interfere with wildlife-dependent recreation.

Chapter 5: Plan Implementation

New and Existing Projects

This CCP outlines an ambitious course of action for the future management of Crab Orchard National Wildlife Refuge. It will require considerable staff commitment as well as funding commitment to actively manage the wildlife habitats and add and improve public use facilities. The Refuge will continually need appropriate operational and maintenance funding to implement the strategies in this plan.

A full listing of unfunded Refuge projects and operational needs can be found in Appendix I. In the appendix, the highest priority Refuge projects are described briefly.

Staffing

Reforestation, aggressive control of invasive species, an increase in the number of acres managed as moist soil units, and improvements to the open land units will require additional staff and operating funds. A person with expertise in agriculture and invasive species will be added to the biological program staff. Also, a person with expertise in Geographic Information Systems will be needed to assist the biological staff with mapping and record keeping for invasive species control and other habitat work. A seasonal tractor operator will need to be hired to help accomplish the habitat work. To improve the quality of services, the Refuge will add a position in the visitor information center to assist with administrative duties.

The completion of the consolidation of the former Playport and Images Marinas will require moving the remainder of the docks from the Images area, removal of the concession building and construction of a boat ramp.

Glenn Smart

Meeting the goals and objectives of this plan will require a 15 percent increase in the Refuge's current operations and maintenance budget.

Partnership Opportunities

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

Southern Illinois Hunting and Fishing Days, Inc. is a non-profit organization that partners with the Refuge to promote hunting and fishing in the area. The Refuge initiated this program in the early 1980s. SI Hunting and Fishing Days assumed the

lead for this activity in the early 1990s. Several thousand people now attend this annual weekend event, which is held at John A. Logan College.

Take Pride in America has been organized and worked with the Refuge since 1988. Take Pride in America has built courtesy docks for boat landings at all three lakes. Take Pride in America organized the construction of bass-rearing ponds and maintains Hogan's Point (Take Pride Point) for fish-offs.

The Crab Orchard Waterfowl Association has provided funds for the construction of moist soil units on the Refuge. Quail Unlimited has provided native grass seed for Refuge prairie restoration.

Touch of Nature, the Friends of Crab Orchard NWR and the Refuge's Visitor Services Program have partnered to provide environmental education opportunities for local schools.

With the help of the following partners, the Refuge is able to provide one of the most successful Kids Fishing Derbys in the area:

University of Illinois Extension
Illinois DNR
Southern Illinois National Hunting and Fishing Days
Timberline Fisheries
Zimmer Radio Group
WalMart
Silkworm Inc.
Marion Pepsi-Cola
Crab Orchard Boat & Yacht Club

The Refuge has many dedicated friends and volunteers that assist with a variety of tasks. The Friends of Crab Orchard National Wildlife Refuge, John A. Logan College, University of Southern Illinois, Southern Illinois Audubon Society, Williamson County Tourism, and Marion U.S. Penitentiary are just a few of the organizations that contribute time to the Refuge. We expect to maintain and enhance these partnerships in the future.

Step-down Management Plans

Step-down management plans describe the specific strategies and implementation schedules for meeting general goals and objectives identified in the CCP. Table 31 shows the step-down management plans we intend to prepare. We have completed two management plans that will be adopted/included under the CCP.

The Natural Resource Damage Assessment (NRDA) Restoration Plan was approved July 21, 1997. The NRDA Restoration Plan describes activities proposed to compensate for lost resources and the services they provide that resulted from PCB contamination on part of the Refuge. Restoration activities included in the plan include reforestation, shoreline and riparian restoration, grassland restoration, public education/outreach, and land acquisition.

The Fire Management Plan, approved January 16, 2002, provides direction and establishes procedures to guide various wildland fire program activities. The Fire Management Plan covers historical and ecological role of fire, fire management objectives, preparedness, suppression, fire management actions and responses, fire impacts, use of prescribed fire, and fire management restrictions.

Monitoring and Evaluation

Monitoring is critical to successful implementation of this plan. Monitoring is necessary to evaluate the progress toward objectives and to determine if conditions are changing.

Accomplishment of the objectives described in this CCP will be monitored annually by the Refuge Manager's supervisor. Successful performance will be tied to the accomplishment of objectives that are scheduled for that year. The public will be informed about the activities of the Refuge staff through an "Annual Report" that will be mailed to all persons on the Refuge mailing list, published on the Refuge's Web site, and its availability will be announced through news releases to the media. The annual report will be published each year in February.

The techniques and details for monitoring related to specific objectives will be specified in the Inventory and Monitoring Step Down Plan.

Substantial changes are likely to occur within the Service and the community during the next 15 years. This plan and its objectives will be examined at least every 5 years to determine if any modifications are necessary to meet the changing conditions.

Plan Review and Revision

The CCP for the Refuge is meant to provide guidance to refuge managers and staff over the next 15 years. However, the CCP is also a dynamic and flexible document and several of the strategies contained in this plan are subject to natural, uncontrollable events such as windstorms and droughts. Likewise, many of the strategies are

Table 31: Step-down Management Plans, Crab Orchard NWR

Title	Service Manual Reference
Occupational Safety and Health	Parts 240-249
Safety Program	240 FW 1-9
Safety Operations	241 FW 1-9
Industrial Hygiene	242 FW 1-13
Hazardous Materials Operations	242 FW 6
Contaminant Institutional Control	
Law Enforcement	Parts 440-459
Pollution Control	Parts 560-569
Policy and Responsibilities	560 FW 1
Pollution Prevention	560 FW 2
Compliance Requirements	Part 561
Clean Water Act	561 FW 3
RCRA – Hazardous Waste	561 FW 6
Pesticide Use and Disposal	Part 562
Pest Management	562 FW 1
External Threats to FWS Facilities	Part 563
Air Quality Protection	563 FW 2
National Wildlife Refuge System (NWRS) Uses	Part 603
NWRS Uses (Appropriate Refuge Uses)	603 FW 1
Priority Wildlife-dependent Recreation	Part 605
Hunting	605 FW 2
Fishing	605 FW 3
Wildlife Observation	605 FW 4
Wildlife Photography	605 FW 5
Environmental Education	605 FW 6
Interpretation	605 FW 7
Visitor Services	
Wilderness Management	Part 610
Special Area Management	Part 611
Research Natural Areas	611 FW 1
National Trails	611 FW 4
Minerals Management	Part 612
Minerals and Mining	612 FW 1
Oil and Gas	612 FW 2
Archeological Resources Inventory	Sec. 110 NHPA; sec. 14 ARPA
Habitat Management Planning	Part 620
Natural Resources Damage Assessment Restoration	
Fire Management	Part 621
Population Management	Part 701

Table 31: Step-down Management Plans, Crab Orchard NWR (Continued)

Title	Service Manual Reference
Inventory and Monitoring	701 FW 2
Propagation and Stocking	701 FW 3
Marking and Banding	701 FW 4
Disease Prevention and Control	701 FW 7
Trapping	701 FW 11
Fishery Resources Management	Part 710
Industrial Operations Management	

dependent upon Service funding for staff and projects. Because of these factors, the recommendations in the CCP will be reviewed periodically and, if necessary, revised to meet new circumstances. If any revisions are major, the review and revision will include the public.

Appendix A: Record of Decision

U.S. Fish and Wildlife Service

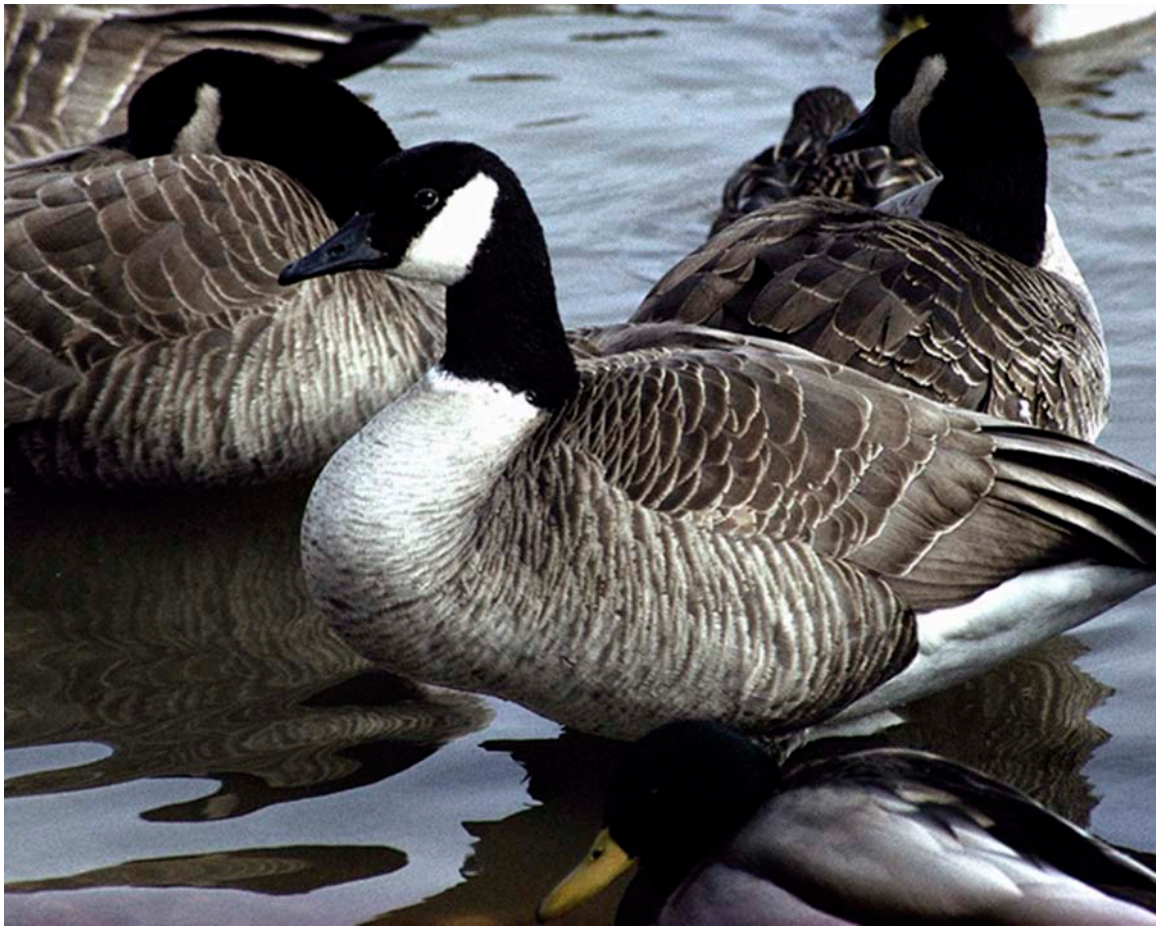
Crab Orchard

National Wildlife Refuge

Environmental Impact Statement and Comprehensive Conservation Plan

Record of Decision

October 2006



Introduction

This Record of Decision (ROD) has been developed by the U.S. Fish and Wildlife Service (Service) in compliance with agency decision-making requirements of the National Environmental Policy Act of 1969 (NEPA), as amended. It documents the decision of the Service, based on the information contained in the Final Environmental Impact Statement (EIS) for the Comprehensive Conservation Plan and the entire administrative record. The Service has selected the preferred alternative (Alternative E) as described in the Final EIS as the best alternative for the Comprehensive Conservation Plan for the Crab Orchard National Wildlife Refuge (NWR). A notice of this decision will be published in the *Federal Register* and a news release will be sent to the media. This document will also be posted on the planning website for the Refuge.

Purpose of Action

The purpose of this action is to specify and adopt a long-term management direction for the Crab Orchard NWR that will achieve the Refuge purposes and the mission of the National Wildlife Refuge System (Refuge System).

Need for Action

For Crab Orchard National Wildlife Refuge, there is a need to meet the Refuge purposes of wildlife conservation, recreation, industry and agriculture as much as possible as a unit of the National Wildlife Refuge System that emphasizes its mission of wildlife conservation. This need has proven difficult to meet in the past because the purposes of the Refuge, which outrank the mission of the Refuge System, often conflict with wildlife conservation and compete unfavorably in the budgeting process. There is a need to specify the priority wildlife species of management concern and, within budget constraints and other limitations, reduce habitat fragmentation. There is a need to recognize the recreational demands of the public, and within budget constraints and the Refuge mission, attempt to meet this demand. There is a need to address the conflicting demands of wildlife- and non-wildlife-dependent recreation. There is a need to improve the relations between the community and the Refuge. In addition, a plan is needed to satisfy the legislative mandates of the National Wildlife Refuge System Improvement Act of 1997, which requires the Service to develop and implement a Comprehensive Conservation Plan for each national wildlife refuge.

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Key Issues

Through public scoping and with input from various agencies and publics, key issues and possible solutions were identified. The issues were grouped into six main topics: 1) recreation, 2) wildlife conservation, 3) refuge purposes, 4) recreational boating, 5) role in regional economy, and 6) communication between the Refuge and community. These issues were thoroughly examined in the Draft and Final EIS.

Alternatives Considered

Five alternatives and their consequences were described in detail in the Draft and Final EISs. Under all alternatives the objective to provide enough food for wintering Canada Geese to support 6.4 million goose-use-days annually would be met; federally listed species, state-listed species and federally proposed species and their habitats would be protected; resident fish and wildlife populations would be maintained or enhanced; communication between the Refuge and the community would be improved; cultural resources, the health and safety of refuge users and staff, and the ecological integrity and the wilderness character of the Crab Orchard Wilderness would be protected; and the Refuge's Fire Management Plan would guide prescribed fire and wildland fire prevention and suppression. The following policies would also apply under all

alternatives: The concept of classifying Refuge lands for various uses and designation as Areas I, II, and III would be dropped; only the industrial area would retain the designation "restricted use area" for safety and security reasons. The length of stay at Refuge campgrounds would be limited to 14 consecutive nights. Group camps would be required to provide environmental education as specified in current agreements. Recreational fees would be made consistent with the Federal Lands Recreation Enhancement Act of 2005 and the standard schedule of fees for most refuges. Small competitive fishing events called "fish-offs" would be limited to three events per year per organization and managed under a permit system. All mowing of pastures, hay fields, and clover fields would take place after August 1 to protect nesting birds.

Alternative A. Current Management (No Action)

Under this alternative the current management activities at the Refuge would continue. The Refuge would continue to provide sufficient habitat for the needs of wintering geese. All current authorized recreation uses and patterns on the Refuge would continue. Current industrial policies would remain in place and the Refuge would provide facilities for the existing tenants at fair market value rental rates. The amount of agricultural land would remain fairly constant. However, some loss of cropland may occur through installing buffer strips needed for soil and water protection.

Glenn Smart

Alternative B. Reduced Habitat Fragmentation: Wildlife-dependent Recreation Emphasis With Land Exchange

Through the years the Refuge has been criticized for its lack of support of the recreational purpose of the Refuge. Recreation on the Refuge drew the greatest number of comments during the scoping of issues. When the Refuge was established, the Director of the Service assured Congress that the Service would be able to manage for the four purposes of the Refuge. In 50 years of management, the Service has not been able consistently to provide facilities and management for quality non-wildlife-dependent recreational experiences. Providing for swimming, picnicking, and power boating does not fit well with the capabilities and resources of the Service. Under this alternative the non-wildlife-dependent recreation that would remain the responsibility of the Refuge would be guided by the philosophy of "consolidate and improve." Over the last decade habitat fragmentation has been identified as a significant result of changing land use. Habitat fragmentation is known to have negative effects on biological diversity.

Under this alternative, management emphasis would be on reducing habitat fragmentation and reconciling conflicts between the Refuge's recreation purpose and the Refuge System mission by focusing on wildlife-dependent recreation on the Refuge while still providing a full spectrum of recreational activities in the area.

Some of the current management activities at the Refuge would be modified to provide greater benefits to wildlife. The main point of this alternative is to offer increased recreational opportunities by exchanging land in the developed northwestern portion of the Refuge for undeveloped land at another location.

The Refuge would update the industrial use policy with the intent of not promoting expansion and consolidating the areas occupied by industrial tenants. The Service would aim to not compete with neighboring industrial parks. If an industrial tenant were to leave the Refuge and their facilities were suitable for occupancy, the Refuge would make them

Bob Etzel

available for new tenants. The amount of row crops would decrease slightly. Current acreage of hay fields and pastures would remain about the same. The Refuge would convert fescue pastures to other cool-season and native warm-season grasses over a period of 15 years and modify grazing regimes to benefit grassland birds.

Alternative C. Open Land Management: Consolidate and Improve Recreation

Both grassland and forest species are negatively affected by habitat fragmentation. Under this alternative the Refuge would take advantage of the lands that are already open and consolidate existing large blocks of open land for grassland dependent species, especially birds. The Refuge recognizes that improvements in the recreation program are needed. Under this alternative the Refuge would satisfy the Refuge's recreation purpose as much as possible within Service budget priorities and expanding emphasis on wildlife-dependent recreation.

Under this alternative cropland and grassland would increase slightly. Pasture and hayfield management would change to provide more emphasis on habitat quality for grassland birds. The Refuge would manage one large forest block to benefit area-sensitive forest birds. To enhance non-wildlife-dependent recreational activities, the Refuge would consolidate marinas and picnic areas, upgrade existing boat ramps, and designate times and places for the various types of boating activities. Camping capacity would be reduced, the quality of camping facilities would be upgraded, and a 14-day maximum stay policy would be implemented. A spectrum of recreational opportunities ranging from more developed recreation at Crab Orchard Lake to less developed opportunities at Devils Kitchen Lake would be provided. If an industrial tenant left the Refuge, the Refuge would not seek a new tenant for the vacant facility. The amount of row crops would increase slightly.

Alternative D: Forest Land Management: Consolidate and Improve Recreation

Under this alternative the Refuge would take advantage of the natural tendency and historical prevalence of forests in the area and consolidate existing large blocks of forest for forest-interior species, especially birds. The Refuge would manage two large forest blocks to benefit area-sensitive forest birds. The Refuge would maintain some early successional habitat. Pasture and hayfield management would change to provide more emphasis on habitat quality for grassland birds, along with an emphasis on cattle production on pastures. To enhance non-wildlife-dependent recreational activities, the Refuge would consolidate marinas and picnic areas, upgrade existing boat ramps, and designate times and places for the various types of boating activities. Camping capacity would be reduced, the quality of camping facilities would be upgraded, and a 14-day maximum stay policy would be implemented. If an industrial tenant left the Refuge, the Refuge would not seek a new tenant for the vacant facility. The amount of row crops and hay fields would decrease slightly. The Refuge would increase forage diversity and use rotational grazing in pastures to increase cattle production.

Alternative E: Reduced Habitat Fragmentation: Consolidate and Improve Recreation (Preferred Alternative)

This alternative has the same habitat, industrial, and agricultural programs as Alternative B and the same recreation management program as Alternative C.

Under this alternative, management emphasis would be on reducing habitat fragmentation by making small changes in the current habitat cover to gain larger, unfragmented blocks of both forest and grassland habitats. Some of the current management activities at the Refuge would be modified to provide greater benefits to wildlife.

The Refuge would update the industrial use policy with the intent of not promoting expansion and

consolidating the areas occupied by industrial tenants. The Service would aim to not compete with neighboring industrial parks. If an industrial tenant were to leave the Refuge and their facilities were suitable for occupancy, the Refuge would make them available for new tenants. The amount of row crops would decrease slightly. Current acreage of hay fields and pastures would remain about the same. The Refuge would convert fescue pastures to other cool-season and native warm-season grasses over a period of 15 years and modify grazing regimes to benefit grassland birds.

The Refuge would satisfy the Refuge's recreation purpose as much as possible within Service budget priorities and expanding emphasis on wildlife-dependent recreation. To enhance non-wildlife-dependent recreational activities, the Refuge would consolidate marinas and picnic areas, upgrade existing boat ramps, and designate times and places for the various types of boating activities. Camping capacity would be reduced, the quality of camping facilities would be upgraded, and a 14-day maximum stay policy would be implemented. A spectrum of recreational opportunities ranging from more developed recreation at Crab Orchard Lake to less developed opportunities at Devils Kitchen Lake would be provided.

Environmentally Preferable Alternative

The Council on Environmental Quality (CEQ) regulations for implementing the NEPA require that the ROD specify "the alternative or alternatives which were considered to be environmentally preferable" (40 CFR 1505.2(b)). This alternative has generally been interpreted to be the alternative that will promote the national environmental policy as expressed in NEPA's Section 101 (CEQ's "Forty Most-Asked Questions," 46 Federal Register, 18026, March 23, 1981). Ordinarily, this means the alternative that causes the least damage to the biological and physical environment; it also means the alternative that best protects, preserves, and enhances historic, cultural, and natural resources.

All action alternatives (B through E) are considered environmentally preferable alternative to Alternative A (No Action). Among the four action alternatives there is little to distinguish their environmental impacts. The primary differences among the alternatives relate to the recreational uses of the Refuge. Alternatives B and E balance benefits to forest and grassland birds slightly more than Alternatives C and D. In Alternative B some wildlife habitat would be lost as additional recreation areas were developed, although overall there would be an increase of about 1,200 acres of wildlife habitat. Alternative E is the alternative considered to have the least adverse effects on the physical and biological environments.

Basis for the Decision

The Service selected Alternative E, as described in the Final EIS, as the best alternative for the Comprehensive Conservation Plan to guide refuge management for the next 15 years. The rationale for choosing the selected alternative as the best alternative for the Comprehensive Conservation Plan is based on the impact of this alternative on the purposes of the Refuge and the issues and needs that surfaced during the planning process. Other factors considered in the decision were public and resource benefits gained for the cost incurred and the extensive public comment. Alternative E is the most environmentally preferable alternative. Alternative E is likely to lead to improvements under the agricultural, wildlife conservation, and recreation purposes of the Refuge. Alternative E is also expected to lead to wider and fairer access to public recreational opportunities. Alternative A was not selected because it would inadequately address the needs and issues that were documented during planning. Alternative B was not selected because the land exchange, which was the heart of the alternative, could not be accomplished within the authorities of the Department of the Interior. Alternatives C and D served to contrast an emphasis on grassland birds with an emphasis on forest birds, and we learned that only marginal benefits would accrue to either group of birds over the reduced habitat fragmentation approach of Alternative B or E.

Chapter 7 of the Final EIS summarized all written comments submitted to the Service regarding the Draft EIS and gave the Service's response to the comments. Based on the comments the preferred alternative was modified to: include an objective and strategies related to hardwood forest management; more explicitly describe the implementation of the 14-day camping length of stay; include a provision for primitive camping at Devils Kitchen Campground; expand the area on Devils

Kitchen Lake in which gas motors would be permitted; and reduce the extent of no wake zoning on Crab Orchard Lake.

Public Comments to Final EIS

The Service filed the Final EIS for the Comprehensive Conservation Plan for Crab Orchard National Wildlife Refuge with the Environmental Protection Agency (EPA) on September 1, 2006. In compliance with agency decision-making requirements of the National Environmental Policy Act of 1969, as amended, the Service is required to circulate the Final EIS for 30 days after filing with the EPA before issuing a Record of Decision on the Comprehensive Conservation Plan.

The Final EIS was announced in the *Federal Register* (71 FR 52138-52139) and distributed to agencies, state and local elected officials, local newspapers, and to businesses and organizations with an interest in the Refuge. The Final EIS was also placed in thirteen local libraries and posted on the planning website for the Refuge. A news release was sent to local newspapers announcing the availability of the Final EIS, and a summary of the Final EIS was mailed to over 1,750 people on the planning mailing list.

During the 30-day circulation period, which ended October 9, 2006, the Service received 67 written comments, which are on file at Refuge headquarters in Marion, Illinois. With one exception, the comments did not raise any issues not addressed in the Final EIS, and the comments did not result in changes to the analysis of environmental consequences or affect the Service's response to similar comments in the Final EIS/CCP. One comment pointed out an inconsistency in the document, which was introduced in the final editing, related to the acres of new moist soil impoundments in the preferred alternative. The Refuge's intention is, as indicated by the response on page 181 of the Final EIS/CCP, to develop 150-200 additional acres of moist soil impoundments. The stand-alone CCP will reflect that intention. The new topic raised during the waiting period was an advocacy for rock climbing on the Refuge.

During the comment period for the Draft EIS/CCP we received only two comments on rock climbing; both were opposed to allowing it on the Refuge. However, sixty-one comments received during the waiting period concerned rock climbing. The Access Fund, a national advocacy organization whose mission is to keep climbing areas open and to conserve the climbing environment, is concerned that we prohibited rock climbing without preparing a Compatibility Determination (CD). They requested that we complete a CD for rock climbing and amend the Final EIS/CCP prior to a Record of Decision. During the waiting period, other citizens and groups have expressed an interest in allowing access for climbing. The Service's consideration of rock climbing is described in the following paragraphs.

Background

Rock climbing has been occurring on Crab Orchard National Wildlife Refuge as an unauthorized use. It has never been officially permitted, nor has it been explicitly addressed in past regulations or plans. In contrast to most public lands that are open to a use unless it is specifically prohibited, a national wildlife refuge is closed until it is opened for a particular use.

To address past ambiguity, the policy of not permitting rock climbing was stated explicitly in the Draft and Final Environmental Impact Statements (EIS) and Comprehensive Conservation Plan (CCP) as a policy common to all alternatives. This policy is not a change from the past. It is an explicit statement of current policy.

The only known location rock climbing occurs on the Refuge is at a rock formation near the Devils Kitchen Dam climbers have named "Opie's Kitchen." The following section describes the Service procedure for determining whether a use is appropriate for a refuge and the application of the procedure to rock climbing at Crab Orchard NWR.

Service Guidance for Determining Appropriate and Compatible Uses

"The refuge manager will decide if a new or existing use is an appropriate use. If an existing use is not appropriate, the refuge manager will eliminate or modify the use as expeditiously as practicable. If a use is not appropriate, the refuge manager will deny the use without determining compatibility." (603 FW 1.3). If a use is found to be appropriate, then it must be determined to be compatible before it is allowed on a refuge. A refuge use is appropriate if the use meets at least one of the following three conditions:

1. It is a wildlife-dependent recreational use.
2. It contributes to fulfilling the refuge purpose(s), the Refuge System mission, or goals or objectives described in a refuge management plan approved after October 9, 1997.
3. The refuge manager has evaluated the use following the guidelines in the appropriate use policy and found that it is appropriate.(603 FW 1.11A)

Rock climbing was evaluated against the above three conditions.

Rock climbing is not a wildlife-dependent recreational use and, therefore, does not meet the first condition.

Rock climbing is recreation and the Refuge has a recreational purpose. The Refuge's recreational purpose is limited, however. The Service's interpretation of the Refuge's purpose is derived from the intent when the Refuge was established. These uses included public hunting, picnicking, fishing, boating, and other aquatic activities. Additionally, there was the expectation of group camps, such as Boy and Girl Scout camps. Rock climbing is considered to be outside the original intent of the recreational purpose and, therefore, does not contribute to the refuge purpose. Rock climbing does not contribute to the Refuge System mission or goals or objectives described in a refuge management plan approved after October 9, 1997. Rock climbing does not meet the second condition.

The refuge manager determines appropriateness of a use by evaluating the use against ten criteria (603 FW 1.11A(3)). Refuge Manager Dan Frisk evaluated the appropriateness of rock climbing and found:

The rock formation used by climbers is within an area of the Refuge designated as the Devil's Kitchen Dam Research Natural Area. The area was designated as a Research Natural Area in 1970. Rock climbing is inconsistent with the goals and objectives of the Devil's Kitchen Dam Research Natural Area in which activities are limited to research, study, observation, monitoring, and educational activities that are non-destructive, non-manipulative, and maintain unmodified conditions (8 RM 10.2). When established, the area was recognized as having a Grade A (essentially undisturbed) sandstone cliff community. Climbers have trampled vegetation, exposed soil to erosion,

U.S. Fish & Wildlife Service

and exposed tree roots in a sensitive zone known for supporting rare plants. Magnesium carbonate chalk left on rock faces is an additional, visible modification to the area. The nearby Shawnee National Forest also contains natural areas. In 1997 the USDA Forest Service closed approximately half of their natural areas to rappelling and rock climbing. The remaining natural areas are being analyzed for future closures.

Rock climbing is not manageable within available budget and staff and its management would divert efforts and resources away from the proper and reasonable management of other priority programs. The possibility of relying heavily on volunteers to aid in management was considered, but the coordination of volunteer efforts would still divert efforts and resources from other priority management needs directly related to the Refuge's purpose and the System mission.

Rock climbing will not be manageable in the future within existing resources. Resources available to the Refuge must be managed carefully to meet its core responsibilities. Given the fifteen year program described in the CCP and the prospect of increasingly tight budgets, we project that it will be even more challenging to meet our core responsibilities in the future. We can envision no scenario where we will have the resources necessary to manage rock climbing.

