Cypress Creek National Wildlife Refuge

Draft Habitat Management Plan

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Summary

This draft habitat management plan (HMP) for Cypress Creek National Wildlife Refuge provides a long term vision and specific guidance on managing Refuge habitat for the next 15 years. This draft HMP is an extension of the CCNWR Comprehensive Management Plan (1997). Both plans are required by the National Wildlife Refuge Improvement Act of 1997, and will help meet the original purposes of CCNWR and contribute to the mission of the National Wildlife Refuge System. This HMP consists of four chapters. Chapter one covers the laws, policies, and conservation plans that effect the management of CCNWR. Chapter two provides historical, physical, and biological descriptions of CCNWR. Chapter three gives a brief description of the habitats, animals and plants that have been identified as Resources of Concern for CCNWR. Chapter four outlines the goals and objectives for managing those priority natural communities identified as Resources of Concern, and outlines the strategies and prescriptions that will be used to accomplish those goals and objectives.

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Chapter I. Introduction

Scope and Rationale

Enactment of the National Wildlife Refuge System Improvement Act in 1977 requires that National Wildlife Refuge System growth and management be planned to contribute to the conservation of ecosystems and that the biological integrity, diversity and environmental health of the System be maintained for the benefit of present and future generations. Addressing the natural resource conservation challenges of the 21st century and fulfilling the Refuge System mission and vision laid out in the Improvement Act will require detailed planning and partnerships. The Comprehensive Conservation Plan (CCP) and Habitat Management Plan (HMP) for each Refuge are essential to the Refuge System's ability to meet these challenges.

Cypress Creek National Wildlife Refuge (CCNWR) completed a Comprehensive Management Plan (CMP) in 1997, which serves as an umbrella plan to guide Refuge staff in the implementation of various preservation, restoration and wildlife-dependent public use activities. A summary of the CCNWR CCP vision, goals, objectives and strategies related to resource protection, habitat restoration and resource management are provided in Appendix 1.

This HMP provides a long-term vision and specific guidance on managing habitat for the resources of conservation concern on CCNWR. The contributions of CCNWR to ecosystem and landscape scale resource and biodiversity conservation are incorporated in this plan. The HMP sets the direction for the next 15 years and will ensure continuity and consistency of the habitat management of CCNWR. A plan review will be conducted every 5 years and adaptive management will be used to assess and modify management activities as research and monitoring may require.

Legal Mandates

Statutory Authority

The National Wildlife Refuge Improvement Act of 1997 established for the first time a singular conservation mission for the National Wildlife Refuge System: *"*To administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans*"*.

The legislation requires that the mission of the System and purposes of the individual refuges are carried out. Refuges must first address their establishing purposes, while at the same time contributing to the broader System and ecosystem needs.

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Refuge Purposes

Purposes of a refuge are those specified in or derived from the law, proclamation, executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, refuge unit, or a refuge sub-unit.

The relationship of the System mission and the purpose(s) of each refuge are defined in Section 3 of the FWS Director Order No. 132 which states:

> "We view the System mission, goals, and unit purpose(s) as symbiotic; however, we give priority to achieving a unit's purpose(s) when conflicts with the System mission or a specific goal exist." Section 14 of this order indicates "When we acquire an addition to a unit under an authority different from the authority used to establish the original unit, the addition also takes on the purpose(s) of the original unit, but the original unit does not take on the purpose(s) of the addition".

Cypress Creek National Wildlife Refuge was established in 1990 for the following purposes:

> …the conservation of wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions…16 U.S.C., Sec. 3901 (b) (Emergency Wetlands Resources Act of 1986)

Cypress Creek National Wildlife Refuge's purpose and importance to migratory birds, particularly waterfowl, were further described in the Service's Environmental Assessment for the proposed establishment of CCNWR (1990) and Approval Memorandum for refuge establishment:

> 1) to protect, restore and manage wetlands and bottomland forest habitats in support of the North American Waterfowl Management Plan; 2) to provide resting, nesting, feeding and wintering habitat for waterfowl and other migratory birds; 3) to protect endangered and threatened species and their habitats; 4) to provide for biodiversity; 5) to protect a National Natural Landmark, 6) and to increase public opportunities for compatible recreation and environmental education.

Links to Other Plans

Refuge Plans

Biological Concept Plan-Cypress Creek National Wildlife Refuge completed a Biological Concept Plan in July 1992, which laid out a general plan to guide restoration and enhancement activities as land was acquired. This plan addressed issues such as control of siltation, restoring old drainage patterns, the need for waterfowl sanctuary areas, and the need for and location of public facilities.

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Comprehensive Conservation Plan (CMP)-Cypress Creek National Wildlife Refuge completed a CMP in December 1996, which provided long-term direction for management, biology, and wildlife-oriented public use. The CMP also highlighted CCNWR's vision to be a "35,000 acre contiguous tract of land by connecting remnants of cypress-tupelo swamp, oak barrens, buttonbush groves, and vast stands of bottomland forests" The CMP has guided management decisions and actions on CCNWR for the last 13 years.

Fire Management Plan (FMP)-A FMP is mandated by the U.S. Fish and Wildlife Service (Service) policy for any Refuges that have "vegetation capable of sustaining fire". The CCNWR FMP addresses wild and prescribed fire events with guidelines on the level of protection needed to ensure safety, protect facilities and resources, and restore and perpetuate natural processes.

State and Regional Plans

Bird Conservation Region (BCR) 24- The Central Hardwoods Joint Venture Concept Plan-CCNWR is included in BCR 24 (The Central Hardwoods). Members of the Central Hardwoods Joint Venture formed a partnership beginning in 2000 with the primary purpose of elevating emphasis on all-bird conservation in the Central Hardwoods Bird Conservation Region (BCR 24). The Central Hardwoods Joint Venture Concept Plan was created in 2003 with the intention to impart the Joint Venture's long term vision.

Partners in Flight (PIF) –Bird Conservation Plan for The Interior Low Plateaus-Formed in 1990, PIF is concerned primarily with landbirds and has developed Bird Conservation Plans for numerous Physiographic areas. These plans include priority species lists, associated habitats, and management strategies. Cypress Creek belongs to the Interior Low Plateau Physiographic area.

Upper Mississippi Valley/Great Lakes Joint Venture Individual Plans-Cypress Creek is part of The Upper Mississippi Valley/Great Lakes Joint Venture (UMVGL). The UMVGL Region provides a wide variety of waterbird nesting, roosting and foraging habitats: marshes, ponds, creeks, streams, sloughs, lake shorelines, islands (especially in the Great Lakes), shoals, river floodplains (especially along the Mississippi, Illinois, Missouri, and Ohio Rivers), and reservoirs. A total of 46 species regularly occur during some portion of the year, including loons, grebes, pelicans, cormorants, herons, night-herons, egrets, bitterns, rails, moorhens, coots, cranes, gulls and terns, and 19 of these species are of high conservation, stewardship or management concern. In a continental context, the Region is extremely important for many of these waterbird species. We utilized the four UMRGLR Joint Venture individual plans listed below in the development of habitat management goals and objectives for CCNWR.

-Shorebirds Upper Mississippi River/Great Lakes Region
-Waterbirds Upper Mississippi River/Great Lakes Region
-Waterfowl Upper Mississippi River/Great Lakes Region

United States Fish and Wildlife Service Region 3 Fish and Wildlife Resource Conservation Priorities-The Fish and Wildlife Resource Conservation Priorities list identifies all the species considered to be in the greatest need of attention under the Fish and Wildlife Service's full span

of authorities. The management strategies identified in the document contribute to the conservation, protection, and recovery of migratory birds, threatened and endangered species, and interjurisdictional fish, as well as the habitat that they depend on, and therefore fulfilling the Service's mission.

Endangered Species Recovery Plans-Cypress Creek follows recovery plan guidelines for the management of federally threatened and endangered species.

Indiana Bat-The endangered Indiana bat's range includes most of the upper Midwestern United States from Oklahoma, Iowa, and Wisconsin east to Vermont and south to northwestern Florida. The distribution of this species is greatest in cave-rich areas where there is suitable forested habitat. During the summer, the Indiana bat disperses over their entire range selecting old growth bottomland hardwood forests and riparian areas for feeding and reproduction. Roosting bats and maternity colonies occur under loose bark of dead standing trees and also under large bark scales on live shagbark hickory, kingnut hickory and water hickory trees, or other trees with loose, shaggy bark. Fourteen Indiana bats were documented on CCNWR during 5 mist net surveys conducted in June 2011.

Gray Bat -The gray bat is listed as endangered and occurs in Alexander, Johnson, Pope, and Pulaski counties where it inhabits caves both during summer and winter. This species forages over rivers and reservoirs adjacent to bottomland forested tracts.

Least tern -The federally endangered interior least tern nests on the Mississippi River and has been observed foraging at Horseshoe Lake State Conservation Area within the Cache River Watershed. Restored wetlands on CCNWR have potential to provide feeding and resting habitat for this species.

Pink Mucket pearlymussel and the Orange-footed pearlymussel- are both found in the Ohio River. Any contribution CCNWR makes to improved water quality may benefit these species.

Illinois Comprehensive Wildlife Conservation Plan & Strategy-The Illinois Comprehensive Wildlife Conservation Plan was completed in 2005. The Plan identifies habitat areas that demonstrate the greatest conservation need and potential, and establishes specific conservation goals for the enhancement and protection of these sites. Natural Division Assessments are provided in the plan and includes priority resources, conservation philosophy, wildlife habitat objectives and key actions for each natural division. The priorities, philosophy, objectives and actions for the Coastal Plain section of the plan are very closely aligned and complimentary with CCNWR's overall resource goals and objectives. We utilized this document in the development of habitat management goals and objectives for CCNWR.

Cache River Watershed Strategic Resource Plan-This planning initiative, completed in 1999, was a cooperative effort of the Cache River Ecosystem Partnership, (NRCS,IDNR, USFWS, TNC, and The Friends of the Cache River Watershed), which is concerned with all natural resources in the Cache River Watershed. The mission of the plan is to promote restoration and maintenance of soil, water, forest, wildlife, and wetland resources in a manner that supports socioeconomic and ecological sustainability.

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Cache River Macrosite Plan-The Nature Conservancy developed a site conservation plan in 2003 based on the vision of preserving the area's biological diversity and to restoring a naturally functioning landscape supporting good examples of natural communities that are stable enough to maintain themselves, large enough to allow for functioning ecological processes, and contiguous enough to provide for the interaction of species by restoring a more natural hydrologic regime, maintaining connections between wetland and non-wetland habitats, protecting existing high quality natural areas, and restoring critically located sites and species.

Continental Plans

North American Bird Conservation Initiative (NABCI) -The NABCI brings together, in a continental effort, shorebird, waterbird, and waterfowl plans to protect and restore all native bird populations and their habitats in North America. All bird conservation partnerships reduce duplication of effort, and identification of unique landscape and habitat elements targeted for protection, management, and restoration. It utilizes Bird Conservation Regions (BCRs) to guide landscape scale, science-based approaches to conserving birds and their habitats.

North American Waterfowl Management Plan-The goal of this plan, which was signed in 1986, is to restore waterfowl populations to historic levels. The NAWMP outlines a broad framework for waterfowl management strategies and conservation efforts in the United States, Canada, and Mexico. This plan is designed to reach its objectives through joint ventures of private, state, and federal participation.

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Chapter II. Background

Refuge Location

Cypress Creek National Wildlife Refuge (CCNWR) is located in southern Illinois just north of the confluence of the Ohio and Mississippi Rivers. Approximately 16,000 acres of the 35,320 acres delineated within the CCNWR acquisition boundary have been purchased. Cypress Creek National Wildlife Refuge is also part of a larger 60,000 acre boundary delineated by the Cache River Wetlands Joint Venture Project. To date, approximately 35,000 acres have been protected and are managed by the United States Fish and Wildlife Service, Illinois Department of Natural Resources (Cache River State Natural Area and Horseshoe Lake Fish and Wildlife Area), and The Nature Conservancy (Grassy Slough Preserve).

The Cache River Basin

Cypress Creek National Wildlife Refuge is within the Cache River basin which drains a watershed of approximately 500,000 acres -- nearly the entire southern tip of Illinois. The major tributaries on the lower Cache within CCNWR are Big Creek, Cypress Creek, Mill Creek and Limekiln Slough. The area is situated at the intersection of four major physiographic regions of the United States, creating a unique area with a rich natural history. Within the Cache River basin, floodplain forests contain a greater diversity of bottomland tree species than any other watershed in Illinois including bald cypress trees that are over 1,000 years old. In addition, there are few places in North America that support the diversity and density of migratory waterfowl, wading birds, and Neotropical migratory songbirds as the Cache River and Cypress Creek Wetlands (IDNR, 1997). Researchers have cataloged 128 breeding songbird species, 49 species of mammals, 32 amphibian species, 43 reptile species, 84 freshwater fish species 47 native mussels, and 34 crustacean species within the watershed. Although the basin only makes up 1.5 percent of Illinois' total land area, the Cache basin harbors 11.5 percent of the remaining high-quality floodplain forest habitat and 91 percent of the state's high quality swamp and wetland communities (IDNR, 1997). As a result of this diversity of habitat and wildlife the Cache River Wetlands and CCNWR has been designated one of 27 Ramsar Wetland of International Importance located in the United States (Ramsar 2010).

CCNWR falls within Alexander, Johnson, Pulaski, and Union Counties, generally between Illinois Route 37 to the east and Illinois Route 127 to the west (Figure 1). CCNWR is located in a section of the Cache River Basin known as the Lower Cache. Prior to settlement, the Cache River originated near Anna, Illinois and flowed in a southeastward direction for about 55 miles toward Belknap, Illinois. This section of river later became known as the "Upper Cache River" after construction of the Post Creek Cutoff. Downstream from this point the river is known as the "Lower Cache River". CCNWR purchase boundary encompasses the Lower Cache River at Highway 37 to its original mouth at the Ohio River near Mound City Illinois. However, the course and length (approximately 110 miles) of the Cache River today has been changed by human-induced alterations summarized in the following sections (Hutchison, 1999).

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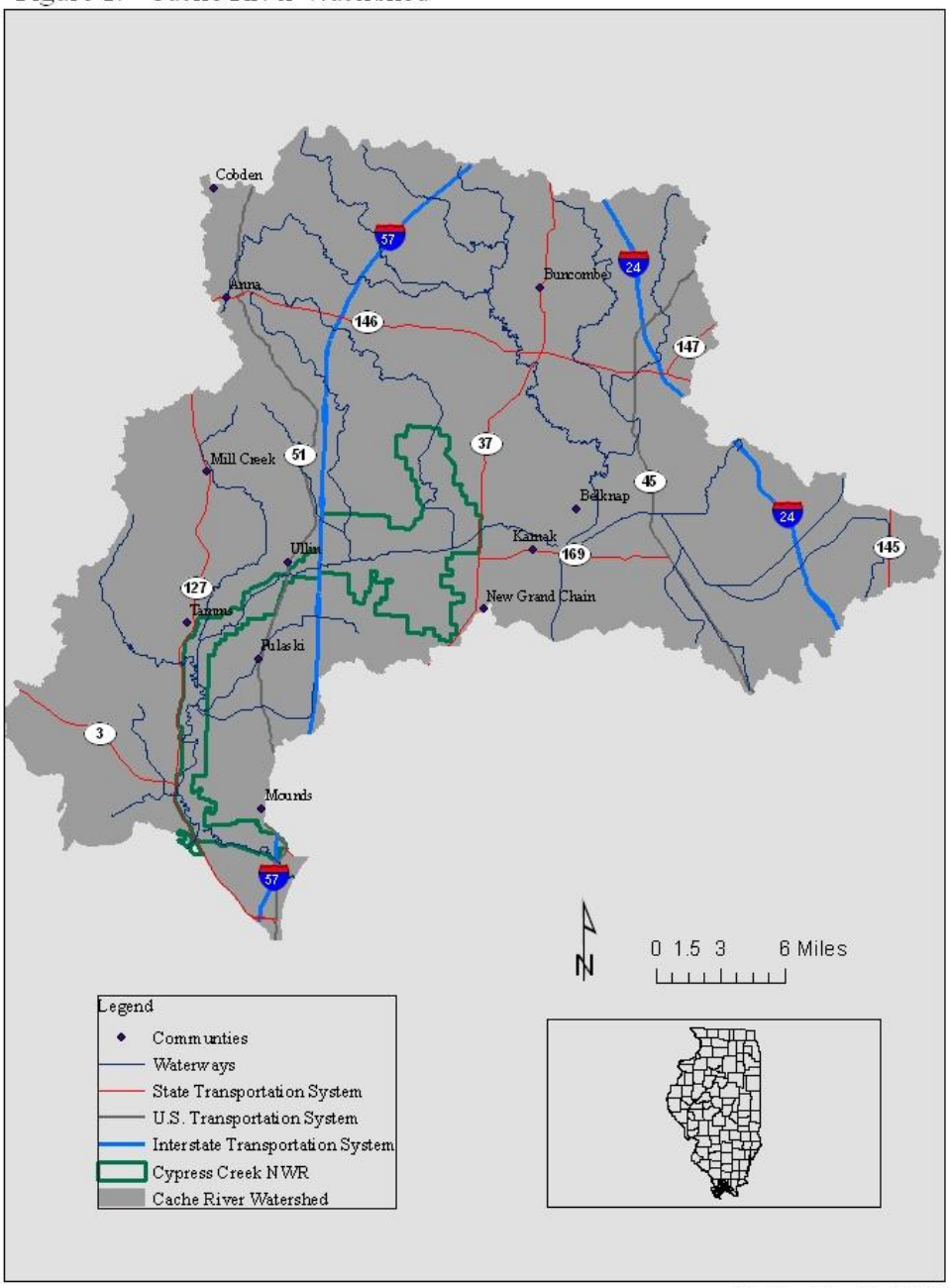
Figure 1. Cache River Watershed



Map Date: November 16, 2010

Physical and Geographic Setting

The physical environment of the Cache River watershed includes 4 physiographic regions (soils, topography, and climate) and explains much about the biological diversity of the region (Figure 2*).* The Cache River watershed lies within one of only six areas in the U.S. where four or more physiographic regions overlap. This phenomenon is a result of a number of physical factors (elevation and convergence of 2 major rivers, diversity of soil and bedrock, geologic uplifts, faulting, glacial history and ancient Paleozoic periods of flooding) that created a diversity of natural communities seldom matched elsewhere in Illinois (IDNR, 1997). The three major physiographic provinces within CCNWR include the Interior Low Plateau to the north, the Upper East Gulf Coastal Plain to the south, and the Mississippi River Alluvial Plain to the southwest. Cypress Creek National Wildlife Refuge is found primarily within the Gulf Coastal province and formerly included extensive stands of floodplain forest and baldcypress-tupelo swamps.

Geographical Definitions

As described by Gough, (2005), sections of the Cache River are defined below. These definitions will be used throughout the plan.

Upper Cache: The Cache River and its watershed that drains into the much flatter Cache Valley. The Post Creek Cut-off sends run-off from the Upper Cache south to the Ohio River, by-passing the Lower Cache.

Middle Cache: The Cache River from Belknap (and the Post Creek Cut-off) west to the mouth of Big Creek (approximately 2 miles east of Ullin). This section is approximately 10 miles and includes Eagle Pond, Long Reach, and Buttonland Swamp. This area has been a focal point for water management in order to protect and preserve key natural resources.

Lower Cache: The Cache River from the mouth of Big Creek to its mouth at the Mississippi Diversion.

Old Cache River Channel: The section of river cut-off from the main channel of the Cache by the Mississippi Diversion. It includes approximately 6 miles of river channel from the diversion east to the Ohio River gates.

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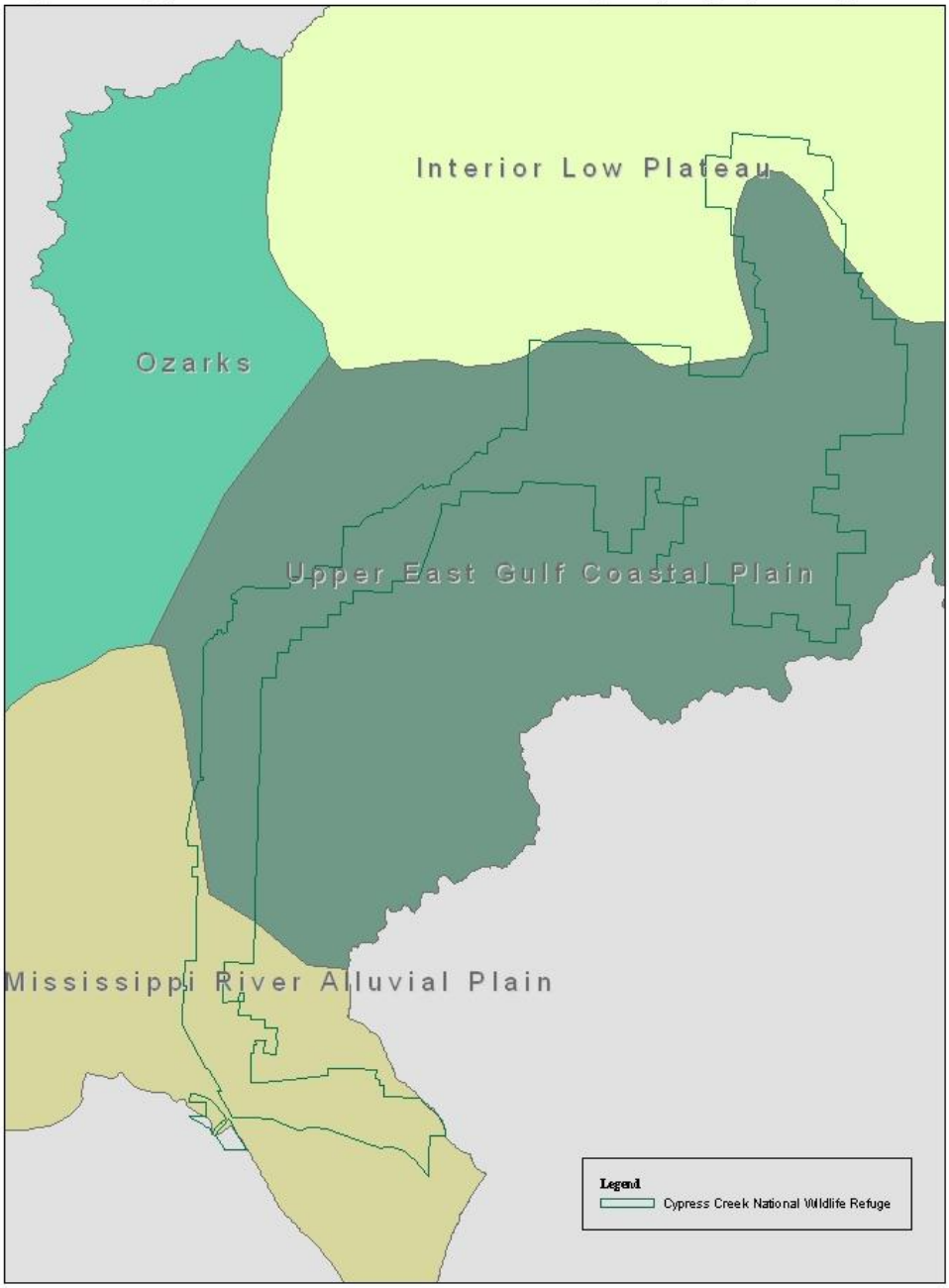
Figure 2. Cypress Creek National Wildlife Refuge Physiographic Regions



Map Date: November 14, 2010

Climate

Climate of the Cache River Watershed consists of warm, humid summers and cool to cold winters. Average annual precipitation is 45 inches; average annual snowfall is 3-10 inches, and frost free days average 230 annually. Late spring through early autumn are classed as sultry with average relative humidity of 80%. Major rainfall events and flooding are not uncommon in January and February, although about 75% of flooding occurs during March, April, and May. Thunderstorms along with the potential for gusty winds, hail, and tornadoes are a major source of summertime precipitation. Snow cover does not generally continue for more than a few consecutive days primarily between December and February (IDNR, 1997).

