FINAL
RESTORATION PLAN

CRAB ORCHARD NATIONAL WILDLIFE REFUGE

MARION, ILLINOIS

July 1997

UNITED STATES DEPARTMENT OF THE INTERIOR

FISH AND WILDLIFE SERVICE

"When we see land as a community to which we belong, we may begin to use it with love and respect. That land is a community is the basic concept of ecology, but that land is to be loved and respected is an extension of ethics. The land ethic simply enlarges the boundaries of the community to include soils, waters, plants, and animals, or collectively: the land."

Aldo Leopold, A Sand County Almanac

ENVIRONMENTAL ASSESSMENT

AND

NATURAL RESOURCE DAMAGE ASSESSMENT

RESTORATION PLAN

CRAB ORCHARD NATIONAL WILDLIFE REFUGE

Final

July 1997

U.S. Fish and Wildlife Service
Region 3
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Abstract: The U.S. Fish and Wildlife Service is planning restoration activities at Crab Orchard National Wildlife Refuge. These restoration activities are to compensate for lost resources and the services they provide that resulted from polychlorinated biphenyl (PCB) contamination on part of the Refuge. Restoration alternatives considered include: no action, reforestation, shoreline and riparian restoration, grassland restoration, enhancement of wilderness and research natural areas, wildlife reintroduction, public education/outreach, and land acquisition.

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EXECUTIVE SUMMARY

The Crab Orchard National Wildlife Refuge (NWR) is located approximately five miles west of Marion, Illinois and is administered by the U.S. Fish and Wildlife Service (Service). The land that is now occupied by the Refuge was used from 1941-1945 by wartime industries to manufacture explosives and supplies under the jurisdiction of the War Department. After World War II, other industries moved into the buildings formerly occupied by the War Department. In 1947, the Refuge was established by an Act of Congress, and the lands administered by the War Department and Soil Conservation Service were transferred to the Service.

Crab Orchard NWR was placed on the Superfund National Priorities List in 1987. Industrial tenants disposed of wastes generated from their operations prior to environmental laws and regulations. The contaminated areas on the Refuge reflect the broad range of substances used in various industrial and Refuge activities. As a result of the Refuge-wide remedial investigation and feasibility study, four sites were identified as containing polychlorinated biphenyl (PCB) wastes. A Record of Decision was signed in August 1990 that selected the remedy for the PCB cleanup.

A Natural Resource Damage Assessment was conducted by the Service, based on lost services, as a result of PCB contamination. A Consent Decree between the Department of Interior and Schlumberger Industries, Inc. was signed in 1991. This Consent Decree included the cleanup activities and costs and a negotiated $2.5 million settlement for injury to or destruction or loss of natural resources resulting from releases of hazardous substances from the PCB sites. Settlement monies will be used for restoration activities that will compensate for the adverse impacts to natural resources and the services they provide as a result of these releases.

The Refuge has developed this Environmental Assessment and Natural Resource Damage Assessment Restoration Plan that outlines the various alternatives for restoration. The restoration alternatives provided in this document were suggested by the general public, non-profit environmental groups, State agencies, and Refuge staff. Although a number of alternatives were considered, including the no action alternative, the preferred alternatives include: reforestation, shoreline and riparian restoration, grassland restoration, public education/outreach program and land acquisition. These restoration alternatives consist of a mixture of management activities that will provide benefits to aquatic and wildlife species. Benefits associated with these alternatives would help to compensate the public for loss of natural resources and the services they provide. These alternatives are consistent with the existing Refuge management plans and contribute towards Refuge objectives and restoration goals. The environmental impacts associated with these restoration activities are minimal when compared to the benefits that will result from the implementation of these restoration efforts.

TABLE OF CONTENTS

Introduction

The goal of the U.S. Fish and Wildlife Service (Service) is to conserve fish and wildlife by protecting and restoring natural ecosystems. This is stated in the Service's concept document entitled, "An Ecosystem Approach to Fish and Wildlife Conservation." Also stated in this document, the vision of the Service is to conserve the nation's natural animal and plant diversity through perpetuation of dynamic, healthy ecosystems.

The mission of the National Wildlife Refuge System, as stated in the Refuge System Manual, is to provide, preserve, restore, and manage a national network of lands and waters sufficient in size, diversity and location to meet society's needs for areas where the widest possible spectrum of benefits associated with wildlife and wildlands is enhanced and made available. One of the goals of the Refuge System is to preserve a natural diversity and abundance of fauna and flora.

One of the vision goals for Crab Orchard National Wildlife Refuge (Refuge) is to protect, enhance, and manage natural resources and ecosystems to sustain optimum fish and wildlife populations, with emphasis on the preservation, enhancement, and restoration of viable populations of animal and plant species whose existence is considered by federal or state authorities to be endangered or threatened. Management actions on the Refuge are designed to create and maintain an interspersion of biologically diverse habitat types.

The term restore is stated in the Service's ecosystem approach concept document, in the mission of the National Wildlife Refuge System, and in the vision statement of the Refuge. Whether restoration is thought of in terms of natural ecosystems, a national network of lands and waters, or populations of endangered or threatened animal and plant species, restoration is a goal for Crab Orchard National Wildlife Refuge.

The restoration alternatives that are presented in this Natural Resource Damage Assessment (NRDA) Restoration Plan were suggested by the general public, non-profit environmental groups, State agencies, and Refuge staff. There is the need to restore or acquire the equivalent of the natural resources that were lost or injured as a result of the polychlorinated biphenyl (PCB) contamination. This Restoration Plan describes the restoration alternatives that have been considered and those that have been selected for implementation on the Refuge.

The restoration alternatives that have been selected include: reforestation, shoreline and riparian restoration, grassland restoration, public education/outreach, and land acquisition. It has been determined that the preferred alternatives do not qualify as major Federal actions significantly affecting the quality of the human environment. Thus, an Environmental Impact Statement is not required. However, the Restoration Plan is written as an Environmental Assessment document.

Chapter 1 - History and Background of the Site

Crab Orchard National Wildlife Refuge is administered by the U.S. Fish and Wildlife Service. From 1941-1945, several wartime industries used the area for the manufacture of explosives and other supplies, under the jurisdiction of the War Department. After World War II, other industries moved into the Refuge to occupy buildings formerly used by the War Department. The Refuge was established in 1947 by an Act of Congress, Public Law 80-361, which transferred to the Service lands administered by the War Department and Soil Conservation Service. The Congressional Act establishing the Refuge mandated that the land would be managed with four broad objectives: wildlife management, agricultural development, recreational use, and industrial operation.

Prior to environmental laws, the industrial tenants on the Refuge often used unlined landfills and dumps to dispose of wastes generated by their operations. The contaminated areas on the Refuge reflect the broad range of substances used in various industrial and Refuge activities. In 1987, the Refuge was placed on the Superfund National Priorities List, a national list of hazardous waste sites prioritized for cleanup. A Refuge-wide remedial investigation and feasibility study was conducted to characterize the contamination on the Refuge. Although numerous sites were characterized, four sites were identified as containing PCB wastes. The locations of these sites are shown on Figure 1: 1) Job Corps Landfill, 2) Water Tower Landfill, 3) Area 9 Landfill and 4) Area 9 Building Complex.

The Service initiated a Natural Resource Damage Assessment for the release of PCBs on the Refuge. Natural Resource Damage Assessment (NRDA) is the process for determining what injury has occurred to natural resources and the services they provide as a result of a release of a hazardous substance, and what compensation is necessary in order to restore the injured resources to a pre-discharge condition. The damage assessment performed for the Refuge was based on lost services as a result of the PCB contamination, including fishing, wildlife observation, camping, picnicking, and swimming/boating. A Record of Decision was signed in August 1990 that selected the environmental remedy for the PCB cleanup. A Consent Decree was signed in 1991 between the Department of Interior and Schlumberger Industries, Inc., that included the cleanup activities and costs, and a negotiated $2.5 million settlement for injury to or destruction or loss of natural resources resulting from releases of hazardous substances at or from the PCB sites. The $2.5 million will be spent solely on restoration activities that will compensate for the adverse impacts to natural resources and the services they provide as a result of the discharge of PCBs. Natural resources are defined in the NRDA regulations as land, fish, wildlife, biota, air, water, ground water, drinking water supplies, and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by the United States, any State or local government, or any foreign government.

The NRDA program is authorized under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), more commonly known as Superfund. Authority for NRDA also lies under the Clean Water Act and the Oil Pollution Act. The NRDA regulations were promulgated by the Department of Interior in 1986 under 43 CFR Part 11. Other laws, regulations, and policies that are applicable to the development and implementation of this NRDA Restoration Plan include: The Crab Orchard National Wildlife Refuge Act of 1947, the Endangered Species Act of 1973, the Migratory Bird Treaty Act of 1918, the National Wildlife Refuge System Administration Act of 1966, the Refuge Recreation Act of 1962, the National Environmental Policy Act of 1970, the National Historic Preservation Act of 1966, the Fish and Wildlife Coordination Act, the U.S. Fish and Wildlife Mitigation Policy of 1981, and the Crab Orchard National Wildlife Refuge Industrial Policy of 1980.

Chapter 2 - Restoration Goals and Objectives

The restoration alternatives that are selected to compensate for the impacted natural resources and the services they provide will incorporate the following restoration goals or objectives.