Rock climbing does not measurably contribute to the public's understanding and appreciation of the Refuge's natural or cultural resources. Certainly, as an outdoor activity, rock climbing may add to a participant's appreciation for the Refuge's natural resources and climbing on a natural feature has characteristics that can not be duplicated indoors. However, given the impacts to the resource, rock climbing's focus on the physical aspect of the sport, and in comparison to other visitors whose intent is

nature study and appreciation, rock climbing does not warrant an evaluation as contributing to understanding and appreciation of the Refuge's natural resources.

Rock climbing can not be accommodated without reducing the potential to provide quality, compatible, wildlife-dependent recreation into the future. As noted in the discussion of budget and staff requirements above, management of rock climbing would divert efforts and resources away from other priority needs, including the provision of quality, compatible, wildlife-dependent recreation.

Summary Finding

The Service generally does not allow a use if any of the ten appropriate use decision criteria receives a negative evaluation, but our guidance does point out the possibility of an exception. "There may be situations where the refuge has exceptional or unique recreational resources, such as rock climbing, that are not available nearby, off the refuge, and the use requires insignificant management resources. In such cases, we may further consider a use" (603 FW 1.11B). This exception does not apply to the Refuge. There are other opportunities to rock climb on public lands in nearby Giant City and Ferne Clyffe State Parks and Shawnee National Forest. And, if rock climbing were allowed on the Refuge, its management would require more than "insignificant management resources." Some climbers claim that the particular challenges and type of climbing (bouldering) that occurs on the Refuge can not be found in nearby areas. We do not think the personal preference to use a specific rock formation outweigh the impacts to resources that occur and the conflicts with other compatible uses and the aims of the Research Natural Area.

Based on an overall assessment of factors contained in Service policy, the Refuge Manager has found that rock climbing at Crab Orchard National Wildlife Refuge is not appropriate. (FWS Form 3-2319, Finding of Appropriateness of a Refuge Use, is on file at the Refuge office.) As a result of this finding and according to Service procedure, rock climbing on the Refuge has been denied by the Refuge Manager without determining compatibility.

Mitigation

Because all practicable means to avoid or minimize environmental harm have been incorporated into the preferred alternative, no mitigation measures have been identified. Means to minimize environmental harm are complemented by a Biological Assessment that was prepared to address any impacts to federally-listed threatened or endangered species. This assessment calls for a tiered approach, whereby impacts and mitigation will be handled on a project-specific basis when project scope and design is articulated. The Biological Assessment concluded that implementation of Alternative E is not likely to adversely affect the Bald Eagle and not likely to jeopardize the continued existence of the Indiana bat. In addition, compatibility determinations were prepared for all uses identified in Alternative E, and these determinations contain stipulations to avoid, minimize, or mitigate any environmental impacts from these uses and associated facilities.

Conclusion

Based on a thorough review of the Administrative Record for this project, and careful consideration of the full range of impacts from the Comprehensive Conservation Plan on all aspects of the human environment, including the social, economic, cultural, and natural resources of the area, I have decided to implement the Comprehensive Conservation Plan for the Crab Orchard National Wildlife Refuge as described in Alternative E in the Final EIS (September 2006).

Robyn Thorson — October 27, 2006

Robyn Thorson — *Date*

Regional Director
U.S. Fish and Wildlife Service

Appendix B: Glossary

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Aquatic Species

Includes all freshwater, anadromous and estuarine fishes, freshwater mollusks, freshwater crustaceans and freshwater amphibians.

Archaeological and Cultural Values

Any material remains of past human life or activity greater than 100 years old which are of archaeological interest as defined by Section 4(a) of the Archaeological Resources Protection Act and 43 CFR Part 7.3.

Biodiversity

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

Candidate Species

Those species for which the Service has on file sufficient information on biological vulnerability and threats to propose them for listing.

Compatible Use

A wildlife-dependent recreational use or any other use of a refuge that, in the sound professional judgment of the Director or designee, will not materially interfere with or detract from the fulfillment of the mission of the System or the purposes of the refuge (PL 105-57).

Comprehensive Conservation Plan

Plan: A document, completed with public involvement, that describes the desired future condition and provides long-term (15 year planning horizon) guidance to accomplish the purposes of the refuge system and the individual refuge units.

Conservation

The management of natural resources to prevent loss or waste. Management actions may include preservation, restoration and enhancement.

Conservation (Species)

The use of all methods and procedures which are necessary to bring any species to the point at which the measures provided are no longer necessary. Such methods and procedures include, but are not limited to, all activities associated with scientific resources management such as research, census, law enforcement, habitat acquisition and maintenance, propagation, live trapping, and transplantation. Conservation is the act of managing a resource to ensure its survival and availability.

Cultural Resources

Cultural Resources: "those parts of the physical environment – natural and built – that have cultural value to some kind of sociocultural group... [and] those non-material human social institutions...." (King, p.9). Cultural resources include historic sites, archeological sites and associated artifacts, sacred sites, traditional cultural properties, cultural items (human remains, funerary objects, sacred objects, and objects of cultural patrimony) (McManamon, Francis P. DCA-NPS; letter 12-23-97 to Walla Walla District, COE), and buildings and structures.

Deepwater

Permanently flooded lands lying below the deepwater boundary of wetlands (Cowardin *et al.*, 1979). Deepwater areas are located below the elevation of the extreme low water of the spring tide in oceans and estuaries, and those portions of rivers and lakes greater than 6.6 feet in depth.

Ecosystem

Dynamic and interrelating complex of plant and animal (including humans) communities and their associated non-living environment.

Ecosystem Approach

1) Protecting or restoring the natural function, structure, and species composition of an ecosystem, recognizing that all components are interrelated. 2) Management of natural resources using system-wide concepts to ensure that all plants and animals in ecosystems are maintained at viable levels in native habitats and that basic ecosystem processes are perpetuated indefinitely (Clark and Zaunbrecher 1987).

Endangered Species

A listed species in danger of extinction throughout all or a significant portion of its range.

Enhance (habitats)

Improves habitat through alteration, treatment, or other land management of existing habitat to increase habitat value for one or more species without bringing the habitat to a fully restored or naturally occurring condition.

Forest Fragmentation

Fragmentation may occur when a forested landscape is subdivided into patches. Fragmentation may also occur when numerous openings for such things as fields, roads, and powerlines interrupt a continuous forest canopy. The resulting landscape pattern alters habitat connectivity and edge characteristics, influencing a variety of species.

Forest Stand Improvement Treatment

A non-commercial, intermediate treatment made in older stands to regulate composition by species and improve stand quality. Techniques include girdling, cutting, and application of herbicide to individual stems.

Geographic Information System, spatial

GIS aids in the collection, analysis, output and distribution of spaital data and information.

Goose-use-day

Enough food to feed one goose for one day.

Improvement Cutting

A commercial, intermediate cutting made in older stands to regulate composition by species and improve stand quality. This type of cutting treatment is accomplished by the sale and harvesting of merchantable trees.

Interjurisdictional Fish

Populations of fish that are managed by two or more states or national or tribal governments because of the scope of their geographic distributions or migrations.

Intermediate Cutting/Treatment

A cutting or treatment applied during that portion of the rotation from the reproduction stage to maturity.

Institutional Control

Institutional controls are non-engineered instruments such as administrative and/or legal controls that minimize the potential for human exposure to contamination by limiting land or resource use. They are generally used in conjunction with, rather than in lieu of, engineering measures such as waste treatment or containment. Institutional controls can be used during all stages of the clean-up process to accomplish various clean-up-related objectives. More than one institutional control should be used and they should be implemented in a series to provide overlapping assurances of protection from contamination.

Invasive Species

An alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health.

Migratory Nongame Birds of Management Concern

Those species of nongame birds that (a) are believed to have undergone significant population declines; (b) have small or restricted populations; or (c) are dependent upon restricted or vulnerable habitats.

Migratory Species

Species that move substantial distances to satisfy one or more biological needs, most often to reproduce or escape intolerable cyclic environmental conditions.

National Wildlife Refuge System

All lands and waters and interests therein administered by the Service as wildlife refuges, wildlife ranges, wildlife management areas, waterfowl production areas, and other areas for the protection and conservation of fish and wildlife, including those that are threatened with extinction.

Protect (habitat)

Maintain current quality or prevent degradation to habitat. The act of ensuring that habitat quantity and quality do not change, most often as a result of human activities but sometimes in response to unwelcome natural processes or phenomena.

Recovery Plans (species)

Documents developed by the Service that outline tasks necessary to stabilize and recover listed species. Recovery plans include goals for measuring species progress towards recovery, estimated costs and time frames for the recovery process, and an identification of public and private partners that can contribute to implementation of the recovery plan.

Regeneration Cutting

A commercial cutting in a mature stand for the purposes of removing the old trees and creating environmental conditions favorable for establishment of reproduction.

Regeneration/Reproduction

These terms are synonymous, meaning the young trees established at the beginning of a rotation.

Restore (habitat)

Returns the quantity and quality of habitat to some previous naturally occurring condition, most often some baseline considered suitable and sufficient to support self-sustaining populations of fish and wildlife.

Riparian Habitats

Those lands adjacent to streams or rivers that form a transition zone between aquatic and upland systems and are typically dominated by woody vegetation that is of a noticeably different growth form than adjacent vegetation. Riparian areas may or may not meet the definition of wetlands used by Cowardin *et al.* (1979).

Rotation

The period during which a single generation is allowed to grow.

Shelterwood Method

A regeneration method in which the older stand is gradually removed in a series of partial cuttings to secure establishment of reproduction before completion of the preceding rotation. The sequence of operations may include preparatory cuttings, seed cuttings, and removal cuttings, in that order.

Species of Concern

A species not on the federal list of threatened or endangered species, but a species for which the Service or one of its partners has concerns.

Stakeholders

State, tribal, and local government agencies, academic institutions, the scientific community, nongovernmental entities including environmental, agricultural, and conservation organizations, trade groups, commercial interests, and private landowners.

Threatened Species

A listed species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Undertaking

A project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; those requiring a Federal permit, license or approval..." (36 CFR 800.16(y); 12-12-2000), i.e., all Federal actions.

Uplands

All lands not meeting the definition of wetlands, deepwater, or riverine.

Watershed

The area drained by a river or stream and its tributaries.

Wetlands

Lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water (Cowardin *et al.*, 1979. In layman's terms, this habitat category includes marshes, swamps and bogs.

Wildlife-dependent Recreational Use

A use of a refuge involving hunting, fishing, wildlife observation and photography, or environmental education and interpretation.

Appendix C: Laws and Orders

Appendix C: Laws and Orders

Numerous Congressional Acts, Executive Orders signed by the President, and regulations grant authority and govern the administration of the Refuge. The following laws and executive orders provide substantive and procedural requirements to be satisfied in the development and implementation of the CCP.

Public Law 80-361

(Approved August 5, 1947; 61 Stat. 770) This Act established Crab Orchard National Wildlife Refuge by directing the transfer of certain lands in Illinois to the Department of the Interior for wildlife conservation, and agricultural, recreational, industrial development and related purposes. The full text is presented in Appendix G.

Public Law 90-339

(Approved June 15, 1968; 82 Stat. 177) This Act provides for adjustment of legislative jurisdiction of the United States on the Refuge.

Public Law 95-616

(Approved November 8, 1978; 92 Stat. 3114) This Act provided that revenue generated on the Refuge will be subject to the Refuge Revenue Sharing Act rather than being deposited in the Treasury as general receipts.

Public Law 99-662

(Approved November 17, 1986; 100 Stat 4257) This Act directed the Secretary to sell surplus water which may be available from Devils Kitchen Lake on the Refuge to the City of Marion, Illinois.

National Wildlife Refuge System Administration Act of 1966

(Derived from sections 4 and 5 of Public Law 89-669, approved October 15, 1966; 80 Stat. 927; 16 USC 668dd et seq.) This Act serves as the "organic act" for the National Wildlife Refuge System. The Act, as amended (National Wildlife Refuge System Improvement Act, Public Law 105-57, October 9, 1997), consolidated the various categories of lands administered by the Secretary of the Interior (Secretary) through the Service into a single National Wildlife Refuge System.

The Act establishes a unifying mission for the Refuge System, a process for determining compatible uses of refuges, and a requirement for preparing comprehensive conservation plans. The Act states first and foremost that the mission of the National Wildlife Refuge System be focused singularly on wildlife conservation.

The Act identifies six priority wildlife-dependent recreation uses, clarified the Secretary's authority to accept donations of money for land acquisition and placed restrictions on the transfer, exchange or other disposal of lands within the Refuge System.

Most importantly, this Act reinforces and expands the "compatibility standard" of the Refuge Recreation Act. The Refuge Administration Act authorizes the Secretary, under such regulations as he may prescribe, to "permit the use of any area within the System for any purpose, including but not limited to hunting, fishing, public recreation and accommodations, and access whenever he determines that such uses are compatible with the major purposes for which such areas were established."

It provides guidelines and directives for administration and management of all areas in the system, including "wildlife refuges, areas for the protection and conservation of fish and wildlife that are threatened with extinction, wildlife ranges, game ranges, wildlife management areas, or waterfowl production areas."

The Secretary is authorized to permit by regulations the use of any area within the system provided "such uses are compatible with the major purposes for which such areas were established."

Public Law 90-404

(Approved July 18, 1968, (82 Stat. 359) This law provides that proceeds from disposal of lands in the system acquired with "duck stamp" funds or by donation are to be paid into the Migratory Bird Conservation Fund, and that the Migratory Bird Conservation Commission must be consulted before disposal of any such acquired land.

A December 3, 1974, amendment entitled "National Wildlife Refuge System Administration Act Amendments of 1974" (P.L. 93-509; 88 Stat. 1603), requires payment of the fair market

value for rights-of-way or other interests granted, with the proceeds deposited into the Migratory Bird Conservation Fund and made available for land acquisition.

Public Law 94-215

(Approved February 17, 1976) (90 Stat. 190) clarified that acquired lands or interests therein can be exchanged for acquired or public lands.

An amendment of February 27, 1976, (P.L. 94-223; 90 Stat. 199) commonly called the Game Range Act, directs that all areas in the system on or after January 1, 1975, "shall be administered by the Secretary through the United States Fish and Wildlife Service" and cannot be transferred or disposed of unless otherwise directed by Acts of Congress. Exceptions are provided for areas administered as part of the system pursuant to cooperative agreements and for transfer or disposal and exchange of acquired lands.

Public Law 95-616

(Approved November 8, 1978, (92 Stat. 3110) amends the 1966 Act to permit the opening of more than 40 percent of an area acquired as a migratory bird sanctuary to hunting when it is determined to be beneficial to the species hunted. Contracts may be entered into for public accommodations and donations of funds may be accepted for land acquisition and management.

Public Law 100-653

(Approved November 14, 1988, (101 Stat. 3825) made violations of the Act or implementing regulations subject to fines under the provisions of Title 18 of the U.S. Code (sections 3571-3574), or one year's imprisonment, or both. This Act also authorized the Secretary to relinquish exclusive legislative jurisdiction over any Service lands to State or territorial authorities (16 U.S.C. 742m).

This Act, Refuge Revenue Sharing Act (16 U.S.C. 715s) – Section 401 of the Act of June 15, 1935, (49 Stat. 383) provided for payments to counties in lieu of taxes, using revenues derived from the sale of products from refuges.

Public Law 88-523

(Approved August 30, 1964, (78 Stat. 701) made major revisions by requiring that all revenues received from refuge products, such as animals, timber and minerals, or from leases or other privileges, be deposited in a special Treasury account and net receipts distributed to counties for public schools and roads.

Public Law 93-509

(Approved December 3, 1974, (88 Stat. 1603) required that moneys remaining in the fund after payments be transferred to the Migratory Bird Conservation Fund for land acquisition under provisions of the Migratory Bird Conservation Act.

Public Law 95-469

(Approved October 17, 1978, (92 Stat. 1319) expanded the revenue sharing system to include National Fish Hatcheries and Service research stations. It also included in the Refuge Revenue Sharing Fund receipts from the sale of salmonid carcasses. Payments to counties were established as:

- on acquired land, the greatest amount calculated on the basis of 75 cents per acre, three-fourths of one percent of the appraised value, or 25 percent of the net receipts produced from the land; and
- on land withdrawn from the public domain, 25 percent of net receipts and basic payments under Public Law 94-565 (31 U.S.C. 1601-1607, 90 Stat. 2662), payment in lieu of taxes on public lands.

This amendment also authorized appropriations to make up any difference between the amount in the Fund and the amount scheduled for payment in any year. The stipulation that payments be used for schools and roads was removed, but counties were required to pass payments along to other units of local government within the county which suffer losses in revenues due to the establishment of Service areas.

Refuge Trespass Act (18 U.S.C. 41)

The Act of June 25, 1948, (62 Stat. 686) consolidated penalty provisions of various Acts from 1905 through 1934 establishing and protecting fish and wildlife areas, and restated the intent of Congress to protect all wildlife within Federal sanctuaries, refuges, fish hatcheries and breeding grounds.

Except as provided by rules and regulations promulgated under authority of law, the Act provides that anyone who hunts, traps or willfully disturbs any wildlife on such areas, or willfully injures, molests or destroys any property of the United States on such lands or waters, shall be fined not more than $500, imprisoned not more than six months, or both.

Public Law 100-653

(Approved November 14, 1988, (102 Stat. 3825) provided that any violation of the Refuge System Administration Act (16 U.S.C. 668dd et seq), or regulations issued under its authority, would be fined in accordance with uniform sentencing provisions established in Public Law 98-473, approved October 12, 1984, (98 Stat. 2028, 2031; 18 U.S.C. 3551 to 3586) or imprisoned not more than one year, or both. This largely supersedes the provisions of the Trespass Act, although the Act was not repealed.

Migratory Bird Treaty Act of 1918 (MBTA)

(16 U.S.C. 703-712; Ch. 128; July 13, 1918; 40 Stat. 755) as amended by: Chapter 634; June 20, 1936; 49 Stat. 1556; P.L. 86-732; September 8, 1960; 74 Stat. 866; P.L. 90-578; October 17, 1968; 82 Stat. 1118; P.L. 91-135; December 5, 1969; 83 Stat. 282; P.L. 93-300; June 1, 1974; 88 Stat. 190; P.L. 95-616; November 8, 1978; 92 Stat. 3111; P.L. 99-645; November 10, 1986; 100 Stat. 3590 as amended. This Act designates the protection of migratory birds as a Federal responsibility. The Act enables the setting of seasons, and other regulations including the closing of areas, Federal or non-Federal, to the hunting of migratory birds.

The original 1918 statute implemented the 1916 Convention between the U.S. and Great Britain (for Canada) for the protection of migratory birds. Specific provisions in the statute included:

Establishment of a Federal prohibition, unless permitted by regulations, to "pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird, included in the terms of this Convention... for the protection of migratory birds... or any part, nest, or egg of any such bird." (16 U.S.C. 703) This prohibition applies to birds included in the respective international conventions between the U.S. and Great Britain, the U.S. and Mexico, the U.S. and Japan, and the U.S. and the Soviet Union.

Authority for the Secretary of the Interior to determine, periodically, when, consistent with the Conventions, "hunting, taking, capture, killing, possession, sale, purchase, shipment, transportation, carriage, or export of any... bird, or any part, nest or egg" could be undertaken and to adopt regulations for this purpose. These determinations are to be made based on "due regard to the zones of temperature and to the distribution, abundance, economic value, breeding habits, and times of migratory flight." (16 U.S.C. 704)

A decree that domestic interstate and international transportation of migratory birds which are taken in violation of this law is unlawful, as well as importation of any migratory birds which are taken in violation of Canadian laws. (16 U.S.C. 705)

Authority for Interior officials to enforce the provisions of this law, including seizure of birds illegally taken which can be forfeited to the U.S. and disposed of as directed by the courts. (16 U.S.C. 706)

Establishment of fines for violation of this law, including misdemeanor charges. (16 U.S.C. 707)

Authority for States to enact and implement laws or regulations to allow for greater protection of migratory birds, provided that such laws are consistent with the respective Conventions and that open seasons do not extend beyond those established at the national level. (16 U.S.C. 708)

Authority to take migratory birds exclusively for scientific or propagation purposes, pending the development of Federal regulations, provided that the take does not violate State or local laws. (16 U.S.C. 709)

A repeal of all laws inconsistent with the provisions of this Act.

Authority for the continued breeding and sale of migratory game birds on farms and preserves for the purpose of increasing the food supply. (16 U.S.C. 711)

The 1936 statute implemented the Convention between the U.S. and Mexico for the Protection of Migratory Birds and Game Mammals. Migratory bird import and export restrictions between Mexico and the U.S. were also authorized, and in issuing any regulations to implement this section, the Secretary of Agriculture was required to consider U.S. laws forbidding importation of certain mammals injurious to agricultural and horticultural interests. Monies for the Secretary of Agriculture to implement these provisions were also authorized.

The 1960 statute (P.L. 86-732) amended the MBTA by altering earlier penalty provisions. The new provisions stipulated that violations of this Act would constitute a misdemeanor and conviction would result in a fine of not more than $500 or imprisonment of not more than six months. Activities aimed at selling migratory birds in violation of this law would be subject to fine of not more than $2000 and imprisonment could not exceed two years. Guilty offenses would constitute a felony. Equipment used for sale purchases was authorized to be seized and held, by the Secretary of the Interior, pending prosecution, and, upon conviction, be treated as a penalty.

Section 10 of the 1969 amendments to the Lacey Act (P.L. 91-135) repealed the provisions of the MBTA prohibiting the shipment of wild game mammals or parts to and from the U.S. or Mexico unless permitted by the Secretary of the Interior. The definition of "wildlife" under these amendments does not include migratory birds, however, which are protected under the MBTA.

The 1974 statute (P.L. 93-300) amended the MBTA to include the provisions of the 1972 Convention between the U.S. and Japan for the Protection of Migratory Birds and Birds in Danger of Extinction. This law also amended the title of the MBTA to read: "An Act to give effect to the conventions between the U.S. and other nations for the protection of migratory birds, birds in danger of extinction, game mammals, and their environment."

Section 3(h) of the Fish and Wildlife Improvement Act of 1978 (P.L. 95-616) amended the MBTA to authorize forfeiture to the U.S. of birds and their parts illegally taken, for disposal by the Secretary of the Interior as he deems appropriate. These amendments also authorized the Secretary to issue regulations to permit Alaskan natives to take migratory birds for their subsistence needs during established seasons. The Secretary was required to consider the related migratory bird conventions with Great Britain, Mexico, Japan, and the Soviet Union in establishing these regulations and to establish seasons to provide for the preservation and maintenance of migratory bird stocks.

Public Law 95-616 also ratified a treaty with the Soviet Union specifying that both nations will take measures to protect identified ecosystems of special importance to migratory birds against pollution, detrimental alterations, and other environmental degradations. (See entry for the Convention Between the United States of America and the Union of Soviet Socialist Republics Concerning the Conservation of Migratory Birds and Their Environment; T.I.A.S. 9073; signed on November 19, 1976, and approved by the Senate on July 12, 1978; 92 Stat. 3110.)

The most recent amendment was part of the 1986 Emergency Wetlands Resources Act (P.L. 99-645), and amended the Act to require that felony violations under the MBTA must be "knowingly" committed.

Bald Eagle Protection Act of 1940

(16 U.S.C. 668-668d, 54 Stat. 250, approved June 8, 1940, and amended by P.L. 86-70 (73 Stat. 143) June 25, 1959; P.L. 87-884 (76 Stat. 1346) October 24, 1962; P.L. 92-535 (86 Stat. 1064) October 23, 1972; and P.L. 95-616 (92 Stat. 3114) November 8, 1978. This Act provides for the protection of the bald eagle (the national emblem) and the golden eagle on and off Federal lands by prohibiting, except under certain specified conditions, the taking, possession and commerce of such birds.

The 1972 amendments increased penalties for violating provisions of the Act or regulations issued pursuant thereto and strengthened other enforcement measures. Rewards are provided for information leading to arrest and conviction for violation of the Act. The 1978 amendment authorizes the Secretary of the Interior to permit the taking of golden eagle nests that interfere with resource development or recovery operations.

Migratory Bird Conservation Act of 1929

(16 U.S.C. 715-715d, 715e, 715f-715r approved February 18, 1929; 45 Stat. 1222) This Act established a Migratory Bird Conservation Commission to approve areas recommended by the Secretary of the Interior for acquisition with Migratory Bird Conservation Funds. The Commission consists of the Secretary of the Interior (as chairman), the Secretaries of Transportation and Agriculture, two members of the Senate and two of the House of Representatives, and an ex-officio member from each State in which acquisition is being considered.

The Commission, through its chairman, is directed to report by the first Monday in December of each year to Congress on its activities during the preceding fiscal year. The Secretary of the Interior is authorized to cooperate with local authorities in wildlife conservation and to conduct investigations, to publish documents related to North American birds, and to maintain and develop refuges. The Act provides for cooperation with States in enforcement. It established procedures for acquisition by purchase, rental or gift of areas approved by the Commission.

Public Law 94-215

(Approved February 17, 1976) (90 Stat. 190) included in acquisition authority under the Act the purchase or rental of a partial interest in land or waters.

Public Law 95-552

(Approved October 30, 1978, (92 Stat. 2071) required that the Secretary of the Interior consult with the appropriate units of local government and with the Governor of the State concerned, or the appropriate State agency, before recommending an area for purchase or rental under the provisions of the Act. This provision was subsequently amended by P.L. 98-200, approved December 2, 1983 (97 Stat. 1378); P.L. 98-548, approved October 26, 1984 (98 Stat. 2774); and P.L. 99-645, approved November 10, 1986 (100 Stat. 3584) to require that either the Governor or the State agency approve each proposed acquisition.

Public Law 95-616

(Approved November 8, 1978, (92 Stat. 3110) authorized acquisition of areas for purposes other than inviolate sanctuary.

Migratory Bird Hunting and Conservation Stamp Act of 1934

(16 U.S.C. 718-718j, 48 Stat. 452) This Act authorized opening a certain portion of a national wildlife refuge to waterfowl hunting.

North American Wetlands Conservation Act

(Public Law 101-233, enacted December 13, 1989; 103 Stat. 1968; 16 U.S.C. 4401-4412) This Act provides funding and administrative direction for implementation of the North American Waterfowl Management Plan and the Tripartite Agreement on wetlands between Canada, U.S. and Mexico.

The Act converts the Pittman-Robertson account into a trust fund, with the interest available without appropriation through the year 2006 to carry out the programs authorized by the Act, along with an authorization for annual appropriation of $15 million plus an amount equal to the fines and forfeitures collected under the Migratory Bird Treaty Act.

Available funds may be expended, upon approval of the Migratory Bird Conservation Commission, for payment of not to exceed 50 percent of the United States share of the cost of wetlands conservation projects in Canada, Mexico, or the United States (or 100 percent of the cost of projects on Federal lands). At least 50 percent and no more than 70 percent of the funds received are to go to Canada and Mexico each year.

A North American Wetlands Conservation Council is created to recommend projects to be funded under the Act to the Migratory Bird Conservation Commission. The Council is to be composed of the Director of the Service, the Secretary of the National Fish and Wildlife Foundation, a State fish and game agency director from each Flyway, and three representatives of different non-profit organizations participating in projects under the Plan or the Act. The Chairman of the

Council and one other member serve ex officio on the Commission for consideration of the Council's recommendations.

The Commission must justify in writing to the Council and, annually, to Congress, any decisions not to accept Council recommendations.

Public Law 101-593

(Approved November 16, 1990 (104 Stat. 2962) provided that the Director is the Federal official responsible for compliance with the National Environmental Policy Act (NEPA) with respect to Council actions, and that recommendation(s) from the Council to the Commission constitute agency action requiring the preparation of Environmental Assessments or Impact Statements. The Chairman of the Council is also required to take steps to ensure public notice of Council meetings.

This Act provides funding and administrative direction for implementation of the North American Waterfowl Management Plan and the Tripartite Agreement on wetlands between Canada, Mexico and the U.S. It establishes a North American Wetlands Conservation Council, the purpose of which is to recommend wetlands conservation projects to the Migratory Bird Conservation Commission. Federal funds may be expended for payment of no more than half of the U.S. share of the cost of wetlands conservation projects in Canada, Mexico or the U.S. (or 100 percent of the cost of projects on federal lands). The Act directs the Secretary of the Interior to develop and implement a wetlands conservation strategy, and report to Congress on project implementation and assessment.

Clean Air Act of 1977, as amended.

The primary objective of this Act is to establish Federal standards for various pollutants from both stationary and mobile sources and to provide for the regulation of polluting emissions via state implementation plans. In addition, and of special interest for Refuges, some amendments are designed to prevent significant deterioration in certain areas where air quality exceeds national standards, and to provide for improved air quality in areas which do not meet Federal standards (non-attainment areas). Part C of the 1977 amendments stipulates requirements to prevent significant deterioration of air quality and, in particular, to preserve air quality in national parks, national wilderness areas, national monuments, and national seashores. The majority of the amendments to the Clean Air Act were enacted in 1977 and are known as the Clean Air Amendments of 1977 (P.L. 95-95; 91 Stat. 685). The primary objective of the Clean Air Act is to establish Federal standards for various pollutants from both stationary and mobile sources and to provide for the regulation of polluting emissions via state implementation plans. In addition, the amendments are designed to prevent significant deterioration in certain areas where air quality exceeds national standards, and to provide for improved air quality in areas which do not meet Federal standards ("nonattainment" areas).