Topography

The elevations in the Cache River watershed range from 890 feet mean sea level (msl) at the northernmost portion of the watershed to a low of 280 feet msl at the Mississippi River. The northern portion of CCNWR (portions of Johnson, Union, and Pulaski Counties) includes bluffs and hills that reach 510 feet msl overlooking the Cache River floodplain. The topography can be rugged with steep ravines and some exposed rock. CCNWR is bounded on the west (Union and Alexander counties) by the Ozark uplift characterized by loose gravel and cobble and drains quickly into the river valleys. The majority of CCNWR is encompassed by the Coastal plain (Alexander and Pulaski counties); while mostly flat, some relief, small knolls and low gently rising ridges are not uncommon throughout the broad alluvial floodplain.

History of the Area

Geographic History

The interaction between landforms, hydrology, and biota are unique in the Cache River watershed. As stated by Gough (2005), the valley was formed and influenced by repeated ice advances 1.8 million to 10,000 years ago. These episodes caused repeated scouring to bedrock and filling with glaciofluvial sediments. Approximately 90% of Illinois was glaciated at least once; however the southern limit of glacial drift did not reach extreme southern Illinois. The Cache River basin marks the geographical point where the last invasion of the sea into the Midwest reached its northernmost limit and lies just south of the southernmost extent of the continental glaciers; although low-lying areas and the river valleys were impacted by drift carried by glacial rivers. The Cache River as it appears today did not exist until the end of the Great Ice Age (13,000 to 10,000 years ago); the general pattern of drainage across the Midwestern states was set millions of years ago when the region became a lowland between the Appalachians and Rocky Mountains. For eons rivers from north, east, and west have met in this southernmost Illinois region and flowed south to the sea (Hutchison, 1999).

About 100,000 years before the present, the low lying areas of the Cache were flooded by meltwaters of the Illinoisan glaciation. During the Wisconsian, the last glaciation, massive torrents of meltwater flowed south and west. This giant river that later became the Ohio River, cut across southern Illinois leaving behind sediment up to 180 feet thick. As the glacier retreated northward, the meltwater slowly dropped and the nearly flat glacial mud left by the ancient Ohio

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blocked its own tributaries to form a series of swamps wetlands and small lakes called the "scatters" (Hutchison, 1984). The Cache River reestablished its channel through these low-lying, flat areas that were once the prehistoric river valley of the Ohio.

Human History

The area's natural resources have always been important to people living in the Cache River valley. Vast tracts of naturally flooded bottomland within the Cache River basin have provided habitat for migratory birds and other wildlife, which in turn have attracted humans for the past 12,000 years or more. Cypress Creek National Wildlife Refuge and the Cache River area was used as a trading crossroads by Native Americans, and has several sites of archeological interest within its boundaries, including the Cypress Citadel site just south of Cypress, Illinois. French Voyageurs gave the river its modern name, calling it "cache" which means secret or hidden place. Euro-American hunters, trappers, and soldiers passed through the Cache River basin in the 18th century, followed by settlers in the 19th century. The intense human use of the area is recorded in archeological sites that can be found throughout CCNWR. A comprehensive cultural resource overview was completed for CCNWR (Kullen et. al, 1996). This report provides a summary of known cultural resources within CCNWR and a five mile radius around it. The report addresses the importance of the various documented sites in terms of scientific, religious, and symbolic values and provides a framework for predicting the frequency and location of undiscovered sites within CCNWR (Kullen et.al., 1996).

Today the Cache River area is primarily rural and most of the land that is not forested is used for agriculture. Over the last 200 years, the basin has been altered by widespread hydrologic alterations and land clearing. The Post Creek cut-off, completed in 1916, was especially damaging to the wetlands because it diverted the upper segment of the Cache River directly into the Ohio River and isolated approximately 40 miles of the middle and lower Cache channel. In the 1960s and 1970s, thousands of acres of floodplain forest were cleared, drained, and converted to agriculture. By the 1980s, natural and agricultural lands began to flood more often. Silt from cleared land and unstable stream channels choked natural drainage paths and sedimentation rates in the Lower Cache were as high as 24 inches per year (Schwegman, 1991).

As a result, local, citizen-based conservation efforts were initiated in the late1970's and received a significant boost with the formation of the Cache River Wetlands Joint Venture in 1990. The partners recognized the need to influence land use changes throughout the 500,000-acre watershed. By working with other groups, including the Soil and Water Conservation Districts, Friends of the Cache River Watershed, universities, landowners and private citizens, the Joint Venture Partnership is uniquely positioned to address the scale and complexity of the efforts needed to protect and restore the Cache – a task no one organization could achieve alone.

Through cooperative conservation, the Cache River Wetlands Joint Venture has acquired and protected approximately 35,000 acres. The focus of CCNWR and Joint Venture partners includes restoring the Cache River structure and function to a level of productivity that will sustain social, agricultural and ecological resources (Cache River Watershed Resource Planning Committee, 1995). This work primarily involves the following:

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- restoration of bottomland hardwood forest, and wetland habitat for migratory waterfowl and shorebirds,
- reduction of sediment loads and runoff from agricultural lands, and the
- restoration of hydrologic processes which will assure a self-sustaining riparian ecosystem.

Associated management and restoration strategies are highlighted in following sections.

Alterations to Land Cover and Natural Hydrology

Land Cover Changes

Over the last 200 years there have been significant changes to the Cache Valley and its natural processes. Prior to human disturbance, the structure and function of natural communities within the Cache River Watershed were in a state of dynamic equilibrium as described by Hutchison (1995):

> "The natural hydrologic regime of the Cache was primarily determined by the geomorphology of the region. The high bedrock hills in the northern part of the watershed were rugged and dissected the stony, high gradient streams. The Cache Valley was broad and flat with sluggish mud-bottomed stream channels and extensive swamps. In the Lower Cache bottoms, tributary streams coming down from the hills followed swales between the low parallel ridges, often flowing back and forth for long distances before finally reaching the main channel. Floodwaters generally spread out over broad areas, and fluctuations in flow were more subtle than today. Periodically, floodwaters flushed the swamps and other wetlands, thus keeping them from filling with upland sediment. The extensive swamps served as reservoirs to temporarily store large amounts of storm water and allow it to move slowly downstream moving through the wide valley on their way to join the Ohio River near Mound City. Thus the stream banks remained well-protected and relatively stable in most places. Channel scour was rare and the waters in all of the streams and swamps were nearly always clear. The abundant springs along the base of the bedrock hills helped to keep the wetlands permanently wet with cold clear water. And occasionally, the Ohio River would flood the entire Cache Valley thereby changing forest structure in some areas, providing aquatic organisms' access to areas that were previously isolated from them, and creating localized areas of scour and deposition.
>
> In the uplands, the fine-textured silt loams were susceptible to erosion, but they were generally well protected by deep leaf litter and various types of vegetation (trees, shrubs, forbs, and grasses). The forest canopy was locally impacted by natural disturbances such as windfalls, floods, diseases, and periodic wildfires. The natural processes allowed for changes due to natural disturbances, because most were localized, did not occur often, and were generally not catastrophic."

The most significant changes, described below, in the watershed that affected the Cache ecosystem are hydrologic alterations undertaken to control flooding and drainage for agriculture (IDNR, 1997). Cumulatively, these changes have disrupted natural flooding regimes, increased sedimentation in the bottomlands, increased channel downcutting and decreased bank stability.

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Post Creek Cut-off

In 1915, the Cache River Drainage Commission completed the construction of the Post Creek Cut-off which diverted water from the Upper Cache River via Post Creek, a tributary, to a point on the Ohio River upstream from the old mouth of the Cache; this seven-mile ditch drained wetlands for agriculture and controlled flooding and essentially split the watershed into 2 halves: the Upper and Lower Cache River (Figure 3). The Upper Cache River channel has a steep gradient and drains about 235,520 acres. The slope through much of the Upper Cache River is 1 to 1.5 feet per mile and increases to 2.5 to 3 feet per mile as the influence of the Post Creek Cutoff becomes more prevalent. (Initial Evaluation Report, Alexander and Pulaski Counties, Illinois, 1984). In the Upper Cache River, the primary problem is erosion and channel entrenchment. Upstream migration of the stream channel and lateral gullying has drained many off-channel wetlands and threatens to drain Heron Pond and Little Black Slough, some of the most significant wetland and natural areas in the State (Cache River Basin: Hydrology, Hydraulics, and Sediment Transport, 1990).

The Middle and Lower Cache River as it exists today has a watershed of approximately 229,120 acres and is about 50 miles long from the Post Creek Cutoff to the mouth of a second diversion ditch near Cache, Illinois, that empties into the Mississippi River. A series of stream modifications during the past 40 years has reduced the length of the Cache River by approximately 35 miles. (USACE, 1984).

The entire reach of the Middle and Lower Cache River was once the ancient channel of the Ohio River. Given this influence, the Lower Cache River floodplain is nearly 4 miles wide and very flat; and on average only falls 1 foot per mile. Buttonland Swamp, a National Natural Landmark (within the Middle Cache) has a gradient of only .2 to .3 feet per mile. Flow reversals in this segment of the river are common due to the slight gradient and influences of Big Creek flows and the Post Creek Cut-off.

Middle Cache River Flow Reversal

Natural drainage and flow patterns of the Cache River have been dramatically changed by numerous alterations. A combination of the Post Creek Cut-off, drainage and channelization activities cause the Cache River to flow backwards (to the east) during major storm events. This occurs when Big Creek, a major tributary, enters the Cache (south of the Bellrose Waterfowl Reserve) with high flow velocities. Over the last century, conversion of forested land to cropland and pasture, together with the channelization of the middle and lower reaches of Big Creek has resulted in a dramatic increase of sediment and the delivery of water to the Cache River. This increased volume exceeds the Cache River's ability to maintain a west and south flow resulting in flow reversal to the east. Since the Post Creek Cut-off was constructed, and increased flow volumes from Big Creek, flow reversals (along with increased sediment delivery) occur more frequently and are more extensive as water follows the path of least resistance to the lowest point at the Post Creek Cut-off.

Levee Construction

Authorized by the Federal Flood Control Act of 1938, the Army Corp of Engineers (USACE) completed several large flood control projects in the area. The Reevseville levee (which separates the Bay Creek and Cache River watersheds) was built to prevent Ohio River floodwater from reaching the MVC. The Cache River Levee (Karnak Levee) was constructed to provide protection for the Middle and Lower Cache River Valley from floodwaters from the Upper Cache River and from backwaters of the Ohio entering through the Post Creek Cut-off. The economic justification for both levees was based on the flood protection they would provide to the towns of Karnak and Ullin. At the same time they provided incentives for the conversion of more wetlands to agriculture. (IDNR, 1997).

In 2003, the Karnak levee received significant damage when two 48" drain culverts washed out leaving a large breach. Without the protection of the levee, Cache River flow reversals have increased, draining wetlands west of the structure and creating the potential for flooding of Karnak from the Upper Cache River. The Illinois Department of Natural Resources is developing proposals to repair the breach that would allow partial reconnection of the Upper Cache with the Middle Valley Cache.

Cache River Diversion

The Lower Cache River diversion was constructed in 1950 and diverts water directly into the Mississippi River. The 1 mile diversion ditch is approximately 60' wide with poured concrete side walls and delivers water from the Lower Cache River directly into the Mississippi River. The seven mile segment (Old Cache Channel) of the Cache River situated between the diversion ditch near Cache, Illinois and the traditional outlet into the Ohio River was severed from the rest of the Cache River watershed when the diversion ditch was constructed. Currently water within the old channel is controlled by the Ohio River flood gates maintained by the USACE. The gates allow for the manipulation of water in the channel for drainage and flood control. In an effort to maintain and support a fishery within the channel, the Cairo Drainage District and USACE have worked cooperatively with CCNWR to maintain a minimum level of water throughout the year.

Stream Channelization and Drainage

Following the levee projects, there was extensive channelization and land clearing of the bottomlands primarily for agriculture. By the 1960's numerous drainage districts had formed in the valley with the focus of clearing and farming much of the Cache River valley bottomlands. (Hutchison, 1997).

The drainage when combined with soil erosion from the uplands, drainage ditches and channelized streams has drastically altered the Middle Cache Valley. Reductions in flow combined with increased sediment loads encouraged sediment deposition resulting in as much as 4 feet in some places (Algire and Cahill 2001) and greatly reduced deep water habitat. Channelization of Big Creek and Cypress Creek significantly increased water velocity and sediment delivery into the Lower Cache River valley as well.(Demissie et al. 1990).

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Big Creek, a major tributary of the Cache is the largest contributor of sediment to the River (Demissie et. al 1990). In addition, it threatens the integrity of CCNWR's Bellrose Waterfowl Reserve which is intensively managed to produce food for waterfowl. The Reserve occupies a small but significant part of the floodplain where Big Creek enters the Cache River. During flood events sediment laden water will back up into the Reserve or break levees resulting in excessive sedimentation and decrease water quality within the units.

Sedimentation

Erosion and sedimentation are a major problem in the Cache River basin due to their negative impacts both on agricultural drainage and on preservation of natural areas. Three sediment monitoring stations are located within the Lower Cache River watershed. The stations are on Big Creek, Cypress Creek, and the Lower Cache River. The stations on Big Creek and Cypress Creek provide information on the amount of sediment being transported into the Middle Cache by tributary streams. The station on the Lower Cache River near Ullin, Illinois, provides information on the amount of sediment leaving the Middle Cache.

Sediment deposition from the lower Cache River near Ullin, Illinois, is lower than the sediment yield from Big Creek alone. The reason for this difference is that the wetlands in Buttonland Swamp trap a significant amount of the sediment delivered from both tributary streams, Big Creek and Cypress Creek. Data collected over a three year period in 1985 to 1988 showed that the Big Creek watershed contributed 58,000 tons/year (70%) of the sediment yield into the Middle and Lower Cache River with Cypress Creek contributing an estimated 10,630 tons (13%) (Demissie et. al. 2001). A primary concern for management of the Middle and Lower Cache River is the amount of sediment deposited in Buttonland Swamp due to reverse flow of the Cache River. This high rate of sedimentation will continue to degrade the aquatic habitat in the lower Cache River and associated wetlands.

Further down stream of Big Creek, as more tributaries enter the Lower Cache River, it widens to 100' (at the mouth of the diversion) and10-15 feet deep; the fall rate increases slightly to 1 foot per mile. The gradual slope of the Cache River is conducive to backwater flooding from the Mississippi River. Floodwater discharge from upland streams creates backwater conditions throughout the valley and further upstream into tributary stream channels. In addition the accumulation of sediment in stream channels reduces the stream flow and increases flooding potential. Continuous accumulation of sediment has changed the hydrology within the wetlands and could result in a change in the types of plants and animals found in that area. (USDA,1987).

Ongoing Restoration Strategies

To date, almost 35,000 acres have been acquired and protected through restoration work in the Cache River basin on both public and private land. This work includes three components: forest and wetland habitat restoration, reduction of sedimentation and stream bank/bed erosion, and hydrologic restoration.

Forest and Wetland Habitat Restoration

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Almost 30,000 acres within the Cache River Watershed, most of which were marginal farmland, have been reforested or restored to wetlands; fourteen thousand of those acres have included private land restoration, and approximately 5,000 acres have included land on CCNWR. Reforestation on CCNWR has included 4300 acres of bottomland and 700 acres of upland, and includes up to 30 species (Refuge Data). The enrollment of private cropland in programs such as the Conservation Reserve Program (CRP) and the Wetlands Reserve Program (WRP) is also an important tool for the preservation of the Cache River wetlands. Reforestation, wetland restoration, and conservation tillage address many of the conservation issues affecting the Cache River Watershed by increasing the function of the floodplain, increasing habitat available to wildlife, and reducing the amount of sediment entering the river from adjacent lands.

Reducing Sedimentation

Restoring forests and wetlands is an important part of fixing the Cache River's hydrology and reducing runoff. A sediment control project popular with private landowners in the Upper Cache involves the construction of in-stream weirs and strategically located flood retention ponds on private land within the Big Creek and Cypress Creek basins, both major contributors of sediment to the Cache River. To date fifty-four, five-acre flood retention ponds have been completed and will contribute to lowering peak flood flows and reducing the amount of sediment being deposited into the Lower Cache. Thirty-eight of sixty planned rock weirs in the Upper Cache, Big Creek and other tributaries will greatly reduce in-stream soil erosion by dissipating the energy of the water preventing further channel incision and lateral gullying that threatens to drain many isolated wetlands, like Heron Pond, in the Upper Cache. In addition, the Conservation Reserve Program's conservation tillage plan has also helped landowners make tremendous progress in reducing sedimentation. From 1987 to 1995 alone, participants in the CRP reduced sedimentation on more than 175,000 acres in the Cache River Watershed by more than 1 million tons annually (Cache River Watershed Resource Planning Committee, 1995).

Restoring Hydrology of the Cache River

The third component of the restoration of the Cache River ecosystem will be the partial reconnection of the Upper, Middle, and Lower segments of the river. The hydrologic alterations in the Cache River have impacted the river's structure and function and ultimately threaten the long-term sustainability of the area's biological diversity. Currently the JVP has developed of a set of reconnection measures that are in the planning stages and will take the efforts and support of public and private entities to accomplish.

Historically, sections of the Middle and Lower Cache River featured wide expanse of open water with depths of more than 10 feet within scour pools (in-channel and off-channel), oxbow lakes, and sloughs. Today much of the Middle and Lower Cache River rarely exceeds four feet due to habitat loss, channelization and drainage. In an effort to restore deepwater habitat and maintain a minimum water level in the Middle Cache the following measures were completed:

1. Two rock weir structures were installed in the Middle Cache River to maintain seasonal low water levels and slow sediment deposition from Big Creek flow reversals. The Diehl dam was

constructed in 1982 west of Long Reach Road; it is located on private property and with the landowner, is maintained by the Illinois Department of Natural Resources under a formal agreement. The Hwy 37 structure was constructed in 1995, and is also critical in reducing sediment deposition in the river channel of the Middle Cache Valley and restoring river bed elevations downstream in the Lower Cache Valley. With restoration and reconnection of the Upper and Lower Cache, these structures will be modified to maintain flow downstream and allow for low and high water regimes.

2. In an effort to restore deepwater habitat, the JVP secured funding to dredge a one mile section of river channel from Long Reach Road upstream to the east (within Buttonland Swamp -MC). The project involved removing excess silt that had accumulated in a section of the Cache River, locally known as Long Reach and Short Reach. The primary goal of this project was to remove excess silt within 60 feet wide by 6 feet deep area. There are expectations to continue dredging upstream as permits and funding are acquired.