Restore the services lost resulting from the release of PCBs.

* Conserve animal and plant diversity by restoring and protecting natural ecosystems, with particular attention given to the presettlement condition of the landscape.

* Protect, enhance, and manage natural resources and ecosystems to sustain optimum fish and wildlife populations with emphasis on the preservation, enhancement, and restoration of viable populations of federal and state endangered and threatened species.

* Incorporate an ecosystem and watershed-based approach.

* Be consistent with other Refuge natural resource management plans.

This Restoration Plan is consistent with the requirements set forth in the Consent Decree. As stated in the Consent Decree, the $2.5 million settlement will be for injury to or destruction or loss of natural resources resulting from releases of hazardous substances at or from the PCBs Operable Unit on the Refuge.

The Restoration Plan will also be consistent with the August 5, 1992, draft restoration guidance entitled "Restoration Planning and Implementation Relative to Natural Resource Damage Settlements or Awards." It is stated in this guidance when planning and implementing a restoration action, priority shall be given to restoration actions that accomplish 1) restoration of in-kind natural resources at the same location, 2) restoration or replacement of in-kind natural resources in the vicinity of the loss, and 3) replacement or acquisition of similar natural resources nearby. Since the responsible party has agreed to restore the PCB sites as part of the remediation or cleanup, this Restoration Plan will address restoration of areas outside of the actual PCB sites but on the Refuge. Acquisition of additional lands will also be considered in the Restoration Plan.

The remediation or cleanup will result in partial restoration of natural resources and the services they provide. This is due to the fact that a landfill will still be present at the Area 9 site, although the PCB levels will be at a much lower level than found initially. Also, the sites will be restored with prairie grasses, vegetation other than what was present prior to cleanup.
The implementation of the Restoration Plan will occur after the PCB Operable Unit site remediation is accomplished. There may be the opportunity for another settlement with a responsible party for either the PCB or other contamination on the Refuge. This will allow the Service to assess other damages associated with the contaminants. A potentially responsible party (PRP) analysis was prepared for the U.S. Army Corps of Engineers in 1992. Under the authority of CERCLA Section 107, this report identified PRPs that may be liable for response costs, health

assessment costs, and natural resource damages associated with a release of hazardous substances. No further investigation has been done since the 1992 report. The Service opted to prepare the NRDA Restoration Plan at this time instead of waiting for any additional settlements. This decision was made since it is uncertain at this time whether there will be any future settlements. In addition, it is reasonable to spend the $2.5 million on restoration measures that will benefit wildlife and associated habitats at this time instead of delaying that benefit for sometime in the future.

Chapter 3 - Restoration Alternatives

3.1 Process for Identifying Alternatives

According to 43 CFR Part 11.82 of the NRDA regulations, a reasonable number of possible alternatives shall be developed for the restoration, rehabilitation, replacement, and/or acquisition of the equivalent of the injured natural resources and the services those resources provide. Each of the possible alternatives may consist of actions that would achieve these purposes singly or in combination with others. Restoration or rehabilitation actions include those activities that will return injured natural resources to their baseline condition as measured in terms of the physical, chemical, or biological properties that the injured resources would have exhibited or the services that would have been provided by those resources had the discharge or release not occurred. Replacement or acquisition of the equivalent means the substitution of the injured natural resources with resources that provide the same or similar services. All of these actions are in addition to the cleanup response actions that are undertaken at the specific contaminated sites.

In order to identify restoration alternatives for the NRDA Restoration Plan, a public scoping meeting was held on December 6, 1994. Twelve individuals presented their views on restoration and submitted ideas for restoration alternatives. Another meeting was held on December 14, 1994, with eleven Refuge, Ecological Services and Fishery Resources Office staff to discuss restoration alternatives and submit ideas for restoration. All of the ideas for restoration alternatives that have been submitted at both meetings were considered in the writing of this Restoration Plan.

3.2. Identified Restoration Alternatives

The following restoration alternative ideas were submitted at the scoping meetings that were held with the public and Service staff. The 'General Suggestions' are not restoration alternatives but general guidance when selecting and implementing the selected restoration alternatives.

Reforestation in order to reduce fragmentation and provide larger tracts of contiguous forested land on the Refuge

Shoreline stabilization along Crab Orchard Lake and riparian restoration along adjoining streams and rivers

Prairie restoration

Savanna restoration

Wetland restoration

Enhancement of the Wilderness Area

Enhancement of the Research Natural Areas

Nursery for propagation of local genotypes in seeds and seedlings

Wildlife reintroduction, e.g., otters, bison

Land acquisition

Diking off the east end of Crab Orchard Lake at SR 148 to establish a moist soil/mudflat area

Bass feeding in the rearing pond for a longer period of time in order to increase the survivorship once the bass are released into the lake

Exotic plant species control

Public education-outreach programs/exhibits - e.g., fish contamination; Superfund cleanup activities; how industry, the public, and the Refuge can work together; what is restoration

Advertising campaign for special events - e.g., incineration, restoration activities

Commercially remove the carp from Crab Orchard Lake

Wildlife population monitoring programs

Habitat enhancement around industrial areas

Forestry demonstration project for Boy Scouts of America

Improve boat docks

Reopen the beaches

Upgrade the cemeteries

Crab Orchard campground renovation

Boat tours/boat acquisition

Aesthetic improvements such as landscaping, signage, and building improvements

Improve or build new marinas

Law enforcement improvements

Monitoring of public perception regarding the contamination

General Suggestions:

Look at presettlement conditions

Seek partnerships with various groups

Look at similar habitat restoration projects for guidance

Look at the practicality of a restoration project

Seek volunteer help

Think Regionally, beyond Refuge boundaries

3.3. Alternatives Considered But Not Given Detailed Study

Although $2.5 million has been allocated for restoration, it is not sufficient to cover all of the restoration alternatives that were suggested. Therefore, it is necessary to narrow down the list to those alternatives that carry out the intent of the NRDA program, are consistent with the restoration goals outlined in this Plan and are cost-effective. The restoration alternatives that were eliminated and the rationales for the elimination are as follows:

Wetland restoration - The Refuge presently has 220 acres of moist soil/mudflat wetlands and 10,000 acres of deepwater habitat with an additional wetland complex presently under development. The presettlement condition of the aquatic habitats of this area consisted largely of rivers, creeks, oxbow lakes and the marshes along these habitats. Since attaining presettlement condition of the landscape is one of the goals of the Restoration Plan, wetland restoration of the marshes along the rivers and creeks, identified as riparian restoration, is a restoration alternative that will be evaluated further.

Nursery - The costs associated with the establishment of a nursery are excessive and the plant needs of the Refuge can be met by the nurseries of the Illinois Department of Natural Resources.

Diking East Crab Orchard Lake - This restoration alternative would include the construction of a berm to create a mudflat/moist soil area in the bay near the Area 9 Landfill. This activity would be a response action in order to isolate the contaminants in the bay from the rest of Crab Orchard Lake. A response action would qualify as a cleanup activity, not a restoration measure. In addition, in order to more fully evaluate the impact

of a berm on the lake and the watershed as a whole, an extensive and costly hydrological and engineering study of Crab Orchard Lake would be necessary. Since the costs may outweigh the benefits, and since the Refuge has a number of other mudflat/moist soil areas, diking of the lake will not be considered further.

Exotic species control - Exotic species control will be incorporated into the selected habitat restoration activities.

Advertising campaign for special events - The costs for a major advertising campaign are excessive. Some advertising will be incorporated in the public education/outreach alternative.

Commercially remove the carp from Crab Orchard Lake - It would be necessary to remove all the carp from the lake in order for carp removal to be effective. Carp removal through netting or the use of chemical treatment would also remove the more desirable aquatic species from the lake system. Therefore, carp removal is not a feasible activity.

Wildlife population monitoring programs - Monitoring programs for both wildlife and plants will be implemented as part of the habitat restoration efforts.

Habitat enhancement around existing industrial areas - Since there is limited money to spend on habitat restoration, it is preferable to focus efforts on the non-industrial areas of the Refuge than attempt to attract wildlife to the existing industrial areas. Habitat restoration will be considered, however, for the abandoned industrial areas of the Refuge.

Forestry demonstration project for Boy Scouts of America - The reforestation restoration effort will likely include a demonstration or exhibit of the benefits of managed reforestation.

Boat docks, beaches, Crab Orchard campground renovation, boat tours/boat acquisition - NRDA restoration activities must directly benefit the natural resources, which, in turn, indirectly benefits the recreational use of the Refuge. Natural resources as defined under the NRDA regulations includes land, fish, wildlife, biota, air, water ground water, drinking water supplies, and other such resources held in trust by the United States government. This definition does not include such things as boat docks and campgrounds.

Upgrade the cemeteries - Upgrading implies mowing and other landscaping efforts and does not qualify as a viable restoration activity.

Aesthetic improvements such as landscaping, signage, and building improvements - Signage and building improvements would not directly benefit the natural resources of the Refuge. Although landscaping could be beneficial to wildlife, it implies a more manicured approach to land manipulation. It is preferred that the activities selected for

implementation include the restoration of the more natural pre-settlement condition of the land.