Federal facilities are required to comply with air quality standards to the same extent as non-governmental entities (42 U.S.C. 7418). Part C of the 1977 amendments stipulates requirements to prevent significant deterioration of air quality and, in particular, to preserve air quality in national parks, national wilderness areas, national monuments and national seashores (42 U.S.C. 7470).

The amendments establish Class I, II and III areas, where emissions of particulate matter and sulfur dioxide are to be restricted. The restrictions are most severe in Class I areas and are progressively more lenient in Class II and III areas.

Mandatory Class I Federal lands include all national wilderness areas exceeding 500 acres. Such lands may not be redesignated (42 U.S.C. 7472). Additionally, national wildlife refuges which exceed 10,000 acres may only be redesignated by States as Class I or Class II areas (42 U.S.C. 7474).

Federal land managers are charged with direct responsibility to protect the air quality and related values (including visibility) of Class I lands and to consider, in consultation with EPA, whether proposed industrial facilities will have an adverse impact on these values (42 U.S.C. 7475(c)). Federal land managers are also required to determine whether existing industrial sources of air pollution must be retrofitted to reduce impacts on Class I areas to acceptable levels.

The Secretary of the Interior, in consultation with other Federal land managers, is required to review all mandatory Class I Federal areas and to identify those where visibility is an important value of the area (42 U.S.C. 7491). Such identifications are to be revised periodically.

EPA is requested to report to Congress regarding methods for achieving greater visibility and to issue regulations towards that objective (42 U.S.C. 7491). Exemptions from such regulations are contingent upon the concurrence of the involved Federal land manager.

Data Quality Act

The Data Quality Act (DQA) is an attempt by Congress to ensure that federal agencies use and disseminate accurate information. The DQA requires federal agencies to issue information quality guidelines ensuring the quality, utility, objectivity and integrity of information that it disseminates and provide mechanisms for affected persons to correct such information.

Federal Water Pollution Control Act, commonly known as the Clean Water Act

(P.L. 92-500, enacted in 1972; amended by P.L. 95-217 in 1977, P.L. 97-117 in 1981, and P.L. 100-4 in 1987). This is the principal law governing pollution in the nation's streams, lakes, and estuaries. It consists of two major parts: regulatory provisions that impose progressively more stringent requirements on industries and cities to abate pollution and meet the statutory goal of zero discharge of pollutants; and provisions that authorize federal financial assistance for municipal wastewater treatment construction. Both parts are supported by research activities, plus permit and enforcement provisions. Programs at the federal level are administered by the Environmental Protection Agency (EPA); state and local governments have major responsibilities to implement those programs.

The objective declared in the 1972 Act is to restore and maintain the chemical, physical, and biological integrity of the nation's water. That objective was accompanied by statutory goals to eliminate the discharge of pollutants into navigable waters by 1985 and to attain, wherever possible, waters deemed "fishable and swimmable" by 1983. While those goals have not yet been achieved, considerable progress has been made, especially in controlling conventional pollutants (suspended solids, bacteria, and oxygen-consuming materials) discharged by industries and municipal sewage treatment plants. Nearly 75% of assessed waters comply with standards for these pollutants. Progress has been mixed in controlling discharges of toxic pollutants (heavy metals, inorganic and organic chemicals), which are more numerous and can harm human health and the environment even when present in minute amounts-at the parts-per-billion level. Moreover, efforts to control pollution from diffuse sources (rainfall runoff, for example) have only recently begun. Overall, data reported by EPA and states indicate that 40% of waters surveyed by states fail to meet water quality standards. Forty-seven states now have some form of fish-consumption advisory in effect (including 100% of Great Lakes waters and a large portion of the nation's coastal waters), due to water pollution problems, and one-third of shellfishing beds are closed or restricted, due to toxic pollutant contamination.

Emergency Wetlands Resources Act of 1986

(Public Law 99-645, approved November 10, 1986; 100 Stat. 3582) The purpose of this Act is: "To promote the conservation of migratory waterfowl and to offset or prevent the serious loss of wetlands by the acquisition of wetlands and other essential habitat, and for other purposes." The Act authorized the purchase of wetlands from Land and Water Conservation Fund monies, removing a prior prohibition on such acquisitions. It required the Secretary to establish a National Wetlands Priority Conservation Plan, required the States to include wetlands in their Comprehensive Outdoor Recreation Plans, and transferred to the Migratory Bird Conservation Fund amounts equal to the import duties on arms and ammunition.

It extended the Wetlands Loan Act authorization through 1988, and forgave the previous advances under the Act. It also required the Secretary to report to Congress on wetlands loss, including an analysis of the role of Federal programs and policies in inducing such losses. In addition, it directed the Secretary, through the Service, to continue the National Wetlands Inventory; to complete by September 30, 1998, mapping of the contiguous United States; to produce, as soon as practicable, maps of Alaska and other noncontiguous portions of the United States; and to pro-

duce, by September 30, 1990, and at ten-year intervals thereafter, reports to update and improve in the September 1982 Status and Trends of Wetlands and Deepwater Habitat in the Conterminous United States, 1950s to 1970s.

Other provisions included: the establishment of entrance fees at National Wildlife Refuges, with fee receipts to be allocated 70 percent into the Migratory Bird Conservation Fund and 30 percent for operations and maintenance at the refuges; an increase in the price of duck stamps from $7.50 to $15.00, to be phased in through 1991; and the establishment of the Bayou Sauvage National Wildlife Refuge in Louisiana.

Fish and Wildlife Act of 1956

This Act established a comprehensive national fish and wildlife policy and broadened the authority for acquisition and development of refuges.

Fish and Wildlife Coordination Act of 1958

This Act allows the Fish and Wildlife Service to enter into agreements with private landowners for wildlife management purposes.

Fish and Wildlife Improvement Act of 1978

(Public Law 95-616, approved November 8, 1978; 16 U.S.C. 7421; 92 Stat. 3110) This Act authorizes the Secretaries of the Interior and Commerce to establish, conduct, and assist with national training programs for State fish and wildlife law enforcement personnel. It also authorized funding for research and development of new or improved methods to support fish and wildlife law enforcement.

The law provides authority to the Secretaries to enter into law enforcement cooperative agreements with State or other Federal agencies, and authorizes the disposal of abandoned or forfeited items under the fish, wildlife, and plant jurisdictions of these Secretaries. It strengthened the law enforcement operational capability of the Service by authorizing the disbursement and use of funds to facilitate various types of investigative efforts.

The statute also contains amendments to: Bald Eagle Protection Act (16 USC 668-668d); Central Valley Project, California, Reauthorization Act of August 27, 1954 (16 USC 695d-695j); Cooperative Research and Training Units Act (16 USC 7853a-753h); Fish and Wildlife Act of 1956 (16 USC 742a-742j); Migratory Bird Conservation Act (16 USC 715 et seq.); Migratory Bird Treaty Act (16 USC 703 et. seq.); National Wildlife Refuge System Administration Act of 1966 (16 USC 668dd-668ee); Refuge Recreation Act (16 USC 460k-460k-4); the Act of August 5, 1947, (16 USC 666g) establishing Crab Orchard National Wildlife Refuge; the Act of April 23, 1928, (16 USC 690e) establishing the Bear River Migratory Bird Refuge; and the Coastal Barrier Resources Act (16 USC 3503).

Land and Water Conservation Fund Act

(Public Law 88-578, approved September 3, 1964; 78 Stat. 897; 16 USC 460l - 460l-11) Since its inception on January 1, 1965, the LWCF has been the principal source of funds for acquiring new recreation lands. It was originally intended to be a revolving fund, and the initial legislation required it to repay advanced appropriations in the 10th year of operation. However, it has never operated as a revolving fund. The authority has been amended frequently, most notably to increase the authorized level of the fund, and to mandate that offshore oil and gas leasing revenues should make up any shortfall from other authorized financing sources. However, the fund's basic purpose has not been altered.

Most appropriations in recent years have been to the four major federal land management agencies-the Forest Service in the Department of Agriculture, and the National Park Service, Fish and Wildlife Service, and Bureau of Land Management in the Department of the Interior. These agencies have purchased or acquired through exchange about 4.5 million acres

This Act authorizes the use of receipts from the sale of surplus Federal land, outer continental shelf oil and gas sales, and other sources for land acquisition under several authorities. The Recreation Coordination and Development Act (Public Law 88-29, approved May 28, 1963, 77 Stat. 49) declared a Congressional policy that "present and future generations be assured adequate outdoor recreation resources" and that "all levels of government and private interests... take prompt and coordinated action... to conserve, develop, and utilize such [their] resources for the benefit and enjoyment of the American people." The Sec-

retary of the Interior was directed to inventory, evaluate and classify outdoor recreation facilities, and formulate and maintain a comprehensive nationwide outdoor recreation plan.

Public Law 88-578

Approved September 3, 1964, (78 Stat. 897) created the Land and Water Conservation Fund, derived from various types of revenue (primarily Outer Continental Shelf oil monies) and authorizes appropriations from the fund for (1) matching grants to States for outdoor recreation projects and (2) land acquisition for various Federal agencies.

P.L. 94-422

Approved September 28, 1976, (90 Stat. 1313) authorized funds for, among other things, the National Wildlife Refuge System for acquisition of: (1) habitat of endangered and threatened species of fish, wildlife and plants under section 5(a) of the Endangered Species Act; (2) areas authorized by section 2 of the Refuge Recreation Act; (3) areas under section 7(a)(5) of the Fish and Wildlife Act of 1956, except migratory waterfowl areas which are authorized by the Migratory Bird Conservation Act; and (4) any areas authorized by specific Acts of Congress.

P.L. 95-42

Approved June 10, 1977, (91 Stat. 210) increased the authorizations for acquisition of certain previously authorized areas.

P.L. 98-369

Approved July 18, 1984, (98 Stat. 1020) provided that up to $1 million annually in excess motorboat fuels tax revenues shall be transferred to the Fund.

P.L. 100-17

Approved April 2, 1987, (101 Stat. 132) extended the motorboat fuels tax component of the Fund through October 1993, and extended the authorization to pay funds received to the Land and Water Conservation Fund, and the Sport Fish Restoration Account through that date.

Public Law 100-203

Approved December 22, 1987, (101 Stat. 1330) reauthorized the Fund without change through the

Lacey Act Amendments

This Act replaces the Black Bass Act of 1926 and most of the original Lacey Act. The Lacey Act Amendments make it unlawful to import, export, transport, buy or sell fish, wildlife and plants taken or possessed in violation of federal, state or tribal law. Interstate or foreign commerce in fish and wildlife taken or possessed in violation of foreign law also is illegal. The Act requires that packages containing fish or wildlife be plainly marked. Enforcement measures include civil and criminal penalties, cancellation of hunting and fishing licenses, and forfeiture.

Timber Protection Act

(Approved September 20, 1922; 16 U.S.C. 594; 42 Stat. 857) This Act authorizes the Secretary of the Interior to protect timber on lands under the Department's jurisdiction from fire, disease and insects, and to cooperate with other Federal agencies, States, or owners of timber.

Reciprocal Fire Protection Act

(Approved May 27, 1955) as amended by the Wildfire Suppression Assistance Act of 1989 (69 Stat. 66, 67; 42 U.S.C. 1856a)(102 Stat. 1615) This Act authorizes reciprocal fire protection agreements with any fire organization for mutual aid with or without reimbursement and allows for emergency assistance in the vicinity of agency facilities in extinguishing fires when no agreement exists.

Wilderness Act of 1964

(PL 88-577, 78 Stat. 890; 16 USC 1121 [note], 1131-1136), as amended. In order to assure that an increasing population, accompanied by expanding settlement and growing mechanization, does not occupy and modify all areas within the United States and its possessions, leaving no lands designated for preservation and protection in their natural condition, it is hereby declared to be the policy of the Congress to secure for the American people of present and future generations the benefits of an enduring resource of wilderness. or this purpose there is hereby established a National Wilderness Preservation

System to be composed of federally owned areas designated by Congress as "wilderness areas," and these shall be administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness, and so as to provide for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness; and no Federal lands shall be designated as "wilderness areas" except as provided for in this chapter or by a subsequent Act.

Public Law 94-577

(Approved October 19, 1976 (90 Stat. 2633) Section 1(f) designated the Crab Orchard Wilderness and Section 6 addressed the administration and management of the area.

Endangered Species Act of 1973

(16 U.S.C. 1531 et seq. as amended) This Act directs Federal agencies to take actions that would further the purposes of the Act and to ensure that actions they carry out, authorize or fund do not jeopardize endangered species or their critical habitat. The Act also provides authority for land acquisition. Conservation of threatened and endangered species has become a major objective of both land acquisition and Refuge management programs.

The Recreation Act

(Public Law 87-714, approved September 28, 1962, 76 Stat. 653; as amended by Public Law 89-669, approved October 14, 1966, 80 Stat. 930; and Public Law 92-534, approved October 23, 1972, 86 Stat. 1063; 16 U.S.C. 460k-460k-4) This Act authorized the Secretary of the Interior to administer refuges, hatcheries and other conservation areas for recreational use, when such uses do not interfere with the area's primary purposes. The Act requires that any recreational use on areas of the National Wildlife Refuge System be "compatible" with the primary purpose(s) for which the area was acquired or established. The Act also requires that sufficient funding be available for the development, operation and maintenance of recreational uses that are not directly related to the area's primary purpose(s). The Act provided for public use fees and permits, and penalties for violation of regulations. It also authorized the acceptance of donations of funds and real and personal property to assist in carrying out its purposes.

Public Law 93-205

Approved December 28, 1973 (87 Stat. 902), authorized acquisition of lands and interests suitable for: 1) fish and wildlife-oriented recreation, 2) protection of natural resources, 3) conservation of endangered or threatened species, or 4) carrying out two or more of the above. Such lands were required to be adjacent to or within an existing conservation area. Acquisition was not permitted with "duck stamp" receipts for these purposes.

Enforcement provisions were amended by Public Law 95-616, approved November 8, 1978 (92 Stat. 3110), and were further revised by Public Law 98-473, approved October 12, 1984 (98 Stat. 2028, 2031), which made violations misdemeanors in accordance with the uniform sentencing provisions of that law (18 U.S.C. 3551-3586).

National Trails System Act

(Public Law 90-543, approved October 2, 1968; 82 Stat. 919; 16 U.S.C. 1241-1249) This Act and its subsequent amendments authorized a national system of trails and defined four categories of trails.

Public Law 95-625

Approved November 10, 1978, (92 Stat. 3511) amended the NTSA to create a new category of National Historic Trails, to closely follow original routes of national historic significance.

National Recreation Trails may be established by the Secretaries of Interior or Agriculture on land wholly or partly within their jurisdiction, with the consent of the involved State(s), and other land managing agencies, if any. National Scenic and National Historic Trails may only be designated by an Act of Congress. Connecting or Side Trails provide access to or among the other classes of trails.

As of 1998, the National Trails System included 20 trails (8 scenic, 12 historic), and of these, segments of 12 crossed units of the National Wildlife Refuge System.

Legislation is pending to add National Discovery Trails as a new category of long-distance trails and designate the American Discovery Trail as the first National Discovery Trail. The American Discovery Trail covers more than 6,000 miles from Delaware to California and crosses through the southern portion of Crab Orchard Refuge.

National Hunting and Fishing Day Statutes

National Hunting and Fishing Day Statutes establishing the fourth Saturday in September of the year indicated as National Hunting and Fishing Day include:

1973 – Public Law 93-23, approved April 20, 1973 (87 Stat. 24)

1974 – Public Law 93-424, approved September 27, 1974 (88 Stat. 1166)

1975 – Public Law 94-96, approved September 18, 1975 (89 Stat. 478)

In addition, P.L. 99-217, approved April 1, 1986 (100 Stat. 81), and P.L. 100-22, approved April 10, 1987 (101 Stat. 267), established the first week of June of those years as National Fishing Week.

After 1975, private organizations have worked directly with the White House to secure Presidential proclamations for the designation. In 1979, former President Carter designated the third Saturday in October of that year, "and thereafter," as National Hunting and Fishing Day, eliminating the need for annual proclamations. Since then, it has been the usual practice for the President to issue a statement each year commemorating the day.

Take Pride in America Program

(Title XI of Public Law 101-628, signed November 28, 1990; 16 USC 4601 note; 104 Stat. 4502) This Act established the TPIA within the Department of the Interior. The purposes of the program include:

Establishing and maintaining a public awareness campaign to instill in the public an appreciation for Federal, State, and local lands, facilities, and cultural and natural resources.

Conducting a national awards program to honor individuals and entities that distinguish themselves in the appreciation, conservation, and stewardship of these resources.

Administering the "Take Pride in America" slogan and logo.

Environmental Education Act of 1990

(Public Law 101-619, signed November 16, 1990; 20 USC 5501-5510; 104 Stat. 3325) This Act established the Office of Environmental Education within the Environmental Protection Agency to develop and administer a Federal environmental education program.

Responsibilities of the Office include developing and supporting programs to improve understanding of the natural and developed environment, and the relationships between humans and their environment; supporting the dissemination of educational materials; developing and supporting training programs and environmental education seminars; managing a Federal grant program; and administering an environmental internship and fellowship program. The Office is required to develop and support environmental programs in consultation with other Federal natural resource management agencies, including the Fish and Wildlife Service.

The Act requires the Education Office Advisory Council to submit a report to Congress by November 16, 1992, regarding obstacles to improving environmental education programs, including those relating to national parks and wildlife refuges.

Antiquities Act of 1906 (16 U.S.C. 431-433)

This Act authorizes the scientific investigation of antiquities on Federal land, subject to the stipulations outlined in permits issued to recognized educational, scientific, and other institutions for the purposes of systematically gathering data. The Act provides that objects taken or collected without a permit may result in a fine and imprisonment of the convicted person.

National Historic Preservation Act of 1966, as amended (16 U.S.C. 470-470t)

This Act establishes as policy that the Federal Government is to provide leadership in the preservation of the Nation's prehistoric and historic resources. Historic preservation is defined in the Act as the protection, rehabilitation, restoration, and reconstruction of sites, buildings, structures, and objects significant in American history, architecture, engineering, and archaeology. Sections

106 and 110 of the Act define the primary requirements for Federal agencies to follow in identifying, evaluating, and protecting significant cultural resources.

Archeological and Historic Preservation Act of 1974 (16 U.S.C. 469-469c)

This Act directs the preservation of historic and archaeological data in Federal construction projects. The Act authorizes Federal agencies to seek future appropriations, to obligate available funding, or to reprogram existing appropriations to provide for the identification and preservation of data.

Archaeological Resources Protection Act of 1979, as amended

This Act protects materials of archaeological interest from unauthorized removal or destruction, and requires Federal managers to develop plans and schedules to locate archaeological resources.

National Environmental Policy Act of 1969 (NEPA), as amended (42 USC 4321-4347; 40 CFR 1500).

This Act requires Federal agencies to examine the impacts upon the environment that their actions might have, to incorporate the best available environmental information, and public participation in the planning and implementation of any major Federal action significantly affecting the quality of the human environment. All Federal agencies must integrate NEPA with other planning

Executive Order 11593, Protection and Enhancement of the Cultural Environment (1971)

This Executive Order directs the Service to consult with Federal and State Historic Preservation Officers when the Service proposes any development activities that would affect archaeological or historic sites to comply with Section 106 of the National Historic Preservation Act of 1966, as amended.

Executive Order 11644, Use of Off-road Vehicles on Public Lands

(Signed February 8, 1972) This purpose of this Executive Order is to establish policies and provide for procedures that will ensure that the use of off-road vehicles on public lands will be controlled and directed so as to protect the resources of those lands, promote the safety of all users of those lands, and to minimize conflicts among the various uses of those lands.

Executive Order 12962, Recreational Fisheries

This Executive Order directs the Service to conserve, restore, and enhance aquatic ecosystems to provide for increased recreational fishing opportunities nationwide. Additionally, the Order directs the Service to provide access to, and promote awareness of, opportunities for public participation and enjoyment of U.S. recreational fishery resources.

Executive Order 11988, Floodplain Management (signed May 24, 1977)

This Executive Order states that each Federal agency shall, in the course of fulfilling their respective authorities, provide leadership and take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains. The purpose of this Order is to prevent Federal agencies from contributing to the "adverse impacts associated with the occupancy and modification of floodplains" and the "direct or indirect support of floodplain development."

Before proposing, conducting, supporting or allowing an action in a floodplain, each agency is to determine if planned activities will affect the floodplain and evaluate the potential effects of the intended actions on its functions. Agencies shall avoid siting development in a floodplain "to avoid adverse effects and incompatible development in the floodplains."

Executive Order 11990, Protection of Wetlands

(Signed May 24, 1977) The purpose of this Executive Order is to avoid to the extent possible the long and short term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative.

Executive Order 12372, Intergovernmental Review of Federal Programs

(Signed July 14, 1982) The purpose of this Executive Order is to foster an intergovernmental partnership and a strengthened federalism by relying on State and local processes for the State and local government coordination and review of proposed Federal financial assistance and direct Federal development.

Executive Order 12898, Environmental Justice in Minority Populations and Low-income Populations

(Signed February 11, 1994; 59 FR 7629; February 16, 1994; Amends: EO 12250, November 2, 1980; Amended by: EO 12948, January 30, 1995)

Executive Order 12996, Management and General Public Use of the National Wildlife Refuge System

(Signed March 25, 1996; 61 FR 13647; March 28, 1996; See: EO 13022, October 31, 1996) This Executive Order states that the System provides important opportunities for compatible wildlife-dependent recreational activities involving hunting, fishing, wildlife viewing, and photography. The Order also directs the Service to recognize these compatible wildlife-dependent uses as priority general public uses of the System, and uses through which the American public can develop an appreciation for fish and wildlife.

Executive Order 13112, Management of Invasive Species

(Signed February 3, 1999) The purpose of this Executive Order is to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause. Each Federal agency whose actions may affect the status of invasive species is directed, to the extent practicable and permitted by law, to identify such actions; and, subject to the availability of appropriations, and within Administration budgetary limits, use relevant programs and authorities to: prevent the introduction of invasive species; detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; monitor invasive species populations accurately and reliably; provide for restoration of native species and habitat conditions in ecosystems that have been invaded; conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species; and promote public education on invasive species and the means to address them; and not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species.

Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds

(Signed January 10, 2001) This Executive Order directed each Federal agency taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations to develop and implement, within 2 years, a Memorandum of Understanding (MOU) with the Fish and Wildlife Service that promotes the conservation of migratory bird populations. A subsequent Director's Order (No. 172), developed in accordance with Executive Order 13186, provides guidance for Service programs relative to the management and conservation of migratory birds. Its purpose is to minimize the potential adverse effects of migratory bird take, with the goal of striving to eliminate take, while implementing our mission. The Director's Order includes guidelines for Migratory Birds and State Programs, National Wildlife Refuge System, Endangered Species, Fisheries and Habitat Conservation, Law Enforcement, International Affairs, and Business Management and Operations.

Federal Noxious Weed Act of 1974

(Public Law 93-629, enacted January 3, 1975; 7 U.S.C. 2801 et. seq.; 88 Stat. 2148) This Act requires the use of integrated management systems to control or contain undesirable plant species, and an interdisciplinary approach with the cooperation of other Federal and State agencies.

The Secretary of Agriculture was given the authority to designate plants as noxious weeds by regulation, and the movement of all such weeds in interstate or foreign commerce was prohibited except under permit. The Secretary was also given authority to inspect, seize and destroy products, and to quarantine areas, if necessary to prevent the spread of such weeds. He was also authorized to cooperate with other Federal, State and local agencies, farmers associations and private individuals in measures to control, eradicate, or prevent or retard the spread of such weeds.

Section 1453 of P.L. 101-624, the 1990 Farm Bill

Enacted November 28, 1990 (104 Stat 3611), amended the Act by requiring each Federal land-managing agency to:

Designate an office or person adequately trained in managing undesirable plant species to develop and coordinate a program to control such plants on the agency's land;
Establish and adequately fund this plant management program through the agency's budget process;
Complete and implement cooperative agreements (requirements for which are provided) with the States regarding undesirable plants on agency land; and
Establish integrated management systems (as defined in the section) to control or contain undesirable plants targeted under the cooperative agreements.

The law also requires that any environmental assessments or impact statements that may be required to implement plant control agreements must be completed within 1 year of the time the need for the document is established.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)

(26 U.S.C. 4611-4682; P.L. 96-510, December 11, 1980; 94 Stat. 2797). Major amendments were enacted in 1983 (42 U.S.C. 9601-9657; P.L. 98-802, August 23, 1983; 97 Stat. 485) and in 1986 (P.L. 99-499; October 17, 1986; 100 Stat. 1613). (The two sets of amendments reconstituted the 26 U.S.C. 4611-82 provisions into a new trust fund at 26 U.S.C. 9507 and operational provisions into the Title 42 sections.) This Act created the Superfund program to clean up hazardous waste sites that pose the greatest risk to public health in the United States and established the National Priorities List (NPL) to track them.

The 1980 statute authorized, through 1985, the collection of taxes on crude oil and petroleum products, certain chemicals, and hazardous wastes. It also established liability to the U.S. Government for damage to natural resources over which the U.S. has sovereign rights [42 U.S.C. 9607(f)(1)] and requires the President to designate Federal officials to act as trustees for natural resources. Use of Superfund monies to conduct natural resource damage assessments was provided in section 11(c)(1) [42 U.S.C. 9611 (c)(1)].

Subchapter I of the 1983 amendments established a comprehensive system to react to releases of hazardous substances and to determine liability and compensation for those affected (42 U.S.C. 9601-9626). The President is authorized to notify Federal and State natural resource trustees of potential damages to natural resources and to coordinate related assessments [42 U.S.C. 9604 (b)(2)]. Revisions to the national contingency plan for removal of oil and hazardous substances and to prioritize such releases were required by the 1983 amendments [42 U.S.C. 9605(a)].

Amendments enacted in 1986 (known as the Superfund Amendment and Reauthorization Act, or SARA):

listed conditions under which a facility or vessel owner may be authorized by the President to conduct remedial or removal actions for the release of hazardous substances (42 U.S.C. 9604);
added effects on natural resources as a criterion for determining facilities to be placed on the National Priorities List, and required the National Contingency Plan to be revised to incorporate a Hazard Ranking System (42 U.S.C. 9605);
mandated the designation of Federal officials to act as trustees for natural resources and to assess damages and injury to, as well as destruction of, or loss of, natural resources (42 U.S.C. 9607);
stipulated that Superfund monies may only be used for natural resource damage claims if all administrative and judicial remedies to recover costs from liable parties have been exhausted (42 U.S.C. 9611);
provided that claims cannot be made to recover for natural resource damages unless the claim is presented within three years after discovering the loss (42 U.S.C. 9612);
added a new section to clarify that Federal facilities are subject to the same cleanup requirements and liability standards as non-governmental entities (42 U.S.C. 9620);

specified that no Federal permits are required for remedial action conducted entirely on-site when such actions comply with the cleanup standards (42 U.S.C. 9604);

required that Federal trustees be notified of any settlement negotiations regarding damages to natural resources, and established circumstances under which Federal trustees may agree not to sue for natural resource damages (42 U.S.C. 9607); and

eliminated the authorization for use of Superfund monies to conduct damage assessments - section 517 of SARA, codified at 26 U.S.C. 9507(c), and reinforced by section 531 of SARA.

The Department of the Interior is a trustee for natural resources, and the Service is responsible for the protection and restoration of trust resources injured by uncontrolled releases of hazardous materials. The Service is responsible for conducting assessments to establish injury and the dollar equivalent of that injury for collection of damages from parties responsible for releasing hazardous materials.

Rehabilitation Act of 1973

This Act requires programmatic accessibility in addition to physical accessibility for all facilities and programs funded by the Federal government to ensure that anybody can participate in any program.

Architectural Barriers Act of 1968

This Act requires federally owned, leased, or funded buildings and facilities to be accessible to persons with disabilities.

Americans With Disabilities Act of 1992

This Act prohibits discrimination in public accommodations and services.

Bureau and agency legal and policy guidance is found in:

1. Departmental Manual: The Departmental Manual can be accessed on-line at http://elips.doi.gov/tableofcontents1.cfm
2. Fish and Wildlife Service Manual: The Fish and Wildlife Service Manual has regulatory force and effect within the Service. It implements the Service's authorities and the Director's policies, and steps down the Service's compliance with other requirements, such as statutes, Executive Orders, Departmental directives, and regulations of other agencies. The Fish and Wildlife Service Manual can be accessed on-line at http://policy.fws.gov/manual.html
3. Refuge Manual: Guidance found in the earlier Refuge Manual may be used when the specific chapter of the Fish and Wildlife Service Manual has not yet been published.