Table 1. Summary of Alterations, Resource Impacts and Restoration Strategy

Alteration	Result	Strategy
Land Cover Conversion of forest to agriculture	Increased discharge/flow volume and velocity -decrease flood storage capacity -accumulation of sediment in stream channels reduces the stream flow and increases flooding potential	Water Retention Basins, Habitat Restoration (WRP, CRP), Remove Highly Erodible Lands
Post Creek Cut-off , Levee Construction, Cache River Diversion	-Lateral gullies, sedimentation, flow reversal -Excessive sedimentation in the lower basin and excessive erosion (entrenchment and lateral gullies) in the upper basin -Cut-off/abandoned many of the historic oxbows and river meanders from the main river channel.	Restoration Measures (Reconnection Structure, East and West Swamp Structures)
Middle Cache River Flow Reversal	-Excessive sedimentation in the Middle Cache	-Restoration Measures (Reconnection Structure, East and West Swamp Structures -Restore floodplain structure and function
Stream Channelization (Cache River, Big Creek, Cypress Creek)	-Lateral gullies, -Increase sedimentation and channel degradation -Loss of deepwater habitat	-Install Newberry Weirs and -Water Retention Structures -Dredging
Loss of Floodplain	-Increased discharge/flow volume and velocity -Sedimentation -Decrease flood storage capacity	-Land Acquisition, -Restore floodplain structure and function -Dredging

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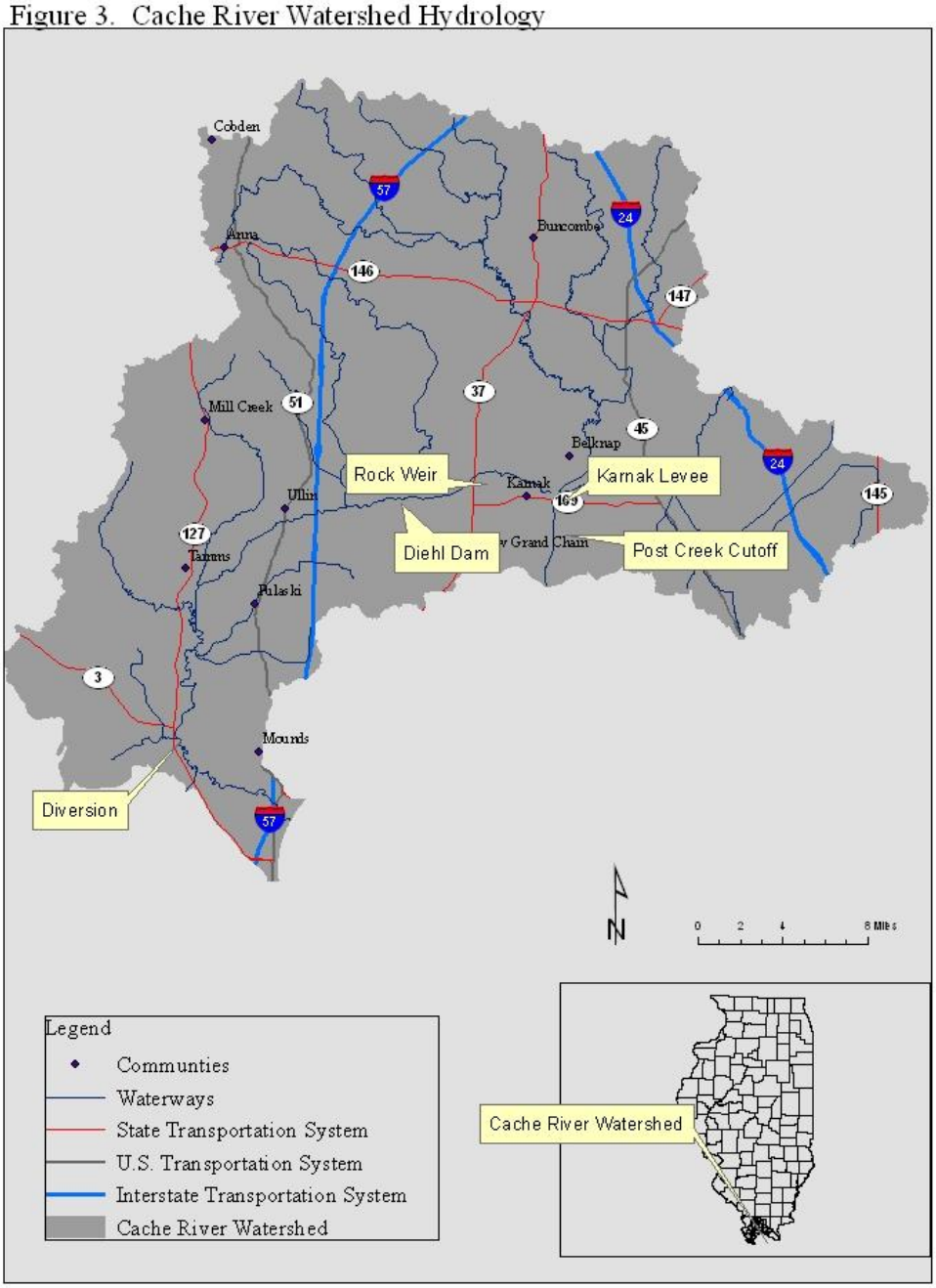
Figure 3. Cache River Watershed Hydrology



Map Date: November 16, 2010

Current Condition and Management Strategies

Refuge Management Units

Cypress Creek National Wildlife Refuge is divided into eight management units that differ in soils, hydrology, topography, land use and vegetative cover. These individual units, (Appendix 3), are described briefly below beginning at the northern end; acreages include land within the CCNWR purchase boundary some of which is currently within private ownership.

Cypress Creek Unit: This unit forms the northernmost boundary of CCNWR and includes some of the higher elevations (500 feet msl) on CCNWR. The area is drained by Cypress Creek which flows into the Cache River south of the Perks Road. The unit contains approximately 6,000 acres of land with over 3500 acres in agriculture (includes private land); in addition to 1,100 acres of low, poorly drained bottomland. To date CCNWR owns 3,400 acres of which 1,611 acres have been restored to forest and wetlands.

Limekiln Slough Unit: This unit includes approximately 6,600 acres with only 22% in Refuge ownership (1,500 acres). The area includes 4,500 acres of agriculture and is bounded on the east, south, and west by low hills. The area is drained by Limekiln Slough which empties into the Cache River. The central portion of the unit historically was a large floodplain forest dominated by oaks and hickories until it was cleared in the 1970's. To date CCNWR owns 1,500 acres of which 850 acres have been restored to forest and wetlands.

Cache River Unit: This unit includes 5,276 acres. The primary feature within this unit is Buttonland Swamp – a National Natural Landmark owned by the Illinois Department of Natural Resources; however CCNWR acquisition boundary forms a buffer around this section of river which widens with a gradual fall of .2-.3 feet per mile. Currently, CCNWR owns 1,136 acres of which 750 acres have been restored to restore the riparian corridor to forest and wetlands. Historically, this section of the river featured wide expanse of open water with depths of more than 10 feet. Within the last century land clearing and channelizations to increase drainage has resulted in excessive silt and sediment deposition eliminating this deep water. In 2002, approximately 1 mile of river within this unit was dredged to remove sediment and initiate deepwater habitat restoration. Today, this section of river contains old growth stands of bald cypress and tupelo and areas dominated by buttonbush.

Butter Ridge Unit: This area contains 5,936 acres of which 60% are in agricultural production. Currently CCNWR owns 2,281 which includes the 1,000 acre Frank Bellrose Waterfowl Reserve; there are 270 acres of moist soil wetlands within the Reserve. This area is intensively managed for waterfowl and shorebirds and provides a sanctuary to migrating ducks. Both Big Creek and Little Creek enters the Cache through the Butter Ridge Unit. Big Creek has a relatively steep hydrologic gradient and drains a basin covering 52 square miles; the channelized lower reach of this tributary bisects the Bellrose Reserve and enters the Cache River. During flood events Big Creek's stream volume and velocity threatens Bellrose moist soil units by backing silt-laden water into the moist soil units and or breaching the levees; Big Creek stream flow can also exceeds the Cache River's ability to maintain a west and south flow thus reversing

the flow of the Cache River and increasing sedimentation into Buttonland Swamp (within the Middle Cache Valley).

Indian Camp Creek: This unit which is low, flat and primarily river floodplain includes approximately 3,000 acres with 1,208 acres in agriculture (primarily private land). Extensive channelization between the towns of Ullin and Tamm's cut-off many of the historic oxbows and river meanders from the main river channel. To date CCNWR owns approximately 1,000 acres which includes floodplain forest and wetlands.

Sandy Creek and Lake Creek Units: These units include 7,432 acres and form a relatively narrow corridor along the Cache River from the town of Tamms to the Mississippi Diversion. Cypress Creek National Wildlife Refuge owns approximately 5,700 acres with 300 acres in agriculture. The remaining acreage has been restored to floodplain forest and wetlands. Extensive channelization between the towns of Sandusky and Ullin, has cut-off many of the historic oxbows and river meanders from the main river channel.

Old Cache Channel Unit: This unit includes 2,537 acres with approximately 1,038 acres in Refuge ownership. Approximately 90% of the unit is low, poorly drained bottomland (~320 feet msl) and is characterized by hydric soils. The Old Cache River Channel forms the south boundary of this unit. In 1950 a ditch was cut on the west end of the channel diverting water from Cache River directly into the Mississippi thus abandoning approximately 6 miles of river channel that empties into the Ohio River. Prior to Refuge ownership, the United States Army Corps of Engineers (USACE) has maintained a floodgate into the Ohio River (on the east end of the old channel). The USACE with the cooperation of the Cairo Drainage District, are currently responsible for manipulating water levels in the channel to maintain drainage and flood control. When the gates are open and the Ohio River is down, water levels can drop to 2' or less; however, existing drainage district staff assist with maintaining a minimal water level in the channel.

The following tables summarize total acreage within each management unit in the purchase boundary (Table 2) and the acreage in Refuge ownership (Table 3).

Table 2. Land Cover Acres within Cypress Creek NWR Management Units (Acquisition Boundary)

Management Unit	Urban	Forested	Wetlands	Water	Grass	Ag	Restored	TOTAL
Cypress Creek	7	1092	314	32	793	2246	1791	**6280**
Limekiln	10	385	79	15	798	4505	902	**6694**
Cache River	15	339	828	188	170	2409	1327	**5276**
Butter Ridge	44	734	230	101	941	3410	474	**5936**
Indian Camp Creek	7	904	398	101	339	1208	35	**2992**
Sandy Creek	5	1250	339	32	343	1045	1151	**4180**
Lake Creek	2	1619	203	89	457	618	264	**3252**
Old Channel	49	272	84	133	106	1868	25	**2537**
TOTAL	**124**	**6595**	**2475**	**691**	**3947**	**17309**	**5869**	**35,320**

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Table 3. Land Cover Acres within Cypress Creek NWR Management Units (Refuge Ownership)

Management Unit	Urban	Forested	Wetlands	Water	Grass	Ag	Restored	TOTAL
Cypress Creek	2	783	208	12	353	450	1611	**3419**
Limekiln	0	111	42	10	163	351	852	**1529**
Cache River	2	148	99	72	37	27	751	**1136**
Butter Ridge	17	484	190	54	314	751	469	**2279**
Indian Creek	2	393	210	42	151	126	35	**959**
Sandy Creek	2	983	289	32	222	277	0	**2952**
Lake Creek	0	1324	185	72	378	531	264	**2754**
Old Channel	2	203	74	101	37	596	25	**1038**
TOTAL	**27**	**4429**	**1297**	**395**	**1655**	**3109**	**4007**	**16,066**

Ongoing Management Strategies

Land Acquisition Program/Priorities

Cypress Creek National Wildlife Refuge was established in 1990 with a land acquisition boundary of 35,320 acres. Refuge land acquisition is ongoing on a willing seller basis. Current refuge acreage totals approximately 16,000 (Figure 4). Land acquisition funding has been through the Land and Water Conservation Fund (LWCF). Refuges using LWCF funding are prioritized based on their potential contribution to the overall refuge system in terms of ecosystem conservation, bird conservation, endangered and threatened species and fisheries and aquatic resources.

In addition to LWCF funding, USFWS has partnered with The Nature Conservancy, Ducks Unlimited Incorporated and the American Land Conservancy to acquire important tracts. These land acquisition partnerships are very important to continued refuge land acquisition. Our partners have access to funding sources other than LWCF and can often complete real estate transactions in a timelier manner than the required Federal Land Acquisition procedures. This is very important in a competitive real estate market, where the seller is often interested in selling their property in as short a timeframe as possible.

All land acquisition is on a willing seller basis, which often results in several tracts to consider for acquisition with a limited amount of funding. Land acquisition is prioritized relative to refuge goals related to the North American Waterfowl Management Plan; protection of valuable wetlands and bottomland hardwoods; and providing contiguous ownership necessary for hydrology restoration activities. Priority is usually given to tracts adjoining the Cache River and major tributaries, tracts with significant wetlands or wetland restoration potential, and tracts that have the potential to increase forest block size.

Refuge Farming Program

The CCNWR Cooperative farm program includes approximately 1413 acres and 11 cooperative farmers. The standard cooperative farm agreement is that each farmer provides all equipment, supplies, and labor to plant, maintain, and harvest the crop. The cooperator harvests 75% of the crop and leaves 25% in the field for the benefit of migratory and resident wildlife.

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Approximately 50% of the land acquired by CCNWR includes a history of agricultural production; many of these acres include highly erodible lands (HEL). Since Refuge establishment, many of these HEL farms or floodplain fields have been removed from production and restored to forest or wetlands. In order to prioritize future restoration of lands within the cooperative farming program, a GIS tract assessment model was recently developed in cooperation with Southern Illinois University (SIU). The parameters for this model or planning guide include: 1) Forest connectivity, 2) NRCS Land Capability Class, 3) Proximity to streams, 4) Presence of HEL, and 5) Presence of wetlands. Preliminary results from this model indicate the fields in the northern portions of CCNWR to be of highest priority for reforestation (Figure 5).

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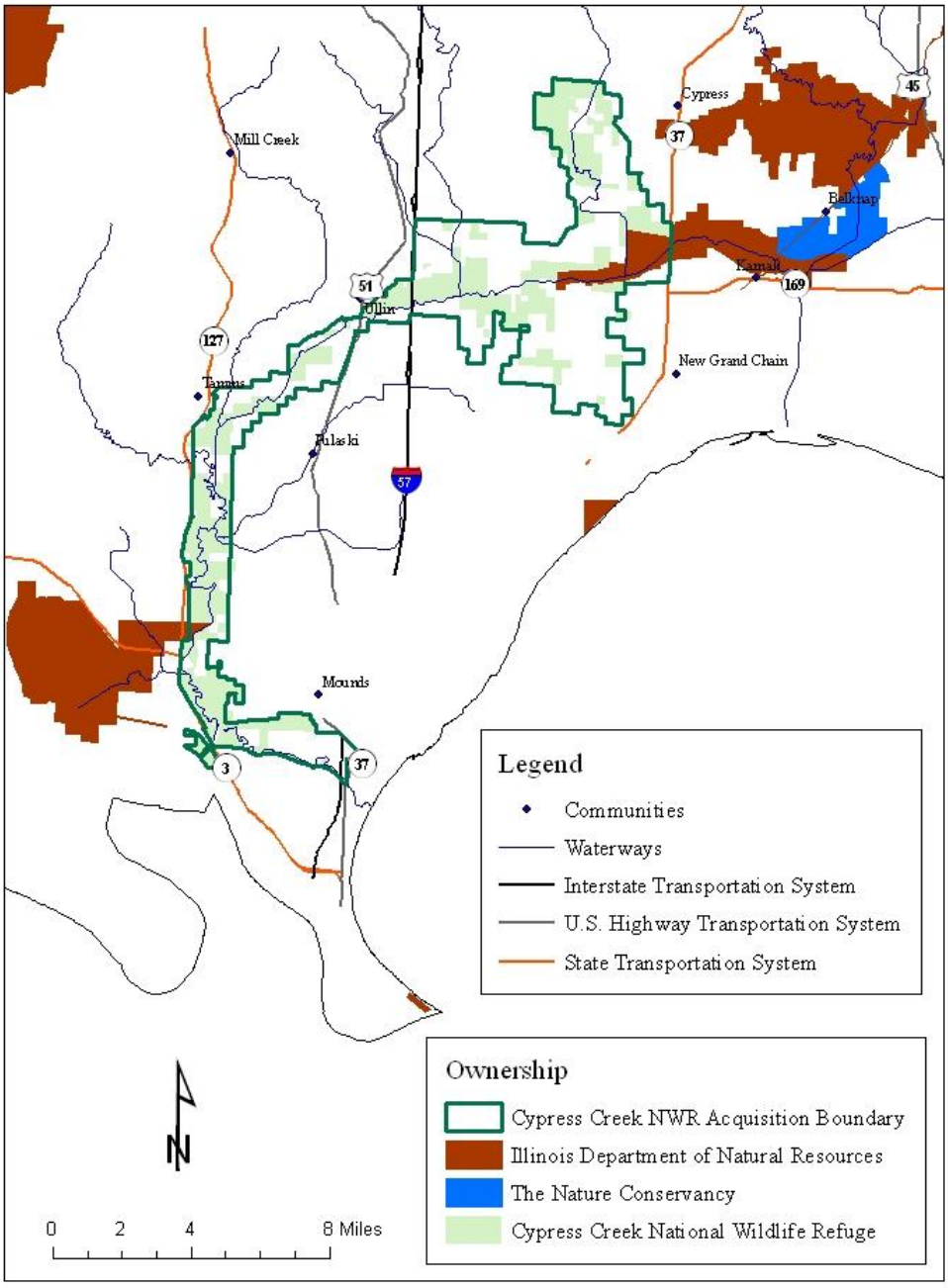
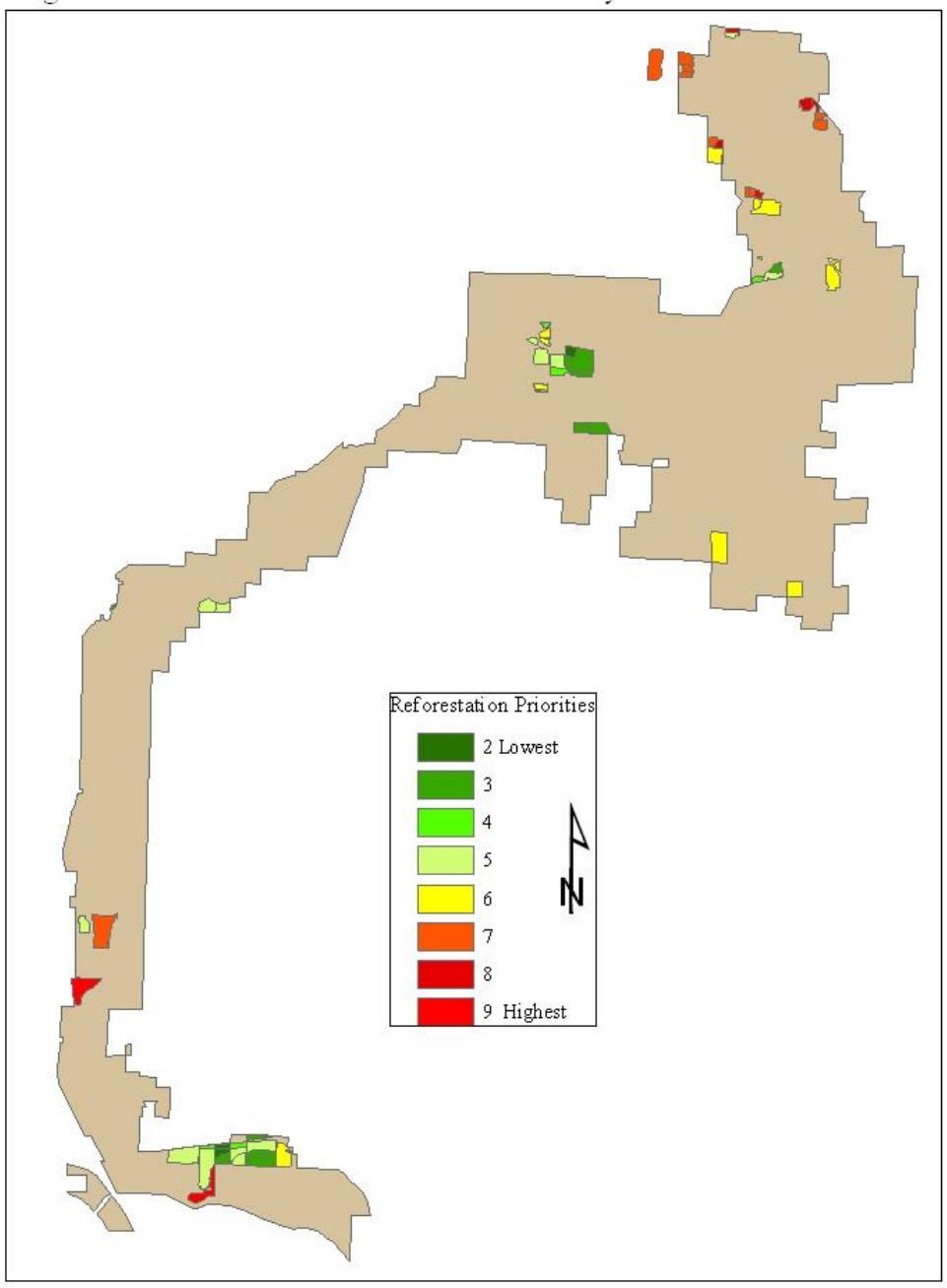
Figure 4. Cypress Creek National Wildlife Refuge Ownership and Acquisition



Map Date: November 17, 2010

Figure 5. Potential Reforestation Land Suitability Model



Wetland Management

Moist Soil - Thirteen moist soil units totaling 700 acres are managed on CCNWR with the primary purpose of producing food for migrating waterfowl. Periodic disturbance and water level manipulation are utilized within the impoundments in order to encourage the germination of valuable moist soil plants such as annual smartweeds, wild millets, and beggar-ticks. Incremental flooding of moist soil units begins in October or November. The units are progressively flooded as waterfowl arrive in order to concentrate feeding areas, and avoid premature deterioration of moist soil seeds. All units remain flooded through the winter and provide invertebrates for early spring migrating waterfowl. Drawdown begins in mid to late March and can occur, depending on the unit anytime between March and the following fall depending on the vegetation community that is desired and the guild of waterbirds that are being targeted. Drawdowns serve as a valuable tool to attract a diversity of foraging birds. An annual water management plan is developed and implemented each year which provides a staggered schedule in order to maximize the diversity of water levels and therefore availability of habitat for the greatest diversity of species.

Other Ephemeral Wetlands - CCNWR contains 10 ephemeral wetlands with no method of water control. Most of these wetlands are less than 5 acres in size. These units are typified by willow and buttonbush along the periphery with emergent vegetation such as Bulrushes, Sedges, Cattail, and Smartweeds growing within the unit. Some of the units include some Bald Cypress Trees as well. These units provide habitat for a number of reptiles and amphibians as well as being important feeding areas for migrating birds and a host of other plant and animal species.

Invasive Species Control

There are a number of invasive species throughout CCNWR. Table 4 shows those species causing the highest level of concern and considered high priority for control measures. The key to controlling invasive species is early detection and treatment which is not always feasible due to staff and funding limitations. Due to limited resources, invasives work at CCNWR has been concentrated on limiting the spread of large infestations, eliminating small infestations (especially those of priority species) where it is possible, and then working on larger infestations when possible. A baseline inventory of invasive species was conducted in order to document and identify the presence of invasive species and the extent of infestation. Current control measures include the use of chemicals and mechanical control.