Law enforcement improvements - Although this may result in benefit to natural resources, such as with anti-poaching efforts, generally law enforcement improvements would not directly benefit the natural resources of the Refuge.

Monitoring of public perception regarding the contamination - This restoration alternative idea would not directly benefit the natural resources of the Refuge.

3.4. Alternatives Considered

The following restoration alternatives are being considered for further study. These alternatives were selected based on consistency with the restoration goals of promoting biological diversity, protection and restoration of endangered and threatened species, consideration of the presettlement conditions, and incorporating an ecosystem approach. In addition, the selection of alternatives is based on compliance with the intent of NRDA to implement restoration activities that will adequately compensate for adverse impacts to natural resources and the services that they provide plus the cost-effectiveness of the alternatives. These restoration alternatives include:

NO ACTION. This alternative looks at the ability of the injured resources to recover on their own under the implementation of existing Refuge management plans. Under existing management plans, 8,500 acres of scrub brush land will be allowed to naturally mature to forest, 3,100 acres of pine and 500 acres of pasture and cropland will be converted to deciduous forest. Approximately 300 acres of cropland will be converted to shallow wetlands and moist soil units. Approximately 225 acres of both grassland and cropland will be converted to prairie. The existing Refuge management plans do not include shoreline or riparian restoration activities except for providing bat habitat along river courses and buffer areas to prevent cattle from approaching shorelines. Basically, no action is not to spend the $2.5 million allocated for natural resource damage restoration. Since the Refuge is committed to spend the $2.5 million on restoration, the no action alternative will not be considered as a viable alternative further in this document.

The following restoration alternatives include activities that are consistent with existing Refuge management plans, are above and beyond what would normally occur, and allow the Refuge to carry out its overall mission.

REFORESTATION. This restoration activity would include the reforestation of 1,520 acres of Refuge land in order to provide larger tracts of contiguous forested land on the Refuge, particularly for neotropical migrant songbirds. This restoration activity would include the planting of native hardwood seedlings, primarily oaks and hickories. Lands available for reforestation include pine plantations, shrub/brush land, pasture, cropland, phasing out of industrial areas, and lands that may be acquired in the future. The existing Refuge management plans identify 500 acres of cropland and pasture for reforestation, the conversion of 3,000 acres of pine plantations

to forest, and 8,500 acres of shrub brush to reforest naturally. The 1,520 acres of reforestation included in this Restoration Plan would consist of actual tree planting of the shrub brush lands, pine plantations, industrial phase-out areas, and newly acquired lands. As stated in "The Changing Illinois Environment: Critical Trends" document, the biological diversity of Illinois is being carried in large part by its forests. Most mammals, birds, and amphibians need forested land for at least part of their life cycles. The woods are home to more than 420 species of birds and other vertebrates. Nearly half of the plant species rare to Illinois are found in its woods. Forest fragmentation has reduced the ability of Illinois forests to maintain biological integrity. The gradual loss of biological diversity observed in Illinois forests in recent decades is reflected in the adaptation to the forest by generalist plant and animal species such as Japanese honeysuckle and brown-headed cowbirds. Forested land predominated the landscape of southern Illinois in presettlement times. The benefits associated with reforestation include providing habitat for neotropical migrant songbirds and other forest-dwelling animals, promotion of biological diversity through larger tracts of contiguous forested land, and enhanced recreational opportunities such as wildlife observation. These benefits would help to compensate for the loss in services such as wildlife observation, camping, and picnicking.

SHORELINE AND RIPARIAN RESTORATION. A severe erosion problem exists along the shoreline of Crab Orchard Lake and adjoining streams, and to a lesser extent along Little Grassy and Devil's Kitchen Lakes. This restoration activity would include the stabilization and restoration of approximately four miles of lake shoreline and riparian streambank on the Refuge. The identification of restorable shoreline and streambank would be based on an assessment of the watershed as a whole. Shoreline and riparian restoration is not included in existing Refuge management plans. Stabilization methods would be evaluated and implemented in those areas where they would be most effective to stabilize and restore the streambanks and shoreline. The "willow-post" method of stabilization would be considered along with the use of "lunkers" in order to stabilize the riparian corridors. The willow-post method includes the planting of willow posts and various native grasses and legumes. The lunkers are large wooden pallets that are placed below the surface of the water along the eroding bank. Both the plantings and the lunkers help to stabilize the banks. A variation of the streambank methods would be implemented for the lake shoreline stabilization. Almost 50% of the amphibians and reptiles known in Illinois have a stream-dependent larval stage and nearly all of them deposit their eggs in water. These complex life cycles are dependent on high quality, varied stream habitat. Sedimentation in streams and lakes has resulted in a decline in plant life. The benefits associated with shoreline and riparian restoration include a reduction in soil erosion, water quality improvement, enhancement of aquatic habitat which, in turn, benefits aquatic organisms, and recreational use improvement. These benefits would help to compensate for the loss in services such as fishing, swimming, and boating.

GRASSLAND RESTORATION. This restoration activity includes the enhancement of 550 acres of existing Refuge pasture and grazing land. Enhancement activities would include the planting of native prairie and savanna grass and forb seeds and seedlings. The existing Refuge management plans have identified 300 acres of pasture or grazing land for grassland restoration. There are an additional 2,000 acres of grazing land on the Refuge. The 550 acres included in this

Restoration Plan would consist of the enhancement of 550 acres of the 2,000 acres of existing pasture or grazing land. The benefits associated with grassland enhancement include reestablishment of native vegetation, promotion of biological diversity, providing habitat for various animals, including endangered and threatened species, and providing recreational opportunities such as wildlife observation. These benefits help to compensate for the loss in services such as wildlife observation, camping, and picnicking.

ENHANCEMENT OF THE WILDERNESS AREA AND THE RESEARCH NATURAL AREAS. This restoration activity would include the enhancement of 200 acres of the Wilderness Area and/or the Research Natural Areas. The enhancement activities would include exotic plant removal, trail maintenance, prescribed burning, planting of native vegetation, and stabilizing streambanks. These enhancement activities are not included in existing Refuge management plans. The wilderness area includes 4,050 acres and the research natural areas include 1,283 acres of primarily forested land. The enhancement activities would help to compensate for the loss in services such as wildlife observation.

WILDLIFE REINTRODUCTION. This restoration activity includes the reintroduction of native wildlife such as the river otter, the American bison, and largemouth bass. The Refuge provides suitable habitat for the river otter. The Illinois Department of Natural Resources has an established program for the reintroduction of the river otter in Illinois that the Refuge could participate in. Otter reintroduction has been considered in the Refuge landscape plan. The reintroduction of the American bison could be a component of the grassland enhancement on the Refuge and also provide a valuable public outreach opportunity. There is an existing program for stocking largemouth bass in Crab Orchard Lake. This restoration activity would provide additional funding to raise the bass to a larger size prior to release. Wildlife reintroduction would help to compensate for the loss in services associated with wildlife, such as fishing and wildlife observation.

PUBLIC EDUCATION/OUTREACH PROGRAM. This restoration activity would include various public education and outreach efforts associated with restoration. These would include the development of exhibits, designing brochures, organizing slide presentations, building nature trails, advertising, and organizing a volunteer/stewardship program to assist with the habitat restoration projects. For example, a public education and outreach program may be developed around the Superfund and NRDA programs emphasizing the message that "prevention" of contamination is a very cost effective strategy when compared to the costs of cleanup and restoration. This could include an exhibit in the Visitor Information Center explaining the cleanup process and how industry and various agencies can work together. The exhibit could also include an explanation of the restoration activities in terms of what they are and the associated benefits to the natural resources of the Refuge. Self-guided trails at both a cleanup site and at one of the restoration sites, such as in a reforested area, could all be part of the public education effort. The damages were based on lost services associated with impacted natural resources, which relates to the public's perception of the contamination. This restoration activity would help

to improve the public's understanding of a problem and the action that was taken to compensate for the impacts to natural resources.

LAND ACQUISITION. This restoration activity would include acquisition of areas that provide services equivalent to those lost at the site. Approximately two hundred acres of land either adjacent to the Refuge or lands identified as privately owned inholdings would be purchased. Compensation for lost services and impacts to natural resources could be made through habitat acquisition. The site would be protected and/or enhanced so that, over time, it would provide full analogous ecological functions. Enhancement and/or active restoration measures would depend on the restoration needs at each site. Acquisition combined with active restoration would cost more per acre and result in acquisition of fewer acres, but would result in a faster recovery of natural resources. Alternatively, if purchased and managed to control land use practices that degrade natural resources (e.g. industrial development, agriculture, livestock grazing, etc.), suitable habitat quality could recover without active restoration.

Chapter 4 - Affected Environment

4.1 Introduction

Crab Orchard National Wildlife Refuge occupies a 43,550 acre area in southwestern Williamson County, Illinois, and small portions of adjacent Jackson and Union Counties, in the southern tip of Illinois. The Refuge encompasses three man-made lakes, namely Crab Orchard Lake, Devils Kitchen Lake and Little Grassy Lake, and surrounding upland areas. The Refuge is located in what is known as "The Land Between the Rivers," because of its geographical location between the Mississippi and Ohio Rivers. Portions of the Shawnee National Forest lie to the south of the Refuge and Giant City State Park is located southwest of the Refuge.