Appendix D: Species Lists

Appendix D: Species Lists, Crab Orchard NWR

This bird list contains 220 species which have been recorded on the refuge. Another 40 species, very rare or accidental and out of their normal range, are listed under "Accidental" birds. This list is based on: U.S. Fish and Wildlife Service. 1994. Birds of Crab Orchard National Wildlife Refuge, Illinois.

Bird Species Found on Crab Orchard NWR

Species	Sp	S	F	W
# – irruptive species seen only during invasion years (2-10 year intervals) * – nests on refuge Sp – March-May S – June-August F – September-November W – December-February a – abundant: common species that is very numerous c – common: certain to be seen in suitable habitat u – uncommon: present but not certain to be seen o – occasional: seen only a few times during a season r – rare: seen only once or twice a year; some years not at all.				
LOONS	u	-	o	u
Common Loon				
GREBES	Sp	S	F	W
Pied-billed Grebe	u	-	c	c
Horned Grebe	c	-	c	o
Eared Grebe	o	-	-	o
CORMORANTS	Sp	S	F	W
Double-crested Cormorant	c	o	a	a
BITTERNS, HERONS	Sp	S	F	W
American Bittern	o	-	r	-
Great Blue Heron	c	c	c	c
Great Egret	o	u	u	-
Little Blue Heron	u	u	u	-
Cattle Egret	o	u	o	-
Green Heron*	u	c	c	-
Black-crowned Night-Heron*	r	o	o	-
Yellow-crowned Night-Heron	r	-	o	-

Bird Species Found on Crab Orchard NWR

Species	Sp	S	F	W
SWANS, GEESE, DUCKS	Sp	S	F	W
Tundra Swan (Whistling Swan)	o	r	u	u
Mute Swan	r	-	r	r
Greater White-fronted Goose	-	-	r	o
Snow Goose	o	-	u	u
Canada Goose*	c	u	a	a
Wood Duck	c	c	c	c
Green-winged Teal	o	-	o	r
American Black Duck	c	-	a	a
Mallard*	c	c	a	a
Northern Pintail	o	-	u	c
Blue-winged Teal	c	u	a	o
Northern Shoveler	a	o	a	c
Gadwall	a	-	a	a
American Wigeon	c	-	c	u
Canvasback	u	-	o	c
Redhead	a	-	u	o
Ring-necked Duck	a	-	a	a
Greater Scaup	r	-	r	-
Lesser Scaup	a	-	a	c
Common Goldeneye	c	-	o	a
Bufflehead	c	-	c	c
Hooded Merganser	c	-	a	a
Common Merganser	a	-	c	a
Red-breasted Merganser	a	-	c	o
Ruddy Duck	a	-	u	c
VULTURES, HAWKS, FALCONS	Sp	S	F	W
Turkey Vulture*	c	c	c	r
Osprey	o	r	o	r
Mississippi Kite	r	r	r	-
Bald Eagle*	u	u	c	c
Northern Harrier (Marsh Hawk)	o	r	o	o
Sharp-shinned Hawk	o	-	u	u
Cooper's Hawk*	u	u	u	o
Northern Goshawk	r	-	r	r
Red-shouldered Hawk*	c	u	u	c
Broad-winged Hawk*	o	u	u	o
Red-tailed Hawk*	c	c	c	c
Rough-legged Hawk	o	r	r	o
Golden Eagle	o	-	o	o

Bird Species Found on Crab Orchard NWR

Species	Sp	S	F	W
American Kestrel*	c	c	c	c
Merlin	r	-	r	r
GALLINACEOUS BIRDS	Sp	S	F	W
Wild Turkey*	c	c	c	c
Northern Bobwhite*	c	c	c	c
RAILS	Sp	S	F	W
Virginia Rail	r	r	r	-
Sora	o	-	o	-
American Coot	u	u	c	c
SHOREBIRDS	Sp	S	F	W
American Golden-Plover	c	-	u	-
Semipalmated Plover	c	-	o	-
Killdeer*	c	c	c	c
American Avocet	-	-	o	-
Greater Yellowlegs	c	-	u	-
Lesser Yellowlegs	c	u	c	-
Solitary Sandpiper	c	o	c	-
Willet	r	o	-	-
Spotted Sandpiper*	u	u	-	-
Semipalmated Sandpiper	u	-	u	-
Least Sandpiper	c	u	u	-
White-rumped Sandpiper	o	-	r	-
Pectoral Sandpiper	a	c	c	-
Stilt Sandpiper	r	-	u	-
Short-billed Dowitcher	o	-	c	-
Long-billed Dowitcher	o	-	o	-
Common Snipe	c	-	c	o
American Woodcock*	c	c	c	o
Wilson's Phalarope	o	r	o	-
GULLS, TERNS	Sp	S	F	W
Bonaparte's Gull	c	-	u	c
Ring-billed Gull	a	o	c	a
Herring Gull	c	-	u	c
Caspian Tern	r	-	r	-
Forster's Tern	o	-	r	-
Black Tern	o	r	u	-

Bird Species Found on Crab Orchard NWR

Species	Sp	S	F	W
DOVES	Sp	S	F	W
Rock Dove	u	u	u	u
Mourning Dove	c	c	c	c
CUCKOOS	Sp	S	F	W
Black-billed Cuckoo	o	o	o	-
Yellow-billed Cuckoo	u	c	c	-
OWLS	Sp	S	F	W
Barn Owl	o	o	o	o
Eastern Screech-Owl*	u	u	u	u
Great Horned Owl*	c	c	c	c
Barred Owl*	c	c	c	c
Short-eared Owl	r	-	o	r
GOATSUCKERS	Sp	S	F	W
Common Nighthawk*	o	u	o	-
Chuck-will's-widow*	o	o	-	-
Whip-poor-will	u	u	o	-
SWIFTS, HUMMINGBIRDS	Sp	S	F	W
Chimney Swift*	c	c	c	-
Ruby-throated Hummingbird*	u	c	o	-
KINGFISHERS	Sp	S	F	W
Belted Kingfisher*	u	u	u	u
WOODPECKERS	Sp	S	F	W
Red-headed Woodpecker*	u	u	u	u
Red-bellied Woodpecker*	c	c	c	c
Yellow-bellied Sapsucker	o	-	o	r
Downy Woodpecker*	c	c	c	c
Hairy Woodpecker*	o	o	o	o
Northern Flicker (Common Flicker)*	c	c	c	c
Pileated Woodpecker*	o	o	o	o
FLYCATCHERS	Sp	S	F	W
Olive-sided Flycatcher	r	-	r	-
Eastern Wood-Pewee*	c	c	u	u
Yellow-bellied Flycatcher	r	-	r	-

Bird Species Found on Crab Orchard NWR

Species	Sp	S	F	W
Acadian Flycatcher*	o	u	u	-
Alder Flycatcher*	r	-	r	-
Willow Flycatcher	r	-	r	-
Least Flycatcher	o	-	o	-
Eastern Phoebe*	c	c	c	o
Great Crested Flycatcher*	c	c	r	-
Eastern Kingbird*	c	c	o	-
LARKS	Sp	S	F	W
Horned Lark*	o	o	o	o
SWALLOWS	Sp	S	F	W
Purple Martin*	c	c	o	-
Tree Swallow*	c	c	c	-
Northern Rough-winged Swallow*	u	c	u	-
Bank Swallow	o	-	-	-
Cliff Swallow*	c	c	o	-
Barn Swallow*	c	c	u	-
JAYS, CROWS	Sp	S	F	W
Blue Jay*	a	a	a	a
American Crow*	c	c	c	-
Fish Crow	o	o	o	o
CHICKADEES	Sp	S	F	W
Carolina Chickadee*	c	c	c	c
Tufted Titmouse*	c	c	c	c
NUTHATCHES	Sp	S	F	W
Red-breasted Nuthatch	o	-	o	u
White-breasted Nuthatch	u	o	u	u
CREEPERS	Sp	S	F	W
Brown Creeper	o	-	o	o
WRENS	Sp	S	F	W
Carolina Wren*	c	c	c	u
House Wren*	c	c	c	-
Winter Wren	o	o	o	-
Sedge Wren	o	o	o	-
Marsh Wren	r	-	r	-

Bird Species Found on Crab Orchard NWR

Species	Sp	S	F	W
KINGLETS	Sp	S	F	W
Golden-crowned Kinglet	u	-	u	u
Ruby-crowned Kinglet	u	-	u	u
Blue-gray Gnatcatcher*	c	c	o	-
THRUSHES	Sp	S	F	W
Eastern Bluebird*	c	c	c	c
Veery	o	-	r	-
Gray-cheeked Thrush	u	-	u	-
Swainson's Thrush	o	-	o	-
Hermit Thrush	o	-	u	r
Wood Thrush*	o	u	r	-
American Robin*	c	c	c	u
THRASHERS	Sp	S	F	W
Gray Catbird*	c	c	c	-
Northern Mockingbird*	c	c	c	c
Brown Thrasher*	c	c	c	o
WAXWINGS	Sp	S	F	W
Cedar Waxwing*	c	u	u	c
SHRIKES	Sp	S	F	W
Loggerhead Shrike	u	u	u	u
STARLINGS	Sp	S	F	W
European Starling*	a	a	a	a
VIREOS	Sp	S	F	W
White-eyed Vireo*	c	c	u	-
Bell's Vireo	r	r	-	-
Yellow-throated Vireo*	o	u	o	-
Warbling Vireo*	c	c	o	-
Red-eyed Vireo*	u	u	o	-
WOOD WARBLERS	Sp	S	F	W
Blue-winged Warbler	o	r	r	-
Golden-winged Warbler	o	r	-	r
Tennessee Warbler	u	-	o	-
Nashville Warbler	r	-	r	-

Bird Species Found on Crab Orchard NWR

Species	Sp	S	F	W
Northern Parula*	c	c	u	-
Yellow Warbler*	o	o	-	-
Chestnut-sided Warbler	o	-	o	-
Magnolia Warbler	o	-	o	-
Cape May Warbler	r	-	r	-
Yellow-rumped Warbler	u	-	u	o
Black-throated Green Warbler	o	-	o	-
Blackburnian Warbler	o	r	r	-
Pine Warbler*	o	u	o	-
Prairie Warbler*	u	u	o	-
Palm Warbler	o	-	o	-
Bay-breasted Warbler	u	-	o	-
Blackpoll Warbler	u	-	r	-
Cerulean Warbler*	o	r	-	-
Black-and-white Warbler	o	r	o	-
American Redstart	o	r	o	-
Prothonotary Warbler*	u	u	r	-
Worm-eating Warbler	r	-	r	-
Ovenbird	o	r	r	-
Northern Waterthrush	o	-	o	-
Louisiana Waterthrush	u	u	r	-
Kentucky Warbler*	u	u	r	-
Common Yellowthroat*	c	c	c	r
Hooded Warbler	o	-	r	-
Wilson's Warbler	o	-	o	-
Canada Warbler	o	-	r	-
Yellow-breasted Chat*	u	u	o	-
TANAGERS	Sp	S	F	W
Summer Tanager*	u	u	o	-
Scarlet Tanager*	u	u	o	-
SPARROWS	Sp	S	F	W
Northern Cardinal*	a	a	a	a
Rose-breasted Grosbeak	o	-	o	-
Blue Grosbeak*	o	o	o	-
Indigo Bunting*	a	a	a	-
Dickcissel*	u	u	-	-
Rufous-sided Towhee*	c	c	c	u
American Tree Sparrow*	c	-	o	c
Chipping Sparrow*	u	u	o	-

Bird Species Found on Crab Orchard NWR

Species	Sp	S	F	W
Field Sparrow*	u	u	o	-
Savannah Sparrow	o	-	u	o
Grasshopper Sparrow*	o	o	r	-
Le Conte's Sparrow	o	-	o	u
Fox Sparrow	o	-	r	u
Song Sparrow*	u	o	o	c
Swamp Sparrow	u	-	u	u
White-throated Sparrow	c	-	c	c
White-crowned Sparrow	c	-	c	c
Dark-eyed Junco	a	-	c	a
MEADOWLARKS, BLACK-BIRDS, ORIOLES	Sp	S	F	W
Red-winged Blackbird*	c	c	a	c
Eastern Meadowlark*	c	c	c	c
Common Grackle*	c	c	a	c
Brown-headed Cowbird*	c	c	c	c
Orchard Oriole*	u	u	o	-
Baltimore Oriole*	u	u	o	-
FINCHES	Sp	S	F	W
House Finch	c	c	c	c
Purple Finch	c	-	u	c
Pine Siskin#	o	-	o	o
American Goldfinch*	c	c	c	c
Evening Grosbeak#	o	-	-	o
OLD WORLD SPARROWS	Sp	S	F	W
House Sparrow*	c	c	c	c

Accidental Species:

Least Bittern

Vermillion Flycatcher

Glossy Ibis

Scissor-tailed Flycatcher

Sandhill Crane

Bewick's Wren

Whooper Swan

Rock Wren

Trumpeter Swan

Water Pipit

Oldsquaw

Solitary Vireo

White-winged Scoter

Philadelphia Vireo

Black Vulture

Orange-crowned Warbler

Common Moorhen

Black-throated Blue Warbler

Black-bellied Plover
Mourning Warbler
Ruddy Turnston
Connecticut Warbler
Dunlin
Swainson's Warbler
Sanderling
Henslow's Sparrow
Baird's Sandpiper
Vesper Sparrow
Upland Sandpiper
Lark Sparrow
Franklin's Gull
Lincoln's Sparrow
Laughing GullLapland Longspur
Black-headed Gull
Pine Grosbeak
Sabine's Gull
Red Crossbill
Least Tern
Rusty Blackbird

Potential Reptile and Amphibian Check List for Crab Orchard National Wildlife Refuge

Common Name	Scientific Name	Class	Residence	Status on Refuge	Habitat
Salamanders					
spotted salamander	*Ambystoma maculatum*	A	B, W	U	W, BF, UF
marbled salamander	*Ambystoma opacum*	A	B, W	U	W, BF
smallmouth salamander	*Ambystoma texanum*	A	B, W	U	W, BF
tiger salamander	*Ambystoma tigrinum*	A	B, W	U	W, UF, BF
eastern newt	*Notophthalmus viridescens*	A	B, W	U	W, BF
northern slimy salamander	*Plethodon glutinosus*	A	B, W	C	UF, BF, RB
lesser siren	*Siren intermedia*	A	B, W	U	W, S
Toads and Frogs					
cricket frog	*Acris crepitans*	A	B, W	A	W, RB, R, UF, S, BF
American toad	*Bufo americanus*	A	B, W	C	W, RB, UF, PF, BF
Fowler-s toad	*Bufo fowleri*	A	B, W	C	W, RB, UF, PF, BF
green treefrog	*Hyla cinerea*	A	B, W	U	W, R, BF
gray treefrog	*Hyla chrysoscelis / versicolor*	A	B, W	C	W, UF, BF, PF
spring peeper	*Pseudacris crucifer*	A	B, W	C	W, UF, BF
upland chorus frog	*Pseudacris feriarum*	A	B, W	C	W, RB, UF, BF
crawfish frog	*Rana areolata*	A	B, W	R	W
bullfrog	*Rana catesbeiana*	A	B, W	A	W, R, BF, S
green frog	*Rana clamitans*	A	B, W	C	W, R, BF, S
southern leopard frog	*Rana sphenocephala*	A	B, W	A	W, R, BF, S
wood frog	*Rana sylvatica*	A	B, W	R	W, BF
eastern spadefoot	*Scaphiopus holbrookii*	A	B, W	R	W, BF
Turtles					
snapping turtle	*Chelydra serpentina*	R	B, W	C	W, R, S
painted turtle	*Chrysemys picta*	R	B, W	C	W, S
eastern box turtle	*Terrapene carolina*	R	B, W	A	RB, UF, PF, BF
red-eared slider	*Trachemys scripta*	R	B, W	C	W, R, S
eastern mud turtle	*Kinosternon subrubrum*	R	B, W	U	W, BF
common musk turtle	*Sternotherus odoratus*	R	B, W	C	W, BF
spiny softshell turtle	*Apalone spinifera*	R	B, W	U	W, R, S
Lizards					
fence lizard	*Sceloporus undulatus*	R	B, W	U	UF, RB, BF
ground skink	*Scincella lateralis*	R	B, W	C	UF, RB, BF
five-lined skink	*Eumeces fasciatus*	R	B, W	C	UF, RB, BF
six-lined racerunner	*Cnemidophorus sexlineatus*	R	B, W	R	RB
Snakes					
worm snake	*Carphophis amoenus*	R	B, W	U	RB, UF, BF
racer	*Coluber constrictor*	R	B, W	C	RB, UF, PF, BF

Potential Reptile and Amphibian Check List for Crab Orchard National Wildlife Refuge

Common Name	Scientific Name	Class	Residence	Status on Refuge	Habitat
ringneck snake	*Diadophis punctatus*	R	B, W	U	RB, UF, BF
rat snake	*Elaphe obsoleta*	R	B, W	C	RB, UF, PF, BF
mud snake	*Farancia abacura*	R	B, W	R	W
eastern hognose snake	*Heterodon platirhinos*	R	B, W	U	RB, UF, PF, BF
prairie kingsnake	*Lampropeltis calligaster*	R	B, W	C	RB
common kingsnake	*Lampropeltis getula*	R	B, W	U	RB, UF, BF
plainbelly water snake	*Nerodia erythrogaster*	R	B, W	C	W, R, S
diamondback water snake	*Nerodia rhombifer*	R	B, W	C	W, R, S
midland water snake	*Nerodia sipedon*	R	B, W	C	W, R, S
rough green snake	Opheodrys aestivus	R	B, W	U	RB, UF, BF, PF
brown snake	Storeria dekayi	R	B, W	U	RB, UF, BF
redbelly snake	Storeria occipitomaculata	R	B, W	R	RB, UF, BF
common garter snake	Thamnophis sirtalis	R	B, W	C	W, S, RB, UF, BF
smooth earth snake	Virginia valeriae	R	B, W	R	RB, UF, BF
copperhead	Agkistrodon contortrix	R	B, W	U	RB, UF, BF
Total Amphibians = 20		Total Reptiles = 28			

Mammal Checklist, CrabOrchard NWR

Common Name	Scientific Name	Status on Refuge
Virginia opossum	*Didelphis virginiana*	C
Southeastern shrew	*Sorex longirostris*	U
Southern short-tailed shrew	*Blarina carolinensis*	U
Least Shrew	*Cryptotis parva*	U
Eastern mole	*Scalopus aquaticus*	U
Little brown bat	*Myotis lucifugus*	U
Northern myotis	*Myotis septentrionalis*	U
Indiana bat	*Myotis sodalis*	unknown
Silver-haired bat	*Lasionycteris noctivagans*	U
Eastern pipistrelle	*Pipistrellus subflavus*	U
Big brown bat	*eptesicus fuscus*	U
Red bat	*Lasiurus borealis*	U
Hoary bat	*Lasiurus cinereus*	U
Evening bat	*Nycticeius humeralis*	unknown
Eastern cottontail	*Sylvilagus floridanus*	U
Swamp rabbit	*Sylvilagus aquaticus*	U
Eastern chipmunk	*Tamias striatus*	U
Woodchuck	*Marmota monax*	U
Gray squirrel	*Sciurus carolinensis*	A
Fox squirrel	*Sciurus niger*	A
Southern flying squirrel	*Glaucomys volans*	U
Beaver	*Castor canadensis*	C
Marsh rice rat	*oryzomys palustris*	unknown
Deer mouse	*Peromyscus maniculatus*	U
White-footed mouse	*Peromyscus leucopus*	U
Cotton mouse	*peromyscus gossypinus*	U
Golden mouse	*Peromyscus nuttalli*	R
Prairie vole	*microtus ochrogaster*	U
Woodland (pine) vole	*Microtus pinetorum*	U
Muskrat	*Ondatra zibethicus*	U
Norway rat	*Rattus norvegicus*	U
House mouse	*Mus musculus*	U
Meadow jumping mouse	*Zapus hudsonius*	U
Coyote	*Canis latrans*	U
Red fox	*Vulpes fulva*	U
Gray fox	*urocyon cinereoargenteus*	R
Raccoon	*Procyon lotor*	C
Long-tailed weasel	*Mustela frenata*	U
Mink	*Mustela vison*	U
Striped skunk	*Mephitis mephitis*	C
River otter	*Lutra canadensis*	R
Bobcat	*Felis rufus*	U
White-tailed deer	*Odocoileus virginianus*	C

Class Code	Type Code	Status Code	Habitat Code
A= Agnatha C= Chondricthyes O= Osteichthyes	A= anadromous C= catadromous F= freshwater S= saltwater	A= Abundant, a common species that is very common C= Common, certain to be seen or encountered in suitable habitat U= Uncommon, present but not always seen R= Rare, seen only occasionally S= Stocked populations	L= Lake R= River P= Pone SL=Slough S=Stream
Names of the fish herein are after: Mayden, R.L. 1992. *Systematics, Historical Ecology, & North American Freshwater Fishes*. Stanford University Press. Stanford, California. Fish distribution data were collected from the following sources:Runyon, K.R. 1997. Determination of the effects of discharge from Little Grassy Fish Hatchery on Little Grassy Creek. M.S. Thesis. Southern Illinois University, Carbondale. 82p.U.S. Fish and Wildlife Service. 1999. Survey of the fish of Crab Orchard National Wildlife Refuge. Illinois Environmental Protection Agency. 1997. An intensive survey of the Big Muddy River Basin.Additional presence, absence and distributional data was obtained from the ichthyology museum at Southern Illinois University at Carbondale.			

Fish Species of Crab Orchard National Wildlife Refuge

Common Name	Scientific Name	Class	Type	Status on Refuge	Habitat	Exotic or Native
Bigmouth buffalo	*Ictiobus cyprinellus*	O	F	U	L	N
Black bullhead	*Ameiurus melas*	O	F	C	L,S,SL,P,R	N
Black buffalo	*Ictiobus niger*	O	F	U	R	N
Black crappie	*Pomoxis nigromaculatus*	O	F	C	L,S,SL,P,R	N
Blacknose dace	*Rhinichthys atratulus*	O	F	R	S	N
Blackspotted topminnow	*Fundulus olivaceus*	O	F	C	S,L,P,R	N
Blackstripe topminnow	*Fundulus notatus*	O	F	C	S,L,P,R	N
Bluegill	*Lepomis macrochirus*	O	F	A	L,S,SL,P,R	N
Bluntnose darter	*Etheostoma chlorosomum*	O	F	R	S,R	N
Bluntnose minnow	*Pimephales notatus*	O	F	A	L,S,R	N
Bowfin	*Amia calva*	O	F	C	L,SL,P,R	N
Brown trout	*Salmo trutta*	O	F	U,S	L	E
Brook silverside	*Labidesthes sicculus*	O	F	C	L,S,R	N
Bullhead minnow	*Pimephales vigilax*	O	F	U	S,SL	N
Central stoneroller	*Campostoma anomalum*	O	F	U	S,R	N
Channel catfish	*Ictalurus punctatus*	O	F	C	S,L,P,R	N
Creek chubsucker	*Erimyzon oblongus*	O	F	C	S,SL	N
Common carp	*Cyprinus carpio*	O	F	A	L,S,SL,P,R	E
Creek chub	*Semotilus atromaculatus*	O	F	C	S,R	N
Fathead minnow	*Pimephales promelas*	O	F	U	S,SL	N
Flathead catfish	*Pylodictis olivaris*	O	F	U,S	L	E
Flier	*Centrarchus macropterus*	O	F	U	S,SL	N
Freshwater drum	*Aplodinotus grunniens*	O	F	U	R	N
Gizzard shad	*Dorosoma cepedianum*	O	F	A	L,S,R	N
Golden shiner	*Notemigonus crysoleucas*	O	F	C	L,S,SL,P,R	N
Grass pickeral	*Esox americanus*	O	F	C	L,S,SL,P,R	N
Green sunfish	*Lepomis cyanellus*	O	F	C	L,S,SL,P,R	N
Hybrid stripedbass		O	F	U,S	L	E
Johnny darter	*Etheostoma nigrum*	O	F	U	S,R	N
Largemouth bass	*Micropterus salmoides*	O	F	C	L,S,SL,P,R	N
Logperch	*Percina caprodes*	O	F	U	L,S	N
Longear sunfish	*Lepomis megalotis*	O	F	C	L,S,P,R	N

Fish Species of Crab Orchard National Wildlife Refuge

Common Name	Scientific Name	Class	Type	Status on Refuge	Habitat	Exotic or Native
Mosquitofish	*Gambusia affinis*	O	F	A	L,S,SL,P,R	N
Orangespotted sunfish	*Lepomis humilis*	O	F	U	L,S,SL,P,R	N
Orangethroat darter	*Etheostoma spectabile*	O	F	U	S,R	N
Paddlefish	*Polyodon spathula*	A	F	R	R	N
Pirate perch	*Aphredoderus sayanus*	O	F	U	S,SL	N
Rainbow trout	*Oncorhynchus mykiss*	O	F	U,S	L	E
Red shiner	*Cyprinella lutrensis*	O	F	C	S,R	N
Redear sunfish	*Lepomis microlophus*	O	F	C	L,S,P,R	N
Redfin shiner	*Lythrurus umbratilis*	O	F	U	S,R	N
Ribbon Shiner	*Lythrurus fumeus*	O	F	R	S,R	N
River darter	*Percina shumardi*	O	F	R	R	N
Shortnose gar	*Lepisosteus platostomus*	O	F	R	R	N
Slough darter	*Etheostoma gracile*	O	F	U	S,SL	N
Small mouth bass	*Micropterus dolomieu*	O	F	R,S	L	E
Small mouth buffalo	*Ictiobus bubalus*	O	F	U	R	N
Spotted bass	*Micropterus punctulatus*	O	F	R	S	N
Spotted sucker	*Minytrema melanops*	O	F	C	L,S,R	N
Steelcolor shiner	*Cyprinella whipplei*	O	F	U	L,S,R	N
Striped bass	*Morone saxatilis*	O	F	C,S	L,R	E
Tadpole madtom	*Noturus gyrinus*	O	F	U	S,R	N
Threadfin shad	*Dorosoma petenense*	O	F	C,S	L	E
Walleye	*Stizostedion vitreum*	O	F	U,S	L	E
Walleye x sauger hybrid		O	F	U,S	L	E
Warmouth	*Chaenobryttus gulosus*	O	F	C	L,S,SL,P,R	N
White bass	*Morone chrysops*	O	F	C	L,S,R	N
White crappie	*Pomoxis annularis*	O	F	C	L,S,SL,P,R	N
White sucker	*Catostomus commersoni*	O	F	U	L,S,R	N
Yellow bass	*Morone mississippiensis*	O	F	C	L,R	N
Yellow bullhead	*Ameiurus natalis*	O	F	U	L,S,SL,P,R	N
Yellow perch	*Perca flavescens*	O	F	C	L	N

TOTALSPECIESCOUNT=61

Vascular Plants of Crab Orchard NWR

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Lycopodiales	*Lycopodiaceae* C Clubmoss	ground-cedar	*Lycopodium complanatum var. flabelliforme*		U			N	
Isoetales	*Isoetaceae* C Quillwort	black quillwort	*Isoetes melanopoda*		U				1
Equisetales	*Equisetaceae* C Horsetail	common horsetail [field horse-tail]	*Equisetum arvense*		LC				1
Equisetales	*Equisetaceae* C Horsetail	scouring rush	*Equisetum hyemale affine*		LA				1
Ophioglossales	*Ophioglossaceae* C Adder-s-tongue	bronze fern [cut-leaved grape fern]	*Botrychium dissectum dis-sectum*		U				1
Ophioglossales	*Ophioglossaceae* C Adder-s-tongue	bronze fern [grape fern]	*Botrychium dissectum obliq-uum*		LC				1
Ophioglossales	*Ophioglossaceae* C Adder-s-tongue	rattlesnake fern	*Botrychium virginianum*		C				1
Ophioglossales	*Ophioglossaceae* C Adder-s-tongue	adder-s-tongue fern	*Ophioglossum vulgatum pycnostichumm*		O				1
Ficales	*Osmundaceae* C Royal Fern	interrupted fern	*Osmunda claytoniana*		R				1
Ficales	*Polypodiaceae* C Fern	resurrection fern	*Polypodium polypodioides*		U				1
Ficales	*Polypodiaceae* C Fern	polypody	*Polypodium virginianum*		LC				1
Ficales	*Polypodiaceae* C Fern	maidenhair fern	*Adiantum pedatum*		LC				1
Ficales	*Polypodiaceae* C Fern	pinnatifid [lobed] spleenwort	*Asplenium pinnatifidum*		R				1
Ficales	*Polypodiaceae* C Fern	ebony spleenwort	*Asplenium platyneuron*		C				1
Ficales	*Polypodiaceae* C Fern	walking fern	*Asplenium rhizophyllum*		LC				1
Ficales	*Polypodiaceae* C Fern	maidenhair spleenwort	*Asplenium trichomanes ssp. trichomanes*		U				1
Ficales	*Polypodiaceae* C Fern	lady fern	*Athyrium angustum*		U				1
Ficales	*Polypodiaceae* C Fern	southern lady fern	*Athyrium asplenioides*		U				1
Ficales	*Polypodiaceae* C Fern	glade fern [narrow-leaved spleenwort]	*Athyrium pycnocarpon*		U				1
Ficales	*Polypodiaceae* C Fern	silvery spleenwort	*Athyrium thelypterioides*		U				1
Ficales	*Polypodiaceae* C Fern	fragile fern	*Cystopteris protrusa*		LA				1