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Table 4. Invasive Species at Cypress Creek National Wildlife Refuge

NAME	SPECIES
Amur Honeysuckle	*(Lonicera maackii)*
Autumn Olive	*(Elaeagnus umbellatae)*
Chinese Yam	(*Dioscorea oppositifolia)*
Garlic Mustard	*(Alliaria petiolata)*
Japanese Chafflower	*(Achyranthes japonica)*
Japanese Hops	(*Humulus japonicus*)
Japanese Honeysuckle	*(Lonicera japonica)*
Japanese Stilt Grass	*(Microstegium vimineum)*
Kudzu	*(Pueraria Montana var. lobata)*
Multiflora Rose	*(Rosa multiflora)*
Oriental Bittersweet	*(Celastrus orbiculatus)*
Phragmites	*(Phragmites australis)*
Princess Tree	*(Paulownia tomentosa)*
Reed Canary Grass	*(Phalaris arundinacea)*
Sericia lespedeza	*(Lespedeza cuneata)*
Tree Of Heaven	*(Ailanthus altissima)*

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Prescribed Burning:

Cypress Creek National Wildlife Refuge has a limited prescribed fire program due to the emphasis on reforestation and wetland restoration. When fire is utilized, it serves the purpose of manipulating vegetation for a desired Refuge goal. Prescribed burns are conducted on approximately 65 acres of warm season grasses located at the Bellrose Waterfowl Reserve. Spring burns have been utilized to reduce thistle, fescue, ragweed, and Johnson grass encroachment in addition to knocking back woody vegetation. Each of these sites provides valuable migratory and nesting habitat for a diversity of grassland birds (prairie warblers, dickcissels, bobwhite quail), short-eared owls, and harriers.

Prescribed fire is also thought to have played an important role in the life history of giant cane. A fire management plan to enhance existing cane growth as well as transplanted cane is necessary in order to maintain a robust giant cane habitat over time. Given the establishing

purposes of CCNWR, a habitat component such as cane, which serves as a sediment filter and a structurally important habitat for rare and endangered species, should be a management priority. Disturbance caused by fire results in multiple benefits including stimulating sprouting of new culms, returning nutrients to the soil, and reducing competition from other plants. In addition, there is evidence that burning may bolster resistance to subsequent environmental shocks (Gagnon 2006).

Current Resource Inventory

Despite changes that have occurred over the years, CCNWR provides valuable habitat for migratory birds as well as numerous species of resident mammals, birds, reptiles, amphibians, and fish. Because of significant natural values and the potential for wetlands restoration, CCNWR was identified as a high priority for acquisition under the New Madrid Wetlands Project – a component of the Lower Mississippi Valley Joint Venture of the NAWMP. In 1994 the area, along with the Cache River SNA, was designated a "Wetland of International Importance" by the Ramsar Convention (1994) and an "Important Bird Area" by Audubon. The area also features a number of ecologically sensitive flora and fauna species and includes eight federally listed and 102 state listed threatened and endangered species. Broad habitat types within CCNWR include: wetlands, bottomland forests, and upland forests.

Vegetation

The Lower Cache River watershed, comprised of four overlapping physiographic regions; the Upper East Gulf Coastal Plains, Ozarks, Mississippi River Alluvial Plain, and the Interior Low Plateau, contains unique plant and animal species influenced and molded by the habitat and environmental conditions within the specific region. When these regions overlap, species from each region can be found together. These conditions create a habitat area of unusual species abundance and diversity.

The Cache River area is composed primarily of wetlands, bottomland forest, upland forest, and agricultural lands . Five general categories of wetlands occur on CCNWR area: 1) swamp; 2) shrub swamp; 3) open water; 4) wet floodplain forest; and 5) successional fields (wet farmland). The swamp and shrub swamp areas are dominated by bald cypress and tupelo trees with varying amounts of buttonbush scrub thicket. Water in these areas stands at a depth of approximately two feet when full. These cypress, tupelo, and other swamp trees make up the oldest living stand of trees east of the Mississippi River. Core samples from some of the largest of the cypress trees (the largest individual with a circumference of 31 feet 2 inches and over 95 feet tall) indicate ages of well over 1,000 years. Two of the largest individual swamp trees of their species in the United States, a water locust (circumference 3 feet 3 inches, height 30 feet), live here. In addition, twelve state champion trees have been recorded in this stand. Surveys have documented the presence of hundreds of trees with trunks larger than four feet in diameter (White, 1980).

The bottomland hardwood forest (wet floodplain forest) represents the transition zone between permanent water areas and uplands. Soils range from areas that are saturated throughout most of the growing season to sites where soil saturation may last a week or month out of the growing

season. In this area, the cypress and tupelo become increasingly less frequent while sweet gum, swamp cottonwood, oak, elm, ash, sugarberry, hickory, and maple become more common.

A wide diversity of forest types, ages, and conditions are found on CCNWR. Forest inventory data is found in Appendix 3.

Several species found in CCNWR are at the northern extent of their range and usually are characteristic of species found at more southern latitudes, notably bald cypress and water tupelo. Many endangered or threatened plant species also occur in the area. The Federally threatened Price's potato bean lives in the wet floodplain forest area. An additional 80 State threatened of endangered plant species have been reported from the four counties that encompass the study area. Forty-three of these have been observed in the study area to date. Surveys in the study area have been revealed 138 species of woody plants (trees, shrubs, and vines), 251 species of non-woody plants, and 11 species of ferns (United States Department of Interior, 1990)

Soils

The soils on the uplands of the Cache Watershed are mainly derived from loess. They have a fragipan, are relatively thin on slopes, and are subject to severe erosion when disturbed. Hosmer, Stoy, Zanesville, Lax, and Alford are typical soils of the hills both north and south of the Basin. Along the upper reaches of the Cache River, Cypress Creek, and Big Creek, the primary bottomland soils are wakeland and Haymond. Downstream along the upper Cache, the swamp soils are mapped as Sharon and Belknap. The terrace soils along the lower Cache in the Basin are Weinbach, Giant, and Sciotoville. The swamp and poorly drained soils along the lower cache are Karnak, Dupo, Belknap, Bonnie, Cape, and Darwin. The natural area soils are mapped as the Karnak-Darwin association. These are light colored and moderately dark colored, fine-textured, poorly drained, slightly acid and medium acid soil. The bottomland soils formed in sediments left from the Ohio River floodplain and in recent alluvium derived from the loess washed down into the Basin. Most of the silty soils, both on the uplands and in the bottomlands, are extremely soluble in water and settle out very slowly.

Wildlife

The Cache River and its associated wetlands are well known for their diversity and outstanding wildlife values. Waterfowl, shorebirds, wading birds, raptors, songbirds, reptiles, amphibians, furbearers and other mammals utilize the area.

Birds - Nearly 250 species of resident and migratory bird species use CCNWR throughout the year. Migrational counts number in the tens of thousands and include ducks, geese, shorebirds, wading birds, and countless other avian species.

Wide arrays of other avian species use CCNWR due to the diversity of habitats within CCNWR and surrounding watershed. Many species of birds are on the Illinois' Endangered, threatened, or species of concern lists.

Neotropical bird studies indicate that CCNWR and the surrounding watershed contain one of the most diverse assemblages of such species remaining in the Midwest.

The Bald Eagle, a recently de-listed species from the federal threatened and endangered list, is a fairly common migrant and winter resident, along the Ohio, Mississippi and area Rivers, and 3 pairs of birds are currently nesting on CCNWR. State listed endangered species which often utilize CCNWR include Northern Harrier, Little Blue Heron, and Barn Owls.

Mammals - CCNWR contains 47 known species of mammals. Resident species include white-tailed deer, squirrel, swamp rabbits, bobcat, and otter.

CCNWR contains large areas with excellent foraging and nursery habitat for the Indiana Bat, a federally listed endangered species.

Reptiles and amphibians - Cypress Creek NWR and the surrounding wetland contain 54 known species of reptiles and amphibians. Of the 20 species of frogs and toads in the state, 18 have been recorded in the watershed.

The state threatened Eastern Ribbon snake and Canebrake rattlesnake, a subspecies of the Timber Rattlesnake both utilize CCNWR and surrounding wetlands.

Cropland/Agriculture

As for most of the state, agriculture has played a significant role in the Cache River watershed. The predominant land use in the basin is agriculture with more than 70% of the watershed (345,000 acres) in production. The small remnants of vast wetlands in the basin only make up about 4% of the watershed (20,000 acres).

The Cache lies farther south than do other "southern" cities as Louisville, Lexington, and Richmond resulting in a relatively long average frost-free growing season of 230 days. Corn and soybeans are the principle crops of the Cache River basin farms along with sorghum, wheat, and hay, and some livestock. Because the dominant soils in the basin are not very fertile and in some years considerably wet compared to the prairie soils of central Illinois, overall yields of staple row crops are typically below the state average.

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Chapter III. Resources of Concern

Identification of Refuge Resources of Concern

As stated in Chapter 1, this Habitat Management Plan (HMP) will set forth strategies for achieving goals and objectives and guide refuge staff in management decisions over the next fifteen years. In order to develop these strategies, it is essential to understand Cypress Creek National Wildlife Refuge authorizing legislation, purpose and related resources of concern. This HMP also documents the process used by refuge staff to identify and prioritize trust resources and other elements of biodiversity for conservation action.

Cypress Creek National Wildlife Refuge was established in 1990 under the Emergency Wetlands Resources Act (16 U.S.C. 3901b, 100 stat.3583, PL 99-645), with the following primary purposes:

> …"the conservation of wetlands of the Nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions" (16 U.S.C., Sec. 3901 (b) (Emergency Wetlands Resources Act of 1986)

Cypress Creek National Wildlife Refuge purpose and importance to migratory birds, particularly waterfowl, were further described in the Service's Environmental Assessment (1990) and Approval Memorandum for Refuge establishment:

> "To protect, restore and manage wetlands and bottomland forest habitats in support of the North American Waterfowl Management Plan; 2) to provide resting, nesting, feeding and wintering habitat for waterfowl and other migratory birds; 3) to protect endangered and threatened species and their habitats; 4) to provide for biodiversity; 5) to protect a National Natural Landmark, 6) and to increase public opportunities for compatible recreation and environmental education"

In addition, the National Wildlife Refuge System Improvement Act of 1997 also requires that System growth and management be planned to contribute to the conservation of ecosystems and that the biological integrity, diversity and environmental health of the System be maintained for the benefit of present and future generations. The Service defines these terms as:

Biological Diversity	The variety of life and its processes, including the variety of living organisms, the genetic differences between them, and the communities and ecosystems in which they occur.
Biological Integrity	Biotic composition, structure, and functioning at genetic, organism, and community levels comparable with historic conditions, including the natural biological processes that shape genomes, organisms, and communities.

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Environmental Health Composition, structure, and functioning of soil, water, air, and other abiotic features comparable with historic conditions, including the natural abiotic processes that shape the environment

In addition to providing habitat for trust species, refuges also support other elements of biodiversity including invertebrates, rare plants, unique natural communities, and ecological processes (USFWS, 1999).

Resources of Concern

Resources of concern were identified through consideration of CCNWR purposes and mandates noted above, and comparison of lists of species and habitats identified in all of the plans listed below. In addition, while compiling the list of resources of concern, an emphasis was placed on those species that are 1) Federal or State threatened or endangered 2) rare, declining or unique to CCNWR and surrounding landscape 3) species which require rare or declining habitat or finally 4) species that are appropriate and native to the area but do not fall into a special category of concern but which we are capable (through management actions) of fulfilling the habitat needs of those species. In order to be able to focus refuge management objectives, a list of species that are considered "priority" resources of concern were chosen. Priority species of concern are those species whose habitat requirements may not necessarily be met by simply protecting the natural community within which they exist, or species which are especially imperiled and may require special consideration. Additionally, natural communities were also chosen as resources of concern when they were specifically identified in the CCNWR purpose, support species or species groups identified in those purposes. Additional factors considered when choosing these communities was the role they play in ecological processes that shape CCNWR habitat, ecosystem drivers that shape surrounding landscapes within the Cache watershed, or finally, their maintenance or restoration of biological integrity, diversity, and environmental health. Using these concepts as a guidance tool, a condensed list of species (Table 5) and natural communities (Table 6) which are resources of concern was developed for CCNWR. Plans used to help identification of resources of concern included:

- Partners in Flight Physiographic Area 14 –Bird Conservation Plan for the Interior Low Plateaus
- Bird Conservation Region 24- CHJV Concept Plan
- UMVGLJV Bird Conservation Plans (shorebird, waterbird, waterfowl, landbird)
- USFWS Region 3 Fish and Wildlife Resource Conservation Priorities
- The North American Waterfowl Management Plan
- Federal Threatened and Endangered Species lists and recovery plans
- Illinois Threatened and Endangered Species list
- Illinois State Comprehensive Wildlife Conservation Plan
- Illinois State Natural Heritage Database
- Cypress Creek Comprehensive Conservation Plan
- The Nature Conservancy Cache River Macrosite Plan

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Table 5. Cypress Creek National Wildlife Refuge Priority Resources of Concern "Species and Species groups"

	Life Cycle/Season	Occurrence in Cache River Watershed	Monitored or Managed For on Refuge	Federal or State Status[1]	USFWS Region 3 Priority Species[2]	Illinois Species of Concern [3]
Birds						
Waterfowl	Migration	Common	Yes			Yes
Shorebirds	Migration/Breeding	Common	Yes			Yes
Forest Birds	Migration/Breeding	Common	Yes			Yes
Wood Duck	Migration/Breeding	Common	Yes	None	Yes	Yes
Red-Headed Woodpecker	Wintering	Common	No	None	Yes	
Little Blue Heron	Breeding	Uncommon	Yes	SE	No	Yes
Amphibians						
Northern Crawfish Frog	Year Round	Uncommon	Yes		No	Yes
Bird-Voiced Treefrog	Year Round	Uncommon	Yes	ST	No	Yes
Reptiles						
Copper-Belly Watersnake	Year Round	Uncommon	No		Yes	Yes
Timber Rattlesnake(Canebrake Rattlesnake)	Year Round	Uncommon	No	ST	Yes	Yes
Fish						
Cypress Minnow	Year Round	Rare	No	SE	No	Yes
Mammals						
Indiana Bat	Breeding	Rare	Yes	SE, FE	Yes	Yes
Plants						
Cypress Knee Sedge	Year Round	Rare	No	SE	No	Yes

1. FE = Federally Endangered, SE = State Endangered, ST = State Threatened
2. (United States Fish and Wildlife Service, 2002)
3. (Illinois Natural Heritage Database, 2010)

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Birds

Waterfowl - The resources available to waterfowl on CCNWR have a historical basis because the Mississippi Flyway corridor associated with the river systems in southern Illinois has been a major site where natural disturbances provided abundant food resources in herbaceous and forested wetlands. (L. Fredrickson, personal communication). Eight waterfowl species that are commonly observed on CCNWR that are USFWS Region 3 Conservation Priority species (USFWS 2002) include Wood Duck, Black Duck, Mallard, Blue-Wing Teal, Northern Pintail, Canvasback, Lesser Scaup, and Canada Goose. Thousands of ducks and geese migrate through and winter in the area (September-March). Increasing land acquisition by public agencies and enrollment of private land in federal programs has resulted in increases in wintering populations of waterfowl within the Cache River Watershed. To date, the Natural Resource Conservation Service has enrolled 10,000 acres of private lands within the Cache River Watershed into the Wetland Reserve Program. CCNWR provides habitat for approximately 26 species of waterfowl throughout the migration and wintering portion of their annual cycle (Refuge data). The forested wetlands of CCNWR also provide valuable breeding habitat for cavity-nesting ducks such as Wood Ducks and Hooded Mergansers.

Forest Song Birds - Cypress Creek National Wildlife Refuge is mostly forested. CCNWR and the surrounding watershed provide important breeding and migration habitat for approximately 150 forest song bird species. These birds benefit from extensive stands of hardwood forests and a major focus of CCNWR management has been the acquisition and restoration of additional floodplain woods. The diversity of the CCNWR forest song bird community results from its mix of swamp, floodplain, and upland forests. Especially rich species diversity has been recorded along naturally occurring levees within the forests. Forest breeding bird surveys and research on nest success conducted on CCNWR and the surrounding Cache River watershed since 1994 give invaluable insight into forest bird habitat suitability), and results of these studies have suggested that CCNWR and the surrounding forests of the Cache River Watershed may make significant contributions to regional populations of forest song birds (Hoover 1996, 2006, Robinson 1995).

Shorebirds - This area is an important migration stopover for shorebirds due to its strategic location between major shorebird flyways along the Ohio and Mississippi Rivers. The interior linear wetland systems of CCNWR and the surrounding Cache River wetlands have the potential to serve as a valuable link between southern non-breeding areas and northern breeding grounds of migrant populations of many Midwestern shorebird species (Hands, 1991, Skagen et al. 1999). Cypress Creek national Wildlife Refuge has conducted spring shorebird surveys since 1996.CCNWR provides habitat for approximately 16 species of shorebirds throughout the fall (July-October) and spring (March-June) migration periods. Six of the shorebird species that use CCNWR are USFWS Region 3 Conservation Priority Species (USFWS 2002, 2004).

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Little Blue Heron - Herons and egrets are especially numerous in the spring and fall (late-April-May and July-September) on CCNWR and within the Cache River watershed. Large rookeries of over 500 nests occur in swamp forests along the south part of the Cache River near the city of Mounds and within the adjacent Cache River State Natural Area. Moist soil impoundments on CCNWR provide hundreds of acres of foraging habitat for Little Blue Herons and other wading birds that show up in both early spring and fall (Laubhan and Fredrickson, 1993).

Amphibians and Reptiles

Approximately 75% of the amphibians and reptiles found in the state of Illinois are known to occur within the Cache River Watershed.

Copperbelly watersnake- Populations of this watersnake in southern Illinois are fragmented and isolated, however, the Cache River Watershed may provide some of the better habitat complexes due to the extent of intact floodplain forest and swamp habitat. The copperbelly watersnake has undergone a long term decline throughout much of its range, primarily due to habitat destruction (Http://www.herpcenter.ipfw.edu.html). It congregates in shrubby wetlands and swamps during the breeding season and then moves over land to other wetlands as seasonal ponds dry up. Copperbelly watersnakes typically forage on small amphibians and fish, but appear to favor adult and larval frogs.

Canebrake rattlesnake- This rattlesnake, a subspecies of the timber rattlesnake inhabits forested swamp along rocky outcrops and bluffs, and canebrakes. Canebrake Rattlesnakes over-winter in the base of hollow trees or in stumps. This species is active April through October in our area. This species is threatened in Illinois. Timber rattlesnakes have been observed in Union County. The major threat to this species is the clearing of forest.

The Northern crawfish frog- This species lives underground most of year in mammal burrows, storm drains, and abandoned crayfish burrows. This species has been observed recently in Johnson, Union, and Alexander counties. Currently, frog call surveys are done on CCNWR every Spring. Crawfish frogs have been observed at six of the sites surveyed on CCNWR. This species is uncommon and declining in some areas where breeding habitats have been drained. Moist soil units and areas such as emergent marsh and sandblows with semi-permanent and permanent water on CCNWR provide important habitat for these and other amphibians. They are most commonly found in habitat with hardpan clay soils in low, wet areas.

Bird-voiced tree frog- This state threatened species inhabits trees and shrubs within bald cypress-tupelo swamps and nearby floodplain forests. In Illinois, this species is only known to be in the four counties which encompass CCNWR, where it can be locally common in areas with good habitat. This species has been documented on four sites on CCNWR. Recent observations have been reported in all four counties within the CCNWR boundary (INHS database). This species is listed as threatened in Illinois.

Fish

Cypress Minnow - This state endangered fish was historically located throughout much of the watershed. This species was once thought to be extirpated in Illinois but was rediscovered in the Cache watershed in 1984. Continued sampling confirmed the species was still present in the Cache River after the 1993 flood (Burr et al. 1996). The cypress minnow is listed as endangered in Illinois.

Mammals

Indiana Bat - Indiana bats are a federally listed endangered species that is experiencing widespread declines. Despite these declines, the species appears to have stable wintering populations within southern Illinois and populations may be increasing within the Cache River Watershed. Potential habitat for this species occurs in caves, mines, small stream corridors with well developed riparian woods, and upland and bottomland forests. Acoustical surveys are currently being conducted on CCNWR in order to locate possible Indiana Bat roosting habitat.

Plants

Cypress Knee Sedge - The cypress-knee sedge is an aquatic sedge that is usually associated with Bald Cypress trees, logs or knees (Voigt and Mohlenbrock, 1964). It occurs in permanently flooded bald cypress-tupelo swamp habitat on CCNWR. This sedge may often be found on floating or partially submerged rotting logs or stumps as well, and in a full range of lighting conditions from full sun to dense canopy. Cypress knee sedge has also been found growing in sink hole type wetlands in Indiana (Tiner 2003), and may be a species associated with sandblow habitat on CCNWR.

Natural Communities

An emphasis was placed on natural communities or habitats that are considered 1) rare, declining or unique to CCNWR and surrounding landscape 2) contain high to medium concentrations of priority species or species groups with similar habitat needs or 3) have the capability (through management actions) to meet the habitat needs of those species. Table 6 highlights priority natural communities and associated Resources of Concern at CCNWR.