The Refuge lies in a transition zone of several ecosystems. As such, this area is very diverse in species composition and habitat types. According to "An Ecosystem Approach to Fish and Wildlife Conservation," the Refuge lies in the Upper Mississippi River/Tallgrass Prairie watershed unit.

According to Schwegman's "Natural Divisions of Illinois," the northern area of the Refuge lies in the Southern Till Plain Division/Mt. Vernon Hill Country Section and the southern area lies in the Shawnee Hills Division/Greater Shawnee Hills Section. In presettlement times, upland forests covered most of the rolling, hilly topography of the north while the unglaciated hill country of the south was characterized by a high east-west escarpment of sandstone cliffs with deep forested ravines.

Based on studies of presettlement (defined as prior to European settlement) conditions that existed in the early 1800s in Williamson County, vegetation included approximately 81% oak-hickory forest, 16% savanna and 3% prairie. Some studies have shown prairie to comprise up to 8% of the landscape in the Williamson County area in presettlement times. A good portion of the Refuge lies in Williamson County. Although the presettlement Refuge land was largely forested, there were areas of open grassland, either as transition zones between forest and prairie or actual prairie. The aquatic habitats of the presettlement condition of the Refuge lands consisted of rivers, creeks and oxbow lakes. Some marsh areas were found along the floodplains of streams.

The presettlement Refuge landscape has been altered by the damming of rivers for the construction of the three reservoirs, by various agricultural practices, and industrial activities. Rivers, creeks, and associated upland forested ridges, ravines, and rolling terrain have been replaced with 8,700 acres of deepwater habitat and approximately 7,000 acres of farmland. However, flat to gently rolling terrain still exists around the man-made lakes in the northern portion of the Refuge while steep cliffs and rocky outcroppings are found in the unglaciated southern part of the Refuge.

4.2. Climate and Soils

Average annual precipitation for the Refuge is approximately 45 inches. Precipitation for 1994 totaled 36.64 inches, compared to 52.53 inches during the floods of 1993. Temperatures in 1994 ranged from a low of -14 in January to a high of 98 in June. In 1993, temperatures ranged from a low of 3 in February to a high of 102 in July and August. In 1994, no problems were observed with high water elevations since precipitation was below normal throughout most of the year.

Soils are developed primarily by the action of climate and living plants and animals upon parent materials. Relief or topography indirectly affects soil formation by influencing drainage conditions. Climate is important in soil development because it influences the type of vegetation growing on soils and also determines the type of weathering that takes place. The humid, temperate climate of southern Illinois is conducive to the growth of forest, although prairie areas existed at the time of settlement. In general, soils developed under grass are darker colored and higher in organic matter than those developed under forest.

Most of the soils in Williamson County developed from glacial till, deposited by the ice of glaciers; loess, deposited by the wind; or alluvium and lake-bed sediments, deposited by water. In the southern portion of the County, soils were formed in place by the weathering of sandstone on the steep, unglaciated slopes.

4.3 Natural Resources and Management

The Refuge is a mosaic of various types of forests, grasslands, old fields, scrub brush, cropland, and wetlands. Deciduous forested land occupies 13,683 acres and pine plantations comprise 3,092 acres. Grasslands occupy 2,300 acres including 75 acres of prairie and the rest as grazing units. Old fields and scrub brush account for 8,500 acres consisting of mixed grasses and shrubs. There are 5,000 acres of cropland. Wetlands consist of 10,000 acres of lakes, ponds, and streams and 2,200 acres of shallow water/seasonal wetlands including forested wetlands and moist soil units.

The first federally designated 'Wilderness' area in Illinois covers 4,050 acres in the southern part of the Refuge. There are twelve Research Natural Areas on the Refuge. Research Natural Areas are lands permanently protected by the federal government to ensure continuation of the nation's diverse natural heritage. The twelve Research Natural Areas comprise 1,353 acres and are representative of various forested community types.

The vegetative cover and habitat types on the Refuge are very diverse. One study of vascular plants in the southern portion of the Refuge listed 573 species, 115 of which are trees and shrubs.

Crab Orchard National Wildlife Refuge hosts a wide variety of animal life. There are over 240 species on the Refuge bird check list. These include 25 species of waterfowl, 35 species of shore/wading birds, 20 species of raptors and 85 species of neotropical migrant songbirds. There

is a large number of wintering Canada geese found on the Refuge. There are 34 species of mammals including whitetail deer, bobcat, beaver, raccoon, coyote, and fox. The Refuge is host to 18 species of amphibians and 28 species of reptiles including the red-backed salamander, leopard frog, copperhead snake and red-bellied turtle. There are 52 species of fish including largemouth bass, crappie, and bluegill. In addition, there is a large variety of insects that inhabit the Refuge.

A long-term natural resource stewardship responsibility overshadows the management of the Refuge's natural resources. One of the vision goals of the Refuge for fish and wildlife populations is to protect, enhance, and manage natural resources and ecosystems to sustain optimum fish and wildlife populations, with emphasis on federal and state threatened and endangered animal and plant species. Refuge management activities that implement this vision goal include prescribed burning, timber thinning/harvesting to convert non-native pine stands to native hardwoods, and reforestation. Additional Refuge management activities include the establishment of moist soil/mudflat units primarily for shorebirds and waterfowl, farming practices that provide feeding and loafing areas for migrating and wintering waterfowl, and prairie restoration.

4.4. Threatened and Endangered Species

Federally threatened and endangered species that are or may be found on the Refuge include:

Bald eagle
Haliaeetus leucocephalus

Least tern
Sterna antillarum

Peregrine falcon
Falco peregrinus anatum

Gray bat
Myotis grisescens

Indiana bat
Myotis sodalis

Mead's milkweed
Asclepias meadii

Bald eagles are successfully reproducing on the Refuge. There are three active bald eagle nests. The Refuge is home to additional migrating bald eagles that spend the winter in the southern Illinois area. The eagle count during the winter of 1994-95 was 24 and the official mid-winter eagle survey of the same time period reported 14 eagles observed.

Least terns and peregrine falcons have been sighted on the Refuge during migration.

Although the gray bat and the Indiana bat have not been sighted on the Refuge, there is suitable habitat for these species. However, both of these species have been found in counties near the Refuge.

It is very unlikely that Mead's milkweed occurs on the Refuge. Only three populations are known to exist in southern Illinois and these are found in remnant barren areas in the Shawnee National Forest.

In addition to these federally threatened and endangered species, there are numerous candidate species that are under consideration for federally threatened and endangered species status. Also, there are Illinois state listed threatened and endangered species that may be found on the Refuge.

4.5. Public Use

There is a wide spectrum of recreational opportunities on and around Crab Orchard, Little Grassy, and Devil's Kitchen lakes. Public use at the Refuge is focused around the Visitor Information Center that provides educational programs, exhibits, informational hand-outs, and a meeting place. The Refuge serves as an outdoor classroom for students and teachers. The Refuge provides interpretive foot trails, interpretive auto tours, and boat cruises. Wildlife observation is the single most popular recreational activity on the Refuge. Fishing and hunting are also popular sports on the Refuge, along with boating, camping, and picnicking.

4.6. Industry/Economy

In keeping with the Refuge's industrial mandate, there are approximately 25 industrial facilities located on the Refuge that provide jobs for the local communities. Industrial activities range from manufacturing and storage facilities to administrative offices. In excess of $45 million is generated annually by the industrial tenants. The Refuge, nestled between the cities of Marion and Carbondale, is an important asset for the local economy through industrial, agricultural, and recreational activities. The tourism industry also benefits from the recreational opportunities such as fishing, wildlife observation, hunting, and camping that are offered on the Refuge.

4.7. Agriculture

In keeping with the agricultural mandate of the Refuge, farming tenants utilize approximately 5,000 acres of Refuge land under a cooperative farm program, growing corn, milo, red clover, soybeans, wheat, and hay. An additional 2,212 acres of Refuge land is used for grazing. Agricultural practices are meshed as much as possible with the Refuge's natural resource management. Cooperative farming and permittee grazing are the primary management tools used to provide feeding and loafing areas for migrating and wintering waterfowl.

4.8. Cultural Resources

Crab Orchard National Wildlife Refuge contains a rich collection of archeological and historic resources representative of all cultural periods for the past 12,000 years. With just 2% of the Refuge surveyed for archeological sites, 121 sites have been recorded on the Refuge. The site-type for the Middle Woodland Crab Orchard tradition is located on the Refuge. The Refuge also contains 55 cemeteries and a reported blockhouse location. The Refuge has no properties listed on the National Register of Historic Places. Sixty-five properties have been determined not eligible for the National Register, including the Ordnance Plant. The remainder are considered eligible pending evaluation.

Chapter 5 - Restoration Alternatives and Environmental Consequences

5.1 Identification of Major Impacts to be Evaluated

The following major impacts will be evaluated for each of the restoration alternatives that have been identified in Chapter 3. The major impacts include:

Impacts on Migratory Birds

Impacts on Threatened and Endangered Species

Impacts on Recreational Use

Impacts on Local Economy

Impacts on Floodplains and Wetlands

Impacts on the Environment

Impacts on Cultural Resources - For all of the restoration alternatives listed below, the potential for project activities to affect prehistoric and historic resources, Native American human remains and cultural objects will be determined early in project planning. To this end, the procedures in 36 CFR 800 implementing Section 106 of the National Historic Preservation Act, requirements of the Native American Graves Protection and Repatriation Act, and policies and standards specified in the Fish and Wildlife Service Manual 614 FW 1-5 will be achieved.