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Ficales	*Polypodiaceae* C Fern	Tennessee fragile fern	*Cystopteris X tennesseensis*		R				1
Ficales	*Polypodiaceae* C Fern	Goldie-s fern	*Dryopteris goldiana*		U				1
Ficales	*Polypodiaceae* C Fern	marginal shield fern [leather fern]	*Dryopteris marginalis*		LC				1
Ficales	*Polypodiaceae* C Fern	sensitive fern	*Onoclea sensibilis*		O				1
Ficales	*Polypodiaceae* C Fern	Christmas fern	*Polystichum acrostichoides*		LC				1
Ficales	*Polypodiaceae* C Fern	blunt-lobed woodsia [common woodsia]	*Woodsia obtusa*		O-C				1
Ginkgoales	*Ginkgoaceae*C Ginkgo	ginkgo [maidenhair tree]	*Ginkgo biloba*	tree	R			E	
Coniferales	*Pinaceae* C Pine	shortleaf pine	*Pinus echinata*	tree	A		E	E	1
Coniferales	*Pinaceae* C Pine	loblolly pine	*Pinus taeda*	tree	C			E	1
Coniferales	*Pinaceae* C Pine	Virginia pine [scrub, Jersey, poverty pine]	*Pinus virginiana*	tree	C			E	1
Coniferales	*Pinaceae* C Pine	Scotch pine	*Pinus sylvestris*	tree	R			E	
Coniferales	*Pinaceae* C Pine	ponderosa pine	*Pinus ponderosa*	tree	R			E	
Coniferales	*Pinaceae* C Pine	eastern white pine	*Pinus strobus*	tree	R			E	
Coniferales	*Pinaceae* C Pine	Norway spruce	*Picea abies*	tree	R			E	
Coniferales	*Taxodiaceae* C Baldcypress	baldcypress	*Taxodium distichum*	tree	O			E	
Coniferales	*Cupressaceae* C Cypress	eastern redcedar	*Juniperus virginiana*	tree	LC			N	1
Typhales	*Typhaceae* C Cat-tail	narrow-leaved cat-tail	*Typha angustifolia*						1
Typhales	*Typhaceae* C Cat-tail	common cat-tail	*Typha latifolia*						1
Najadales	*Potamogetonaceae* C Pond-weed	waterthread pondweed	*Potamogeton diversifolius*		O				1
Najadales	*Potamogetonaceae* C Pond-weed	leafy pondweed	*Potamogeton foliosus*		U				1
Najadales	*Potamogetonaceae* C Pond-weed	American pondweed	*Potamogeton nodosus*		LC				1
Alismatales	*Alismaceae* C Water Plantain	arrowhead [arrowleaf]	*Sagittaria calycina*		R				1

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Alismatales	*Alismaceae* C Water Plantain	water plantain [small-flowered water plantain]	*Alisma plantago-aquatica parviflorum*		R(1) C				1
Hydrocharitales	*Hydrocharitaceae* C Frog-s-bit	anacharis [Canadian waterweed]	*Elodea canadensis*		U				1
Cyperales	*Poaceae* C Grass	giant cane	*Arundinaria gigantea*	shrub	U			N	
Cyperales	*Poaceae* C Grass	goose grass [yard grass]	*Eleusine indica*		LC			E	1
Cyperales	*Poaceae* C Grass	three-flowered melic grass	*Melica nitens*		U				1
Cyperales	*Poaceae* C Grass	orchard grass	*Dactylis glomerata*		C				1
Cyperales	*Poaceae* C Grass	bluegrass	*Poa angustifolia*		R				1
Cyperales	*Poaceae* C Grass	annual bluegrass [low speargrass]	*Poa annua*		O				1
Cyperales	*Poaceae* C Grass	Canadian bluegrass	*Poa compressa*		O				1
Cyperales	*Poaceae* C Grass	Kentucky bluegrass	*Poa pratensis*		LC				1
Cyperales	*Poaceae* C Grass	woodland bluegrass	*Poa sylvestris*		U				1
Cyperales	*Poaceae* C Grass	chess [field brome]	*Bromus arvensis*		LC				1
Cyperales	*Poaceae* C Grass	hairy brome [hairy chess]	*Bromus commutatus*		LC				1
Cyperales	*Poaceae* C Grass	awnless brome [Hungarian, smooth brome]	*Bromus inermis*		O				1
Cyperales	*Poaceae* C Grass	Japanese brome [Japanese chess]	*Bromus japonicus*		LC				1
Cyperales	*Poaceae* C Grass	Canada brome [woodland brome]	*Bromus pubescens*		O				1
Cyperales	*Poaceae* C Grass	bald brome [chess]	*Bromus racemosus*		LA				1
Cyperales	*Poaceae* C Grass	cheat grass brome [downy brome]	*Bromus tectorum*		LA				1
Cyperales	*Poaceae* C Grass	fowl manna grass	*Glyceria striata*		LC				1
Cyperales	*Poaceae* C Grass	purple-top [false red-top, tall red-top]	*Tridens flavus*		A				1
Cyperales	*Poaceae* C Grass	lace grass	*Eragrostis capillaris*		O				1

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Cyperales	*Poaceae* C Grass	stink grass [stinking love grass]	*Eragrostis cilianensis*		O				1
Cyperales	*Poaceae* C Grass	sandbar love grass	*Eragrostis frankii*		U				1
Cyperales	*Poaceae* C Grass	Carolina love grass [small love grass]	*Eragrostis pectinacea*		LC				1
Cyperales	*Poaceae* C Grass	purple love grass [sand love grass]	*Eragrostis spectabilis*		O				1
Cyperales	*Poaceae* C Grass	nodding fescue	*Festuca obtusa*		O				1
Cyperales	*Poaceae* C Grass	English bluegrass [meadow fescue]	*Festuca pratensis*		O-LA				1
Cyperales	*Poaceae* C Grass	curly grass [poverty oat grass]	*Danthonia spicata*		LC				1
Cyperales	*Poaceae* C Grass	shining wedge grass	*Sphenopholis nitida*		R				1
Cyperales	*Poaceae* C Grass	prairie wedge grass [prairie wedgescale]	*Sphenopholis obtusata*		O				1
Cyperales	*Poaceae* C Grass	bearded wheat [wheat]	*Triticum aestivum*		R				1
Cyperales	*Poaceae* C Grass	little barley [small wild barley]	*Hordeum pusillum*		LC				1
Cyperales	*Poaceae* C Grass	bottlebrush grass	*Elymus histrix*						1
Cyperales	*Poaceae* C Grass	hairy wild rye [silky wild rye, slender wild rye]	*Elymus villosus*						1
Cyperales	*Poaceae* C Grass	lyme grass [Virginia wild rye]	*Elymus virginicus virginicus*						1
Cyperales	*Poaceae* C Grass	lyme grass [Virginia wild rye]	*Elymus virginicus glabriflorus*						1
Cyperales	*Poaceae* C Grass	giant foxtail [nodding foxtail]	*Setaria faberii*		LC			E	1
Cyperales	*Poaceae* C Grass	pigeon grass [yellow foxtail]	*Setaria glauca*		O-LC			E	1
Cyperales	*Poaceae* C Grass	common foxtail [green foxtail]	*Setaria viridis*		O			E	1
Cyperales	*Poaceae* C Grass	barnyard grass	*Echinochloa muricata*		LC				1

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Cyperales	*Poaceae* C Grass	bead grass [hairy lens grass]	*Paspalum ciliatifolium*		LC				1
Cyperales	*Poaceae* C Grass	bead grass	*Paspalum dissectum*		R				1
Cyperales	*Poaceae* C Grass	smooth lens grass	*Paspalum laeve*		LA				1
Cyperales	*Poaceae* C Grass	bead grass [hairy seed paspalum]	*Paspalum pubiflorum*		O-LA				1
Cyperales	*Poaceae* C Grass	panic grass	*Panicum anceps*		LC				1
Cyperales	*Poaceae* C Grass	fall panicum [knee grass]	*Panicum dichotomiflorum*		LC				1
Cyperales	*Poaceae* C Grass	panic grass	*Panicum gattingeri*		LA				1
Cyperales	*Poaceae* C Grass	Munro grass	*Panicum rigidulum*		LC				1
Cyperales	*Poaceae* C Grass	smooth crab grass	*Digitaria ischaemum*		LA				1
Cyperales	*Poaceae* C Grass	hairy crab grass [common crab grass]	*Digitaria sanguinalis*		LC				1
Cyperales	*Poaceae* C Grass	stoutwood reed	*Cinna arundinacea*		O				1
Cyperales	*Poaceae* C Grass	red top	*Agrostis alba*		LC				1
Cyperales	*Poaceae* C Grass	tickle-grass [hair grass, winter bent grass]	*Agrostis hyemalis*		LC				1
Cyperales	*Poaceae* C Grass	autumn bent grass [upland bent grass]	*Agrostis perennans*		C				1
Cyperales	*Poaceae* C Grass	muhly	*Muhlenbergia bushii*		R				1
Cyperales	*Poaceae* C Grass	common satin grass [nimble will, wirestem muhly]	*Muhlenbergia frondosa*		LC				1
Cyperales	*Poaceae* C Grass	nimble will	*Muhlenbergia schreberi*		LC				1
Cyperales	*Poaceae* C Grass	muhly [rock satin grass]	*Muhlenbergia sobolifera*		O				1
Cyperales	*Poaceae* C Grass	three-awn	*Aristida longispica*		O				1
Cyperales	*Poaceae* C Grass	plains three-awn [prairie three-awn, wire grass]	*Aristida oligantha*		LC				1
Cyperales	*Poaceae* C Grass	timothy	*Phleum pratense*		O				1

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Cyperales	*Poaceae* C Grass	dropseed [rough dropseed, tall dropseed]	*Sporobolus asper*		U				1
Cyperales	*Poaceae* C Grass	northern rush grass [poverty dropseed]	*Sporobolus vaginiflorus*		LC				1
Cyperales	*Poaceae* C Grass	long-awned wood grass	*Brachyelytrum erectum*		O				1
Cyperales	*Poaceae* C Grass	rice cutgrass	*Leersia oryzoides*		LC				1
Cyperales	*Poaceae* C Grass	white grass	*Leersia virginica*		O				1
Cyperales	*Poaceae* C Grass	silver plume grass	*Erianthus alopecuroides*		LC				1
Cyperales	*Poaceae* C Grass	Indian grass [yellow Indian grass]	*Sorghastrum nutans*		LC				1
Cyperales	*Poaceae* C Grass	Johnsongrass [Egyptian millet]	*Sorghum halepense*		LC				1
Cyperales	*Poaceae* C Grass	Elliott-s broom-sedge	*Andropogon elliotii*		LC				1
Cyperales	*Poaceae* C Grass	big bluestem [turkeyfoot]	*Andropogon gerardii*		LC				1
Cyperales	*Poaceae* C Grass	broom-sedge	*Andropogon virginicus*		C				1
Cyperales	*Poaceae* C Grass	little bluestem	*Schizachyrium scoparium [Andropogon scoparius]*		LC				1
Cyperales	*Poaceae* C Grass	gama grass	*Tripsacum dactyloides*		LC				1
Cyperales	*Poaceae* C Grass	corn [maize]	*Zea mays*		LA				
Cyperales	*Cyperaceae* C Sedge	bearded flat sedge	*Cyperus aristatus*		O				1
Cyperales	*Cyperaceae* C Sedge	chufa [ground almond, nut sedge, yellow nutgrass]	*Cyperus esculentus*		LC				1
Cyperales	*Cyperaceae* C Sedge	slender flatsedge	*Cyperus ferruginescens*		O				1
Cyperales	*Cyperaceae* C Sedge	fern flatsedge	*Cyperus filiculmis*		R				1
Cyperales	*Cyperaceae* C Sedge	hedgehog club rush	*Cyperus ovularis*		O				1
Cyperales	*Cyperaceae* C Sedge	straw colored flatsedge	*Cyperus strigosus*		LC				1
Cyperales	*Cyperaceae* C Sedge	needle spike rush	*Eleocharis acicularis*		LC				1
Cyperales	*Cyperaceae* C Sedge	spike rush	*Eleocharis elliptica elliptica*		U				1

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Cyperales	*Cyperaceae* C Sedge		*Eleocharis obtusa*		LC				1
Cyperales	*Cyperaceae* C Sedge	hair sedge [threadleaf beak-seed]	*Bulbostylis capillaris*		U				
Cyperales	*Cyperaceae* C Sedge	dark green rush [green bul-rush]	*Scirpus atrovirens*		LC				
Cyperales	*Cyperaceae* C Sedge	wool grass	*Scirpus cyperinus*		LC				
Cyperales	*Cyperaceae* C Sedge	red bulrush	*Scirpus pendulus*		O				
Cyperales	*Cyperaceae* C Sedge	great bulrush	*Scirpus acutus*		R				2
Cyperales	*Cyperaceae* C Sedge	nut-rush	*Scleria pauciflora*		R				1
Cyperales	*Cyperaceae* C Sedge	sedge	*Carex albursina*		O-C				1
Cyperales	*Cyperaceae* C Sedge	sedge	*Carex artitecta*		C				1
Cyperales	*Cyperaceae* C Sedge	woodland sedge	*Carex blanda*		O				1
Cyperales	*Cyperaceae* C Sedge	sedge	*Carex bushii*		C				1
Cyperales	*Cyperaceae* C Sedge		*Carex cephalophora*		O				1
Cyperales	*Cyperaceae* C Sedge		*Carex convoluta*		O				1
Cyperales	*Cyperaceae* C Sedge	fringed sedge	*Carex crinita*		O				1
Cyperales	*Cyperaceae* C Sedge	sedge	*Carex cristatella*		U				1
Cyperales	*Cyperaceae* C Sedge	sedge	*Carex digitalis*		U				1
Cyperales	*Cyperaceae* C Sedge	Emory sedge	*Carex emoryi*		U				1
Cyperales	*Cyperaceae* C Sedge	sedge	*Carex festucacea*		O				1
Cyperales	*Cyperaceae* C Sedge	sedge	*Carex frankii*		O				1
Cyperales	*Cyperaceae* C Sedge	sedge	*Carex glaucodea*		C				1
Cyperales	*Cyperaceae* C Sedge	sedge	*Carex hirsutella*		LC				1
Cyperales	*Cyperaceae* C Sedge	bottlebrush sedge	*Carex hystricina*		LC				1
Cyperales	*Cyperaceae* C Sedge	grass sedge	*Carex jamesii*		O				1
Cyperales	*Cyperaceae* C Sedge	sedge	*Carex lurida*		LC				1
Cyperales	*Cyperaceae* C Sedge	Mead sedge	*Carex meadii*		U				1

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Cyperales	*Cyperaceae* C Sedge	sedge	*Carex muhlenbergii*		C				1
Cyperales	*Cyperaceae* C Sedge	sedge	*Carex normalis*		O				1
Cyperales	*Cyperaceae* C Sedge	sedge	*Carex oligocarpa*		R				1
Cyperales	*Cyperaceae* C Sedge	Pennsylvania sedge	*Carex pennsylvanica*		LC				1
Cyperales	*Cyperaceae* C Sedge	sedge	*Carex physorhyncha*		LC				1
Cyperales	*Cyperaceae* C Sedge	sedge	*Carex retroflexa*		O				1
Cyperales	*Cyperaceae* C Sedge	sedge	*Carex rosea*		O				1
Cyperales	*Cyperaceae* C Sedge	broom sedge	*Carex scoparia*		U				1
Cyperales	*Cyperaceae* C Sedge	sedge	*Carex styloflexa*		U				1
Cyperales	*Cyperaceae* C Sedge	sedge	*Carex tenera*		U				1
Cyperales	*Cyperaceae* C Sedge	sedge	*Carex texensis*		O				1
Cyperales	*Cyperaceae* C Sedge	sedge	*Carex torta*		LA				1
Cyperales	*Cyperaceae* C Sedge	sedge	*Carex tribuloides*		O				1
Cyperales	*Cyperaceae* C Sedge	sedge	*Carex umbellata*		O				1
Cyperales	*Cyperaceae* C Sedge	fox sedge	*Carex vulpinoidea*		LC				1
Arales	*Araceae* C Arum	green dragon	*Arisaema dracontium*		O				1
Arales	*Araceae* C Arum	jack-in-the-pulpit [Indian turnip]	*Arisaema triphyllum*		C-O				1
Arales	*Araceae* C Arum	sweet flag [flag root, calamus]	*Acorus americanus*		U				1
Arales	*Lemnaceae* C Duckweed	Columbian water-meal [common water-meal]	*Wolffia columbiana*		LA				1
Arales	*Lemnaceae* C Duckweed	big duckweed [common ducksmeat, duckweed]	*Spirodela polyrhiza*		LA				1
Arales	*Lemnaceae* C Duckweed	duckweed	*Wolffiella gladiata*		LA				1
Commelinales	*Commelinaceae* C Spiderwort	spiderwort	*Tradescantia ohiensis*		U				1
Commelinales	*Commelinaceae* C Spiderwort	common spiderwort	*Tradescantia virginiana*		C				1

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Commelinales	*Commelinaceae* C Spider-wort	wide-leaved spiderwort	*Tradescantia subaspera*		LC				1
Commelinales	*Commelinaceae* C Spider-wort	common dayflower	*Commelina communis*		LC				1
Juncales	*Juncaceae* C Rush	knotty-leaved rush [tapertip rush]	*Juncus acuminatus*		LC				1
Juncales	*Juncaceae* C Rush	two-flowered rush	*Juncus biflorus*		LC				1
Juncales	*Juncaceae* C Rush	rush	*Juncus brachycarpus*		LA				1
Juncales	*Juncaceae* C Rush	Dudley rush	*Juncus dudleyi*		O				1
Juncales	*Juncaceae* C Rush	common rush	*Juncus effusus solutus*		O				1
Juncales	*Juncaceae* C Rush	inland rush	*Juncus interior*		U				1
Juncales	*Juncaceae* C Rush	rush	*Juncus nodatus*		U				1
Juncales	*Juncaceae* C Rush	rush	*Juncus secundus*		O				1
Juncales	*Juncaceae* C Rush	path rush [poverty rush]	*Juncus tenuis*		LA				1
Juncales	*Juncaceae* C Rush	Torrey rush	*Juncus torreyi*		LC				1
Juncales	*Juncaceae* C Rush	common wood rush	*Luzula multiflora multiflora*		C				1
Juncales	*Juncaceae* C Rush	wood rush	*Luzula multiflora echinata*		O				1
Liliales	*Liliaceae* C Lily	large-flowered bellwort [big merry bells]	*Uvularia grandiflora*		O				1
Liliales	*Liliaceae* C Lily	field garlic	*Allium vineale*		A			E	1
Liliales	*Liliaceae* C Lily	wild garlic [wild onion]	*Allium canadense*		LA				1
Liliales	*Liliaceae* C Lily	garlic [garlic onion]	*Allium sativum*		O				1
Liliales	*Liliaceae* C Lily	false garlic [crow poison]	*Nothoscordum bivalve*		LC				1
Liliales	*Liliaceae* C Lily	orange day-lily [day-lily]	*Hemerocallis fulva*		LC			E	1
Liliales	*Liliaceae* C Lily	Turk-s-cap lily [Michigan lily]	*Lilium michiganense*		U				1
Liliales	*Liliaceae* C Lily	superb lily [Turk-s-cap lily]	*Lilium superbum*		R				1
Liliales	*Liliaceae* C Lily	yellow dog-tooth violet [yellow adder-s tongue]	*Erythronium americanum*		LA				1

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Liliales	*Liliaceae* C Lily	common star-of-Bethlehem [dove=s dung]	*Ornithogalum umbellatum*		LC				1
Liliales	*Liliaceae* C Lily	yucca [Adam=s needle, Spanish bayonet]	*Yucca flaccida*		U				1
Liliales	*Liliaceae* C Lily	asparagus [garden asparagus]	*Asparagus officinalis*		O				1
Liliales	*Liliaceae* C Lily	false Solomon=s-seal [wild spikenard]	*Smilacina racemosa*		LA				1
Liliales	*Liliaceae* C Lily	small Solomon=s-seal	*Polygonatum biflorum*		O				1
Liliales	*Liliaceae* C Lily	great Solomon=s-seal	*Polygonatum commutatum*		U				1
Liliales	*Liliaceae* C Lily	red trillium [recurved wakerobin]	*Trillium recurvatum*		C				1
Liliales	*Liliaceae* C Lily	white trillium [declined trillium]	*Trillium flexipes*		LC				1
Liliales	*Smilacaceae* C Greenbrier	greenbrier [catbrier, bullbrier]	*Smilax bona-nox*		U				1
Liliales	*Smilacaceae* C Greenbrier	greenbrier [catbrier]	*Smilax glauca*		LC				1
Liliales	*Smilacaceae* C Greenbrier	bristly greenbrier [catbrier]	*Smilax hispida*		O				1
Liliales	*Smilacaceae* C Greenbrier	carrion flower	*Smilax pulverulenta*		O				1
Liliales	*Smilacaceae* C Greenbrier	greenbrier [catbrier]	*Smilax rotundifolia*		U				1
Liliales	*Dioscoreaceae* C Yam	wild yam	*Dioscorea villosa*		LC				1
Liliales	*Dioscoreaceae* C Yam	wild yam	*Dioscorea quaternata*		C				1
Liliales	*Dioscoreaceae* C Yam	Chinese yam [cinnamon vine]	*Dioscorea oppositifolia [D. batatas]*		U			E	
Liliales	*Amaryllidaceae* C Amaryllis	common goldstargrass [yellow stargrass]	*Hypoxis hirsuta*		LC				1
Liliales	*Amaryllidaceae* C Amaryllis	daffodil	*Narcissus pseudo-narcissus*		LC				1
Liliales	*Amaryllidaceae* C Amaryllis	poet=s narcissus	*Narcissus poeticus*		U				1
Liliales	*Iridaceae* C Iris	blackberry lily	*Belamcanda chinensis*		U			E	
Liliales	*Iridaceae* C Iris	flag [German iris, fleur-de-lis]	*Iris X germanica*		O				

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Liliales	*Iridaceae* C Iris	blue-eyed grass	*Sisyrinchium albidum*		O				
Liliales	*Iridaceae* C Iris	common blue-eyed grass [stout blue-eyed grass]	*Sisyrinchium angustifolium*		O				
Orchidales	*Orchidaceae* C Orchid	nodding ladies-tresses	*Spiranthes cernua*		O-LC				
Orchidales	*Orchidaceae* C Orchid	little ladies-tresses	*Spiranthes tuberosa*		U				
Orchidales	*Orchidaceae* C Orchid	rattlesnake plantain	*Goodyera pubescens*		R				
Orchidales	*Orchidaceae* C Orchid	large twayblade [lily tway-blade, purple twayblade]	*Liparis lilifolia*		LC-O				
Orchidales	*Orchidaceae* C Orchid	puttyroot orchid [Adam-and-Eve]	*Aplectrum hyemale*		LC-O				
Orchidales	*Orchidaceae* C Orchid	Wister-s coral-root orchid [coral root]	*Corallorhiza wisteriana*		R				
Piperales	*Saururaceae* C Lizard-tail	lizard-s-tail	*Saururus cernuus*		LC				
Salicales	*Salicaceae* C Willow	black willow	*Salix nigra*	tree	C			N	1
Salicales	*Salicaceae* C Willow	brittle willow [crack willow]	*Salix fragilis*		O			E	1
Salicales	*Salicaceae* C Willow	prairie willow [dwarf prairie willow]	*Salix humilis*		R				1
Salicales	*Salicaceae* C Willow	sandbar willow	*Salix exigua [S. interior]*		O				1
Salicales	*Salicaceae* C Willow	white poplar	*Populus alba*	tree	O			E	1
Salicales	*Salicaceae* C Willow	eastern cottonwood	*Populus deltoides*	tree	C			N	1
Juglandales	*Juglandaceae* C Walnut	butternut [white walnut]	*Juglans cinerea*	tree	R			N	1
Juglandales	*Juglandaceae* C Walnut	black walnut	*Juglans nigra*	tree	O			N	1
Juglandales	*Juglandaceae* C Walnut	shagbark hickory [scaly-bark hickory]	*Carya ovata*	tree	O-C			N	1
Juglandales	*Juglandaceae* C Walnut	shellbark hickory [kingnut hickory]	*Carya laciniosa*	tree	R			N	1
Juglandales	*Juglandaceae* C Walnut	mockernut hickory	*Carya tomentosa*	tree	O			N	1
Juglandales	*Juglandaceae* C Walnut	pignut hickory	*Carya glabra*	tree	C			N	1

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Juglandales	*Juglandaceae* C Walnut	small pignut hickory [false shagbark hickory]	*Carya ovalis*	tree	C			N	1
Juglandales	*Juglandaceae* C Walnut	bitternut hickory	*Carya cordiformis*	tree	C			N	1
Juglandales	*Juglandaceae* C Walnut	black hickory	*Carya texana*	tree	R			N	1
Juglandales	*Juglandaceae* C Walnut	pecan	*Carya illinoensis*	tree	O			N	
Fagales	*Betulaceae* C Birch	river birch [red birch]	*Betula nigra*	tree	C			N	1
Fagales	*Betulaceae* C Birch	common alder [smooth alder]	*Alnus serrulata*	tree	R			N	
Fagales	*Betulaceae* C Birch	eastern hophornbeam [ironwood]	*Ostrya virginiana*	tree	C			N	
Fagales	*Betulaceae* C Birch	American hornbeam [blue-beech]	*Carpinus caroliniana*	tree	R			N	
Fagales	*Betulaceae* C Birch	hazelnut [American filbert]	*Corylus americana*	shrub	O			N	
Fagales	*Fagaceae* C Beech	American beech [beech]	*Fagus grandifolia caroliniana*	tree	O			N	1
Fagales	*Fagaceae* C Beech	American chestnut	*Castanea dentata*	tree	R			N	
Fagales	*Fagaceae* C Beech	Chinese chestnut (various hybrids)	*Castanea mollissima*	tree	R			E	
Fagales	*Fagaceae* C Beech	white oak	*Quercus alba*	tree	C			N	1
Fagales	*Fagaceae* C Beech	post oak	*Quercus stellata*	tree	A			N	1
Fagales	*Fagaceae* C Beech	bur oak [mossy cup oak]	*Quercus macrocarpa*	tree	O			N	1
Fagales	*Fagaceae* C Beech	swamp white oak	*Quercus bicolor*	tree	R			N	
Fagales	*Fagaceae* C Beech	swamp chestnut oak [cow oak, basket oak]	*Quercus michauxii*	tree	C			N	
Fagales	*Fagaceae* C Beech	chinkapin oak [yellow chestnut oak]	*Quercus prinoides acuminata [Q. muehlenbergii]*	tree	O			N	
Fagales	*Fagaceae* C Beech	northern red oak	*Quercus rubra*	tree	C			N	1
Fagales	*Fagaceae* C Beech	pin oak	*Quercus palustris*	tree	A			N	1
Fagales	*Fagaceae* C Beech	scarlet oak	*Quercus coccinea*	tree	R			N	1