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Table 6. Cypress Creek National Wildlife Refuge Priority Resources of Concern " Natural Communities"

Priority Natural Communities	**Associated Resources of Concern**
Bottomland Forest	Indiana Bat, Forest Birds (*Yellow-Billed Cuckoo, red-headed woodpecker, Wood thrush, Cerulean Warbler, Prothonotary Warbler , Yellow throated warbler, Kentucky warbler and Louisiana Waterthrush),*Waterfowl (*Mallards, WoodDucks, Mergansers*) Copperbelly watersnake)
Cypress-Tupelo Swamp	Waterfowl, Forest Birds (*Yellow-throated warbler, Red-headed woodpecker, Prothonotary warbler*), Bird-voiced tree frog Cypress Knee Sedge
Non-forested, ephemeral wetlands (including moist soil units and unmanaged wetlands)	Waterfowl, Shorebirds, Little Blue Heron, Crawfish Frog, Copperbelly water snake
Canebrakes	Forest Birds (*Swainson's Warbler*), Canebrake Rattlesnake

Identification of Habitat Requirements

The goal at CCNWR is to provide the optimum quality and quantity of habitat possible in order to fulfill the habitat needs of our priority species and species groups. This involves taking into account the vegetative characteristics, timing of availability, distribution, and the associated ecological processes necessary to support these species.

Birds

Waterbirds - Many of the species of wintering and migrating water birds using CCNWR have similar habitat needs. With a well-planned management strategy, we have the capabilities to maximize the wildlife for which we are providing suitable habitat. For example, the majority of priority species require shallow water depths (0-10 inches) in order to forage, therefore, keeping the water levels in flooded impoundments below 10 inches will maximize the number of species that benefit. The wetlands within the Cache River Watershed produce an abundance and diversity of invertebrates, crustaceans, amphibians, fish, and plant material which are essential for the survival of the diverse waterbird species using CCNWR. Table 7 summarizes the chronology of waterbird use at Cypress Creek National Wildlife.

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Table 7. Chronology of waterbird use at Cypress Creek National Wildlife Refuge

Season	**Bird Species**	Date
Early Fall	Blue-winged teal, Northern pintail, Rails, Bitterns, Shorebirds	August 1-November 9
Mid Fall	American wigeon, Gadwall, Green-winged teal, Snipe, White Fronted Geese	November 10-November 24
Late Fall	Mallards, Canada Geese	November 24-January 5
Early Spring	Mallards, Northern pintail, Canada Geese	March 1-March 31
Mid Spring	Teal, Northern Shoveler, Shorebirds, Rails, Herons	April 1-May 25
Late Spring	Herons, Shorebirds	May 25-July 8

Waterfowl - Waterfowl, particularly dabbling ducks, tend to concentrate in shallow water wetlands where natural "moist soil" plants such as wild millet, panic grass and beggarticks are abundant. (Fredrickson 1982). Row crops have traditionally been an integral part of waterfowl management in this area, and are particularly important in providing high energy foods for concentrations of larger waterfowl such as geese and mallards during fall migration and winter (Ringelman, 1990). Early fall migrants such as Blue-wing Teal and Northern Pintail begin to arrive in southern Illinois as early as mid September. These shallow water foragers require the smaller seeds from moist soil plants such as panic and crab grasses, and use water depths 5-8 inches. Mallard, Gadwall, and American Widgeon arrive in mid fall (October) and also utilize shallow water less than 10 inches deep for optimum foraging. Northern Shovelers can use a variety of water depths, because they are able to strain invertebrates from the surface of deeper water. Mallard and Pintail feed extensively from the bottom; however, Mallards generally dabble from the surface in shallower water, while Pintails are more likely to tip-up in deeper water. Blue winged Teal frequent areas with submerged vegetation (Fredrickson 1982).

Diving ducks such as Lesser Scaup and Ring - necked Ducks use both shallow and deep water areas on CCNWR for feeding and loafing. A lack of deepwater habitat on
In the spring, both dabbling and diving ducks rely heavily on protein rich invertebrates as a major food source as they prepare for egg laying or molting .

Shorebirds - Migratory shorebirds require substantial energy to replace depleted fat reserves that fuel their long distance migrations (Helmers 1992). Macroinvertebrates are a key energy resource for shorebirds. Many shorebirds feed predominately on fly larvae during migration.

Shorebirds are a morphologically diverse group that exploits shallowly flooded wetlands. Preferred foraging depths range from 1-3 inches. For the most part, shorebirds require mudflats or shallow water of 2 inches or less, and prefer vegetation height to be less than half their body height (Helmers 1992). Common Snipe and Pectoral Sandpipers will forage on sites with short, moderately dense vegetation; however most shorebirds prefer sites with less than 25% vegetative cover. Shorebirds respond very well to shallow water zones interspersed with mudflats.

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Shorebirds migrating through southern Illinois respond well to early spring drawdowns conducted within moist soil units. Most areas within moist soil impoundments provide ideal foraging habitat because they are free of vegetation after spring drawdown.

Wading Birds - Herons prefer open water with an abundance of submerged and floating vegetation but only sparse emergent vegetation. Little Blue Herons and other waders frequent the herbaceous marsh areas and moist soil units on CCNWR in the spring and summer as water levels are decreasing, and food resources are concentrated. Incorporating some late season drawdowns into CCNWR water management plan could increase habitat available to Little Blue Herons and other waders. Wading species also respond well to newly re-vegetated and re-flooded impoundments in the late summer and fall. Little Blue Herons, as with many wading birds, typically forage in shallow water between 2-6 inches (Rodgers et al. 1995).

Forest Birds - Forest songbirds have been negatively affected by forest fragmentation, resulting in reduced populations and lower reproductive success (Hoover 2005). In addition, forest bird species richness has been positively correlated with forest patch size. Key spatial features that are required by forest interior birds are larger forest patches (> 70 ha) or, in other words, patches with larger amounts of core or interior habitat, and patches surrounded by habitats that allow dispersal (for example, grassland rather than agriculture). Forest tracts within the Cache river watershed tend to be long and linear and of limited size. As a result, species that have moderate or low forest tract size requirements such as Acadian Flycatcher, Wood Thrush, and Prothonotary Warbler may be more apt to show high nesting productivity. Some of the key structural features required by forest interior birds are high levels of structural diversity, tall canopies, closed canopies, and a mix of dense and open understory.

Amphibians and Reptiles

Copperbelly watersnake- This snake is associated with shrubby wetlands and swamps, emergent wetlands and floodplain forests (Hyslop, 2001, Herbert, 2003). They tend to shy away from moving water such as rivers. This species congregates in shrub swamps during the breeding season and then moves over land to other wetlands as seasonal ponds dry up. This species requires a matrix of wooded or vegetated corridors that provide protection from predators as they migrate among wetlands between seasons. Copperbellies typically forage in shallow water, in the order of 5-10 cm. While they may bask on logs and shrubs in deeper water, they do not utilize deeper water, except as a potential travel lane. Given their mobility on uplands, copperbellies can be found far away from water, but also at farm ponds and other wetlands that are situated well away from the floodplain. Excursions into uplands usually last from one to several days, but have been recorded as long as two weeks. When not in wetlands the snakes are often found in very thick vegetation, under mats of detritus, or in burrows (Http://www.herpcenter.ipfw.edu.html). They will also exploit springs adjacent to floodplains if suitable emergent or shrubby habitat is available. Individuals using uplands favor forest gaps and forest/field margins. They usually avoid farm fields, but may use old fields adjacent to forest and wetlands. Copperbellies typically hibernate in crayfish burrows in areas that may be prone to spring flooding (Kingsbury and Coppola, 2000).
These areas are generally above the water table in the fall, but come spring they may be inundated by several feet of water. Copperbellies will not leave their overwintering sites during

the winter if they are flooded, and can survive underwater for extended periods (weeks) if the water is cold. A high water table protects the ground from freezing. This is what protects the copperbellies in the winter as they hibernate. Drawing water down in wetlands during the winter may thus have a devastating impact on copperbellies as well as other amphibians and reptiles overwintering there.

Canebrake rattlesnake- Canebrake rattlesnakes inhabit heavy forest along rocky outcrops and bluffs and are active April through October in our area. They are often observed sunning on rock ledges near winter dens. They forage during summer in upland forests and some border and disturbed habitats where rodents are abundant. The Canebrake rattlesnake diet consists mainly of small mammals, such as mice, squirrels, and chipmunks. Mating usually occurs in July and August with 6-10 young born late summer or early autumn of the following year. The species is threatened in Illinois. Canebrake rattlesnakes have been observed in Union County. Threats to this species include clearing of forest.

Northern crawfish frog - The Northern crawfish frog lives underground most of year in mammal burrows, storm drains, and abandoned crayfish burrows. This species has been observed recently in Johnson, Union, and Alexander counties. Their diet consists of crayfish, and small amphibians and reptiles. Adults breed in pools during March and April, sometimes in large numbers. Female lays 3,000-7,000 eggs, and the tadpoles transform in midsummer. This species is uncommon and declining in some areas where breeding habitats have been drained. They are most commonly found in habitat such as prairies, woodlands, and brushy fields in hardpan clay soils in low, wet areas.

Bird-voiced tree frog-Bird-voiced tree frogs inhabit trees and shrubs within Bald cypress-tupelo swamps and nearby floodplain forests. Adult diet includes small arboreal insects and spiders. This species breeds mid-May to August. Eggs are laid in shallow water in submerged packets that hatch in a few days into colorful tadpoles which then develop into adults within about a month. Threats include clearing and draining of bald cypress-tupelo swamps. This species is only known to be in extreme southern counties, where it is locally common in some good habitats. Recent observations have been reported in Alexander, Pulaski, Johnson and Union Counties in recent years (INHS database). This species is threatened in Illinois.

Fish

Cypress Minnow- The cypress minnow is a bottomland species that inhabits sluggish back waters of streams, oxbows and cypress swamps over soft substrates such as sand, silt, detritus and mud. Protection from wetland destruction, pollution, and excessive siltation are the primary needs of this species.

Mammals

Indiana Bat- The Indiana bat migrates seasonally between winter hibernacula and summer roosting habitats. Winter hibernacula used include caves and abandoned mines that fulfill their need for cold temperatures during hibernation. In late March or early April, female bats emerge from hibernacula and migrate to summer roosts, where they form nursery colonies under the

loose, exfoliating bark of trees, or in tree cavities and crevices. During the summer months, this species forages along the corridors of small streams, within the canopy of floodplain and upland forests, over clearings with early successional vegetation, along the borders of croplands, and over small pools and ponds, but prefer to forage over forested areas. In summer they forage exclusively on flying insects.

Plant Species

Cypress Knee Sedge-The cypress-knee sedge is aquatic sedge that is usually associated with Bald Cypress trees, logs or knees. It occurs in permanently flooded bald cypress-tupelo swamp habitat on CCNWR. This sedge may often be found on floating or partially submerged rotting logs or stumps as well, and in a full range of lighting conditions from full sun to dense canopy. Associated species on CCNWR may include: baldcypress, swamp black gum, red maple, possum haw, and buttonbush.

Table 8. Timing of Habitat Needs for Resources of Concern at Cypress Creek National Wildlife Refuge

Focal Species	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Birds												
Waterfowl	■	■	■	■				■	■	■	■	■
Shorebirds				■	■	■		■	■	■		
Forest Birds				■	■	■	■	■	■	■		
Wood Duck			■	■	■	■	■	■	■	■	■	
Little Blue Heron				■	■		■	■	■			
Amphibians												
Northern Crawfish Frog	■	■	■	■	■	■	■	■	■	■	■	
Bird-Voiced Treefrog	■	■	■	■	■	■	■	■	■	■	■	
Focal Species	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Reptiles												
Copper-Belly Watersnake	■	■	■	■	■	■	■	■	■	■	■	
Timber Rattlesnake	■	■	■	■	■	■	■	■	■	■	■	
Fish												
Cypress Minnow	■	■	■	■	■	■	■	■	■	■	■	
Mammals												
Indiana Bat	■	■	■	■	■	■	■	■	■	■	■	
Plants												
Cypress Knee Sedge	■	■	■	■	■	■	■	■	■	■	■	

Priority Natural Communities

Bottomland Forest/Cypress Tupelo Swamp

Although some of the finest remaining examples of forested wetlands and swamps in the state of Illinois occur within the Cache watershed, just 700 acres are considered high quality (IDNR, 1997). This leaves great cause for concern over both the extent and functionality of these forested wetlands. The hydrologic alterations mentioned in chapter 2 have dramatically altered the natural interaction of the Cache River with the surrounding floodplain, which is critical to maintaining the structure and function of these communities (TNC 2002). In many cases there is a reduction or total elimination of a natural flood pulse. Seasonal inundation followed by long periods of drying is important processes for these natural communities and the species that rely on them. For example, research by Dr. Jeff Hoover with the Illinois Natural History Survey has shown that restoring a more natural flooding and drying regime has the potential to decrease rates of nest predation on forest birds (Hoover, 2006).

In addition to the hydrologic alterations, these forested wetlands have suffered greatly from fragmentation due to clearing (primarily for agricultural purposes).

Nonforested, Ephemeral Wetlands

These ephemeral wetlands provide important feeding areas for migrating waterbirds as well as a host of other species of plants and animals. In addition, they provide critical habitat for a number of amphibians and reptiles. Connectivity is a key component for these wetlands-connectivity between upland and wetland habitats as well as the connectivity of a diversity of hydroperiods. Most amphibian and reptile life cycles require connectivity of wetlands (for breeding and feeding) and uplands (for hibernation). Consequently, Restoration and management of a complex of non-forested ephemeral wetlands throughout CCNWR should also benefit scores of shorebirds, wading birds, waterfowl, herp species, and a number of other organisms (fish, invertebrates etc).

Canebrakes

Dense stands of giant cane (*Arundinaria gigantea*) were historically found in bottomland sites in the southeastern United States, and information from the General Land Office surveys indicates that canebrakes were common within the Cache River Watershed as well. This floodplain community which is largely missing from the landscape now once provided habitat for a number of rare or extirpated species such as the Swainson's Warbler, Bachman's Warbler, and the Swamp Rabbit. Although the large stands of cane have disappeared, the small patches that remain provide habitat for several cane-obligate butterflies (Brantley and Platt 2001). Canebrakes are now considered to be a critically endangered ecosystem (Brantley and Platt 2001). Additionally, giant cane growing in riparian buffers enhances water quality and stabilizes stream banks, reducing nitrates and sediments in ground water and overland flow because of its dense mat of culms and rhizome Reconciling conflicting habitat needs

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Conflicting Needs

Habitat management activities inherently create short term conflicts between species and species groups that arise as vegetative, soil, or hydrological manipulations are completed. For example, timber harvest or timber stand improvement activities temporarily change the vertical structure and canopy closure in the forest, which can negatively impact forest interior bird species. Additionally, vegetation management in the open lands can adversely affect existing plant communities in the short term. Disking, mowing, flooding, and prescribed fire essentially decimate the existing plant community and vertical structure upon which some species depend for food, cover, and breeding habitat. Conversely, these same actions benefit other species as desirable vegetation replaces the undesirable plant species or is rejuvenated from the initial treatment, thereby creating desirable habitat conditions. However, these impacts are typically short term in duration and have long term positive benefits for priority species. Today, active wildlife management practices have become essential as natural ecological processes and habitats
have been limited and even eliminated in some cases. In a normal annual hydrological cycle, CCNWR has the capacity to meet the habitat needs for the priority wildlife resources of concern. Each year, a complex of different wetland types is provided, either by natural means or through management decisions and manipulations. The manipulation of impounded wetlands influences plant diversity, seed production, and aquatic invertebrate communities. Forested tracts will be managed through sound silvicultural practices to ensure that the forest provides desirable tree species and structural composition which meet the needs of priority species. Consequently, initial conflicts among species groups are remedied through time and kept to a minimum through unit evaluation, prioritization, and planning. Refuge actions will be prioritized by establishing purposes and when appropriate, to support objectives established under conservation partnership plans. Management actions will be based on sound science and the best technology to ensure quality management for target natural resources and provide a model for land management. Management efforts will focus on meeting habitat objectives to fulfill the needs of target natural resources, and any conflicts will be resolved by priority decisions based on establishing purposes. For example, the refuge will provide an inviolate sanctuary for wintering waterfowl and other migratory birds. Additionally, refuge management actions will benefit migratory birds, but will emphasize wintering waterfowl management. Likewise, there are objectives to protect, manage, and enhance the ever diminishing bottomland hardwood forest ecosystem, to protect endangered species, and to protect, manage, and enhance habitat for other species of wildlife and plants, and to provide compatible public use opportunities.

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Chapter IV. Management Objectives, Strategies and Prescriptions

The following goals and objectives were developed as a result of discussions held during a habitat management workshop held at CCNWR in May 2006. Natural resource experts familiar with CCNWR and the habitat management planning process were invited to this workshop to assist in identifying management goals and objectives and the strategies necessary to obtain them. The following goals and objectives are based on those workshop discussions, goal and objectives set forth in the CCNWR CMP, and further literature review. The strategies and prescriptions developed to meet CCNWR objectives are presented as well.

Bottomland Forest

Goal

Maintain healthy, functioning bottomland forest communities associated with the Cache River and its tributaries.

Rationale

The objectives for forest habitat management on CCNWR must focus on managing a diverse forest with complex vertical structure and species diversity to meet the needs of a broad range of forest birds and animals enhancing and restoring habitat for endangered species, and conserving examples of rare and declining natural systems. More than 50% percent of the original deepwater swamps in southern Illinois have been lost during the last century (Fish and Wildlife Service, 1990), and the regeneration of these swamps has become an important issue.

Effective restoration and management of all bottomland hardwood forests on CCNWR will provide important habitat for migrating waterbirds, as well as amphibians, reptiles, fish and other wildlife. The existing bottomland hardwood forests on CCNWR provide important habitat for several high priority species of migrating waterfowl and nesting forest birds, in addition to serving as potential roosting areas for the federally endangered Indiana Bat and the state endangered Rafinesque's big-eared bat. It is important to maintain a system of wetlands that will continue to provide habitat for species of various life stages such as hibernation, reproduction, and migration.

Objective 1

Within 2 years of plan approval, examine and document the 4500 acres (Figure 6) of existing mature bottomland hardwood sites to determine geologic history, condition, historic vegetation communities and ecological processes, historic and current abiotic conditions, and degree of disturbance, in order to assist Refuge staff in making decisions concerning appropriate restoration and enhancement measures that may need to be applied.

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Rationale

Since CCNWR was created under the authority of the Emergency Wetlands Act, the protection of these natural communities is a high priority. Potential issues which could affect the forest condition of CCNWR bottomland forests include sedimentation from surrounding lands, stream incision, lateral gullying and water quality. Investigations of this type will assist Refuge staff in making the appropriate decisions concerning restoration and enhancement measures that may need to be applied.

Strategies

1) Examine historic literature, aerial imagery, maps, soil, geomorphology, and river gage data to compile information on the geologic history, condition, and distribution of pre-settlement vegetation communities and ecological processes to obtain information and reports on past and present conditions

2) Develop a set of guiding principles for the area for use in sustaining long-term functions, values, and processes; better emulate natural hydrological and community dynamics and maximize critical resources for migratory water birds and associated forest birds.

Prescription

Existing and potential restoration and enhancement sites for bottomland forest on CCNWR will be located within two years after plan approval with the completion of a hydrogeomorphic evaluation of CCNWR. An evaluation of the geology, soils, topography, climate and hydrology, historic vegetation and ecological processes of current sites will be conducted using refuge field data, General Land Observer notes; soils survey maps, long term climate and stream gage data, elevation and other historic information. Soil maps will be examined in order to determine where appropriate soils exist. Potential restoration sites and measures located through the course of this study will be evaluated depending on factors such as cost, degree of current disturbance, location and other such factors by Refuge staff as well as members of the Cache River Joint Venture.

Objective 2

Within 4 years of plan approval, perform mist-net surveys within all eight management units and place transmitters on at least 2 Indiana bats within each unit in order to locate existing bat roosting and maternity colonies throughout the entire Refuge. Mist- net surveys combined with radio-telemetry will determine presence/absence of various bat species as well as the location of Indiana Bat roosting and maternity colony sites. Location of maternity colony sites will enhance knowledge of what the Indiana bat summer populations are within CCNWR and also to understand what type of habitat is being used by this species for roosting and maternity areas. A two-mile radius around all roost trees will be managed for bat roosting/maternity colony habitat. In other words, managed to include an abundance of trees with exfoliating bark such as shag

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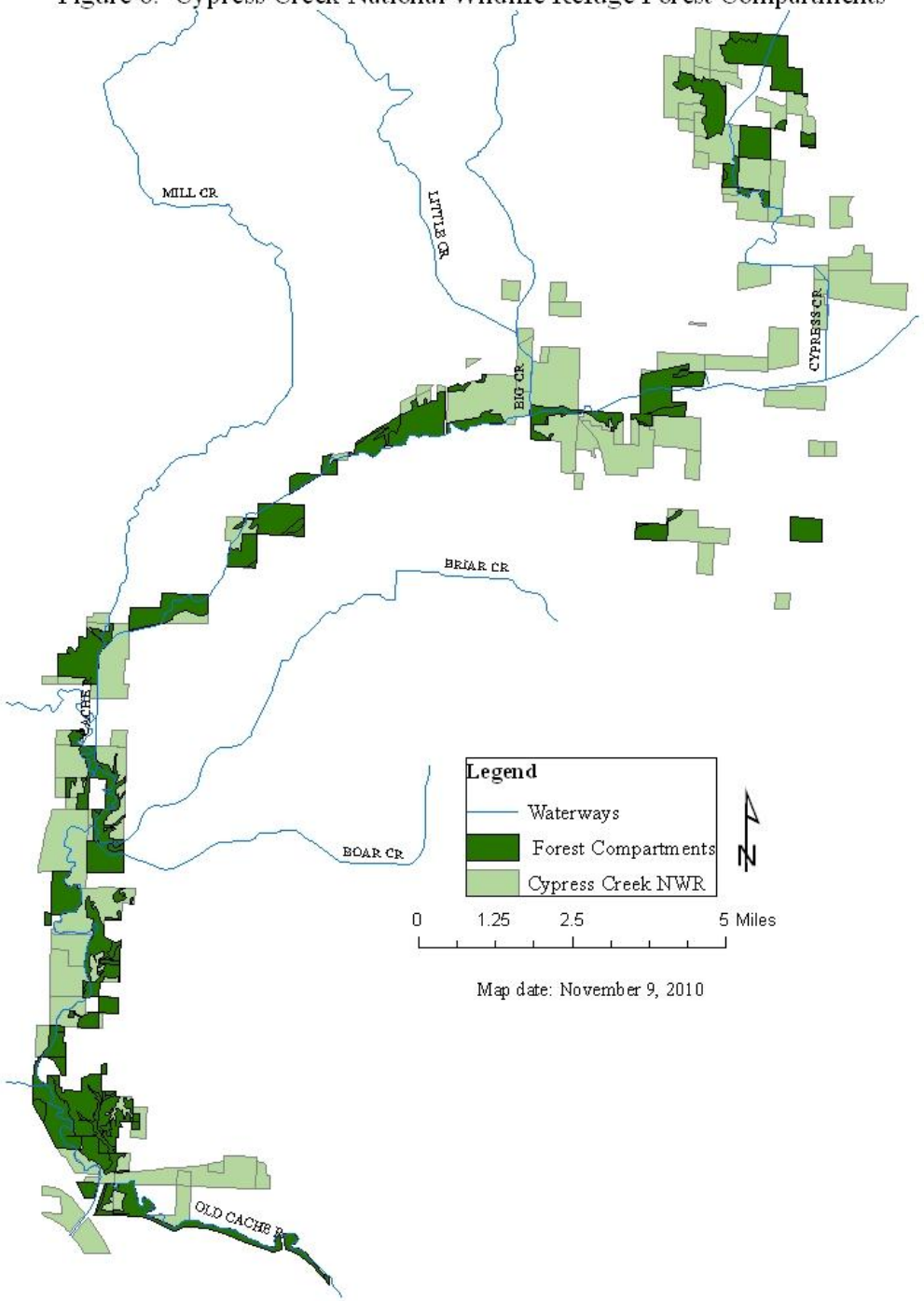
bark hickory, overcup oak, pecan, etc. with a diameter at breast height (dbh) greater than of 11 inches and retain or create snags with exfoliating bark from April-August.