5.2. Restoration Alternatives

NO ACTION

The no action alternative is to not spend the $2.5 million allocated for natural resource damage restoration. The goal of NRDA is to make the environment and public whole for injuries to natural resources resulting from hazardous releases at the site. This goal is achieved through returning injured natural resources to baseline and compensating for interim losses of natural resources through restoration, rehabilitation, replacement or acquisition of equivalent natural resources. The no action alternative does not allow for restoration, rehabilitation, replacement, or acquisition of equivalent resources injured by site releases. Remediation of the site will not result in full restoration of injured resources. Without restoration, natural resources and the services they provide may never reach pre-release conditions and the public would not be compensated for injury to natural resources. The no action alternative is not consistent with the project mission and goals nor the intent of NRDA and will not be further considered.

REFORESTATION

This restoration activity would include the reforestation of 1,520 acres in order to provide larger tracts of contiguous forested land on the Refuge. This restoration would occur on shrub brush land, pine plantations, industrial phase-out areas, and newly acquired lands. Lands would be planted with native hardwoods, primarily oaks and hickories. Reforestation under this restoration plan would accelerate the reforestation effort that is currently implemented under existing Refuge management plans.

Migratory Birds

Reforestation would provide larger tracts of contiguous forested land. These Refuge lands could connect with other lands beyond the Refuge boundary such as the Shawnee National Forest. Reforestation would greatly benefit the neotropical migrant songbird populations by providing the habitat they need for nesting, roosting, and feeding, particularly such birds as the American redstart, yellow-throated vireo, and the hooded warbler that are highly sensitive to forest fragmentation. Forested habitat would also benefit other migratory birds such as the red-shouldered hawk.

Threatened and Endangered Species

Of the federally endangered and threatened species, the bald eagle and Indiana bat are endangered species that would benefit from reforestation of Refuge land. The bald eagle roosts and nests in forested areas near water bodies and the Indiana bat requires a wooded and riparian summer habitat. The cerulean warbler, which is a category 2 candidate species for federally endangered or threatened status, is a neotropical migrant songbird that is highly sensitive to fragmentation of forested habitat. Reforestation of Refuge land would benefit the cerulean warbler, along with the other neotropical migrant songbirds, including the Illinois state threatened brown creeper and veery. Reforestation would provide forested habitat for nesting and for feeding during migration for these neotropical migrant and resident songbirds, along with other wildlife that inhabit the forested lands.

Recreational Use

Reforestation would provide additional forested habitat on the Refuge. This would result in an increase in such recreational uses as wildlife observation, camping, picnicking, and hiking. Educational programs could also be offered that relate to reforestation and the value of larger forested tracts of land for wildlife.

Local Economy

The local economy would benefit from reforestation as a result of the increased use of the Refuge for such things as wildlife observation, camping and picnicking. The increased visitation would benefit such establishments as hotels, restaurants, grocery stores, and novelty shops.

Floodplains and Wetlands

Reforestation would benefit the floodplain and wetland areas that are adjacent to or located within the reforested land due to a reduction in erosion of the soils in the reforested areas. This reduction in erosion results from the stabilization of the soil from the trees and the understory vegetation, including shrubs and the herbaceous layer. Reforested lands would also provide upland areas for wildlife that inhabit wetlands and need uplands for part of their life cycle, such as for the red-spotted newt.

Environment

Reforestation would benefit the environment as a whole by providing habitat that dominated the landscape of southern Illinois in presettlement times. This, in turn, would promote the biological diversity that occurs in forested habitats and the wildlife that evolved with the forests. Forested areas cleanse the air improving air quality, and also serve as nature's air conditioners during warmer days. There would be some short-term impacts to the environment as a result of reforestation. These could include physical clearing, prescribed burning, or the use of herbicides on the more undesirable vegetation. These activities would be necessary in order to prepare the land for planting and manage the areas once trees are planted. Every effort would be made to reduce erosion onto surrounding land during restoration activities. There would be loss of other habitat types in order to accommodate the reforestation, including shrub brush land, pine plantations, and pasture land. However, the forested lands would provide more biologically diverse habitat on the Refuge than the habitats that were replaced.

SHORELINE AND RIPARIAN RESTORATION

This restoration activity would include the stabilization and restoration of approximately four miles of lake shoreline and riparian streambank on the Refuge. The identification of restorable shoreline and streambank would be based on an assessment of the watershed as a whole. Shoreline and riparian restoration are not included in existing Refuge management plans.

Migratory Birds

Shoreline stabilization and riparian restoration would have a beneficial impact on migratory birds, particularly the water birds such as herons, ducks, and geese. This restoration activity would reduce the erosion that presently occurs in the Crab Orchard Lake watershed, thus improving the habitat and water quality of the lakes and streams in the watershed. Aquatic organisms would

benefit from the habitat and water quality improvements, which in turn, would benefit animals that feed on the aquatic organisms, particularly migratory water birds.

Threatened and Endangered Species

Shoreline stabilization and riparian restoration would benefit the bald eagle, least tern, peregrine falcon, Indiana bat, and gray bat. Since all of these species inhabit areas that include aquatic environments, improving the aquatic habitats through shoreline and riparian restoration would benefit the wildlife that feed in these areas.

Recreational Use

Recreational use would benefit from shoreline stabilization and riparian restoration. This restoration activity would improve the aquatic habitat and water quality of the Refuge lakes and associated streams, thus providing benefit to the aquatic organisms. As a result of these improvements, it is expected that recreational use of the Refuge would increase, particularly for fishing, swimming, and boating. Educational programs may also be offered that relate to riparian and shoreline stabilization and restoration.

Local Economy

It is expected that the local economy would benefit from the shoreline stabilization and riparian restoration. This restoration activity would improve the habitat for aquatic organisms, particularly for the fish. This, in turn, would benefit the sport fishing of the Refuge lakes, thus improving the local economy through the patronizing of such businesses as hotels, restaurants, and camping facilities. The local economy may also benefit temporarily from contracts with local engineering and construction firms to assist the Refuge in performing a hydrological study and other activities related to shoreline and riparian restoration.

Floodplains and Wetlands

Shorelines and riparian corridors include the floodplains and wetlands that serve as transition zones between lakes and streams and the upland areas. The functions and values of floodplains and wetlands would be enhanced through stabilization and restoration of shorelines and riparian corridors, including such functions as water quality improvement, erosion control, flood reduction, and providing breeding and feeding areas for aquatic organisms.

Environment

Anticipated environmental impacts as a result of shoreline stabilization and riparian restoration would include: grading of soil to reduce the slope of the shoreline and streambanks, insertion of willow posts or other techniques used to stabilize the banks, and activities associated with planting of native vegetation. There may also be some temporary water quality impacts from an

increase in turbidity during the shoreline and riparian restoration activities. Every effort would be made to reduce erosion of soil onto surrounding land and into water during restoration activities. Presently, erosion occurs on a regular basis along the shoreline and streambanks within the Crab Orchard Lake watershed, particularly during heavy rainfall and strong wave action. The erosion results in water quality impairment due to the runoff of soil. The erosion also results in the loss of soil, associated seed base, and vegetation. This restoration activity would reduce erosion, improve water quality, and enhance aquatic habitat, which, in turn, benefits aquatic organisms.

GRASSLAND RESTORATION

This restoration activity includes the enhancement of 550 acres of existing Refuge pasture and grazing land. Enhancement activities would include the planting of native grass and forb seeds and seedlings. This restoration would allow the Refuge to improve additional grassland habitat than what is included in existing management plans.

Migratory Birds

Grassland restoration would increase habitat diversity for numerous migratory species that inhabit grassland areas including the bobolink, dickcissel, sedge wren, blue-winged teal, song sparrow, and the common yellowthroat.

Threatened and Endangered Species

Grassland restoration would provide habitat for the federally endangered and Illinois state endangered peregrine falcon. Grassland restoration would also benefit the Bachman's sparrow and the loggerhead shrike which are listed as category 2 candidates for federally threatened or endangered species status, and Illinois state endangered and threatened species, respectively. True prairie species that would benefit from grassland restoration include the Illinois state endangered upland sandpiper, northern harrier, and short-eared owl.

Recreational Use

Grassland restoration would benefit recreational uses such as wildlife observation, hiking, and hunting. This would be accomplished through improved habitat with the associated grassland species. Educational programs would be developed and presented that relate to grassland restoration.

Local Economy

The local economy would benefit by the increased use of the Refuge as a wildlife observatory, reflected in the patronizing of local businesses and establishments.

Floodplains and Wetlands

Grassland restoration would help reduce soil erosion by stabilizing the land through the establishment of native forbs and grasses. This reduced erosion would benefit the floodplain and wetland areas that are located in the same watershed as the restored grasslands primarily through reduction of sediment loading. The grasslands may include wetland areas, thus the wetlands themselves would benefit directly from the restoration. Benefits would include water quality improvement and enhanced wildlife habitat. Grassland restoration may also benefit wetland wildlife that inhabit upland areas during part of their life cycles, such as for salamanders and turtles.