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Fagales	*Fagaceae* C Beech	black oak [yellow-barked oak]	*Quercus velutina*	tree	C-O			N	1
Fagales	*Fagaceae* C Beech	southern red oak [Spanish oak]	*Quercus falcata*	tree	O			N	1
Fagales	*Fagaceae* C Beech	cherrybark oak	*Quercus pagoda*	tree	R			E	
Fagales	*Fagaceae* C Beech	blackjack oak	*Quercus marilandica*	tree	O			N	1
Fagales	*Fagaceae* C Beech	willow oak	*Quercus phellos*	tree	R			E	
Fagales	*Fagaceae* C Beech	shingle oak	*Quercus imbricaria*	tree	A			N	1
Fagales	*Fagaceae* C Beech	Shumard oak	*Quercus shumardii*	tree	O			N	1
Utricales	*Ulmaceae* C Elm	sugarberry	*Celtis laevigata*	tree	R			N	1
Utricales	*Ulmaceae* C Elm	common hackberry	*Celtis occidentalis*	tree	C			N	1
Utricales	*Ulmaceae* C Elm	dwarf hackberry	*Celtis tenuifolia var. georgiana*	tree	R			N	1
Utricales	*Ulmaceae* C Elm	slippery elm [red elm]	*Ulmus rubra*	tree	O			N	1
Utricales	*Ulmaceae* C Elm	American elm	*Ulmus americana*	tree	C			N	1
Utricales	*Ulmaceae* C Elm	winged elm	*Ulmus alata*	tree	C			N	1
Utricales	*Moraceae* C Mulberry	osage-orange [hedge-apple]	*Maclura pomifera*	tree	O			E	1
Utricales	*Moraceae* C Mulberry	red mulberry	*Morus rubra*	tree	O			N	1
Utricales	*Moraceae* C Mulberry	white mulberry	*Morus alba*	tree	O			E	1
Utricales	*Moraceae* C Mulberry	paper-mulberry	*Broussonetia papyrifera*	shrub	O			E	
Utricales	*Urticaceae* C Nettle	Canada wood nettle [wood nettle]	*Laportea canadensis*		LA				1
Utricales	*Urticaceae* C Nettle	Pennsylvania pellitory	*Parietaria pensylvanica*		U				1
Utricales	*Urticaceae* C Nettle	false nettle	*Boehmeria cylindrica*		LC				1
Utricales	*Urticaceae* C Nettle	Canada clearweed [coolwort, richweed]	*Pilea pumila*		LC				1
Aristolochiales	*Aristolochiaceae* C Birthwort	Virginia snakeroot [birthwort]	*Aristolochia serpentaria*		O				1
Aristolochiales	*Aristolochiaceae* C Birthwort	Canada wild ginger	*Asarum canadense reflexum*		C-LA				1
Polygonales	*Polygonaceae* C Buckwheat	slender knotweed	*Polygonum tenue*		C				1

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Polygonales	*Polygonaceae* C Buckwheat	knotweed	*Polygonum aviculare*		LC				1
Polygonales	*Polygonaceae* C Buckwheat	copse bindweed [false buck-wheat]	*Polygonum cristatum [P. scandens dumetorum]*		O				1
Polygonales	*Polygonaceae* C Buckwheat	Virginia knotweed	*Polygonum virginianum*		C				1
Polygonales	*Polygonaceae* C Buckwheat	curttop lady=s thumb [pale smartweed]	*Polygonum lapathifolium*		O				1
Polygonales	*Polygonaceae* C Buckwheat	Pennsylvania smartweed [common smartweed]	*Polygonum pensylvanicum laevigatum*		O				1
Polygonales	*Polygonaceae* C Buckwheat	mild water pepper [swamp smartweed]	*Polygonum hydropiperoides*		LA				1
Polygonales	*Polygonaceae* C Buckwheat	bristly smartweed [smart-weed]	*Polygonum setaceum inter-jectum*		U				1
Polygonales	*Polygonaceae* C Buckwheat	dotted smartweed	*Polygonum punctatum*		LC				1
Polygonales	*Polygonaceae* C Buckwheat	spotted lady=s thumb	*Polygonum persicaria*		U				1
Polygonales	*Polygonaceae* C Buckwheat	creeping smartweed	*Polygonum cespitosum long-isetum*		LC				1
Polygonales	*Polygonaceae* C Buckwheat	common sorrel [red sorrel, sheep sorrel]	*Rumex acetosella*		LC				1
Polygonales	*Polygonaceae* C Buckwheat	bitter dock [blunt-leaved dock, broad-leaved dock]	*Rumex obtusifolius*		U				1
Polygonales	*Polygonaceae* C Buckwheat	curly dock [sour dock, yellow dock]	*Rumex crispus*		O				1
Polygonales	*Polygonaceae* C Buckwheat	pale dock [smooth dock, water dock]	*Rumex altissimus*		R				1
Caryophyllales	*Chenopodiaceae* C Goosefoot	goosefoot	*Chenopodium standleyanum [C. boscianum]*		U				1
Caryophyllales	*Chenopodiaceae* C Goosefoot	lamb=s-quarters	*Chenopodium album*		O-LC				1
Caryophyllales	*Amaranthaceae* C Amaranth	pigweed	*Amaranthus sp.*						
Caryophyllales	*Phytolaccaceae* C Pokeweed	pokeweed	*Phytolacca americana*		O-LC				1

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Caryophyllales	*Portulacaceae* C Purslane	common garden purslane	*Portulaca oleracea*		LC				1
Caryophyllales	*Portulacaceae* C Purslane	spring beauty	*Claytonia virginica*		LA				1
Caryophyllales	*Caryophyllaceae* C Pink	nodding mouse-ear chickweed	*Cerastium nutans*		O				1
Caryophyllales	*Caryophyllaceae* C Pink	mouse-ear chickweed	*Cerastium pumilum*		O				1
Caryophyllales	*Caryophyllaceae* C Pink	common mouse-ear chickweed	*Cerastium vulgatum*		LC				1
Caryophyllales	*Caryophyllaceae* C Pink	common chickweed	*Stellaria media*		LA				1
Caryophyllales	*Caryophyllaceae* C Pink	thyme-leaved sandwort	*Arenaria serpyllifolia*		O				1
Caryophyllales	*Caryophyllaceae* C Pink	jagged chickweed	*Holosteum umbellatum*		U				1
Caryophyllales	*Caryophyllaceae* C Pink	Debtford pink	*Dianthus armeria*		LC				1
Caryophyllales	*Caryophyllaceae* C Pink	sleepy catchfly	*Silene antirrhina*		O				1
Caryophyllales	*Caryophyllaceae* C Pink	starry campion	*Silene stellata*		O				1
Magnoliales	*Magnoliaceae* C Magnolia	yellow-poplar [tulip-tree, tulip-poplar]	*Liriodendron tulipifera*	tree	O-LC			N	1
Magnoliales	*Annonaceae* C Custard-apple	common pawpaw [banana tree]	*Asimina triloba*	small tree	LC			N	1
Ranunculales	*Ranunculaceae* C Buttercup	wild columbine	*Aquilegia canadensis*		R				1
Ranunculales	*Ranunculaceae* C Buttercup	dwarf larkspur [wild larkspur]	*Delphinium tricorne*		LC				1
Ranunculales	*Ranunculaceae* C Buttercup	virgin-s bower	*Clematis virginiana*		O				1
Ranunculales	*Ranunculaceae* C Buttercup	bristly buttercup	*Ranunculus hispidus*		C				1
Ranunculales	*Ranunculaceae* C Buttercup	early buttercup	*Ranunculus fascicularis*		LC				1
Ranunculales	*Ranunculaceae* C Buttercup	hooked buttercup	*Ranunculus recurvatus*		O				1
Ranunculales	*Ranunculaceae* C Buttercup	little-leaf buttercup [small-flowered crowfoot]	*Ranunculus abortivus abortivus*		C				1
Ranunculales	*Ranunculaceae* C Buttercup	small-flowered crowfoot	*Ranunculus abortivus acrolasius*		U				1
Ranunculales	*Ranunculaceae* C Buttercup	small-flowered crowfoot	*Ranunculus micranthus*		O				1
Ranunculales	*Ranunculaceae* C Buttercup	goldenseal	*Hydrastis canadensis*		LC				1
Ranunculales	*Ranunculaceae* C Buttercup	tall anemone	*Anemone virginiana*		O				1

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Ranunculales	*Ranunculaceae* C Buttercup	doll=s-eyes [white baneberry]	*Actaea pachypoda*		LC				1
Ranunculales	*Ranunculaceae* C Buttercup	false rue-anemone	*Isopyrum biternatum*		LC				1
Ranunculales	*Berberidaceae* C Barberry	mayapple	*Podophyllum peltatum*		LA				1
Ranunculales	*Berberidaceae* C Barberry	blue cohosh	*Caulophyllum thalictroides*		U				1
Ranunculales	*Berberidaceae* C Barberry	Japanese barberry	*Berberis thunbergii*	shrub	R			E	1
Ranunculales	*Menispermaceae* C Moon-vine	moonseed	*Menispermum canadense*		O				1
Ranunculales	*Menispermaceae* C Moon-vine	cupseed	*Calycocarpum lyonii*		R				1
Nymphaeales	*Nelumbonaceae* C Lotus	American lotus [giant lotus lily]	*Nelumbo lutea*		LC				
Nymphaeales	*Nymphaeaceae* C Waterlily	spatterdock	*Nuphar luteum*		LA				1
Nymphaeales	*Ceratophyllaceae* C Horn-wort	coontail [hornwort]	*Ceratophyllum demersum*		U				1
Magnoliales	*Lauraceae* C Laurel	common sassafras [red sassa-fras, white sassafras]	*Sassafras albidum*	tree	C			N	1
Magnoliales	*Lauraceae* C Laurel	spicebush [feverbush, wild all-spice]	*Lindera benzoin*	shrub	LA			N	1
Papaverales	*Papaveraceae* C Poppy	bloodroot	*Sanguinaria canadensis*		C			N	1
Papaverales	*Papaveraceae* C Poppy	Celandine poppy [wood poppy]	*Stylophorum diphyllum*		LA				1
Papaverales	*Papaveraceae* C Poppy	Celandine	*Chelidonium majus*					E	2
Papaverales	*Fumariaceae* C Fumitory	pale corydalis	*Corydalis flavula*		LA				1
Papaverales	*Fumariaceae* C Fumitory	squirrel-corn	*Dicentra canadensis*		LA				1
Papaverales	*Fumariaceae* C Fumitory	Dutchman=s-breeches	*Dicentra cucullaria*		C				1
Capparales	*Cruciferae* C Mustard	mouse-eared cress	*Arabidopsis thaliana*		O				1
Capparales	*Cruciferae* C Mustard	smooth rock cress	*Arabis laevigata*		LC				
Capparales	*Cruciferae* C Mustard	wintercress [yellow rocket]	*Barbarea vulgaris*		O			E	1

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Capparales	*Cruciferae* C Mustard	bird=s rape [field mustard, turnip]	*Brassica rapa*		R				1
Capparales	*Cruciferae* C Mustard	shepherd=s-purse	*Capsella bursa-pastoris*		O			E	1
Capparales	*Cruciferae* C Mustard	Pennsylvania bitter cress	*Cardamine pensylvanica*		LC				1
Capparales	*Cruciferae* C Mustard	hairy bitter cress	*Cardamine hirsuta*		O			E	1
Capparales	*Cruciferae* C Mustard	small-flowered bitter cress	*Cardamine parviflora arenicola*		U				1
Capparales	*Cruciferae* C Mustard	toothwort [pepper-root]	*Dentaria laciniata*		LA			N	1
Capparales	*Cruciferae* C Mustard	short-fruited Whitlow-grass	*Draba brachycarpa*		O				1
Capparales	*Cruciferae* C Mustard	mouse-eared Whitlow-grass [vernal Whitlow-grass]	*Eriophila verna*		O				1
Capparales	*Cruciferae* C Mustard	common peppergrass [poor-man=s pepper]	*Lepidium virginicum*		O-LA				1
Capparales	*Cruciferae* C Mustard	field peppergrass [field cress]	*Lepidium campestre*		O				1
Hamamelidales	*Hamamelidaceae* C Witch-hazel	sweetgum [red gum]	*Liquidambar styraciflua*	tree	O-LA			N	1
Hamamelidales	*Platanaceae* C Planetree	American sycamore [button-wod]	*Platanus occidentalis*	tree	LC			N	1
Rosales	*Crassulaceae* C Stonecrop	widow=s-cross [stonecrop]	*Sedum pulchellum*		LC				1
Rosales	Escalloniaceae	Virginia willow [sweet-spires]	*Itea virginica*	shrub	?				
Rosales	*Saxifragaceae* C Saxifrage	ditch stonecrop	*Penthorum sedoides*		O				1
Rosales	*Saxifragaceae* C Saxifrage	wild hydrangea	*Hydrangea arborescens*	shrub	O			N	
Rosales	*Saxifragaceae* C Saxifrage	Forbes= saxifrage	*Saxifraga forbesii*		LA				1
Rosales	*Saxifragaceae* C Saxifrage	bishop=s-cap	*Mitella diphylla*		R				1
Rosales	*Saxifragaceae* C Saxifrage	small-flowered alumroot [late alumroot]	*Heuchera parviflora rugelii*		LC				1
Rosales	*Saxifragaceae* C Saxifrage	tall alumroot	*Heuchera americana hirsuticaulis*		C				1

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Rosales	*Rosaceae* C Rose	Allegheny blackberry [common blackberry]	*Rubus allegheniensis*		C				1
Rosales	*Rosaceae* C Rose	blackberry	*Rubus alumnus [R. orarius]*		O				1
Rosales	*Rosaceae* C Rose	arching dewberry [southern dewberry]	*Rubus enslenii*		U				1
Rosales	*Rosaceae* C Rose	dewberry	*Rubus flagellaris*		C				1
Rosales	*Rosaceae* C Rose	black raspberry [blackcap raspberry]	*Rubus occidentalis*		LC				1
Rosales	*Rosaceae* C Rose	blackberry	*Rubus pensylvanicus*		C				1
Rosales	*Rosaceae* C Rose	velvet-leaved dewberry	*Rubus roribaccus*		LC				1
Rosales	*Rosaceae* C Rose	hawthorn	*Crataegus pruniosa*		?			N	
Rosales	*Rosaceae* C Rose	red haw	*Crataegus mollis*		C			N	
Rosales	*Rosaceae* C Rose	cock-spur hawthorn	*Crataegus crus-galli*	small tree	O			N	
Rosales	*Rosaceae* C Rose	serviceberry [shadbush, shadblow, juneberry]	*Amelanchier arborea*	small tree	LC			N	1
Rosales	*Rosaceae* C Rose	common apple	*Malus pumila*	tree	R				
Rosales	*Rosaceae* C Rose	wild sweet crabapple	*Malus coronaria*	tree	U				1
Rosales	*Rosaceae* C Rose	Iowa crabapple	*Malus ioensis*	tree	U				1
Rosales	*Rosaceae* C Rose	common pear	*Pyrus communis*	tree	R				
Rosales	*Rosaceae* C Rose	pasture rose	*Rosa carolina*	vine	C			N	1
Rosales	*Rosaceae* C Rose	swamp rose	*Rosa palustris*	vine	O			N	
Rosales	*Rosaceae* C Rose	multiflora rose [Japanese rose]	*Rosa multiflora*	shrub	A			E	1
Rosales	*Rosaceae* C Rose	Illinois rose [prairie rose, climbing rose]	*Rosa setigera*		O-LC				
Rosales	*Rosaceae* C Rose		*Rosa sp. (Hybrid cultivar)*						
Rosales	*Rosaceae* C Rose	black cherry	*Prunus serotina*	tree	C			N	1

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Rosales	*Rosaceae* C Rose	American plum [wild plum]	*Prunus americana*	shrub	C			N	1
Rosales	*Rosaceae* C Rose	Chickasaw plum	*Prunus angustifolia*		LC				1
Rosales	*Rosaceae* C Rose	wild goose plum	*Prunus hortulana*		U				1
Rosales	*Rosaceae* C Rose	peach	*Prunus persica*	tree	R				1
Rosales	*Rosaceae* C Rose	swamp agrimony [small-flowered agrimony]	*Agrimonia parviflora*		LC				1
Rosales	*Rosaceae* C Rose	soft agrimony	*Agrimonia pubescens*		U				1
Rosales	*Rosaceae* C Rose	woodland agrimony	*Agrimonia rostellata*		C				1
Rosales	*Rosaceae* C Rose	wild strawberry	*Fragaria virginiana*		LC				1
Rosales	*Rosaceae* C Rose	white avens	*Geum canadense*		C				1
Rosales	*Rosaceae* C Rose	spring avens	*Geum vernum*		LC				1
Rosales	*Rosaceae* C Rose	sulfur cinquefoil	*Potentilla recta*		LC			E	1
Rosales	*Rosaceae* C Rose	common cinquefoil	*Potentilla simplex*		C				1
Rosales	*Rosaceae* C Rose	Indian physic [American ipecac]	*Porteranthus stipulatus [Gillenia stipulata]*		C				1
Rosales	*Caesalpiniaceae* CCaesalpinia	eastern redbud	*Cercis canadensis*	tree	O-C			N	1
Rosales	*Caesalpiniaceae* CCaesalpinia	honeylocust	*Gleditsia triacanthos*	tree	O			N	1
Rosales	*Caesalpiniaceae* CCaesalpinia	Kentucky coffeetree	*Gymnocladus dioicus*	tree	O			N?	
Rosales	*Caesalpiniaceae* CCaesalpinia	wild senna	*Cassia marilandica*						
Rosales	*Caesalpiniaceae* CCaesalpinia	partridge pea [locust-weed]	*Cassia fasciculata*						
Rosales	*Fabaceae* CBean	kudzu-vine	*Puereria lobata*	vine	R			E	
Rosales	*Fabaceae* CBean	soybean	*Glycine max*		LA			E	
Rosales	*Fabaceae* CBean	American wisteria	*Wisteria frutescens*	vine	?				

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Rosales	*Fabaceae* CBean	sesbania	*Sesbania macrocarpa [S. exaltata]*		LC				
Rosales	*Fabaceae* CBean	dull-leaf indigobush [false indigobush]	*Amorpha fruticosa*	shrub	R			N	1
Rosales	*Fabaceae* CBean	black-locust	*Robinia pseudoacacia*	tree	LC			N?	1
Rosales	*Fabaceae* CBean	rattlebox	*Crotalaria sagittalis*		O				1
Rosales	*Fabaceae* CBean	pencil-flower	*Stylosanthes biflora*		O				1
Rosales	*Fabaceae* CBean	low hop clover	*Trifolium campestre*		O				1
Rosales	*Fabaceae* CBean	Alsike clover	*Trifolium hybridum*		U				1
Rosales	*Fabaceae* CBean	red clover	*Trifolium pratense*		LC				1
Rosales	*Fabaceae* CBean	white clover	*Trifolium repens*		LC				1
Rosales	*Fabaceae* CBean	black medic	*Medicago lupulina*		O				1
Rosales	*Fabaceae* CBean	alfalfa	*Medicago sativa*		U				1
Rosales	*Fabaceae* CBean	butterfly-pea	*Clitoria mariana*		U				1
Rosales	*Fabaceae* CBean	hoary tick trefoil	*Desmodium canescens*		O				1
Rosales	*Fabaceae* CBean	hairy tick trefoil	*Desmodium ciliare*		LC				1
Rosales	*Fabaceae* CBean	beggar-s lice [pointed tick trefoil]	*Desmodium glutinosum*		U				1
Rosales	*Fabaceae* CBean	glaucus tick trefoil	*Desmodium laevigatum*		C				1
Rosales	*Fabaceae* CBean	bare-stemmed tick trefoil	*Desmodium nudiflorum*		LC				1
Rosales	*Fabaceae* CBean	Nuttall-s tick trefoil	*Desmodium nuttallii*		O				1
Rosales	*Fabaceae* CBean	stiff tick trefoil	*Desmodium obtusum*		U				1
Rosales	*Fabaceae* CBean	panicled tick trefoil	*Desmodium paniculatum*		C				1
Rosales	*Fabaceae* CBean	beggar-s lice [white-flowered tick trefoil]	*Desmodium pauciflorum*		U				1
Rosales	*Fabaceae* CBean	round-leaved tick trefoil	*Desmodium rotundifolium*		U				1
Rosales	*Fabaceae* CBean	sessile-leaved tick trefoil	*Desmodium sessilifolium*		U				1

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Rosales	*Fabaceae* CBean	scurf-pea [Sampson=s snaker-oot]	*Psoralea psoralioides eglandulosa*		LC				1
Rosales	*Fabaceae* CBean	wild bean	*Strophostyles helvola*		O				1
Rosales	*Fabaceae* CBean	wild bean	*Strophostyles leiosperma*		O				1
Rosales	*Fabaceae* CBean	umbellate wild bean	*Strophostyles umbellata*		U				1
Rosales	*Fabaceae* CBean	hog-peanut	*Amphicarpa bracteata bracteata*		U				1
Rosales	*Fabaceae* CBean	hog-peanut	*Amphicarpa bracteata comosa*		O				1
Rosales	*Fabaceae* CBean	hairy-fruited vetch	*Vicia dasycarpa*		LA				1
Rosales	*Fabaceae* CBean	ground nut	*Apios americana*		LC				1
Rosales	*Fabaceae* CBean	goat=s-rue	*Tephrosia virginiana*		O				1
Rosales	Mimosaceae	mimosa	*Albizia julibrissin*	tree	R			E	
Rosales	Mimosaceae	Illinois/prairie mimosa [Illinois bundleflower]	*Desmanthus illinoensis*					N	
Geraniales	*Geraniaceae* C Geranium	Carolina cranesbill	*Geranium carolinianum*		LC				1
Geraniales	*Geraniaceae* C Geranium	wild geranium	*Geranium maculatum*		C				1
Geraniales	*Oxalidaceae* C Wood-sorrel	upright yellow wood-sorrel	*Oxalis dillenii*		A				1
Geraniales	*Oxalidaceae* C Wood-sorrel	common wood-sorrel [yellow wood sorrel]	*Oxalis stricta*		U				1
Geraniales	*Oxalidaceae* C Wood-sorrel	violet wood-sorrel [purple oxalis]	*Oxalis violacea*		LC-O				1
Geraniales	*Balsaminaceae* C Balsam	orange-spotted touch-me-not [jewelweed]	*Impatiens capensis [I. Biflora]*		LA				1
Geraniales	*Balsaminaceae* C Balsam	pale touch-me-not	*Impatiens pallida*		LA				1
Linales	*Linaceae* C Flax	flax	*Linum medium*		LC				1
Linales	*Linaceae* C Flax	stiff yellow flax	*Linum striatum*		U-R				1
Sapindales	*Rutaceae* C Rue	prickly-ash [toothache tree]	*Zanthoxylum americanum*		U-R				1

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Sapindales	*Simarubaceae* C Quassia	tree-of-heaven	*Ailanthus altissima*	tree	U-R			E	1
Sapindales	*Anacardiaceae* C Sumac	smooth sumac	*Rhus glabra*	shrub	C			N	1
Sapindales	*Anacardiaceae* C Sumac	winged [shining, dwarf] sumac	*Rhus copallina*	shrub	C			N	1
Sapindales	*Anacardiaceae* C Sumac	fragrant sumac [aromatic sumac]	*Rhus aromatica*	shrub	O			N	1
Sapindales	*Anacardiaceae* C Sumac	poison-ivy	*Toxicodendron radicans*	shrub, vine	A			N	1
Sapindales	*Staphyleaceae* C Bladdernut	American bladdernut	*Staphylea trifolia*	shrub	LA			N	1
Sapindales	*Aceraceae* C Maple	sugar maple [hard maple, rock maple]	*Acer saccharum*	tree	C			N	1
Sapindales	*Aceraceae* C Maple	southern sugar maple	*Acer barbatum*	tree	O			N	
Sapindales	*Aceraceae* C Maple	silver maple [river, soft, white maple]	*Acer saccharinum*	tree	C			N	1
Sapindales	*Aceraceae* C Maple	red maple	*Acer rubrum var. rubrum*	tree	O			N	1
Sapindales	*Aceraceae* C Maple	red maple	*Acer rubrum var. trilobum*	tree	R			N	1
Sapindales	*Aceraceae* C Maple	boxelder [ash-leaved maple]	*Acer negundo*	tree	O-LA			N	1
Polygalales	*Polygalaceae* C Milkwort	red milkwort [field milkwort]	*Polygala sanguinea*		O				1
Euphorbiales	*Euphorbiaceae* C Spurge	nodding spurge [wartweed]	*Chamaesyce maculata [Euphorbia maculata]*		C				1
Euphorbiales	*Euphorbiaceae* C Spurge	milk spurge	*Chamaesyce supina [Euphorbia supina]*		LC				1
Euphorbiales	*Euphorbiaceae* C Spurge	milk spurge	*Chamaesyce humistrata [Euphorbia humistrata]*		U				1
Euphorbiales	*Euphorbiaceae* C Spurge	flowering spurge	*Euphorbia corollata*		C				1
Euphorbiales	*Euphorbiaceae* C Spurge	wood spurge	*Euphorbia commutata*		LC				1
Euphorbiales	*Euphorbiaceae* C Spurge	wild poinsettia	*Euphorbia dentata [Poinsettia dentata]*		O				1
Euphorbiales	*Euphorbiaceae* C Spurge	sand croton [rushfoil]	*Crotonopsis elliptica*		LC				1

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Euphorbiales	*Euphorbiaceae* C Spurge	capitate croton [wooly croton]	*Croton capitatus*		O				1
Euphorbiales	*Euphorbiaceae* C Spurge	croton [prairie tea]	*Croton monanthogynus*		LC				1
Euphorbiales	*Euphorbiaceae* C Spurge	slender three-seeded mercury	*Acalypha gracilens*		O				1
Euphorbiales	*Euphorbiaceae* C Spurge	three-seeded mercury	*Acalypha rhomboidea*		C				1
Euphorbiales	*Euphorbiaceae* C Spurge	Virginia three-seeded mercury	*Acalypha virginica*		O				1
Celastrales	*Celastraceae* C Staff-tree	bittersweet [climbing bittersweet]	*Celastrus scandens*	vine	C			N	1
Celastrales	*Celastraceae* C Staff-tree	eastern wahoo [burningbush]	*Euonymus atropurpureus*	shrub	O			N	1
Celastrales	*Celastraceae* C Staff-tree	climbing euonymus [winter creeper]	*Euonymus fortunei var. radicans*	vine	O			E	
Celastrales	*Aquifoliaceae* C Holly	deciduous holly [swamp holly]	*Ilex decidua*	shrub	R			N	1
Celastrales	*Aquifoliaceae* C Holly	American holly	*Ilex opaca*	shrub	R			N	
Rhamnales	*Rhamnaceae* C Buckthorn	New-Jersey-tea [wild snowball]	*Ceanothus americanus*	shrub	O			N	1
Rhamnales	*Vitaceae* C Grape	Virginia creeper	*Parthenocissus quinquefolia*	vine	C			N	1
Rhamnales	*Vitaceae* C Grape	raccoon grape	*Ampelopsis cordata*	vine	U			N	1
Rhamnales	*Vitaceae* C Grape	summer grape	*Vitis aestivalis*	vine	C			N	1
Rhamnales	*Vitaceae* C Grape	winter grape	*Vitis cinerea*	vine	U			N	1
Rhamnales	*Vitaceae* C Grape	frost grape	*Vitis vulpina*	vine	O			N	1
Malvales	*Tiliaceae* C Linden	American linden [basswood]	*Tilia americana*	tree	U-R			N	1
Malvales	*Malvaceae* C Mallow	prickly sida	*Sida spinosa*		O			E	1
Theales	*Hypericaceae* C St. John=s-wort	marsh St. John=s-wort	*Triadenum walteri*		O				1
Theales	*Hypericaceae* C St. John=s-wort	shrubby St. John's-wort	*Hypericum prolificum*	shrub	LC			N	1
Theales	*Hypericaceae* C St. John=s-wort	nits-and-lice	*Hypericum drummondii*		U				1

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Theales	*Hypericaceae* C St. John=s-wort	pineweed	*Hypericum gentianoides*		O				1
Theales	*Hypericaceae* C St. John=s-wort	dwarf St. John=s-wort	*Hypericum mutilum*		O				1
Theales	*Hypericaceae* C St. John=s-wort	common St. John=s-wort	*Hypericum perforatum*		U				1
Theales	*Hypericaceae* C St. John=s-wort	spotted St. John=s-wort	*Hypericum punctatum*		O				1
Theales	*Hypericaceae* C St. John=s-wort	St. Andrew=s cross	*Hypericum stragulum*		O				1
Violales	*Cistaceae* C Rockrose	narrow-leaved pinweed	*Lechea tenuifolia*		O				1
Violales	*Violaceae* C Violet	common blue violet	*Viola pratincola*		LC				1
Violales	*Violaceae* C Violet	downy yellow violet	*Viola pubescens*		C				1
Violales	*Violaceae* C Violet	Johnny-jump-up [wild pansy]	*Viola rafinesquii*		LA				1
Violales	*Violaceae* C Violet	wooly blue violet	*Viola sororia*		C				1
Violales	*Violaceae* C Violet	cream violet [common white violet]	*Viola striata*		LA				1
Violales	*Violaceae* C Violet	cleft violet	*Viola triloba var. triloba*		C				1
Violales	*Violaceae* C Violet	lobed violet [cleft violet]	*Viola triloba var. dilatata [V. falcata]*		O				1
Violales	*Violaceae* C Violet	green violet	*Hybanthus concolor*		LC				1
Violales	*Passifloraceae* C Passion-flower	small passion-flower	*Passiflora lutea var. glabri-flora*		O				1
Violales	*Passifloraceae* C Passion-flower	large passion-flower [may-pops]	*Passiflora incarnata*		R				1
Proteales	*Elaeagnaceae* C Oleaster	autumn-olive [oleaster]	*Elaeagnus umbellata*	shrub	LC			E	1
Myrtales	*Lythraceae* C Loosestrife	tooth-cup	*Rotala ramosior*		O				1
Myrtales	*Lythraceae* C Loosestrife	purple loosestrife	*Lythrum salicaria*	shrub	R			E	