Figure 6. Cypress Creek National Wildlife Refuge Forest Compartments



Rationale

Many species of bats, including the federally endangered Indiana Bat and the state endangered Rafinesque's big-eared bat use bottomland forests for both summer foraging and roosting habitat. A limiting factor for these bat species as well as several other species of wildlife will be roost trees. Indiana Bats are almost always found under the exfoliating bark of dead or dying trees (Carter 2006). Snags with cavities and trees with exfoliating bark are valuable as roosting and maternity sites for bats as well as many other wildlife species" (Saugey, 1997). Snag and cavity tree retention, and regeneration of exfoliating barked trees for future roost trees are an important part of this forest management objective. In addition, one of the twenty-three existing Primary 1 Indiana bat hibernacula is located less than 2 miles from CCNWR boundary. Primary 1 hibernacula are considered essential to the recovery and long term conservation of Indiana bats. This type of management will also create habitat opportunities for a variety of other wildlife species such as overwintering insectivorous birds (ex: red-headed woodpecker), and nesting birds (ex: brown creepers, wood ducks, hooded mergansers).

Strategies

1) Acoustical survey monitoring for areas with high bat activity and possible roost and maternity trees.

2) Retention of any exfoliating-barked trees, dead or alive, canopy gaps, or any trees with a dbh greater than 11 inches.

3) Perform any forest management activities outside the summer roosting period between April 1 and November 15.

4) Protect riparian corridors.

Prescription

Acoustical surveys will be done each night during May through September in order to locate forested areas with high levels of bat activity. Mist-netting will be conducted within the areas with the highest activity in an effort to locate both roosting and maternity colony habitat.

All standing, dead trees will be retained unless removal is necessary for human safety or to accomplish management objectives. All known roost trees within five miles of known roosts or hibernacula will be retained, as well as a diversity of age, size and species classes of potential roost trees within these areas. When the removal of dead trees or trees with exfoliating bark is required for safety or to accomplish forest management objectives it will be done between

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November 15 and April 1. Any areas where tree removal is done outside this time period will be evaluated for bat-usage prior to removal. Potential roost-trees cannot be removed during this period unless they are evaluated and/or surveyed to confirm non-use by roosting bats.

Approximately 50 to 75 percent of live trees with a diameter greater than 11 inches diameter at breast height (DBH) will be maintained in known roosting habitats. These habitats should include mostly species with exfoliating bark, such as American elm, slippery elm, eastern cottonwood, bitternut hickory, shellbark hickory, shagbark hickory and red oak species.
An abundance of canopy gaps will be maintained within known roosting habitats. Gaps will be created where necessary through the use of group selection of undesirable (for roost trees) species. These canopy gaps will serve to help warm existing roost trees, create forage areas, and help to enhance desirable regeneration. An average overstory closure between 30 and 80 percent will be maintained in stands with live trees greater than 11 inches DBH, where possible, except for shrub swamps.

Objective 3

Within 15 years of plan approval, evaluate 100 percent of existing mature forest stands as to whether they satisfy the desired forest conditions in Table 9. (Lower Mississippi Joint Venture 2006) and implement active management on 35-50 percent of any mature forest that does not meet the desired stand structure conditions recommended within these guidelines.

Rationale

As stated above, the objective for forest habitat management on CCNWR is to develop, manage and perpetuate the diversity of native wildlife populations. In particular, this includes providing habitat and protection for those species of plants and animals that are endangered or threatened, waterfowl and other migratory birds. The desired forest conditions found in Table 9 were created by the Lower Mississippi Joint Venture (2006) with population sustainability in mind. Although specific habitat requirements vary among species, many forest wildlife species share broad, overlapping habitat requirements, on which these recommended forest conditions have been based. The successful implementation of these recommendations will require coordination with a detailed, monitoring program.

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Table 9. Desired Forest Conditions as determined by the Lower Mississippi Joint Venture

Forest Variables[1]	Desired Stand Structure	Conditions That may Warrant Management
Primary Management Factors		
Overstory Canopy Cover	60-70%	➢ 80%
Midstory Cover	25-40%	<20% or > 50%
Basal Area	13.7-16 m²/ha with ≥ 25% in older age classes[2]	> 20.6 m²/ha or ≥ 60% in older age classes
Tree Stocking	60-70 %	< 50% or > 90 %
Secondary Management Factors		
Dominant Trees[3]	➢ 5/ha	< 2.5/ha
Understory Cover	25-40%	< 20%
Regeneration[4]	30-40% of area	<20% of area
Coarse Woody Debris (>25 cm diameter)	≥ 14 m³/ha	< 7 m³/ha
Small Cavities (hole < 25 cm diameter)	➢ 10 visible holes/ha or > 10 "snag" stems/ha ≥ 10 cm dbh or ≥ 5 stems/ha > 51 cm dbh	< 5 visible holes/ha or < 5 snags/ha ≥10 cm dbh or < 2.5 stems/ha ≥ 51 cm dbh
Den Trees/Large Cavities[5]	One visible hole/4 ha or ≥ 5 stems/ha ≥ 66 cm dbh (≥ 1.8 m² BA/ha ≥ 66 cm dbh)	No visible holes/ 4 ha or < 2.5 stems/ha ≥ 66 cm dbh (< 0.9 m² BA/ha≥ 66 cm dbh)
Standing Dead and/or Stressed Trees[5]	➢ 15 stems/ha ≥ 25 cm dbh or ≥ 5 stems/ha ≥ 51 cm dbh (> 0.9 m² BA/ha > 25 cm dbh)	< 10 stems ≥ 25 cm dbh/ha or < 2.5 stems/ha ≥ 51 cm dbh (< 0.5 m² BA/ha≥ 25 cm dbh)

[1]Promotion of species and structural diversity within stands is the underlying principle of management. Management actions should promote vines and cane within site limitations.
[2]We view "older age class" as those stems approaching biological maturity. We do not advocate coring for defining age but instead using species/site/size relationships as practical surrogates to discern age.
[3]Dominants (a.k.a. emergents) should have stronger consideration on more diverse sites, such as ridges and first bottoms.
[4] Advanced regeneration of shade-intolerant trees in sufficient numbers (ca. 1,000/ha) to ensure their succession to forest canopy. Areas lacking overstory canopy (i.e. group cuts) should be restricted to < 20% of stand area.
[5] Utilizing BA parameters allows the forest manager to maintain this variable in size classes most suitable for the stand, versus pinpointing specific size classes as noted.

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Strategies

1) Analyze each of the eight refuge management units on a systematic basis, and then make decisions to implement the best management action for individual stands within these management units. The scope of the management plan is 15 years, so perhaps a goal of evaluating one management unit per year would be viable. The Habitat Inventory completed in 2006 (Battaglia) will be used to prioritize unit assessment.

2) Perform timber stand improvement methods such as chemical injection, thinning, commercial sale, fire etc. in stands that do not meet the desired forest conditions.

3) Identify areas for cane restoration.

Prescription

The forest inventory that was completed in 2006 (Battaglia 2006) as well as additional forest monitoring will be used in order to assess current forest stand conditions and make decisions as to whether specific stands warrant management at this time. An additional 100 permanent plots will be established in addition to those established during the forest inventory; and ten to fifteen plots will be sampled/re-measured each year on a five to ten year rotation. Parameters measured will be: tree species, number, diameter, volume, age, vine component, density/complexity of canopy layers, forest covertype, and history. Once a description of the forest habitat is complete, the forest management objective is to maintain seventy to ninety percent of the forest area within CCNWR under active management via sustainable silvicultural practices to attain the desired stand conditions listed in Appendix 3 with thirty to fifty percent of the forest area under active management meeting the desired stand conditions.

Stands that contain dominant canopy trees with a diversity of species, age classes and health, but with an estimated canopy closure greater than 80 percent will be candidates for thinning back to an estimated 60 percent canopy closure. The desired habitat will be achieved by removal of undesirable trees, especially those that are suppressing regeneration of desirable species.

In mature stands (those with an average dbh of 11 inches or greater) lacking the qualities (age classes, species composition, health etc.) to achieve the desired forest conditions, regeneration will be a consideration. Shelterwood establishment cuts, small clearcuts, group selection (in areas 1/4 to 1 acre), or clearcuts (in areas > 5 acres) will be used to restore these types of stands depending on the existing level of regeneration within each individual stand.

Forest stands with a heavy (greater than 50%) shade tolerant midstory will receive both midstory and overstory treatments. This will prevent undesirable midstory trees from taking over the stand. Selected midstory and overstory trees will be removed to maintain the presence of a desirable species mix in the mid and understory levels, preventing the loss of shade intolerant species. Trees of commercial quality should be sold and cut, and the remaining trees will be removed by noncommercial means. This will be accomplished by cutting, girdling, herbicide treatment, or, controlled burning.

Habitat improvements may be accomplished through either chemical or mechanical means or controlled burns. In cases where commercial operations are not feasible, other available means will be used. This may involve refuge staff, contractors, youth conservation corps, approved volunteers, or educational institutions under cooperative agreements.

Objective 4

Within 15 years of plan approval, manage 1500 acres of bottomland hardwood forest for greater migratory waterfowl habitat by increasing species diversity, age class and occurrence of mast producing trees such as red oaks (in particular red oaks with smaller acorns such as Pin, Cherrybark, Willow, Water, and Nuttall) to 40-60% and maintaining in flooded condition between November and February as winter habitat for priority waterfowl species such as Mallards, American Black Ducks, Wood Ducks, and Hooded Mergansers.

Rationale

This area has traditionally been important to waterfowl due to its location on the Mississippi Flyway and waterfowl, according to Refuge purpose, are one of the featured species groups of CCNWR. Eight species commonly observed on CCNWR between November and February are USFWS Region 3 Conservation Priority species (USFWS 2002). In addition to using bottomland forests as a major food source, waterfowl use the forest for shelter, protection from predators, and freedom from human disturbance (Baldassarre & Bolen, 1994). These forested areas will enhance an existing complex of habitats on CCNWR which enables ducks to feed on acorns and invertebrates in flooded forests, or on seeds of moist-soil plants in seasonally flooded openings, to roost and court in more open marshes and sloughs, and to escape predation and social harassment in shrub swamps.

Strategies

1) Plant 40-60 percent hard mast species in all new bottomland reforestation plantings.

2) Encourage mast-producing oaks wherever possible.

Prescription

Hard mast species will comprise 40-60 percent of all new bottomland reforestation plantings, with possible higher percentages in areas not expected to have significant natural regeneration. Preferably, oak species with smaller acorns such as Pin, Cherrybark, Willow, Water, and Nuttall will be used when these species can be acquired. Plantings will consist of an initial planting density of 435 seedlings per acre. Plots will be established in order to monitor seedling survival in all new reforested plantings. The acceptable survival rate three years post planting will be a minimum of 300 trees per acre.

Wherever possible, mast-producing oaks will be encouraged, following similar management strategies as indicated in Objective 3.

Objective 5

Within 12 years of plan approval, reforest 1,200 acres of bottomland forest in order to increase forest connectivity and acreage of interior forest. (interior forest is any forest greater than 500 meters from cropland, pasture, grassland, urban, and suburban areas) Protect and maintain large corridors of contiguous bottomland forest with linkages between upland and bottomland habitat

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in order to sustain and promote viable populations of forest interior birds and other wildlife species such as the copperbelly water snake.

Rationale

Forest song birds have been negatively affected by forest fragmentation, resulting in reduced populations and lower reproductive success. In addition, forest bird species richness has been positively correlated with forest patch size (Hoover et. al. 1995). In small patches, forest birds are subjected to: (1) more competition with other species (2) increased parasitism from brown-headed cowbirds (Robinson and Wilcove 1994, Hoover et. al. 1995), (3) increased likelihood of predation (Andrén and Angelstam 1988; Marzluff and Restani, 1999), (4) greater disturbance from human activities (Knight and Gutzwiller, 1995), and (5) increased isolation and inhibition of dispersal (Doak et al. 1992).

Species such as the state-threatened copperbelly water snake congregate in shallowly flooded bottomland forest during the breeding season (March-June) and then require a matrix of wooded or vegetated corridors in order to migrate to other wetlands as seasonal wetlands become dry. Providing wetland and forest complexes at appropriate spatial scales is important for the conservation of these species (Petranka et al., 2006).

Strategies

1) Utilize biologically based, spatially explicit decision support tools (Reforestation Priority Model, Table 9) to determine high priority areas for restoration.

2) Restore approximately100 acres of forest each year.

3) Avoid the introduction of habitat conditions suitable to cowbird propagation.

4) Conduct point count surveys to monitor changes in these populations, particularly in habitats altered by forest management activities.

5) Stay current with the latest research findings on habitat use by these species.

Prescription

Table 10 shows the high priority areas for reforestation, and the timeline for reforestation of these areas over the next 10 years. Prioritization of these areas was determined with a GIS decision support model which was developed by Refuge staff using the habitat requirements of forest bird species which are considered high priority within the Cache River Watershed, (Twedt et al. 2004), in combination with the agricultural suitability model shown in Figure 5. This model enhances forest bird conservation on CCNWR, and helps prioritize forest restoration to reduce fragmentation and increase the area of interior forest. This tool enables Refuge staff to rely more on ecologically-based strategies rather than opportunity-based when choosing priority

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sites for land acquisition and restoration. Approximately 100 acres will be restored to bottomland hardwood habitat each year, following the timeline presented below.

Table 10. Timeline for restoration of agricultural fields on Cypress Creek National Wildlife Refuge

Year	Tract Number	Acres	Total Acres
2012	113,13	84,7	91
2013	91A, 93, 29	52,23,40	115
2014	36,49	36,79	115
2015	13A, 55	31,87	118
2016	274,10b,170a	61, 41, 43	145
2017	170a, 135	43,72	115
2018	255, 274	91, 58	149
2019	274	80, 22,30,23	155
2020	255a, 274	23,16,55,18, 29	141
Totals			**1,144**

Wide mowed roadsides and fire roads will be avoided where possible in order to decrease the introduction of habitat conditions suitable to cowbird propagation and increase connectivity.

Forest management will concentrate on providing a range of habitats, on developing complex vertical structure, and maintaining integrity of interior forest (See objective 3). Point count surveys will be conducted in order to monitor forest bird populations, in particularly in habitats altered by forest management activities. Refuge staff will stay current with the latest research findings on habitat management for these species.

Objective 6

Within 15 years of plan approval, enhance the diversity and wildlife habitat value of 450 acres of pulpwood plantation (Figure 7) by thinning the overstory, and under planting various bottomland hardwood mast producing trees.

Rationale: These tracts were purchased from a private paper company, and since the primary goal was the production of pulp fiber, there were no hard mast trees planted. These plantations provide a beneficial overstory canopy, however there is no development of lower vegetative layers, low diversity and no mast.

Strategies

1) Remove undesirable species by appropriate methods determined for each individual stand.

2) Supplemental plantings of desirable species.

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Prescription

Stands will be evaluated on an individual basis and plans will be made as to the best methods for enhancement based on the age of the trees, thickness of the understory etc. In mature stands (those with an average dbh of 11 inches or greater) commercial operations may need to be considered. Small clearcuts, or thinning may be used in order to open up areas where underplanting of hard mast species can be done. These stands will be reevaluated four years after the initial cut, to ensure that stands are sufficiently regenerating.

In intermediate stands where commercial thinning may not be an option, undesirable species will be removed by chemical injection, girdling, fire, or mechanical means such as bulldozer or chainsaw in combination with underplanting desirable species. Monitoring and treatment of invasive species will be very important within these areas.

In cases where commercial operations are not realistic, other available means will be used. This may involve refuge staff, contractors, youth conservation corps, approved volunteers, or educational institutions under cooperative agreements. Habitat improvements may be accomplished in any number of ways including chemical or mechanical means.

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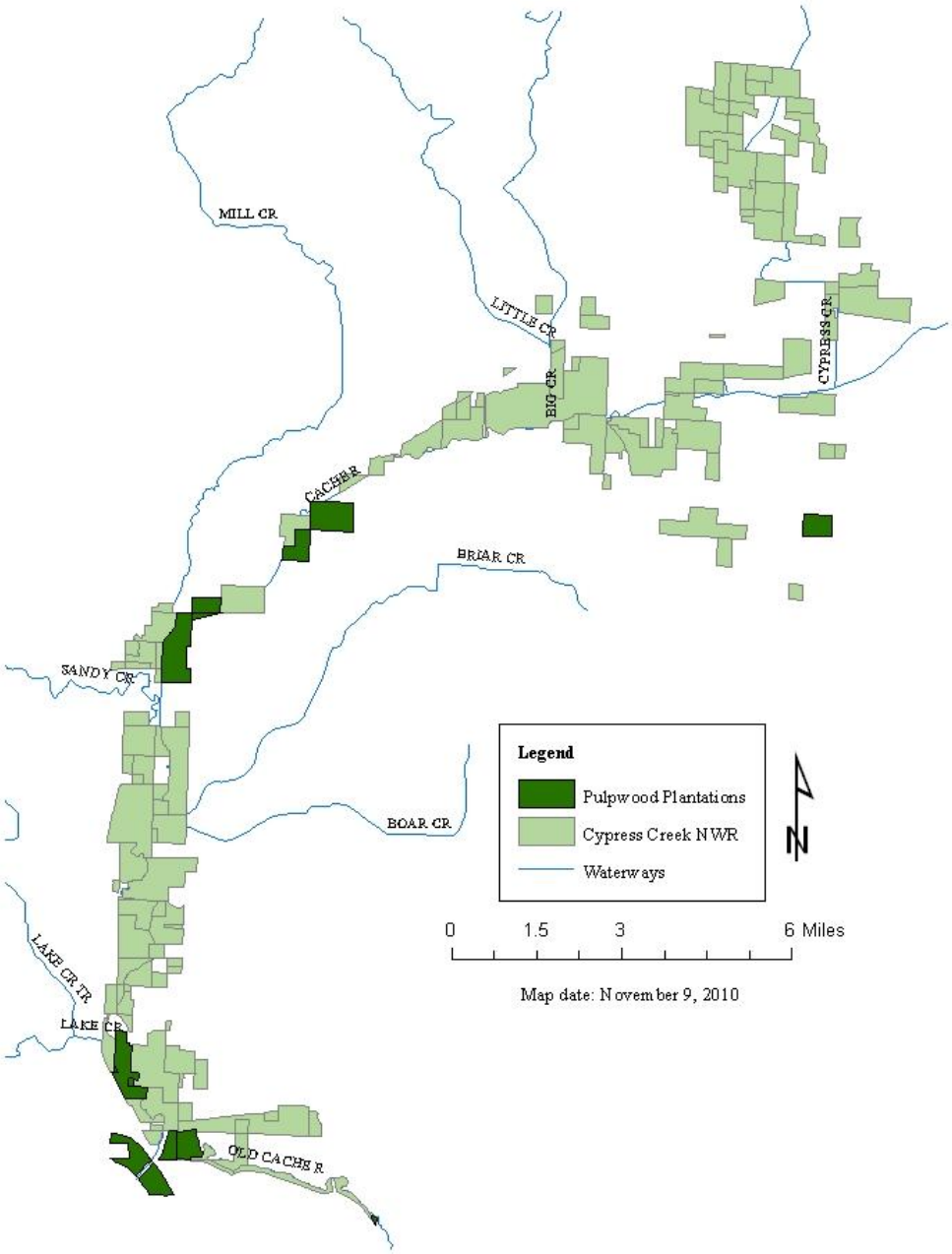
Figure 7. Cypress Creek National Wildlife Refuge Pulpwood Plantations



Baldcypress-Tupelo Swamp

Goal

Manage healthy and sustainable bald cypress-tupelo swamp habitats within a matrix of other bottomland and upland habitats.

Rationale

More than half of the wetlands in the United States have been converted to other land use types (Dahl, 1990). In southern Illinois, for example, more than fifty percent of the original deepwater swamps have been lost during the last century (Fish and Wildlife Service 1990), and the regeneration of these swamps has become an important issue. Since CCNWR was established under the authority of the Emergency Wetlands Act, the protection of these natural communities is a high priority.