Environment

Environmental impacts that may be associated with grassland restoration include preparation of the land for planting either through physical clearing, prescribed burning, or the use of herbicides on undesirable vegetation. Planting would be accomplished with either a planter or manual labor. Every effort would be made during the restoration activities to reduce soil erosion. Management of the restored grassland would be accomplished primarily through prescribed burning. Although the existing Refuge management plans include grassland enhancement activities, additional grassland improvements could be accomplished through this restoration activity.

ENHANCEMENT OF THE WILDERNESS AREA AND THE RESEARCH NATURAL AREAS

This restoration activity would include measures that can be taken to enhance the Wilderness Area and the Research Natural Areas on the Refuge. These measures may include such things as removing exotic vegetation, prescribed burning, promoting the growth of native vegetation, riparian restoration, trail maintenance, etc.

Migratory Birds

Since the Wilderness Area and the Research Natural Areas are largely forested, the migratory birds that would benefit from the enhancement of these areas primarily include the neotropical migrant and resident songbirds. These areas would provide both feeding and nesting habitat for birds migrating through and breeding on the Refuge. Other migratory birds that would benefit from the enhancement activities include the Cooper's hawk and the sharp-shinned hawk.

Threatened and Endangered Species

Threatened and endangered species that would benefit from the enhancement activities include the bald eagle, Indiana bat, and gray bat since these species rely on forested habitat for roosting, feeding or nesting. A federally proposed category 2 threatened or endangered species that would benefit from the enhancement activities is the cerulean warbler. There are a number of Illinois

state threatened or endangered species that would benefit from the enhancement of forested habitat including the veery, the brown creeper, and the dusky salamander.

Recreational Use

Enhancement activities would increase the recreational enjoyment of these areas primarily through wildlife observation and hiking. Educational programs could be developed and presented that relate to the enhancement activities and habitat improvement.

Local Economy

The increased use of the Refuge by the public through such activities as wildlife observation, hiking, camping, and picnicking would benefit the local economy by patronizing local businesses and establishments, such as hotels and restaurants.

Floodplains and Wetlands

Although the Wilderness Area and the Research Natural Areas are largely forested, they do include floodplains along the streams and forested wetlands in the depressional areas. The enhancement activities would include these wetland areas along with the more upland forested land. In addition, any floodplains and wetlands in the watersheds of the Wilderness Area or the Research Natural Areas would benefit from the enhancement activities due to reduced erosion and improved habitat.

Environment

Enhancement activities may include such things as removing the exotic plant species, prescribed burning, and trail stabilization. All of these activities would involve the use of manual labor. No earthmoving equipment would be used for the enhancement activities. It is preferred that exotic plants be removed either through physical removal or through burning. Herbicide use would be used for exotic plant removal only when absolutely necessary. Trails would be stabilized through the construction of steps along the slopes and the use of wood chips to reduce erosion. Enhancement of the Wilderness and Research Natural Areas is not included in existing Refuge management plans.

WILDLIFE REINTRODUCTION

This restoration activity includes the restoration or reintroduction of native animals. Two species under consideration are the river otter and the American bison. The Refuge could provide suitable habitat for either of these species. Another wildlife reintroduction restoration activity could be support for the existing bass reintroduction program.

Migratory Birds

Wildlife reintroduction would be indirectly beneficial to migratory birds through the promotion of biological diversity.

Threatened and Endangered Species

Wildlife reintroduction would benefit threatened and endangered species by reintroducing the Illinois state endangered river otter. Also, threatened or endangered species would benefit through promotion of biological diversity.

Recreational Use

Depending on the species that would be selected, wildlife reintroduction would benefit the recreational uses of wildlife observation, hiking, camping, picnicking, and fishing. Educational programs could be developed and presented that relate to wildlife reintroduction.

Local Economy

Depending on the species selected for reintroduction, wildlife reintroduction would improve the local economy. For example, the reintroduction of bison on a restored grassland would be very attractive to tourists. This, in turn, would bring in business to the local establishments such as hotels and restaurants.

Floodplains and Wetlands

Wildlife reintroduction would benefit floodplains and wetlands if a species was selected for reintroduction that inhabits either floodplains or wetlands, such as the river otter. Restoration of this native species would promote the natural biological diversity of the riverine ecosystem.

Environment

Environmental impacts would be associated with the bison reintroduction. Impacts would result from the construction of fence, the treading of vegetation by the bison, and possible runoff from the grazed areas into nearby streams. These impacts could be minimized by periodically moving the bison to alternate grassland areas. This would allow the grazed areas to recover from bison use. There are no anticipated environmental impacts from otter reintroduction or the bass reintroduction program.

PUBLIC EDUCATION/OUTREACH PROGRAM

This restoration activity would include various public education and outreach efforts associated with restoration. These could include exhibits, brochures, slide presentations, nature trails,

advertising, and organizing a volunteer/stewardship program to assist with the habitat restoration projects. A public education program could be developed around the Superfund and NRDA programs, including exhibits explaining the cleanup process, the restoration activities, and how industry and various agencies can work together for a common good. Self-guided trails at both a cleanup site and at one of the restoration sites could all be part of the public education effort.

Migratory Birds

Public education/outreach would benefit migratory birds indirectly through the education process. Through education, the public will better understand, appreciate, and respect migratory birds and their associated habitats.

Threatened and Endangered Species

Public education/outreach would benefit threatened and endangered species indirectly through the education process. Through education, the public would better understand and appreciate threatened and endangered species, and the importance of the restoration and protection of their habitats.

Recreational Use

Public education/outreach is a component of recreational use. As such, recreational use would benefit by the implementation of public education and outreach activities.

Local Economy

It is anticipated that the local economy would benefit from public education/outreach through increased awareness by the public of the Refuge and its resources, with a desire to better understand and take part in activities on the Refuge. This would be a boost to the local economy through increased tourism.

Floodplains and Wetlands

The flood plains and wetlands would benefit indirectly by public education/outreach through the public's understanding and appreciation of various habitats, leading to an increased desire to protect and restore these habitats.

Environment

The environment would benefit as a whole from public education/outreach through a better understanding and appreciation for the environment, and a desire to protect and restore valuable habitats.

LAND ACQUISITION

This restoration activity would include the acquisition and/or enhancement of approximately 200 acres of land either adjacent to the Refuge or lands identified as privately owned inholdings. The acquired land would be managed according to existing Refuge management plans. Although land acquisition is always an option for the Refuge, the Refuge would be able to purchase additional land under NRDA.

Migratory Birds

Migratory birds would benefit from land acquisition through the protection and active restoration of additional land within the Refuge boundary. This land may otherwise be developed for other uses.

Threatened and Endangered Species

Likewise, threatened and endangered species would benefit from an increased Refuge land base through the protection and enhancement of this land under the National Wildlife Refuge System. This land may otherwise be developed for other purposes.

Recreational Use

Land acquisition would benefit recreational use as do the other public Refuge lands. The recreational uses of the acquired land would depend on the landscape and its associated habitats.

Local Economy

Likewise, the local economy would benefit depending on the recreational uses offered by the acquired land.

Floodplains and Wetlands

Floodplains and wetlands would benefit by land acquisition if acquired land included floodplain and wetland habitat. The benefit would lie in the protection and enhancement offered to the land under the National Wildlife Refuge System.

Environment

The environment of the Refuge would benefit from land acquisition by providing larger tracts of contiguous protected habitat and the associated benefits to wildlife. The land would be managed

according to existing Refuge management plans, allowing such activities as reforestation and prescribed burning.

Chapter 6 - Costs of Restoration Alternatives

The costs for the various restoration alternatives are as follows.

REFORESTATION

Reforestation costs include seedlings, preparation of the soil for planting, actual planting, planting equipment, tree shelters, tree mats, maintenance of the planted area, and herbicides. Seedling costs alone are estimated at $184 per acre for primarily oak species. When considering all the activities and equipment necessary for reforestation, the cost is estimated to be $500 per acre. This restoration alternative includes the reforestation of 1,520 acres of Refuge land, at $500 per acre, for an estimated cost of $760,000.

SHORELINE AND RIPARIAN RESTORATION

The willow-post method is a proven method of stabilizing riparian banks. Lake shoreline stabilization techniques exist but are not as proven as the streambank methods. The advantages of both the riparian and shoreline methods, when compared to more traditional stabilization methods, are that they are relatively inexpensive, they are environmentally sound and of lower maintenance, and they facilitate the use of native vegetation as a means of effective, long-term control for stabilizing streambanks and shorelines.

The cost of the willow-post method is estimated at $7-$15 per linear foot. If lunkers are used along with the willow-posts, the cost of the lunkers is $16 per linear foot. Lake shoreline methods cost from $10-$45 per linear foot. Riparian restoration is estimated at $30 per linear foot and the lake shoreline restoration at $30 per linear foot. Approximately four miles of streambank and lake shoreline could be restored for an estimated cost of $640,000.

GRASSLAND RESTORATION

For grassland restoration, the cost is estimated to be $200 per acre. This cost includes the native prairie grass and forb seeds, site preparation and planting, equipment, labor, and if necessary, herbicide use. Grassland restoration of 550 acres would cost approximately $110,000.