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Myrtales	*Lythraceae* C Loosestrife	water-willow [swamp loosestrife]	*Decodon verticillatus*						
Myrtales	*Onagraceae* C Evening Primrose	enchanter-s nightshade	*Circaea lutetiana*		O				1
Myrtales	*Onagraceae* C Evening Primrose	marsh purslane	*Ludwigia palustris var. americana*		U				1
Myrtales	*Onagraceae* C Evening Primrose	seedbox	*Ludwigia alternifolia*		LC				1
Myrtales	*Onagraceae* C Evening Primrose	creeping primrose willow	*Ludwigia peploides*		LC				1
Myrtales	*Onagraceae* C Evening Primrose	common evening primrose	*Oenothera biennis*		C				1
Myrtales	*Onagraceae* C Evening Primrose	ragged evening primrose	*Oenothera laciniata*		U				1
Myrtales	*Onagraceae* C Evening Primrose	cinnamon willow herb	*Epilobium coloratum*		O				1
Caryophyllales	*Cactaceae* C Cactus	prickly-pear	*Opuntia humifusa [O. rafinesquii, O. compressa]*						1
Haloragales	*Haloragidaceae* C Water Milfoil	spiked water milfoil	*Myriophyllum exalbescens*		LA				1
Lamiales	*Callitrichaceae* C Water Starwort	terrestrial starwort [water starwort]	*Callitriche terestris*		O				1
Cornales	*Cornaceae* C Dogwood	blackgum [sour gum, black tupelo]	*Nyssa sylvatica*	tree	O			N	
Cornales	*Cornaceae* C Dogwood	flowering dogwood [white dogwood]	*Cornus florida*	small tree	C			N	1
Cornales	*Cornaceae* C Dogwood	rough-leaved dogwood	*Cornus drummondii*	shrub	O			N	1
Cornales	*Cornaceae* C Dogwood	gray [panicled] dogwood	*Cornus racemosa*	shrub	O			N	
Umbellales	*Araliaceae* C Ginseng	devil's-walking-stick [Hercules'-club, angelica-tree]]	*Aralia spinosa*	small tree	O			N	1

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Umbellales	*Araliaceae* C Ginseng	American spikenard	*Aralia racemosa*		R				1
Umbellales	*Araliaceae* C Ginseng	ginseng	*Panax quinquefolium*		U				1
Umbellales	*Apiaceae* CCarrot or Parsley	rattlesnake master	*Eryngium yuccifolium*						1
Umbellales	*Apiaceae* CCarrot or Parsley	Queen Anne-s lace [wild carrot]	*Daucus carota*					E	1
Umbellales	*Apiaceae* CCarrot or Parsley	water hemlock	*Cicuta maculata*						1
Umbellales	*Apiaceae* CCarrot or Parsley	wood angelica	*Angelica venenosa*		R				1
Umbellales	*Apiaceae* CCarrot or Parsley	wild chervil	*Chaerophyllum procumbens*		LC				1
Umbellales	*Apiaceae* CCarrot or Parsley	wild chervil	*Chaerophyllum tainturieri*		U				1
Umbellales	*Apiaceae* CCarrot or Parsley	honewort	*Cryptotaenia canadensis*		LC				1
Umbellales	*Apiaceae* CCarrot or Parsley	harbinger-of-spring [pepper-and-salt]	*Erigenia bulbosa*		C				1
Umbellales	*Apiaceae* CCarrot or Parsley	anise-root	*Osmorhiza longistylis*						1
Umbellales	*Apiaceae* CCarrot or Parsley	Canadian black snakeroot [short-styled snakeroot]	*Sanicula canadensis*		C				1
Umbellales	*Apiaceae* CCarrot or Parsley	yellow meadow parsnip	*Thaspium trifoliatum var. flavum*		R				1
Umbellales	*Apiaceae* CCarrot or Parsley	meadow parsnip	*Thaspium trifoliatum var. trifoliatum*		O				1
Umbellales	*Apiaceae* CCarrot or Parsley	hedge parsley	*Torilis japonica*		LC				1
Ericales	*Ericaceae* C Heath	farkleberry	*Vaccinium arboreum*	shrub	C			N	1
Primulales	*Primulaceae* C Primrose	shooting-star	*Dodecatheon meadia*		LC				1
Primulales	*Primulaceae* C Primrose	French-s shooting-star	*Dodecatheon frenchii*		LC				1
Primulales	*Primulaceae* C Primrose	brookweed [water pimpernel]	*Samolus valerandii*		U				1
Primulales	*Primulaceae* C Primrose	fringed loosestrife	*Lysimachia ciliata*		LC				1
Primulales	*Primulaceae* C Primrose	lance-leaved loosestrife [narrow-leaved loosestrife]	*Lysimachia lanceolata*		O				1

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Ebenales	*Ebenaceae* C Ebony	common persimmon [possum-wood]	*Diospyros virginiana*	tree	A			N	1
Scrophulariales	*Oleaceae* C Olive	white ash	*Fraxinus americana*	tree	O			N	1
Scrophulariales	*Oleaceae* C Olive	green ash	*Fraxinus pennsylvanica*	tree	A			N	1
Scrophulariales	*Oleaceae* C Olive	Forsythia	*Forsythia spp.*	shrub	R				
Scrophulariales	*Oleaceae* C Olive	common lilac	*Syringa vulgaris*	shrub	R				
Scrophulariales	*Oleaceae* C Olive	European privet	*Ligustrum vulgare*	shrub	R			E	
Gentianales	*Gentianaceae* C Gentian	American columbo	*Frasera caroliniensis*		O				1
Gentianales	*Gentianaceae* C Gentian	rose gentian [rose pink, marsh pink]	*Sabatia angularis*		O				1
Gentianales	*Apocynaceae* C Dogbane	dogbane [Indian hemp]	*Apocynum cannabinum*		LC				1
Gentianales	*Asclepiadaceae* C Milkweed	tall green milkweed	*Asclepias hirtella*		U				1
Gentianales	*Asclepiadaceae* C Milkweed	swamp milkweed	*Asclepias incarnata*		LC				1
Gentianales	*Asclepiadaceae* C Milkweed	purple milkweed	*Asclepias purpurascens*		O				1
Gentianales	*Asclepiadaceae* C Milkweed	common milkweed	*Asclepias syriaca*		C				1
Gentianales	*Asclepiadaceae* C Milkweed	butterfly-weed	*Asclepias tuberosa var. interior*		C				1
Gentianales	*Asclepiadaceae* C Milkweed	variegated milkweed [white milkweed]	*Asclepias variegata*		O				1
Gentianales	*Asclepiadaceae* C Milkweed	horsetail milkweed [whorled milkweed]	*Asclepias verticillata*		O				1
Gentianales	*Asclepiadaceae* C Milkweed	blue vine	*Cynanchum laeve*		O				1
Polemoniales	*Convolvulaceae* C Morning-glory	small white morning-glory	*Ipomoea lacunosa*		O				1
Polemoniales	*Convolvulaceae* C Morning-glory	wild sweet potato vine	*Ipomoea pandurata*		U				1
Polemoniales	*Polemoniaceae* C Phlox	cleft phlox	*Phlox bifida*		LC				1
Polemoniales	*Polemoniaceae* C Phlox	blue phlox	*Phlox divaricata ssp. laphamii*		C				1

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Polemoniales	*Polemoniaceae* C Phlox	garden phlox	*Phlox paniculata*		O-LC				1
Polemoniales	*Polemoniaceae* C Phlox	Jacob-s-ladder	*Polemonium reptans*		C				1
Polemoniales	*Hydrophyllaceae* C Water-leaf	broad-leaved waterleaf	*Hydrophyllum canadense*		LA				1
Polemoniales	*Hydrophyllaceae* C Water-leaf		*Phacelia bipinnatifida*		C				1
Lamiales	*Boraginaceae* C Borage	wild comfrey	*Cynoglossum virginianum*		O				1
Lamiales	*Boraginaceae* C Borage	stickseed	*Hackelia virginiana*		LC				1
Lamiales	*Boraginaceae* C Borage	bluebells [Virginia cowslip]	*Mertensia virginica*		LA				1
Lamiales	*Boraginaceae* C Borage	scorpion-grass	*Myosotis macrosperma*		O				1
Lamiales	*Verbenaceae* C Verbena	blue vervain	*Verbena hastata*		O				1
Lamiales	*Verbenaceae* C Verbena		*Verbena X illicita*		R				1
Lamiales	*Verbenaceae* C Verbena	narrow-leaved vervain	*Verbena simplex*		U				1
Lamiales	*Verbenaceae* C Verbena	white vervain	*Verbena urticifolia*		O				1
Lamiales	*Verbenaceae* C Verbena	fog-fruit	*Phyla lanceolata*		LC				1
Lamiales	*Lamiaceae* C Mint	lyre-leaved sage [cancer-weed]	*Salvia lyrata*		O				1
Lamiales	*Lamiaceae* C Mint	downy skullcap	*Scutellaria incana*		LC				1
Lamiales	*Lamiaceae* C Mint	mad-dog skullcap	*Scutellaria lateriflora*		O				1
Lamiales	*Lamiaceae* C Mint	small skullcap	*Scutellaria leonardii*		U				1
Lamiales	*Lamiaceae* C Mint	ground ivy [gill-over-the-ground]	*Glechoma hederacea var. micrantha*		LC			E	1
Lamiales	*Lamiaceae* C Mint	burgamot mint [Monarda, bee balm]	*Monarda bradburiana*		LC				1
Lamiales	*Lamiaceae* C Mint	wild bergamot	*Monarda fistulosa*		O				1
Lamiales	*Lamiaceae* C Mint	henbit	*Lamium amplexicaule*		O			E	1
Lamiales	*Lamiaceae* C Mint	purple dead nettle	*Lamium purpureum*		LA			E	1
Lamiales	*Lamiaceae* C Mint	pagoda plant [wood mint]	*Blephilia ciliata*		O				1

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Lamiales	*Lamiaceae* C Mint	pagoda plant	*Blephilia hirsuta*		LC				1
Lamiales	*Lamiaceae* C Mint	stone mint [dittany]	*Cunila origanoides*		C-O				1
Lamiales	*Lamiaceae* C Mint	common water horehound	*Lycopus americanus*		O				1
Lamiales	*Lamiaceae* C Mint	bugle weed	*Lycopus virginicus*		LC				1
Lamiales	*Lamiaceae* C Mint	self heal [heal-all]	*Prunella vulgaris var. elongata*		LC				1
Lamiales	*Lamiaceae* C Mint	mountain mint	*Pycnanthemum pycnanthemoides*		O				1
Lamiales	*Lamiaceae* C Mint	slender mountain mint	*Pycnanthemum tenuifolium [P. flexuosum]*		C				1
Lamiales	*Lamiaceae* C Mint	American germander [wood sage]	*Teucrium canadense var. virginicum*		O				1
Lamiales	*Lamiaceae* C Mint	richweed [citronella horse balm]	*Collinsonia canadensis*		U				1
Lamiales	*Lamiaceae* C Mint	yellow giant hyssop	*Agastache nepetoides*		R				1
Lamiales	*Lamiaceae* C Mint	beefsteak plant	*Perilla frutescens*		LC				1
Lamiales	*Lamiaceae* C Mint	hairy synandra [white-flowered mint, synandra]	*Synandra hispidula*		R		E		
Lamiales	*Lamiaceae* C Mint	false pennyroyal	*Trichostema brachiatum*		LC				1
Polemoniales	*Solanaceae* C Nightshade	ground-cherry	*Physalis heterophylla*		U				1
Polemoniales	*Solanaceae* C Nightshade	annual ground-cherry	*Physalis pubescens*		R				1
Polemoniales	*Solanaceae* C Nightshade	horse-nettle	*Solanum carolinense*		O				1
Polemoniales	*Solanaceae* C Nightshade	black nightshade	*Solanum ptycanthum*		U				1
Scrophulariales	*Scrophulariaceae* C Figwort	moth mullein	*Verbascum blattaria*		O				1
Scrophulariales	*Scrophulariaceae* C Figwort	wooly mullein	*Verbascum thapsus*		C			E	1
Scrophulariales	*Scrophulariaceae* C Figwort	candelabra plant [Culver-s-root]	*Veronicastrum virginicum*		O				1
Scrophulariales	*Scrophulariaceae* C Figwort	corn speedwell [blue speedwell]	*Veronica arvensis*		C				1

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Scrophulariales	*Scrophulariaceae* C Figwort	purslane speedwell [white speedwell]	*Veronica peregrina*		C				1
Scrophulariales	*Scrophulariaceae* C Figwort	false pimpernel	*Lindernia dubia*		U				1
Scrophulariales	*Scrophulariaceae* C Figwort	clammy hedge-hyssop [common hedge-hyssop]	*Gratiola neglecta*		O				1
Scrophulariales	*Scrophulariaceae* C Figwort		*Leucospora multifida*		O				1
Scrophulariales	*Scrophulariaceae* C Figwort	smooth false foxglove	*Aureolaria flava*		LC				1
Scrophulariales	*Scrophulariaceae* C Figwort	water hyssop	*Bacopa rotundifolia*		LC				1
Scrophulariales	*Scrophulariaceae* C Figwort	smooth beard-tongue	*Penstemon calycosus*		O				1
Scrophulariales	*Scrophulariaceae* C Figwort	foxglove beard-tongue [foxglove penstemon]	*Penstemon digitalis*		O				1
Scrophulariales	*Scrophulariaceae* C Figwort	pale beard-tongue	*Penstemon pallidus*		LC				1
Scrophulariales	*Scrophulariaceae* C Figwort	winged monkey-flower [common monkey-flower]	*Mimulus alatus*		O				1
Scrophulariales	*Scrophulariaceae* C Figwort	blue-eyed Mary	*Collinsia verna*		LA				1
Scrophulariales	*Scrophulariaceae* C Figwort	late figwort	*Scrophularia marilandica*		LC				1
Scrophulariales	*Scrophulariaceae* C Figwort	false foxglove	*Agalinis fasciculata*		U				1
Scrophulariales	*Scrophulariaceae* C Figwort	false foxglove	*Agalinis paupercula*		U				1
Scrophulariales	*Scrophulariaceae* C Figwort	slender false foxglove	*Agalinis tenuifolia*		O				1
Scrophulariales	*Acanthaceae* C Acanthus	water-willow	*Justicia americana*		LC				1
Scrophulariales	*Acanthaceae* C Acanthus	hairy ruellia [wild petunia]	*Ruellia humilis*		O				1
Scrophulariales	*Acanthaceae* C Acanthus	stalked ruellia [wild petunia]	*Ruellia pedunculata*		C				1
Scrophulariales	*Bignoniaceae* C Trumpet Creeper	trumpet-creeper [trumpet-vine]	*Campsis radicans*	vine	C			N	1
Scrophulariales	*Bignoniaceae* C Trumpet Creeper	northern [hardy] catalpa [cigar tree, Indian bean]	*Catalpa speciosa*	tree	O			N	1
Scrophulariales	*Bignoniaceae* C Trumpet Creeper	southern [common] catalpa [lady cigar tree]	*Catalpa bignonioides*	tree	R			E	

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Plantaginales	*Plantaginaceae* C Plantain	bracted plantain	*Plantago aristata*		LA				1
Plantaginales	*Plantaginaceae* C Plantain	buckhorn [English plantain]	*Plantago lanceolata*		LC			E	1
Plantaginales	*Plantaginaceae* C Plantain	common plantain	*Plantago major*		LC			E	1
Plantaginales	*Plantaginaceae* C Plantain	small plantain	*Plantago pusilla*		O				1
Plantaginales	*Plantaginaceae* C Plantain	red-stalked plantain [Rugel-s plantain]	*Plantago rugelli*		LC			N	1
Plantaginales	*Plantaginaceae* C Plantain	dwarf plantain	*Plantago virginica*		LC				1
Rubiales	*Rubiaceae* C Madder	common buttonbush	*Cephalanthus occidentalis*	shrub	O			N	1
Rubiales	*Rubiaceae* C Madder	annual bedstraw [goosegrass, cleavers]	*Galium aparine*		LA				1
Rubiales	*Rubiaceae* C Madder	wild licorice	*Galium circaezans*		C				1
Rubiales	*Rubiaceae* C Madder	shining bedstraw	*Galium concinnum*		C-O				1
Rubiales	*Rubiaceae* C Madder	hairy bedstraw [purple bed-straw]	*Galium pilosum*		O				1
Rubiales	*Rubiaceae* C Madder	sweet-scented bedstraw	*Galium triflorum*		O				1
Rubiales	*Rubiaceae* C Madder	rough buttonweed [poorjoe]	*Diodia teres*		LC				1
Rubiales	*Rubiaceae* C Madder	large buttonweed [Virginia buttonweed]	*Diodia virginiana*		R				1
Rubiales	*Rubiaceae* C Madder	tiny bluets	*Hedyotis crassifolia [Hous-tonia minima]*		LC				1
Rubiales	*Rubiaceae* C Madder	long-leaved bluets	*Hedyotis longifolia [Houston-nia longifolia]*		O				1
Rubiales	*Rubiaceae* C Madder	slender-leaved bluets	*Hedyotis nuttalliana [Hous-tonia tenuifolia]*		O				1
Rubiales	*Rubiaceae* C Madder	broad-leaved bluets	*Hedyotis purpurea [Houston-nia purpurea]*		U				1
Rubiales	*Rubiaceae* C Madder	small bluets [star violet]	*Hedyotis pusilla [Houston-nia pusilla]*		LC				1

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Dipsacales	*Caprifoliaceae* C Honeysuckle	arrowwood	*Viburnum dentatum [recognitum]*	shrub	C			N	
Dipsacales	*Caprifoliaceae* C Honeysuckle	southern wild-raisin	*Viburnum nudum*	shrub	?				
Dipsacales	*Caprifoliaceae* C Honeysuckle	smooth arrowood	*Viburnum recognitum*		?				
Dipsacales	*Caprifoliaceae* C Honeysuckle	nannyberry	*Viburnum lentago*	shrub	?				
Dipsacales	*Caprifoliaceae* C Honeysuckle	rusty nannyberry [southern blackhaw]	*Viburnum rufidulum*	shrub	U			N	1
Dipsacales	*Caprifoliaceae* C Honeysuckle	blackhaw [nannyberry]	*Viburnum prunifolium*	shrub	O				1
Dipsacales	*Caprifoliaceae* C Honeysuckle	American elder [elderberry, golden elder]	*Sambucus canadensis*	shrub	LC			N	1
Dipsacales	*Caprifoliaceae* C Honeysuckle	coralberry [Indian-currant, buck-brush]	*Symphoricarpos orbiculatus*	shrub	LC			N	1
Dipsacales	*Caprifoliaceae* C Honeysuckle	Japanese honeysuckle	*Lonicera japonica var. japonica*	vine	A			E	1
Dipsacales	*Caprifoliaceae* C Honeysuckle	Japanese honeysuckle	*Lonicera japonica var. chinense*	vine	R			E	1
Dipsacales	*Caprifoliaceae* C Honeysuckle	Amur honeysuckle	*Lonicera maackii*		U				1
Dipsacales	*Caprifoliaceae* C Honeysuckle	trumpet honeysuckle [firecracker honeysuckle]	*Lonicera sempervirens*	vine	U			N	1
Dipsacales	*Caprifoliaceae* C Honeysuckle	Illinois horse gentian	*Triosteum illinoense*		O				1
Dipsacales	*Caprifoliaceae* C Honeysuckle	late horse gentian	*Triosteum perfoliatum*		O				1
Dipsacales	*Valerianaceae* C Valerian	pink valerian	*Valeriana pauciflora*		LC				1
Dipsacales	*Valerianaceae* C Valerian	corn salad [lamb-s lettuce]	*Valerianella radiata*		LC				1

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Dipsacales	*Dipsacaceae* C Teasel	common teasel	*Dipsacus sylvestris*		O			E	1
Cucurbitales	Cucurbitaceae CGourd	bur cucumber	*Sicyos angulatus*	vine					
Campanulales	*Campanulaceae* C Bell-flower	Venus= looking glass	*Triodanis perfoliata*		LC				1
Campanulales	*Campanulaceae* C Bell-flower	American bellflower	*Campanula americana*		C				1
Campanulales	*Campanulaceae* C Bell-flower	cardinal-flower	*Lobelia cardinalis*		U				1
Campanulales	*Campanulaceae* C Bell-flower	Indian tobacco	*Lobelia inflata*		LC				1
Campanulales	*Campanulaceae* C Bell-flower	blue cardinal-flower	*Lobelia siphilitica*		O				1
Asterales	*Asteraceae* C Aster	common milfoil [common yarrow, nosebleed]	*Achillea millefolium*		C				1
Asterales	*Asteraceae* C Aster	common ragweed [bitterweed, Roman wormwood]	*Ambrosia artemisiifolia*		C				1
Asterales	*Asteraceae* C Aster	lanceleaf ragweed [southern ragweed]	*Ambrosia bidentata*		LC				1
Asterales	*Asteraceae* C Aster	giant ragweed [buffalo weed, horse weed]	*Ambrosia trifida*		O				1
Asterales	*Asteraceae* C Aster	everlasting [ladies= tobacco]	*Antennaria plantaginifolia var. plantaginifolia*		LC				1
Asterales	*Asteraceae* C Aster	everlasting [ladies= tobacco, pussytoes]	*Antennaria plantaginifolia var. ambigens*		U				1
Asterales	*Asteraceae* C Aster	common burdock [smaller burdock]	*Arctium minus*		U				1
Asterales	*Asteraceae* C Aster	Drummond=s aster	*Aster drummondii*		O-LC				1
Asterales	*Asteraceae* C Aster	side-flowered aster [white woodland aster]	*Aster lateriflorus*		LA				1
Asterales	*Asteraceae* C Aster	New England aster	*Aster novae-angliae*		R				1

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Asterales	*Asteraceae* C Aster	purple daisy [spreading aster]	*Aster patens*		C-O				1
Asterales	*Asteraceae* C Aster	hairy aster	*Aster pilosus*		C				1
Asterales	*Asteraceae* C Aster	arrow aster [arrow-leaved aster]	*Aster X sagittifolius*		U				1
Asterales	*Asteraceae* C Aster	Short-s aster	*Aster shortii*		LC				1
Asterales	*Asteraceae* C Aster	panicled aster [tall white aster, white field aster]	*Aster simplex*		R				1
Asterales	*Asteraceae* C Aster	aster	*Aster turbinellus*		O				1
Asterales	*Asteraceae* C Aster	swamp marigold [tickseed sunflower]	*Bidens aristosa*		LA				1
Asterales	*Asteraceae* C Aster	Spanish needles	*Bidens bipinnata*		LC				1
Asterales	*Asteraceae* C Aster	nodding beggar-ticks [stick-tight]	*Bidens cernua*		U				1
Asterales	*Asteraceae* C Aster	European beggar-ticks [swamp tickseed]	*Bidens tripartita*		O			E	1
Asterales	*Asteraceae* C Aster	false aster	*Boltonia asteroides*		LC				1
Asterales	*Asteraceae* C Aster	false boneset	*Brickellia eupatorioides*		O				1
Asterales	*Asteraceae* C Aster	pale Indian plantain	*Cacalia atriplicifolia*		O				1
Asterales	*Asteraceae* C Aster	great Indian plantain	*Cacalia muhlenbergii*		LC				1
Asterales	*Asteraceae* C Aster	common chicory [blue sailors]	*Cichorium intybus*		R				1
Asterales	*Asteraceae* C Aster	field thistle [pasture thistle]	*Cirsium discolor*		O-LC				1
Asterales	*Asteraceae* C Aster	bull thistle	*Cirsium vulgare*		R				1
Asterales	*Asteraceae* C Aster	horseweed [mule weed]	*Conyza canadensis*		LC				1
Asterales	*Asteraceae* C Aster	tall coreopsis	*Coreopsis tripteris*		O				1
Asterales	*Asteraceae* C Aster	yerba de tajo	*Eclipta prostrata*		O				1
Asterales	*Asteraceae* C Aster	elephant-s-foot	*Elephantopus carolinianum*		O				1
Asterales	*Asteraceae* C Aster	fire weed	*Erechtites hieracifolia*		O-LC				1
Asterales	*Asteraceae* C Aster	annual fleabane	*Erigeron annuus*		LC				1

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Asterales	*Asteraceae* C Aster	marsh fleabane [Philadelphia fleabane]	*Erigeron philadelphicus*		C				1
Asterales	*Asteraceae* C Aster	daisy fleabane [rough fleabane, whitetop fleabane]	*Erigeron strigosus*		C				1
Asterales	*Asteraceae* C Aster	tall boneset [tall thoroughwort]	*Eupatorium altissimum*		R				1
Asterales	*Asteraceae* C Aster	blue boneset [mistflower, wild ageratum]	*Eupatorium coelestinum*		LC				1
Asterales	*Asteraceae* C Aster	hollow joe-pye weed [trumpet weed]	*Eupatorium fistulosum*		U				1
Asterales	*Asteraceae* C Aster	common boneset [thoroughwort]	*Eupatorium perfoliatum*		LC				1
Asterales	*Asteraceae* C Aster	white snakeroot	*Eupatorium rugosum*		C				1
Asterales	*Asteraceae* C Aster	late boneset	*Eupatorium serotinum*		LC				1
Asterales	*Asteraceae* C Aster	grassleaf goldenrod	*Euthamia graminifolia*		U				1
Asterales	*Asteraceae* C Aster	catfoot [old-field balsam, sweet everlasting]	*Gnaphalium obtusifolium*		O				1
Asterales	*Asteraceae* C Aster	early cudweed [purple cudweed]	*Gnaphalium purpureum*		U				1
Asterales	*Asteraceae* C Aster	purple-headed sneezeweed	*Helenium flexuosum*		O				1
Asterales	*Asteraceae* C Aster	pale sunflower [ten-petal sunflower]	*Helianthus decapetalus*		R				1
Asterales	*Asteraceae* C Aster	divergent sunflower [woodland sunflower]	*Helianthus divaricatus*		C				1
Asterales	*Asteraceae* C Aster	small wood sunflower	*Helianthus microcephalus*		O-LC				1
Asterales	*Asteraceae* C Aster	Jerusalem artichoke	*Helianthus tuberosus var. subcanescens*		LC				1
Asterales	*Asteraceae* C Aster	false sunflower [sunflower heliopsis]	*Heliopsis helianthoides*		U				1
Asterales	*Asteraceae* C Aster	hairy hawkweed	*Hieracium gronovii*		C				1

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Asterales	*Asteraceae* C Aster	marsh elder [sumpweed]	*Iva annua*		U				1
Asterales	*Asteraceae* C Aster	false dandelion	*Krigia biflora*		O				1
Asterales	*Asteraceae* C Aster	dwarf dandelion [potato dandelion]	*Krigia dandelion*		LC				1
Asterales	*Asteraceae* C Aster	Canada lettuce [horseweed, wild lettuce]	*Lactuca canadensis*		C				1
Asterales	*Asteraceae* C Aster	blue lettuce [woodland lettuce]	*Lactuca floridana*		O				1
Asterales	*Asteraceae* C Aster	willow-leaved lettuce	*Lactuca saligna*		LC				1
Asterales	*Asteraceae* C Aster	compass plant [prickly lettuce]	*Lactuca serriola*		C				1
Asterales	*Asteraceae* C Aster	common tansy [ox-eye daisy, white daisy]	*Leucanthemum vulgare*		C				1
Asterales	*Asteraceae* C Aster	blazing star	*Liatris scabra*		LC				1
Asterales	*Asteraceae* C Aster	button snakeroot [marsh blazing star]	*Liatris spicata*		LC				1
Asterales	*Asteraceae* C Aster	pineapple weed	*Matricaria matricarioides*		LC				1
Asterales	*Asteraceae* C Aster	American feverfew [wild quinine]	*Parthenium integrifolium*		O				1
Asterales	*Asteraceae* C Aster	leafcup	*Polymnia canadensis*		O				1
Asterales	*Asteraceae* C Aster	bears foot [leafcup, yellowflower]	*Polymnia uvedalia*		U				1
Asterales	*Asteraceae* C Aster	tall white lettuce	*Prenanthes altissima*		LC				1
Asterales	*Asteraceae* C Aster	great white lettuce	*Prenanthes crepidinea*		LA				1
Asterales	*Asteraceae* C Aster	false dandelion	*Pyrrhopappus carolinianus*		O				1
Asterales	*Asteraceae* C Aster	black-eyed Susan	*Rudbeckia hirta*		C				1
Asterales	*Asteraceae* C Aster	cutleaf coneflower [wild golden glow]	*Rudbeckia laciniata*		O				1

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		
Asterales	*Asteraceae* C Aster	golden ragwort [groundsel, squaw-weed]	*Senecio aureus*		LA				1
Asterales	*Asteraceae* C Aster	butterweed [groundsel, ragwort]	*Senecio glabellus*		LC				1
Asterales	*Asteraceae* C Aster	wholeleaf rosinweed	*Silphium integrifolium*						1
Asterales	*Asteraceae* C Aster	cup plant [cup rosinweed]	*Silphium perfoliatum*		O				1
Asterales	*Asteraceae* C Aster	tall goldenrod	*Solidago altissima*		A				1
Asterales	*Asteraceae* C Aster	Buckley-s goldenrod	*Solidago buckleyi*		U				1
Asterales	*Asteraceae* C Aster	bluestem goldenrod [woodland goldenrod]	*Solidago caesia*		C				1
Asterales	*Asteraceae* C Aster	early goldenrod	*Solidago juncea*		C				1
Asterales	*Asteraceae* C Aster	Dyersweed goldenrod [gray goldenrod]	*Solidago nemoralis*		C-O				1
Asterales	*Asteraceae* C Aster	elm-leaved goldenrod	*Solidago ulmifolia*		C				1
Asterales	*Asteraceae* C Aster	red-seeded dandelion [smooth dandelion]	*Taraxacum laevigatum*		R				1
Asterales	*Asteraceae* C Aster	common dandelion	*Taraxacum officinale*		LC				1
Asterales	*Asteraceae* C Aster	goat-s beard [sand goat-s beard]	*Tragopogon dubius*		O				1
Asterales	*Asteraceae* C Aster	wing stem [yellow iron weed]	*Verbesina alternifolia*		LA				1
Asterales	*Asteraceae* C Aster	yellow crownbeard	*Verbesina helianthoides*		O				1
Asterales	*Asteraceae* C Aster	tall iron weed	*Vernonia gigantea*		O				1
Asterales	*Asteraceae* C Aster	Missouri ironweed	*Vernonia missurica*		U				1
Asterales	*Asteraceae* C Aster	cocklebur	*Xanthium strumarium var. canadensis*		O-LA				1

Vascular Plants of Crab Orchard NWR (Continued)

Order	Family	Common Name(s)	Scientific Name(s)	Growth Form	Frequency of Occurrence	Status		Native /Exotic	Ref.
						Fed.	State		

Frequency of Occurrence Key

A = abundant

LA = locally abundant

C = common

LC = locally common

O = occasional

R = rare? = undocumented

Reference Key1 = Ulaszek, Eric F. 1988. The vascular flora of the Devils Kitchen Lake area, Williamson and Union counties, Illinois. M.S. thesis, Southern Illinois University, Carbondale. 98p.2 = Mohlenbrock, Robert H., and John W. Voigt. 1959. A flora of southern Illinois. Southern Illinois University Press, Carbondale and Edwardsville. 390 p.General ReferencesIverson, L.R., D. Ketzner, and J. Karnes. 1999. Illinois Plant Information Network. Database at http://www.fs.fed.us/ne/delaware/ilpin.html. Illinois Natural History Survey and USDA Forest Service.Mohlenbrock, Robert H., and John W. Voigt. 1959. A flora of southern Illinois. Southern Illinois University Press, Carbondale and Edwardsville. 390 p.Petrides, George A. 1986. A field guide to trees and shrubs. Peterson Field Guide Series. Houghton Mifflin Co., Boston. 428 p.Pohl, Richard W. 1968. How to know the grasses. William C. Brown Co. Publishers, Dubuque, Iowa. 200 p.