Proper restoration and management of all Refuge bald cypress-tupelo swamps will provide important habitat for migrating waterbirds, amphibians, reptiles, fish and other wildlife. The existing bald cypress-tupelo swamps on CCNWR provide important habitat for several high priority species such as nesting Wood Ducks, Hooded Mergansers, and Yellow-Throated Warblers. In addition to serving as potential roosting areas for the federally endangered Indiana Bat and the state endangered Rafinesque's big-eared bat, which frequently uses hollow tupelo trees that are characteristic of older bald cypress- tupelo forests (Gooding and Langford, 2004). Historically, much of the Cache River basin was seasonally flooded bald cypress forest that was species rich. (Hutchison, 1995, Middleton, 2003). It is important to maintain such a system of wetlands that will continue to provide habitat for species of various life stages such as hibernation, reproduction, and migration.

Objective 1

Within 2 years of plan approval, examine and describe all Refuge bald cypress-tupelo swamps. Describe the swamp size, water depth, species diversity and locations of these swamps based on examination of Refuge field data, GLO notes and other historic information, aerial imagery, and other information to indicate current site locations and conditions.

Objective 2

Within 2 years of plan approval, determine the historical presence and distribution of baldcypress-tupelo swamps, as well as historic swamp characteristics. This information will be used to examine the potential to restore seasonally flooded baldcypress-tupelo swamp.

Rationale

Gathering more detailed information of this type will assist refuge staff in developing a management plan for a sustainable bald cypress- tupelo swamp component on CCNWR. Hydrology is a fundamental factor in the early life-history of bald cypress in swamp conditions

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(Mattoon, 1916; Middleton, 2000, Jones et al., 1988). There is a need to examine the hydrology of existing sites, and to determine whether there is a need and/or potential to restore a more natural hydrology within existing swamps. Many of the swamps in the lower Cache have a seasonal flood pulse associated with high water levels in the winter, followed by a natural dry period during the late summer in most years (Middleton, 2003). Baldcypress regeneration is dependent on this type of pulse to create occasional mudflats that are required for seedling germination.

Strategies

1) Identify and map the basin perimeters of all existing bald cypress-tupelo swamp sites in order to determine the location and size.

2) Collect basic information on the hydrology, soils, and plant communities on each site.

3) Examine and document current and pre-disturbance hydrologic characteristics.

4) Examine and document topographic maps and aerial photography in order to identify swamp restoration sites.

5) Identify any threats to existing stands.

6) Obtain topographic, drainage, and runoff information from the Natural Resource Conservation Service Field Office.

7) Determine locations and types of former baldcypress-tupelo swamps by examining historical photographs and maps, GLO notes, and talking to local residents.

8) Examine and document flood elevations and floodplain information by looking at Illinois floodplain maps, and additional information from zoning and planning offices, USACE, FEMA Flood Hazard Maps, or IDNR.

9) Examine National Wetland Inventory Maps.

10) Obtain elevation surveys conducive to developing at least six inch contours for all potential restoration.

Prescription

Existing and potential restoration sites for baldcypress-tupelo swamps within CCNWR boundary will be located within two years after plan approval with the completion of a hydrogeomorphic evaluation of the entire refuge. An evaluation of the geology, soils, topography, climate and hydrology of current sites will be conducted using refuge field data, GLO notes, NWI Maps and other historic information. Soil maps will be examined in order to determine where wetland soils exist. Potential restoration sites located through the course of this study will be evaluated for

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restoration opportunities depending on factors such as cost, degree of current disturbance, location etc.

Objective 3

Within 15 years of plan approval, enhance existing or begin restoration on 100 acres of potential Baldcypress-tupelo habitat within the CCNWR boundary.

Rationale

See Rationale on page 55.

Strategies

1) Examine maps with local topography and aerial photography in order to identify swamp restoration sites associated with the primary sources of water within the Cache River Watershed.

2) Obtain topographic, drainage, and runoff information from the NRCS Field Office.

3) Determine locations and types of former Baldcypress-Tupelo Swamps by examining historical photographs and maps, GLO notes, and talking to local residents.

4) Examine flood elevations and floodplain information by looking at Illinois floodplain maps, and additional information from zoning and planning offices, USACE, FEMA Flood Hazard Maps, or IDNR.

5) Examine National Wetland Inventory Maps.

6) Supplement sites with seed or seedlings if necessary.

7) Obtain elevation surveys conducive to developing at least six inch contours for all potential restoration.

Prescription

Baldcypress-tupelo habitat is suited to, and can probably be restored and/or enhanced most easily within the abandoned channels that exist on CCNWR. In some locations, simply planting seedlings or spreading seed will be sufficient to restore this type of habitat, however, in others; there may be a need to restore a semi permanent water regime. In some areas, such as the Poole wetland, cypress-tupelo habitat is slowly converting to open water habitat because water is present year round, never allowing for germination of baldcypress and tupelo seedlings. Structural modifications may be needed in some of these areas in order to restore a hydrologic regime where surface water is present an average of three to nine months out of the year and has the capability to dry out periodically during late summer. Existing and potential restoration sites for bald-cypress wetlands will be located within two years after plan approval through the completion of a hydrogeomorphic (HGM) evaluation of the entire refuge. An evaluation of the

geology, soils, topography, climate and hydrology of current sites will be conducted using refuge field data, GLO Notes, National Wetland Inventory Maps (NWI) and a combination of other information (see above strategies). Soil maps will be examined in order to determine where wetland soils exist. Potential restoration sites located through the course of this study will be evaluated for restoration opportunities depending on factors such as cost, degree of current disturbance, location etc. Vegetation transects will be completed within existing bald cypress wetlands to determine diversity and cover of native and invasive or non-native plant species. Note: Since the historic presence of these wetlands was a function of disturbances such as ice, wind or fire, location of possible restoration sites will be highly dependent on locating those areas where the appropriate hydrology can be restored in order to establish and maintain this type of habitat.

Herbaceous Wetlands

Goal

Manage non-forested, herbaceous wetlands within a matrix of other bottomland and upland habitats. These wetlands will be managed as a complex rather than isolated habitats and require connectivity among a diversity of wetland types with variable hydroperiods.

Rationale

Proper restoration and management of a complex of herbaceous wetlands will provide important feeding areas for migrating birds and a host of other wildlife and plant species as well as being critical habitat for a number of amphibians and reptiles.

Objective 1

Within 2 years of the plan's approval, determine location, size, depth, and species diversity of existing herbaceous wetlands, and sedge meadows, based on examination of Refuge field data, GLO (General Land Office, State of Illinois land surveys) notes and other historic information, aerial infra-red imagery, and other information. Develop a plan for an appropriate and sustainable herbaceous wetland component on CCNWR.

Objective 2

Within 2 years of the plan's approval, determine appropriate locations for restoration of herbaceous wetlands and sedge meadows based on GLO notes and other historic information, aerial infra-red imagery, examination of refuge field data, and other information to indicate current locations and potential reconstruction sites in order to develop a plan for an appropriate and sustainable herbaceous wetland component on CCNWR.

Rationale

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The Cache River Watershed was densely forested prior to settlement, and non-forested sites with herbaceous wetlands occurred within openings in the floodplain forests. These openings included temporary or ephemeral basins, in areas that underwent scouring during flood flows. Other openings were created by beavers, lightning ice, and wind. As a result, there was an even greater diversity of plant and animal life in the watershed. It is important to maintain a system of wetlands that will provide habitat for various life stages of resident species for hibernation, reproduction, and migration. Marsh and wading birds would also benefit greatly from additional herbaceous wetland areas within the watershed. Management as a complex of wetlands would also help to mitigate the seasonal water loss that occurs due to moist soil management water manipulations.

Strategies

1) Identify and map the basin perimeters of all existing herbaceous wetland sites greater than ¼ acre in order to determine the location and size.

2) Collect basic information on the hydrology, soils, and plant communities on each site.

3) Complete vegetation transects in order to determine diversity and cover of native and invasive or non-native plant species.

4) Determine where wetland soils exist, and examine current and pre-disturbance hydrologic characteristics.

5) Examine topographic maps and aerial photography in order to identify wetland restoration sites associated with the primary sources of water within the Cache River Watershed.

6) Determine locations and types of former wetlands by examining historical photographs and maps, GLO notes, and talking to local residents.

7) Determine distribution of historic and present day wetlands, by examining watershed soil maps.

8) Examine flood elevations and floodplain information by looking at Illinois floodplain maps, and additional information from zoning and planning offices, the Army Corps of Engineers, and the Federal Emergency Management Agency Flood Hazard Maps.

9) Examine National Wetland Inventory Maps.

10) Obtain elevation surveys conducive to developing at least six inch contours for all potential restoration.

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Prescription

Existing and potential restoration sites for herbaceous wetlands will be located within two years after plan approval through the completion of a hydrogeomorphic (HGM) evaluation of the entire refuge. An evaluation of the geology, soils, topography, climate and hydrology of current sites will be conducted using refuge field data, GLO Notes, National Wetland Inventory Maps (NWI) and a combination of other information (see above strategies). Soil maps will be examined in order to determine where wetland soils exist. Potential restoration sites located through the course of this study will be evaluated for restoration opportunities depending on factors such as cost, degree of current disturbance, location etc. Vegetation transects will be completed within existing herbaceous wetlands to determine diversity and cover of native and invasive or non-native plant species. Note: Since the historic presence of these wetlands was a function of disturbances such as ice, wind or fire, location of possible restoration sites will be highly dependent on locating those areas where the appropriate hydrology can be restored in order to establish and maintain this type of habitat.

Objective 3

Within 15 years of the plan's approval, achieve a 100 acre increase in herbaceous wetland and sedge meadow habitat through a decrease in scrub shrub wetland (willow, cottonwood, buttonbush) and wet agricultural fields, as well as enhancement of existing unmanaged wetlands. Increasing herbaceous wetlands will involve maintaining woody cover below 25%, and encouraging growth and expansion of sedges and rushes. Some of the more ubiquitous sedge species in the watershed include: Carex vulpinoidea, Cyperus esculentus, Eleocharis obtusa, Eleocharis tenuis and Scirpus atrovirens (Mohlenbrock, 1959).

Rationale

CCNWR currently has 250 acres of unmanaged, herbaceous wetlands, (Figure 8) some of which may have the potential for enhancement. These areas provide important habitat for a number of amphibians and reptiles, as well as being important feeding areas for migrating birds and other wildlife and plant species. Shallow wetlands with water levels less than 15 centimeters, and extensive coverage of emergent vegetation such as bulrush and sedge have great importance for nesting and migrating marsh birds such as the state endangered King Rail, the American Bittern, and Black Rail. At the present time, emergent wetland habitat is extremely limited on CCNWR and within the Cache River Watershed.

Strategies

1) Use prescribed fire, disking, plowing, roller chopping, mowing and herbicide application to control woody growth.

2) Control Water levels to encourage germination of sedges and other emergent wetland vegetation.

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3) Supplemental seeding to enhance emergent plant growth.

4) Controlling invasives.

Prescription

Efforts to change willow shrub areas to herbaceous wetlands in some areas will be enhanced by reducing the soil moisture. This effort will be most suitable in areas that are above the 2 year flood frequency zone, such as point bars, swales or ridges, and areas with non-clay soils.

Lowering of water levels to less than 15 inches will be incorporated where possible through the use of draw downs where water control structures are present, notches in water structures, beaver control etc in order to discourage growth of undesirables such as water primrose and water pepper. When possible, sites will be placed on a 1-2 year drawdown cycle as well. Draw downs will be incorporated in the late summer or fall in order to encourage sedge species germination in shallow water, or wet soil. During the conversion stage prescribed burning may be conducted every other year. When conversion has been achieved and the objective is to maintain the herbaceous wetland, the burning frequency may be reduced to every three or four years. When possible, summer mowing of willows and trees will be done in order to reduce the amount of resprouting compared to dormant season cuts; however, compaction of wet soils must be avoided. Summer mowing will be conducted during dry years when the ground can support equipment without disturbing the soil and when possible, these areas will be kept dry through autumn to reduce sprouting.

The objective is to remove trees in these areas and to reduce willow and other shrubs to acceptable limits (<25%) for herbaceous wetland and sedge meadow plant communities. Fall mowing followed by flooding in the spring will be used when flooding is possible and does not interfere with other habitat objectives. In these cases, it will be imperative that the cut surfaces are topped by water in the spring. Herbicide may be used on a limited scale. One effective application will be with a wick applicator the second year after mowing, since only new willow and tree growth will be high enough to receive the herbicide. Herbicide applications will be in early summer and followed by burning later in the fall, after the woody vegetation has died. In areas where herbicide is not used, mowing should take place during the summer following a burn. Willows will then re-sprout and are subject to burning two years later. Planting seeds or plugs may be an option depending on factors such as cost, existing seed bank, degree of disturbance etc.

Objective 4

Manage 270 acres of moist soil impoundments at Bellrose Waterfowl Reserve for desirable annual moist soil vegetation. The objective will be to achieve a minimum of 60% (192 acres) cover of “good” or “desirable” plants and produce a minimum of 400 pounds of readily available moist soil seeds per acre from September through April. The three impoundments will be managed as a complex in order to provide a diversity of water depths at various times in order to provide the maximum benefits to migratory waterfowl. Management capabilities within these impoundments allow for manipulation of water during both fall flooding and spring drawdown.

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Due to the exposure of these units to major flood events, it must be acknowledged that in some years, certain events preventing the meeting of the objectives are likely to occur.

Rationale

Although the Cache River Watershed was densely forested prior to settlement, there were open areas lacking trees (Hutchison, 1995). Herbaceous wetlands occurred within openings in the floodplain forests of the Cache River Watershed in temporary or ephemeral basins, or in areas that underwent scouring during flood flows. Disturbance from beavers, lightning and wind could sometimes create openings as well. In some cases, larger wetland basins with seasonal hydrology likely produced vast amounts of food when dried early (Fredrickson 2006). Many desirable species of wetland plants satisfy nutritional requirements and provide suitable habitats for waterfowl and many other species of wildlife throughout the year. As stated in Chapter 2, CCNWR's purpose, and primary establishment goal is providing resting, nesting, feeding and wintering habitat for waterfowl and other migratory birds is the establishing purpose.

Strategies

1) Maintain a hydrologic regime with appropriate depth, duration and timing for optimizing use by waterfowl, while at the same time providing habitat for shorebirds, marsh birds, and wading birds when possible.

2) Manage water levels to enhance germination of desirable wetland plants using knowledge of:

a) Topographic and hydrologic conditions within each impoundment.

b) Germination requirements of desirable plants such as wild millets, smartweeds, pigweeds, flat sedge, and cutgrass species.

c) Germination requirements of undesirable species such as cocklebur, water primrose, water pepper, and willow.

3) Integrate a rotation of disturbance (ex: disking, mowing, crops, burning) within and among moist soil impoundments to provide periodic soil disturbance and control woody vegetation.

4) Obtain elevation surveys conducive to developing at least six inch contours for all potential restoration.

Prescription

The moist soil impoundments at Bellrose Waterfowl Reserve (Figure 8) will be managed as a complex to provide diverse water levels for a variety of species. Water level manipulations will be timed to coincide with the arrival times and populations of migrant species. The following is

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an example of an annual flood regime and will be modified on an annual scale in order to meet habitat objectives:

Fall flooding: Early fall flooding will begin with shallow inundation of impoundments to accommodate increasing waterfowl populations Ten percent of the entire area (30 acres) will be gradually flooded in early fall (beginning in mid to late September) for migrant Blue-winged teal, Northern Pintail and Wood Ducks, with a gradually increasing flooding regime to accommodate increasing waterfowl populations, with a goal of 85% (230 acres) of the surface area flooded to an average depth of 30 centimeters or less by mid-December This flooding strategy will maximize moist soil seed availability for foraging, migrating and wintering dabbling ducks (eg, teal, pintail, mallards). (See Table 10 for a sample annual schedule of water management).

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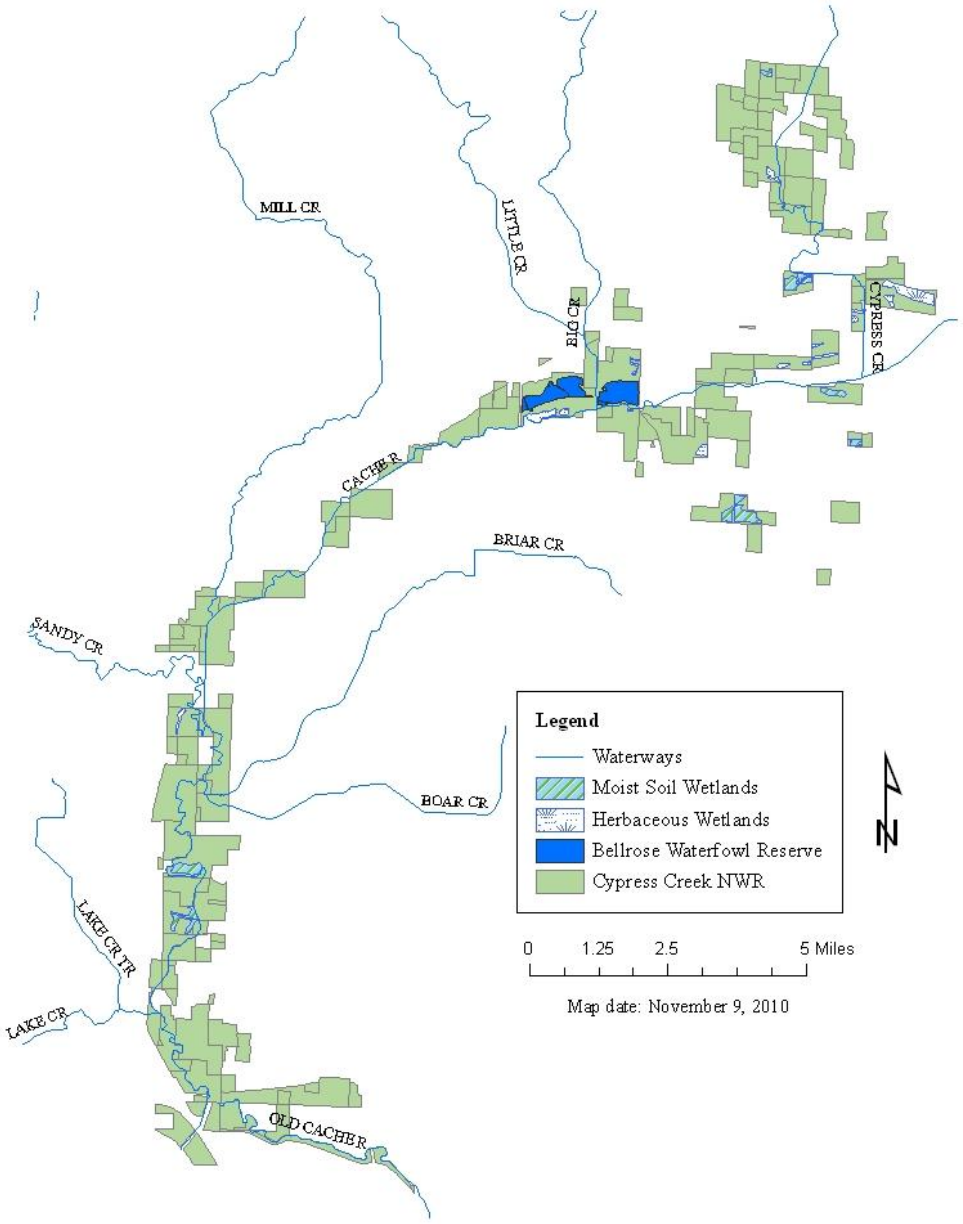
Figure 8. Cypress Creek National Wildlife Refuge Herbaceous Wetlands



Spring drawdown: Gradual, staggered drawdowns of all units will be initiated in order to maximize foraging habitat for migratory waterfowl, shorebirds, wading birds and rails when possible. Thirty percent of the area will be drawn down beginning in mid to late February for early migrants such as Mallards and Northern Pintail, Forty percent of the area will be drawn down from mid-March to mid-April for mid spring migrants such as teal, Northern Shovelers, as well as incidental shorebirds, rails, and herons, and thirty percent will be drawn down from mid-April until mid-May in order to encourage a greater diversity of moist soil plant species as well as to provide incidental habitat for late spring wading and shorebird species.

Water levels will be managed to enhance germination of desirable wetland plants using the bathymetry data collected for each unit used in combination with germination requirements of desirable plants such as wild millets, smartweeds, flat sedges, and cutgrass species as well as germination requirements of the undesirable species such as cocklebur, water primrose, water pepper and willow (Table 11).

As needed, based on plant community composition, a rotation of disturbance (ex: disking, crops, burning) will be incorporated within and among the three moist soil impoundments to provide periodic soil disturbance and control woody vegetation. When crops are planted they will be "dirty" ie: rows will be spaced 30" apart and will only be sprayed once, as a post-emergent application in order to encourage growth of annual native moist soil plants in the understory.

Table 11. Sample Target Water elevations for Bellrose Waterfowl Reserve (feet above MSL)

Date	Unit 1	Unit 2	Unit 3	Acres Flooded
Oct 1	331.0	329.0	Dry	29.37
Nov 1	332.0	329.5	328.0	155.2
Dec 1	332.0	330.0	328.4	254.5
Jan 1	332.0	330.5	328.5	293.5
Feb 1	332.0	330.5	328.5	293.5
Mar 1	331.5	329.5	328.5	216.3
Apr 1	331.0	329.5	328.4	133.4
May 1	330.0	329.0	328.2	38.72

Vegetation monitoring will be conducted in moist soil units in order to determine the quality of moist soil habitat in each impoundment. Vegetation sampling will be conducted using a systematic sampling grid creating one sampling point per every 2 acres within each moist soil impoundment. Percent cover of the top six plant species within a one meter square plot will be recorded at each sampling point. Each impoundment will then be rated on a scale of 0-100% based on the percent cover of good waterfowl plant species. Seed production will also be calculated within these plots using the techniques of Laubhan and Fredrickson (1992).

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Objective 5

Manage 300 acres of moist soil impoundments outside the Bellrose Waterfowl Reserve as a complex in order to provide a diversity of water depths at various times in order to provide the maximum benefits to migratory birds and other wildlife. Management capabilities within these moist soil impoundments allow for enhanced manipulations of water levels during drawdown. Gradual, staggered drawdowns will begin in mid February, and continue through July in order to maximize foraging habitat for migratory waterfowl, shorebirds, wading birds and rails when possible.