ENHANCEMENT OF WILDERNESS AREA AND RESEARCH NATURAL AREAS

Some of the enhancement activities such as exotic plant species removal and trail maintenance could be carried out by volunteer help. Costs associated with actual planting of trees, grasses, and forbs would be similar to the costs identified in the reforestation and grassland restoration. The enhancement of 200 acres of Wilderness Area and Research Natural Areas would cost approximately $50,000.

WILDLIFE REINTRODUCTION

The reintroduction of native wildlife would include the river otter, the American bison, and largemouth bass. The Illinois Department of Natural Resources already has an established program for the reintroduction of the river otter in Illinois. The cost associated with the release of river otters in suitable habitat is approximately $10,000-$15,000 per release. A release includes 10 females and 15 males. Activities performed prior to the release such as transportation, medical monitoring, tags, and vaccinations are done in collaboration with the University of Illinois.

For bison reintroduction, bison may be available free of charge either through the U.S. Fish and Wildlife Service or through the Ted Turner Foundation. The largest expense would be in fencing and the establishment and maintenance of a water source. This work would largely be done by Refuge maintenance staff. There are additional costs of transporting the bison and the testing required for disease. In general, bison need less care than cattle. Although their preferred food includes native prairie grasses, they will feed on supplemental feed such as hay. The cost associated with bison reintroduction is estimated to be $85,000.

The bass reintroduction would involve providing additional funding for the existing largemouth bass program on the Refuge. Funding would be utilized to purchase minnows for feeding reared bass. The estimated cost is $1-$2 per fish. Since approximately 7500 fish are released each year, this would cost $15,000 per year, or approximately $50,000 for a three year period.

The total cost for wildlife reintroduction would be approximately $150,000.

PUBLIC EDUCATION/OUTREACH PROGRAM

The cost associated with a public education/outreach program would include such things as exhibits, brochures, slide programs, nature trails, outdoor amphitheatre, and advertisements. Estimated costs for individual outreach program is given in section 8.3. It is anticipated that several outreach programs would be developed to complement the restoration activities at an estimated cost of $210,000.

LAND ACQUISITION

The current real estate value of land in the Williamson County area ranges from $1,000-$10,000 per acre, with an average value of $3,000 per acre. The per-acre costs for restoration for reforestation is estimated to be $500.00 - $1,000.00 per acre. Active restoration measures would depend on the restoration needs at each site. Acquisition combined with active restoration would cost more per acre and result in acquisition of fewer acres, but would result in a faster recovery of natural resources. The total cost of land and restoration activities is estimated to be approximately $780,000.

Chapter 7 - Consultation and Coordination

7.1 Public Involvement

The Natural Resource Damage Assessment process parallels the National Environmental Policy Act (NEPA) process. The NRDA Restoration Plan was prepared as an Environmental Assessment document. In the Environmental Assessment, various restoration alternatives were identified and evaluated. Public participation is an important component of both NRDA and NEPA. The Refuge held a public scoping meeting in December 1994. The purpose of the meeting was to receive input and ideas from the public on various restoration alternatives that would be considered during the preparation of the Restoration Plan. The final draft of the Restoration Plan will be announced in the local newspapers and will be made available to the public for a thirty day comment period. At that time, a public information meeting in accordance with the Refuge's standard procedures for public meetings. will be held to address the Environmental Assessment and Restoration Plan in Marion, Illinois. Public comments will be addressed in the final Plan.

During the public scoping meeting and subsequent to it, several issues and concerns were identified. Several people suggested that NRDA money be spent on the renovation and construction of boat docks and marinas, particularly since damages were based on lost services. According to the NRDA regulations, natural resource damage assessment money must benefit the natural resources directly. Boat docks and marinas are not defined as natural resources under the regulations. Therefore, NRDA money cannot be spent on boat docks and marinas.

Another concern raised during the scoping process is the incineration of the PCB wastes and whether any impacts that may result from the incineration process could be addressed or mitigated under NRDA. Environmental or human health impacts are not expected to result from the incineration process. However, if impacts do occur, human health impacts cannot be assessed under NRDA. Environmental impacts could be assessed provided that there is the potential for another NRDA settlement with another responsible party for the PCB contamination.

A third concern raised during the scoping process is that we do not know enough about actual injury to natural resources to proceed with a NRDA Restoration Plan. The settlement was based on lost services due to the PCB contamination. A Natural Resource Damage Assessment can be based on injury to natural resources or lost services associated with the impacted natural resources. If other potentially responsible parties are identified, another damage assessment would be performed and actual injury to natural resources could be assessed.

7.2. List of Agencies and Individuals Consulted in the Preparation of the Restoration Plan.

Refuge staff at Crab Orchard NWR
Ecological Services staff, Marion, IL field office
Fishery Resources Office staff, Marion, IL
Cypress Creek National Wildlife Refuge, Jerry Updike
Illinois Dept. of Natural Resources, Chris Bickers
Illinois Dept. of Natural Resources, Todd Fink
Illinois Dept. of Natural Resources, Fran Hardy
Illinois Dept. of Natural Resources, Robert Bluett
Illinois Dept. of Natural Resources, Union County Nursery, Don Hauseman
Illinois Dept. of Natural Resources, Mason County Nursery, David Horvath
Illinois Dept. of Natural Resources, Illinois State Water Survey, Don Roseboom
The Nature Conservancy, Max Hutchinson
Sierra Club, Shawnee Group, Marti Crothers
Phoenix Audubon Society of Southern Illinois, Laraine Wright
Southern Illinois University Fisheries, Chris Kohler
Illinois State Water Survey, Don Roseboom
Society for Ecological Restoration
Prairie State Park, Missouri, Larry Larson
Biohabitats/Ecological Restoration and Management, Karen Pugh
Freshwater Farms Nursery, Rick Storre
R.S. Blakely, Concerned Citizens of Williamson County
Rose Rowell, Southern Coalition of Protecting the Environment
Gary Wolf, private citizen
Mark Donham, private citizen
Kristi Hanson, private citizen
Warren Brown, private citizen

Chapter 8 - Preferred Restoration Alternatives

8.1. Basis For Selection

The restoration alternatives that were selected for implementation include:

REFORESTATION

SHORELINE AND RIPARIAN RESTORATION

GRASSLAND RESTORATION

PUBLIC EDUCATION/OUTREACH PROGRAM

LAND ACQUISITION

The preferred restoration alternatives are depicted in Figure 2, along with approximate percentage of budget allocations for each project. The restoration alternatives that were not selected include enhancement of the Wilderness Area and Research Natural Areas, and wildlife reintroduction. Although these are worthwhile activities, the decision was made to focus on the habitat restoration activities of reforestation, shoreline and riparian restoration, and grassland restoration. Through the additional selection of public education/outreach and land acquisition, these restoration alternatives provide a balanced approach to compensate for lost services.

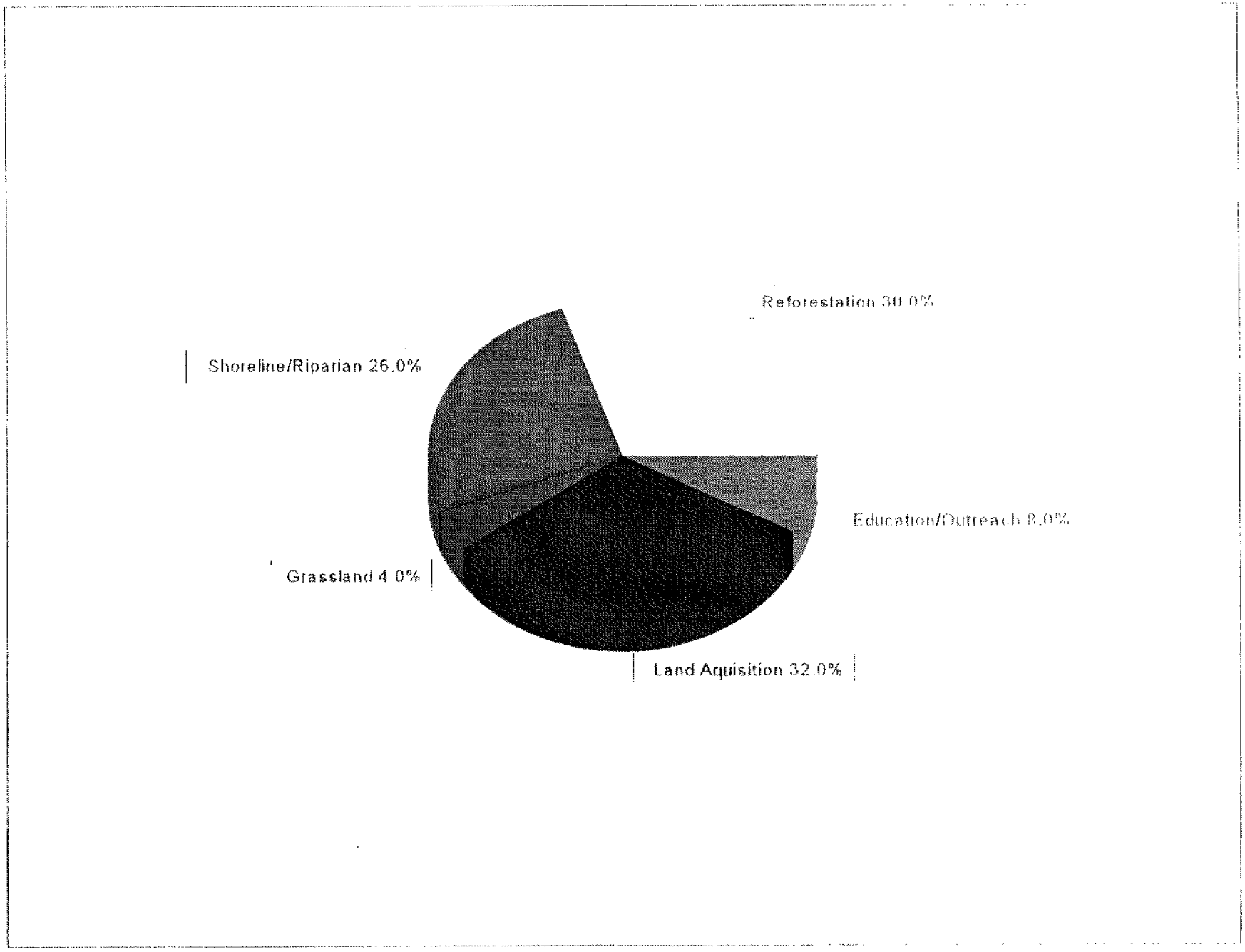
The selected restoration activities contribute towards the Refuge objectives and restoration goals that were stated earlier in this document. The environmental impacts associated with these restoration activities are minimal when compared to the benefits that will result from the implementation of these restoration efforts. The restoration activities are consistent with existing Refuge management plans, and fit well into the overall vision of the Refuge. The restoration alternatives complement each other and promote an ecosystem approach to the conservation, protection, and management of natural resources.