Appendix E: State-listed Species Potentially Found at Crab Orchard NWR

State-listed Species Potentially Found at Crab Orchard NWR

Birds	Status	Breeding Status
Birds		
Pied-billed Grebe *(Podilymbus podiceps)*	Threatened	Migrant
American Bittern *(Botaurus lentiginosus)*	Endangered	Migrant; former breeder
Least Bittern *(Ixobrychus exilis)*	Threatened	Migrant; former breeder
Snowy Egret *(Egretta thula)*	Endangered	Migrant
Little Blue Heron *(Egretta caerulea)*	Endangered	Migrant
Black-crowned Night Heron *(Nyctanassa nycitcorax)*	Endangered	Migrant
Yellow-crowned Night Heron *(Nyctanassa violacea)*	Endangered	Migrant
Northern Harrier *(Circus cyaneus)*	Endangered	Migrant
Mississippi kite *(Icitinia mississippiensis)*	Endangered	Migrant
Red-shouldered Hawk *(Buteo lineatus)*	Threatened	Breeder
Bald Eagle *(Haliaeetus leucocephalus)*	Threatened	Breeder
Osprey *(Pandion haliaetus)*	Endangered	Migrant; former breeder
Peregrine Falcon *(Falco peregrinus)*	Endangered	Migrant
Common Moorhen *(Gallinula chloropus)*	Threatened	Migrant
Sandhill Crane *(Grus Canadensis)*	Threatened	Migrant
Upland Sandpiper *(Bartramia longicauda)*	Endangered	Migrant; former breeder
Wilson's Phalarope *(Phalaropus tricolor)*	Endangered	Migrant
Forster's Tern *(Sterna forsteri)*	Endangered	Migrant
Least Tern *(Sterna antillarum)*	Endangered	Migrant
Black Tern *(Chlidonias niger)*	Endangered	Migrant
Barn Owl *(Tyto alba)*	Endangered	Migrant
Short-eared Owl *(Asio flammeus)*	Endangered	Migrant
Loggerhead Shrike *(Lanius ludovicianus)*	Threatened	Breeder
Brown Creeper *(Certhia americana)*	Threatened	Migrant
Bewick's Wren *(Thryomanes bewickii)*	Endangered	Migrant
Henslow's Sparrow *(Ammodramus henslowii)*	Endangered	Breeder
Mammals		
Indiana bat *(Myotis sodalis)*	Endangered	Status Unknown
Golden mouse *(Ochrotomys nuttalli)*	Threatened	Breeder
Marsh rice rat *(Oryzomys palustris)*	Threatened	Breeder
River otter *(Lutra canadensis)*	Threatened	Status Unknown
Plants		
Hairy synandra *(Synandra hispidula)*	Endangered	

Appendix F: Bibliography

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Appendix G: Public Law 80-361

Appendix G: Public Law 80-361

[Public Law 361 - 80th Congress]

[Chapter 489 - 1st Session]

[H.R. 3043]

AN ACT

To provide for the transfer of certain lands to the Secretary of the Interior, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That in order to promote the orderly development and use of the lands and interests therein acquired by the United States in connection with the Crab Orchard Creek project and the Illinois Ordnance Plant in Williamson, Jackson, and Union Counties, Illinois, consistent with the needs of agriculture, industry, recreation, and wildlife conservation, all of the interests of the United States in and to such lands are hereby transferred to the Secretary of Interior for administration, development, and disposition, in accordance with the provisions of this Act.

Sec. 2. All of the lands transferred to the Secretary of the Interior, pursuant to the provisions of this Act, first shall be classified by him with a view to determining, in cooperation with Federal, State, and public or private agencies and organizations, the most beneficial use that may be made thereof to carry out the purposes of this Act, including the development of wildlife conservation, agricultural, recreational, industrial, and related purposes. Such lands as have been or may hereafter be determined to be chiefly valuable for industrial purposes shall be leased for such purposes at such times and under such terms and conditions as are consistent with the general purposes of Section 2 of the Surplus Property Act of 1944, as amended, and with the purposes of this Act. Except to the extent otherwise provided in this Act, all lands herein transferred shall be administered by the Secretary of the Interior through the Fish and Wildlife Service in accordance with the provisions of the Act of August 14, 1946 (Public Law 732, Seventy-ninth Congress), and Acts supplementary thereto and amendatory thereof for the conservation of wildlife, and for the development of the agricultural, recreational, industrial, and related purposes specified in this Act: Provided, that no jurisdiction shall be exercised by the Secretary of the Interior over that portion of such lands and the improvements thereon which are now utilized by the War Department directly or indirectly until such time as it is determined by the Secretary or War that utilization of such portions of such lands and the improvements thereon directly or indirectly by the War Department is no longer required: Provided further, That, subsequent to the determination referred to in the preceding proviso, the lands and improvements mentioned therein shall be administered by the Secretary of the Interior, and any lease or other disposition thereof shall be made subject to such terms, conditions, restrictions, and reservations imposed by the Secretary of War as will, in the opinion of the Secretary of War, be adequate to assure the continued availability for war production purposes of such lands and improvements.

Approved August 5, 1947.

Appendix H: Compatibility Determinations

In accordance with the Refuge Improvement Act of 1997, no uses for which the Service has authority to regulate may be allowed on a unit of Refuge System unless it is determined to be compatible. A compatible use is a use that, in the sound professional judgment of the refuge manager, will not materially interfere with or detract from the fulfillment of the National Wildlife Refuge System mission or the purposes of the national wildlife refuge. Managers must complete a written compatibility determination for each use, or collection of like-uses, that is signed by the manager and the Regional Chief of Refuges in the respective Service region.

Below is a list of draft compatibility determinations that were included in the Draft EIS/CCP to allow public review and comment:

Biking/Jogging and Footraces
Boating
Camping, Swimming and Picnicking
Cemetery Operations
Collection of Wild Plant Foods for Personal Use
Cooperative Farming
Fire Department Training
Fishing (Competitive Events)
Fishing (Recreational)
Grazing of Livestock
The Haven Operations
Haying
Horseback Riding
Hunting of Fox
Hunting of Migratory Waterfowl and Game Birds, Resident Game and Furbearers (Recreational)
Industrial Operations
Installation of Nesting Structures by Public or Groups
Interpretation and Environmental Education
Priority Wildlife-dependent Recreational Uses on Lands Proposed to be Acquired
Sewage Collection System Replacement by the City of Marion
Trapping of Furbearers
Waterskiing
Wildlife Observation and Interpretation
Wood Cutting and Timber Harvest
Youth Camp Operations

Final compatibility determinations for all the above uses, except foxhunting, were prepared following release of the Record of Decision. The compatibility determinations are available for viewing at Refuge headquarters. A draft compatibility determination for foxhunting was initially prepared as part of the planning process and as a reevaluation of a determination of "not compatible" made in 1992. Foxhunting was again determined to be "not compatible" in the draft compatibility determination. With the signing of the Record of Decision, the Refuge now has an approved comprehensive conservation plan. Because foxhunting with horses conflicts with the comprehensive conservation plan goals of protecting the integrity of the Refuge's biological resources and the enjoyment of high quality experiences for a wide-range of wildlife dependent uses, foxhunting on the Refuge has been denied without formally determining its compatibility with a final compatibility determination (603 FW 2.10D(1)(c)). This section of the Service Manual documents the process whereby a refuge manager should deny a proposed use without determining compatibility if the proposed use conflicts with the goals or objectives in an approved management plan such as a comprehensive conservation plan.

Appendix I: Refuge Operating Needs System (RONS) and Maintenance Mangement System (MMS) Projects

Appendix I: Refuge Operating Needs System (RONS) and Maintenance Management System (MMS) Projects

Refuge Operating Needs System (RONS)

Project No.	Project Title and Description	Cost Estimate (1,000 of $)
97001	*Increase Pest Plant Control:* Use a combination of mechanical and chemical measures to eliminate autumn olive on the Crab Orchard National Wildlife Refuge. Natural plant succession is virtually impossible on areas of the refuge due to the existence and increasing amount of autumn olive. This exotic woody plant is an early invader and tends to out-compete native woody plants. The project will reduce and control invasion of autumn olive throughout the refuge.	$56.808
97003	*Conduct Nongame Bird Census:* Conduct a nongame bird census on the refuge to provide a better understanding of bird use of the refuge with emphasis on Midwest species of concern. Information will be used to help the refuge make management decisions relating to restoring fragmented forests and grasslands. A standardized census method will be used in cooperation with the Illinois Natural History Survey and Illinois Department of Natural Resources.	$34.56
97009	*Reduce Forest Fragmentation:*Forest habitat fragmentation will be reduced by restoring the native hardwood vegetative cover on selected parcels of open land. Restoration involves mechanical and chemical site preparation treatment, cover crop establishment, planting native seedlings, monitoring forest development, and follow-up silvicultural treatments. Providing large blocks of high quality habitat should increase nesting success of forest interior bird species and also help preserve biological diversity. This project will decrease habitat fragmentation and improve wildlife productivity.	$20.24
97008	*Enhance Timber Management:*Conduct forest habitat improvement treatments using various silvicultural practices including thinning, stand improvement cutting, and regeneration cutting. A priority project on the Refuge is the conversion of 3,500 acres of non-native pine plantations to an oak-hickory forest. An inventory of advanced hardwood seedlings and sprouts will be conducted on 600 acres of pine plantation per year to determine if an adequate number of trees are present before the overstory is converted to native hardwoods. Removal of pine trees will be done to improve habitat conditions for many species of migratory birds that depend on large tracts of native hardwood forest.	$181.6
98027	*Conduct Indiana Bat survey:* Conduct an Indiana bat survey on the Crab Orchard National Wildlife Refuge. In order to avoid adverse impacts to the federally endangered Indiana bat and to comply with endangered species laws and regulations, surveys will be conducted within refuge pine stands. Conversion of 3,500 acres of nonnative pine trees to native hardwood forest is a very high refuge priority.	$27
98036	*Provide Shoreline Stabilization for Crab Orchard Lake:* Stabilize the shoreline of Crab Orchard Lake with filter fabric and rock. Erosion is occurring along 14 miles of the shoreline of Crab Orchard Lake. Wind driven waves are the primary cause of the erosion and rock will slow the process, reducing siltation and improving water quality. Crab Orchard Lake provides habitat for waterfowl, herons, egrets, shorebirds and fish. The lake is also used for various forms of water recreation.	$418

Refuge Operating Needs System (RONS)

Project No.	Project Title and Description	Cost Estimate (1,000 of $)
RONS Tier 2		
03001	Law Enforcement Position Increased Funding:	$5
04001	Fulltime Law Enforcement Officer	$136
02001	Thin non-native pine plantations to encourage growth of desirable hardwoods	$90
02002	Convert fescue pastures to native warm season grasses and better cool season non-native grasses	$58
02007	Increase technical oversight of Refuge agricultural program	$40
99801	Volunteer Program Enhancement	$50
99003	Improve Visitor Services	$630
02003	Convert hay fields from cool-season cover to warm-season cover	$16
02012	Protect visitors and provide officer safety	$31
02005	Maintain early succession habitat (shrubland) with burning and mowing	$46
02011	Educate Visitors and schoolchildren	$28
02008	Remove woody fence row and roadside vegetation to enhance Refuge grass-lands for breeding birds	$40
02004	Add 30-foot wide field borders of native warm season grasses to farm fields	$4
02010	Install water monitoring devices on the Refuge's 3 large reservoirs	$38
98029	Increase aquatic resources surveys and monitoring	$102
02009	Remove trees from 140 ammunition storage bunkers	$114
98010	Conduct archeological survey of the refuge	$595
00003	Protect Visitors and Refuge Resources from illegal activities	$160

Maintenance Management System (MMS) Projects

Project No.	Project Title	CostEstimate (1000's of $)
00432	Replace / Replace Deficient Heating System in the Headquarters Building	$153
00364	Devils Kitchen Dam – Phase I [d]	$500
03507	CN Construct Turning Lanes at Visitor Center on SR 148.	$600
00434	Replace West Gate Road Bridge.	$377
00364	Devils Kitchen Dam – Phase II [cc]	$1,700
98052	Shoreline habitat restoration and stabilization	$3,563
02003	Replace deteriorated 4 inch steel waterline at Crab Orchard Campground	$364
98333	CN Repair Devils Kitchen bridge.	$139
00130	Replace deteriorated water distribution lines in the SE quadrant.	$471
98022	Remove Sewage & Water Treatment Plant	$2,279
98042	Construct Visitor & Learning Center	17,092
02001	Repair Deficiencies on Pond A-41 as Outlined in Dam Safety Report	$485

Maintenance Management System (MMS) Projects

Project No.	Project Title	CostEstimate (1000's of $)
00130	Replace deteriorated water distribution lines in NW Quadrant.	$471
02504	Upgrade Line Roads at Devils Kitchen Area. FHWA Route No. 115	$4,500
02502	Repair Devils Kitchen Road. FHWA Route No. 017	$770
86015	Replace deteriorated Pond A-41 Water Control Structure.	157
03508	"PE Road, Parking Lot, and Bridge Rehabilitation"	$300
86004	Resurface Cambria Point Lane. FHWA Route No. 105	$153
00130	Replace deteriorated water distribution lines in the NE quadrant.	$472
98011	Remove unused warehouses in Area-7 of the industrial area	$294
00435	Repair deficient Wolf Creek Bridge at Causeway	$110
98020	Remove line roads at Devils Kitchen Lake	$281
01019	"John Deere 550B Dozer, 78hp, winch"	$152
01028	"Champion 710A Road Grader, 135hp, 12' blade"	$142
01047	"Caterpillar D4C III LGP Dozer, 87hp w/cab, 25"" track shoes"	$121
02502	Repair Surfacing on Headquarters Parking – FHWA Route No. 901	$180
02503	Repair Surfacing on Chamesstown School Trail Parking - FHWA Route No. 902	$215
02505	Repair Surfacing on Primex Stringtown Parking	$339
02506	Repair Surfacing on Images Marina Parking – FHWA Route No. 906	$393
02507	Repair Surfacing on SR 13 Boat Landing – FHWA Route No. 907	$168
02509	Repair Surfacing on Line 16 Parking – FHWA Route No. 914	$122
02510	Repair Surfacing on Wolf Creek Fishing Access Parking – FHWA Route No. 915	$115
02513	Repair Surfacing on Devil's Kitchen Campground Parking - FHWA Route No. 925	$139
02514	Repair Surfacing on Devil's Kitchen Boat Ramp Parking – FHWA Route No. 926	$146
02515	Repair Surfacing on Tacoma Lake Road Parking – FHWA Route No. 927	$105
02524	Repair Surfacing on Primex Warehouse Parking – FHWA Route No. 939	$201
02526	Repair Surfacing on Ensign-Bickford Parking – FHWA Route No. 941	$297
02527	Repair Surfacing on Diagraph Corporation Main Parking – FHWA Route No. 942	$166
02531	Repair Surfacing on Pigeon Creek Road – FHWA Route No. 010	$121

Maintenance Management System (MMS) Projects

Project No.	Project Title	CostEstimate (1000's of $)
02533	Repair Surfacing on Stringtown Road – FHWA Route No. 012	$884
02534	Repair Surfacing on Post Oak Road – FHWA Route No. 013	$184
02535	Repair Surfacing on Research Road – FHWA Route No. 014	$126
02536	Repair Surfacing on Wolf Creek Road – FHWA Route No. 015	$919
02537	Repair Surfacing on Tacoma Road – FHWA Route No. 016	$998
02539	Repair Surfacing on Odgen Road East – FHWA Route No. 018	$292
02539	Repair Surfacing on Odgen Road West – FHWA Route No. 019	$686
02541	Repair Surfacing on Old Highway 13 – FHWA Route No. 100	$359
02543	Repair Surfacing on Greenbriar Road – FHWA Route No. 102	$442
02544	Repair Surfacing on Crab Orchard Campground – FHWA Route No. 103	$2,111
02545	Repair Surfacing on Images Marina Road – FHWA Route	$310
02546	Repair Surfacing on Cambria Point Lane – FHWA Route	$152
02547	Repair Surfacing on Haven Access Loop – FHWA Route	$129
02550	Repair Surfacing on Spillway Landing Road - FHWA Route No. 109	$148
02551	Repair Surfacing on Propeller Road – FHWA Route No. 110	$413
02552	Repair Surfacing on Broken Handle Road – FHWA Route	$207
02553	Repair Surfacing on Bald Eagle Lane – FHWA Route	$562
02554	Repair Surfacing on Devils Kitchen Campground – FHWA Route No. 113	$412
02555	Repair Surfacing on Devils Kitchen Boat Ramp Access – FHWA Route No. 114	$114
02556	Repair Surfacing on Devil's Kitchen Line 11 Road – FHWA Route No. 115	$571
02558	Repair Surfacing on Devils Kitchen Line 13 Road – FHWA Route No. 117	$734
02559	Repair Surfacing on Devils Kitchen Line 16 Road – FHWA Route No. 118	$587
02561	Repair Surfacing on Cedar Point Youth Camp Road – FHWA Route No. 120	$285
02562	Repair Surfacing on Devil's Kitchen Line 3 Road – FHWA Route No. 121	$294

Maintenance Management System (MMS) Projects

Project No.	Project Title	CostEstimate (1000's of $)
02563	Repair Surfacing on Devil's Kitchen Line 5 Road – FHWA Route No. 122	$1,036
02565	Repair Surfacing on Devil's Kitchen Line 6 Road – FHWA Route No. 124	$177
02566	Repair Surfacing on Devils Kitchen Line 6 Loop Road – FHWA Route No. 125	$530
02567	Repair Surfacing on Devils Kitchen Line 6 Spur Road – FHWA Route No. 126	$106
02568	Repair Surfacing on Devils Kitchen Line 6 Loop Spur Road – FHWA Route No. 127	$163
02571	Repair Surfacing on Little Grassy Lake Campground Road – FHWA Route No. 130	$212
02004	"Freightliner Dump Truck, 52000 GVWR"	$100
00399	Visitor Center Dam Rehabilitation [d/cc]	$3,000
01NNN	Cleanup of Pesticide Contamination in Area 7 Buildings	$140
98033	Enhance environmental education and interpretation opportunities	$162
00001	"Develop interpretive, regulatory, and directional signing"	$112
99001	Improve access to house boat pumpout station	$130
98035	Provide adequate parking for the Playport Marina	$370
99003	Improve Visitor Services	$630
00003	Protect Visitors and Refuge Resources from illegal activities	$160
03001	Demolition and Disposal of an abandoned water tower a the south end.	$100
03002	Removal and Disposal of Wharehouse S-4-3.	$130
03004	Construct a Building Addition to the Headquarters Building	$350
03006	Construct and Office Addition to the Visitor Center.	$300
03007	Repair erosion on Little Grassy Dam.	$180
03008	Replace deteriorated cyclone fence around Area 6 Igloo Complex	$804
03009	Replace deteriorated cyclone fence around Area 13 Igloo Complex.	$917
03010	Upgrade Crab Orchard Campground Campsites.	$360

Appendix J: Programmatic Biological Opinion Transmittal Memo

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Marion Illinois Suboffice (ES)
8588 Route 148
Marion, IL 62959
(618) 997-3344

August 7, 2006

Memorandum

To: Dan Frisk, Refuge Manager, Crab Orchard National Wildlife Refuge

From: Joyce Collins, Assistant Field Supervisor, Marion, Illinois Ecological Services Office

Subject: Crab Orchard National Wildlife Refuge, 2006 Comprehensive Conservation Plan

This memorandum transmits the Fish and Wildlife Service's Programmatic Biological Opinion for the Crab Orchard National Wildlife Refuge (Refuge) 2006 Comprehensive Conservation Plan (CCP). This programmatic opinion addresses the effects of the proposed action on the endangered Indiana bat (*Myotis sodalis*) in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et. seq.). Formal consultation was initiated on May 12, 2006.

The Refuge provided the Marion, Illinois Ecological Services Field Office with a Programmatic Biological Assessment dated April 11, 2006, and subsequently revised May 12, 2006, that assessed the effects of the proposed CCP on both the threatened bald eagle (*Haliaeetus leucocephalus*) and the Indiana bat. We concur with your assessment that the proposed CCP is not likely to adversely affect the bald eagle. Therefore, this species will not be discussed further.

This Programmatic Biological Opinion is based on information provided in the April/May 2006 Programmatic Biological Assessment, the 2005 Draft Environmental Impact Statement and CCP, conversations with your staff, electronic exchanges of information and other sources of information. After reviewing the current status of the Indiana bat, the environmental baseline for the action area, the effects of the proposed 2006 CCP and the cumulative effects, it is the Service's biological opinion that the 2006 CCP, as proposed, is not likely to jeopardize the continued existence of the Indiana bat. A complete administrative record of this consultation is on file at the Service's Marion, Illinois Ecological Services Field Office.

2.

I want to thank you and your staff for your cooperation during the development of this biological opinion. I believe the 2006 CCP will benefit the conservation status of all federally listed species on the Refuge. If you have any questions or concerns about this consultation or the consultation process in general, please feel free to contact me.

cc: IDNR (Kath, Shimp)
USFWS (Nelson, Pruitt, Szymanski)

APPENDIX A

Crab Orchard National Wildlife Refuge

STANDARDS AND GUIDELINES FOR INDIANA BAT PROTECTION

Potential Indiana Bat Roosting Habitat in Refuge Forests

Where large overstory, hardwood trees will be cut from 4/1 – 9/30, mist-netting surveys, exit surveys or other surveys approved by the U.S. Fish and Wildlife Service, Ecological Services, would be done prior to harvest or cutting to identify known roosting habitats. Mature leave trees in areas where the shelterwood and shelterwood with reserves harvest methods are applied (including throughout the uplands) will include mixtures of the following tree species preferred by Indiana bats for roosting where they exist: silver maple (*Acer saccharinum*), bitternut hickory (*Carya cordiformis*), shagbark hickory (*Carya ovata*), white ash (*Fraxinus americana*), green ash (*Fraxinus pennsylvanica*), eastern cottonwood (*Populus deltoides*), white oak (*Quercus alba*), post oak (*Quercus stallata*), black locust (*Robinia pseudoacacia*), American elm (*Ulmus americana*), and slippery elm (*Ulmus* rubra).

Should a roost site be discovered the Refuge will initiate Tier II consultation with U.S. Fish and Wildlife Service Ecological Services Office in Marion, Illinois before forest management occurs within 5 miles of the site.

Snags and Cavity Trees

Retain all standing dead trees (snags and stubs) and cavity trees unless necessary to cut for human safety or to accomplish project objectives. Dead trees and cavity trees that are potential roost trees cannot be removed from 4/1-9/30 unless they are evaluated (biological evaluation by biologists) and/or surveyed according to accepted protocols to document non-use by roosting bats.

Hibernacula

There are no known or historic hibernacula located on the Refuge or within five miles of the Refuge boundary. Should a hibernaculum be discovered, The Refuge will initiate consultation with U.S. Fish and Wildlife Service, Ecological Services Office in Marion, Illinois before forest management occurs within 5 miles of a known hibernaculum.

Pesticides

The use of pesticides is allowed following appropriate environmental consideration that indicates use will meet management objectives. Protective measures will be implemented where needed wherever aquatic pesticides would be used and near stream courses wherever terrestrial pesticides would be used.

Non-native Invasive Species

The risk of damage from existing non-native invasive species should be reduced through integrated pest management. Invasion-prevention measures should be implemented to maintain native ecosystems. Existing population of non-native invasive species should be eradicated, controlled and/or reduced. Effects of management activities on the invasion and spread of non-native invasive species should be considered and mitigated, if needed. Natural areas and lands adjacent to natural areas have the highest priority for the prevention and control of non-native invasive species.

Prescribed Fire Timing

Fire Management Plan - To reduce the chances of affecting maternity roosts and foraging habitats of Indiana bats, no prescribed burns shall occur in forest habitat from 1 April-30 September. Prescribed burns in grassland habitat between 1-15 April will require consultation with and approval by the U.S. Fish and Wildlife Ecological Services Office in Marion, Illinois

Smoke Management

Fire Management Plan - Smoke-management planning is used to control the effects of smoke emissions and meet air-quality standards. Prescribed burning will comply with state air pollution regulations. During prescribed fires, consideration shall be given to smoke-sensitive areas including Indiana bat hibernacula that may lie downwind of the burn.

Soil and Water Protection

Work with farmers to establish buffer strips and keep livestock away from streams and ponds. Continue using current soil and water protection measures in the Refuge farm program: use no insecticides, use only Service-approved herbicides,

use minimum tillage practices, and use winter cover crops.

Continue cleanup of contaminated sites. Ensure Refuge industrial operations conform to prescribed environmental standards.

Refuge forest management activities will be guided by the best-management practices defined by the Illinois Department of Natural Resources Division of Forest Resources (October 2000) and may include streambank restoration and/or stabilization, and management of large woody debris.

Air Protection

Emissions from prescribed burning activities must comply with applicable Federal and state standards. The latest guidelines are in the Interim Air Quality Policy on Wildland and Prescribed Fire (USEPA 1998).

All management-ignited prescribed fires shall be carried out in accordance with the provisions of an approved burning plan, in accordance with manual direction and other appropriate guidelines and direction.

Monitoring and Reporting

Any surveys for Indiana bats that involve bat handling will require consultation with U.S. Fish and Wildlife Service, Ecological Services, and adequate training of survey crews by experienced personnel. Mist-netting procedures developed by Garner and Gardner (1992) will be used. For surveys that include bat handling, an annual report of bat-monitoring activities and involved personnel will be provided to the Marion, Illinois office of the U.S. Fish and Wildlife Service.