8.2. Implementation and Management

The reforestation and grassland restoration would be implemented and managed along with the existing Refuge reforestation and grassland restoration programs. Basically, Refuge staff and volunteers would perform the planting and management of the restored areas. Public education/outreach would be a component of the actual restoration activities, with the implementation of outreach programs by existing Refuge and volunteer staff. Land acquisition would be implemented as any other land acquisition would be, and the management of the acquired lands would be consistent with the existing Refuge management plans.

Figure 2. Preferred Restoration and Cost Allocation

Figure 2. Preferred Restoration and Percentages of Fund Allocation



The shoreline and riparian restoration would be a new endeavor for the Refuge. Ground work for addressing bank erosion along tributaries of Devil's Kitchen Lake have previously been accomplished by the Devil's Kitchen Lake Watershed Planning Group. This group, composed of representatives of various Federal and State organizations, would be consulted to identify areas to restore in the entire Crab Orchard Lake watershed. The implementation of the shoreline and riparian restoration would require expertise beyond existing Refuge staff. The Illinois State Water Survey of the Illinois Department of Natural Resources would be consulted to identify areas for restoration and methods to employ. The actual implementation of the restoration measures would be accomplished as much as possible with existing Refuge and Fishery Resources Office staff, and volunteers. Assistance may also be available from the Natural Resources Conservation Service. The management of the restored areas would be handled largely by Refuge staff and volunteers. The restoration plan will be subject to an annual review to evaluate the efficacy of the implemented projects. Feasibility of the projects and recommendations for improvements will be reviewed. Any necessary revisions or corrective measures will be based on documented evidence and best professional judgement. Major revisions to the plan will be subject to public review.

8.3 Budget

Funds available through the negotiated settlement for restoration projects are $2.5 million. Settlement monies would be allocated over a three year period for the various restoration projects. Detailed schedules and budgets for implementation of specific projects will develop as the restoration process continues and the individual projects are selected. Fund monies will be allocated at approximately 30% for reforestation, 26% for shoreline and riparian restoration, 4% for grassland, 8% for public education/outreach programs, and 32% for land acquisition. The CONWR staff will administer project funds. The budget and finance staff of CONWR are familiar with the "Superfund Financial Management and Record keeping Guidance for Federal Agencies" (EPA publication EPA 220 M-89 00) and accountability will be maintained in accordance with this guidance. The Refuge staff has approximately 5 years experience managing similar funds for an ongoing CERCLA project.

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The Upper Mississippi River Conservation Committee Newsletter, January/February 1995.Response to Comments

Appendix A. Response to Public Comments

Written comments and responses received during the public review and comment period and the June 30, 1997, public meeting at the Crab Orchard National Wildlife Refuge concerning the "Final Environmental Assessment and Restoration Plan Crab Orchard National Wildlife Refuge".

Shoreline and Riparian Restoration

Comment #1: "Would hope that restoration will include areas that are heavily used for recreation". (Commenter unidentified)

Response: The primary purpose of shoreline and riparian habitat restoration is natural resource conservation. Any developed recreational facilities/areas, which are threatened by shoreline erosion, will be considered. A ranking system will be developed in order to aid in selecting shoreline sites to be restored. Providing protection to recreational areas will be one factor in that ranking system. Additionally, the quality of recreational experiences by Refuge visitors should increase from all shoreline restoration due to improvements in water quality and aesthetics.

Comment #2: Letter from the Illinois Environmental Protection Agency, dated July 8, 1997, signed by Robert L. Hite. This three-page letter with several attachments contained numerous comments and pieces of information relative to water quality protection and shoreline restoration. Some contents of the letter were specifically aimed at the restoration plan, while other comments were more indirect.

Response: Crab Orchard Lake water shed was impacted by the release of PCB contamination. Shoreline and riparian habitat restoration efforts will be focused on Crab Orchard lake and its water shed The selection of specific shoreline or stream bank restoration sites will be based on a watershed assessment and will be coordinated with other natural resource agencies and conservation organizations as indicated on page 37 of this plan. The Illinois Environmental Protection Agency and the U.S. Army Corps of Engineers Waterways Experiment Station will be consulted, as both of these organizations have extensive experience and knowledge in shoreline restoration and stabilization.

Indeed, it may be beneficial to revisit some of the issues dealt with by the Devil's Kitchen Lake work group. However, it is beyond the scope and purpose of this restoration plan to define the Service's role in future watershed management.

While the preferred method of shoreline restoration will be re-establishment of native vegetation, the Service recognizes other shoreline stabilization methods, such as rip rap and sheet piling will be necessary.

While the preferred method of shoreline restoration will be re-establishment of native vegetation, the Service recognizes other shoreline stabilization methods, such as rip rap and sheet piling will be necessary.

Grassland Restoration

Comment #1: "Put prairie plants on prairie soil" (Commenter unidentified)

Response: In selecting sites for grassland restoration under this plan, soil type will be an important determining factor. Sites with soils conducive to establishing and maintaining native grasses and forbs will receive high consideration for restoration. However, other determining factors, such as current site land use, slope, and surrounding land uses, will also be considered.

Reforestation

Comment #1: "While the focus on reforestation is admirable, the fact that many grassland bird species (migratory and resident) are declining at faster rates than forest birds is lost in the emphasis on forest habitat." (Commenter unidentified)

Response: The Restoration Plan includes enhancement of 550 acres of grassland which would provide quality habitat for many migratory and resident bird species. An emphasis on reforestation has been made to accomplish the important goal of restoring and protecting natural ecosystems, with particular attention given to the presettlement condition of the landscape. In the early 1800's, 91.4 percent of Williamson County was forest and 8.6 percent was prairie. Williamson County is now 28.4 percent forest and 32.7 percent grassland according to the Illinois Natural History Survey. Even after the Restoration Plan is implemented, the proportion of forest on the Refuge will be much lower than in presettlement times and the proportion of grassland will be much higher.

Comment #2: "I wonder why the Refuge opened up the woods around the office building, creating new cowbird habitat, a large gap in the canopy." (Commenter unidentified)

Response: The Refuge used funds from the Watchable Wildlife program to rehabilitate the wooden deck at the office building which had become unsafe because of rotten boards. To justify use of these funds for this project, brushy vegetation between the deck and the lake was cleared to offer a view of the water where many birds congregate. The Refuge will consider the option of not mowing this area during the breeding season to avoid providing favorable cowbird feeding habitat.

Land Acquisition

Comment #1: "Yes! This is a good idea, particularly to consolidate into larger tracts." (Commenter unidentified)

Response: Concur

Comment #2: "Definitely support acquisition of land, especially grassland, fallow fields." (Commenter unidentified)

Response: Concur

Education /Outreach

Comment #1: An observation blind at Heron Flats (Northeast area) would be very good. Also need to restore mud-flats environment at current photo blind (is now filled in with plants and grasses--original mud-flats were very productive for migrating shorebirds. (Commenter unidentified)

Comment #2: Ditto above! Duck, Grebs, Coots, and Mergansers were also using it. (Commenter unidentified)

Response: Comments #1 & #2: Rather than additional wildlife observation recreational facilities, the education/outreach program objectives are to emphasize the natural environment, its vitality, and the negative effects of environmental contamination. A better informed public who is knowledgeable about the impacts of contamination and the cost-effective strategy of prevention is the goal of this program.

Comment #3: Not too many asphalted paths! (Commenter unidentified)

Response: All trails will be constructed in an environmentally friendly manner and will be surfaced to meet the standards of the Americans with Disabilities Act.