Rationale

See Objective 4 above.

Strategies

1) Maintain a hydrologic regime with appropriate depth, duration and timing for optimizing use by waterfowl, while at the same time providing habitat for shorebirds, marsh birds, and wading birds.

> Spring drawdown: Thirty percent of the area (approximately 75 acres) will be drawn down in mid to late February for early migrants such as Mallards and Northern Pintail, Forty percent of the area (approximately 100 acres) will be drawn down in mid March and April for Mid Spring migrants such as Teal, Northern Shovelers, Shorebirds, Rails, and Herons, and thirty percent (approximately 75 acres) will be drawn down from mid-April to mid-May in order to encourage a greater diversity of moist soil plant species as well as to provide incidental habitat for late spring wader and shorebird species.

2) Integrate 3-4 year rotation of disturbance (ex: disking, crops, burning) within and among moist soil impoundments to provide periodic soil disturbance and control woody vegetation.

3) Manage water levels to enhance germination of desirable wetland plants and prevent germination of undesirable plants.

Prescription

The remaining 300 acres of moist soil impoundments (Figure 8) will be managed similarly to the Bellrose impoundments. Water levels will be managed to enhance germination of desirable wetland plants using knowledge of topographic and hydrologic conditions within each impoundment as well as germination requirements of desirable plants such as wild millets, smartweeds, pigweed, flat sedges, and cutgrass species as well as the undesirable species such as cocklebur, water primrose, water pepper and willow. The following is an example of an annual flood regime and will be modified on an annual scale in order to meet habitat objectives. Because of the lack of pumping capabilities within these units, two to three boards will be placed

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in each structures in mid to late September and continually added (one board added every two weeks) as the winter progresses in order to mimic the gradual flooding occurring at Bellrose. For spring drawdown, 30% percent of the area (approximately 75 acres) will be drawn down in mid to late February for early migrants such as Mallards and Northern Pintail, 40% percent of the area (approximately 100 acres) will be drawn down in mid-March and April for mid spring migrants such as Teal, Northern Shovelers, shorebirds, rails, and herons, and 30% percent (approximately 75 acres) will be drawn down from mid-April to mid-May in order to encourage a greater diversity of moist soil plant species as well as to provide incidental habitat for late spring wader and shorebird species. Bathymetry data will be collected using the methods established by Nelson (2007) and water gauges will be installed at all control structures so that water levels within these units can be managed more effectively.

Canebrakes

Goal

Inventory, protect, enhance and restore a matrix of giant cane habitat within the bottomland forest habitat inside CCNWR boundary.

Objective 1

Within 8 years of plan approval, determine the presence and distribution of giant cane on CCNWR in order to determine the spatial distribution of existing giant cane patches, and collect data on historical distribution of giant cane within the Cache River Watershed in order to enhance the ability of refuge staff in determining the most appropriate locations for re-establishment of giant cane habitat.

Rationale

Giant Canebrake communities were once a dominant landscape feature which represented critical habitat for a number of rare or extirpated species such as the black bear, and the Bachman's Warbler. Canebrakes disappeared rapidly following European settlement due to a combination of overgrazing, altered burning regimes, agricultural land clearing, and changes in floodplain hydrology (Brantley and Platt 2001) and are nearly nonexistent today. Canebrakes represent critical habitat for several forest birds including American Woodcock, Hooded Warbler, and the rare, state endangered Swainson's Warbler, as well as other wildlife species such as swamp rabbits and canebrake rattlesnakes. In addition, at least six lepidopteron species have recently been identified as bamboo obligates (Gagnon 2006). Four of which, the Creole pearly Eye, cobweb little skipper, the yellow little skipper, and the cane little skipper are listed as Species in Greatest Need of Conservation for Illinois (Illinois Department of Natural Resources 2005). Giant cane has also been identified as an excellent riparian buffer because it serves as a good filter. Cane growing in riparian buffers enhances water quality by reducing sedimentation and removing nitrates, as well as stabilizing stream banks (Zaczek et al. 2004). Canebrakes are now considered one of the most imperiled types of plant communities in the country, and the inventory and management of remaining canebrakes deserve high priority (Brantley and Platt 2001, Noss et al.1995). Because canebrakes are a historical component of healthy, bottomland

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forested wetlands, and they also serve to improve the water quality of those wetlands, the restoration of canebrakes is considered a high priority pursuant to the establishment purposes of CCNWR.

Knowing the current and historical distribution of giant cane habitat is a critical step in order for Refuge staff to plan enhancements and locations for supplemental plantings. Understanding the juxtaposition of existing patches will allow refuge staff to rely more on ecologically based strategies rather than opportunity-based when choosing sites for enhancement and restoration.

Strategies

1) Acquire infrared aerial images over CCNWR acquisition boundary.

2)Identify and map the perimeters of all significant existing giant cane patches (greater than 10 m in width and/or length) in order to determine location and size.

3) Collect abiotic information on each site.

Prescription

A winter aerial flight capturing infrared imagery of the entire refuge was completed in March 2010 and that imagery was used to digitize existing cane patches within CCNWR (Figure 9). The cane located using the imagery as well as any known existing patches are currently being ground-truthed and mapped in order to have a complete map of all existing cane habitat on CCNWR. With a goal of mapping the cane on the entire refuge within two years of plan approval, all the cane patches located will be re-visited in order to do a complete site assessment. All management units will be completed within eight years of plan approval. For each well-defined canebrake greater than 10-m in length and/or width, the following attributes will be measured: approximate length and width of the canebrake; estimated stem density (stems/m^2) and average height of the canebrake. Each canebrake will receive a score based on the overall size (area), stem density and height. Canebrakes that are small (e.g. <200m^2), sparse (e.g.stem density <10 per m^2) and short (e.g. <2m tall) receive low scores whereas those that are large (e.g. >500m^2), dense (e.g. stem density >20 per m^2) and tall (e.g. >2m tall) receive higher scores. Soils, hydrology or flooding potential, canopy cover, co-existing plant communities, and distance to nearest cane patch will be recorded as well.

Objective 2

Within ten years of plan approval, enhance by increasing stem density, height and extent of a minimum of 40 acres of currently existing giant cane habitat by employing management actions such as supplementing already-present but sparse growth areas with additional planting, eliminating mowing or agricultural crop production adjacent to existing patches, or by thinning the forest canopy in areas where cane patches exist in large areas, but lack dense structure. Priority areas will be chosen where existing cane patches are located in close proximity to each other in order to maximize the connectivity of individual patches, and therefore the total acreage of individual canebrakes.

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Rationale

Enhancement of the existing canebrakes in the bottomland forests of CCNWR will enhance the health and wildlife benefits of these wetlands through improvements in water quality and improvements to the vertical structure.
Enhancing cane growth will be beneficial in areas where cane is already sparsely growing. Canebrake restoration will be fairly straightforward in these areas, because the cane may only need a more favorable environment to expand the occupied area or to form dense thickets. The rapid vegetative expansion of cane into abandoned agricultural field has been recorded historically (Platt and Brantley 1997), suggesting that taking fields out of agricultural production or installing buffers around the edges may enhance existing stands of cane. Canebrakes growing within the forest interior will inevitably decline if located under a closed canopy (Gagnon 2006). Giant cane stands require at least partial sunlight to maintain a dense structure which is necessary to provide critical habitat for species such as swamp rabbits, canebrake rattlesnakes, and Swainson's Warblers. A study in southern Illinois found 70% of Swainson's Warblers studied established territories within hardwood forests with 50% or more of the basal area of the dominant and co-dominant trees consisting of softwoods such as silver maple, sweetgum, sycamore, elm, and cottonwood with a high canopy and an understory composed mainly of dense giant cane.(Eddleman et al. 1980).

Strategies

1) Install buffers along all existing agricultural fields with significant (greater than 10m in length or width) giant cane growth around the perimeter or remove these areas entirely from agricultural production, in order to allow the natural spread of giant cane rhizomes.

2) Perform measures in order to thin the existing forest canopy in areas with significant understory giant cane growth such as chemical injection etc in order to enhance naturally occurring cane growth.

3) Perform supplemental plantings of cane rhizomes in areas with significant giant cane growth in order to enhance the spread of naturally occurring cane.

Objective 3

Within 15 years of plan approval, plant 30 acres of giant cane in existing forest openings and as a buffer along forest/cropland or riparian boundaries in order to improve soil/water/wildlife benefits. Also, it is a high priority to continue research efforts currently underway to determine the best procedures for transplanting cane. Giant cane restoration methodologies are still being tested, and continuation of these methods will be based on survival success of planted cane patches.

Rationale

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Planting cane will expedite the enhancements being done to existing patches, which will in turn accelerate the beneficial effects to the wetlands and bottomland forests of CCNWR. Planting cane in a forest opening, where it can receive partial sunlight will result in much faster production of stem density (culms/m²) than cane planted within the shaded forest. Canebrake habitat along forest and field edges will soften the edge effects by providing cover and foraging habitat opportunities for many species, as well as serve as an effective filter of agricultural sediment. The filtering effects of cane were shown by Schoonover et al. (2006). When Giant cane buffers outperformed forest buffers in reducing incoming sediment mass. Continued research is a necessary component since restoration efforts up to this point have been limited due to the lack of available planting stock and difficulties in propagation of cane (Zaczek et al. 2004), In addition, descriptions of minimum habitat standards for species such as the Swainson's warbler are still lacking. Patch size (area) and culm density appear to be important defining parameters; however, historical and current literature provides few actual measurements. In a study done on 5 study sites in Arkansas, Louisiana, Mississippi, and Florida, researchers concluded that stem densities from 30,000 to 50,000 stems/ha provide the cover necessary for high-quality Swainson's Warbler habitat (Graves 1996). In southern Illinois, the average stem density in Swainson's nesting habitat was 26,390 stems/ha, and no birds were detected in areas with
5,000 stems/ha.(Eddleman et al. 1980).

Strategies

1) Gather giant cane rhizomes from existing stands in late winter and early spring in order to use as planting stock.

2) Transplant cane rhizomes focusing on existing forest openings greater than 1 acre and 50 foot wide buffers along forest/cropland boundaries, with appropriate hydrology and soils.

3) Transplant cane rhizomes in 1 or 2 acres patches along mature forest edge before implementing reforestation on adjoining land in order to promote "interior" cane.

4) Continue research to determine best management practices for transplanting giant cane.

Prescription (Objective 2 and 3)

Five acres of existing cane habitat will be enhanced each year through a combination of methods. Buffers measuring 50 feet wide will be installed along any existing agricultural fields that have cane growing adjacent within the first year of plan implementation. In addition, five acres of existing cane in forested areas will be enhanced with the creation of canopy gaps. Priority areas for cane enhancement will be chosen by choosing cane patches that have higher scores (see Prescription for cane inventory), and are near other cane patches. This will ensure that restoration will take place in areas with the most chance of filling in the canopy gaps created.

Canopy gaps that are between ¼ acre and 1 acre in size will be created through the use of girdling and chemical injection. The girdling and injections will take place between March and June for maximum efficiency of the process. The goal will be to thin enough trees to leave two

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to four trees in a one acre area adjacent to any cane patches greater than or equal to 1 acre. Shade intolerant species that will most rapidly attain dominant crown position will be favored as the trees left within these gaps.

A minimum of two acres of giant cane will be planted each year. Planting will take place in March or April while the cane is still dormant. Rhizomes will be collected from existing stands either during the preceding fall or in the spring before planting occurs. Rhizomes collected in the fall will be stored in a cooler at 40 degrees Fahrenheit. Approximately 3500 bare rhizomes will be collected each year and re-planted using a tree planter. Rhizomes will be planted on a five foot by five foot spacing. Priority restoration sites will be the buffered areas alongside cane growing adjacent to agricultural fields as well as within sites slated for reforestation that have the appropriate hydrology and soils.

Objective 4

Within five years of plan approval, develop a management strategy, based on adaptive management that provides periodic disturbances, such as those that would have historically been generated by windstorms and fire. Implementing a management plan involving overstory thinning, periodic prescribed fire, fertilization, and supplemental plantings in at least 10% of existing cane within CCNWR boundary annually will encourage more robust canebrake habitat.

Rationale

A management plan to enhance existing cane growth as well as transplanted cane is necessary in order to maintain a robust giant cane habitat over time. Given the establishing purposes of CCNWR, a habitat component such as cane, which serves as a sediment filter and a structurally important habitat for rare and endangered species, should be a management priority. Disturbance caused by fire results in multiple benefits including stimulating sprouting of new culms, returning nutrients to the soil, and reducing competition from other plants. In addition, there is evidence that burning may bolster resistance to subsequent environmental shocks (Gagnon 2006). Mowing cane may result in re-sprouting of culms as well, and could be used as an alternative where burning is not feasible.

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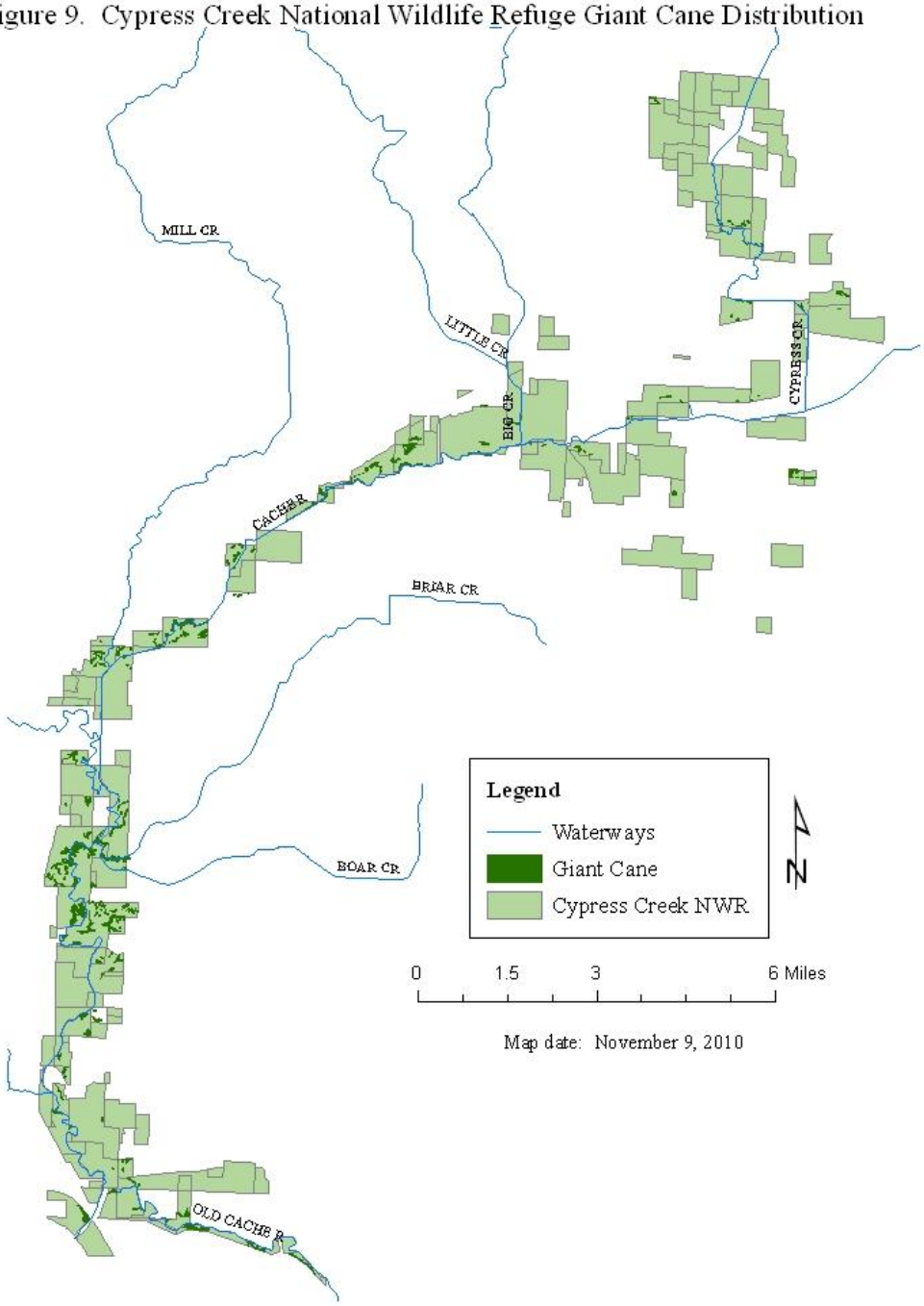
Figure 9. Cypress Creek National Wildlife Refuge Giant Cane Distribution



Strategies

1) Perform late fall or early winter prescribed burns.

2) Fertilize cane patches that appear stressed.

3) Monitor survival of existing canebrakes.

Prescriptions

Native American use of fire, for agricultural use, warfare, hunting etc, resulted in burning of canebrakes an average of once every 7-10 years, a practice that has been shown to be beneficial in maintaining and expanding canebrakes by eliminating competing woody vegetation (Brantley and Platt 2001,Gagnon 2006). An on-going management strategy will be implemented in which the health of existing canebrakes are assessed every 3-4 years in order to document any spread, reduction or movement of existing cane patches. Late fall and early winter prescribed burns will be conducted in well established, dense canebrakes on seven to ten year intervals in order to stimulate re-sprouting of new culms, return nutrients to the soil, and reduce competition from other plants. When Cane patches appear stressed, they may be fertilized in order to postpone flowering and subsequent diebacks. All cane patches will be monitored closely for the presence of invasive species.

Agricultural Fields

Goal

Maintain a cropland management program that supports Refuge purposes to restore and manage wetlands and bottomland forest habitats and provide migratory and wintering habitat for waterfowl and other migratory birds. Over 50% of Refuge lands purchased have a long-standing history of agricultural use. Agriculture in combination with best management practices will be used in order to prevent the invasion of undesirable vegetation, noxious weeds, and to prepare the land for restoration.

Rationale

At Refuge establishment (1990), agriculture lands within CCNWR acquisition boundary totaled 22,026 acres. To date, CCNWR includes approximately 16,000 acres. Of those 16,000 acres currently in ownership, approximately 50% were originally in agriculture (mostly corn, beans, and milo). Approximately 80% of the purchased agriculture land included highly erodible lands or floodplain fields which were taken out of production and restored to forest, wetland, or moist soil wetlands. To date 1,413 acres of CCNWR is in row crop (this acreage will change as farm land is acquired). The majority of these acres (1,219) exist to control invasive noxious weeds and prepare lands for future habitat restoration; 194 crop acres, in conjunction with moist soil production, at the Bellrose Waterfowl Reserve exists to enhance habitat and food resources for migratory birds. Current crop land and agricultural land acquired in the future will be evaluated

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and prioritized for reforestation (with the exception of 194 acres at the Bellrose Reserve). This is consistent with CCNWR EA (1990), which states up to 10% of the most suitable and productive upland areas (within Refuge ownership) could remain in agriculture to support Refuge habitat management goals.

Table 12. Agricultural Fields on Cypress Creek National Wildlife Refuge

Tract Number	Total Acreage
127,135,135a, 137	194
255, 274	553
36	98
55	56
49	60
113	78
93	30
91a	62
13	7
29	40
135	80
205	26
10b	69
170	60
Total	**1,413**

Objective 1

Within 2 years of the approved plan prioritize restoration of approximately 860 acres of agriculture land.

Rationale

Currently approximately 1000 acres are enrolled in the Cooperative Farming program. These acres include a history of agricultural production and over 860 acres of highly erodible lands. Since Refuge establishment, a focus of CCNWR is to remove HEL and floodplain fields from production and restored these acreages to forest or wetlands. In order to prioritize future restoration of lands within the cooperative farming program, a GIS tract assessment model will be used to determine the potential for restoration (based on wildlife habitat values) and/or the potential of each field to reconnect with existing habitat (forest/wetlands). Preliminary results from this model indicate the fields in the northern portions of CCNWR to be of highest priority for restoration (see Table 10).

Strategies

1) Assess the distribution, extent, and type of existing crop programs on surrounding private and state land.

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2) Determine the agricultural suitability and the potential for reforestation based on habitat values provided within the Land Capability/GIS tract assessment model and Reforestation Priority Model.

Prescription

With the use of the Reforestation Priority Model and the Land Capability Tract assessment model, prioritize the restoration of 860 acres which are identified as highly erodible or marginal farmland. Existing and potential restoration and enhancement sites for bottomland forest within CCNWR boundary will be located within two years after plan approval with the completion of a hydrogeomorphic evaluation of the entire refuge. An evaluation of the geology, soils, topography, climate and hydrology of current sites will be conducted using refuge field data, GLO notes; soils survey maps, long term climate and stream gage data, elevation and other historic information. Soil maps will be examined in order to determine where appropriate soils exist. Potential restoration sites and measures located through the course of this study will be evaluated depending on factors such as cost, degree of current disturbance, location and other such factors by refuge staff as well as members of the Cache River Joint Venture.

Objective 2

Within 12 years of plan approval, convert 1200 acres of cropland to forest in order to increase forest connectivity/interior.

Rationale

CCNWR was established to manage and perpetuate the diversity of indigenous wildlife populations. This includes protecting and restoring habitat for a diversity of species including plants and animals that are endangered or threatened, waterfowl and other migratory birds. Agriculture in conjunction with moist soil production will enhance habitat and food resources for migratory waterfowl at the Bellrose Waterfowl Reserve; approximately 200 acres of row crop will be maintained at this site. Remaining acreage within the cooperative farming program will be used to control noxious weeds and prepare priority sites for restoration.

Strategies

1) Use biologically based, spatially explicit decision support tools (reforestation priority model) to determine high priority areas for restoration.

2) Retire a minimum of 100 acres of crop land annually and restore to forest and or wetland habitat.

3) Concentrate on providing a range of habitats, on developing complex vertical structure, and maintaining integrity of interior forest.

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Prescription

By using the reforestation priority model, cropland areas will be prioritized for restoration. From the priority list, a minimum of 100 acres will be targeted each year. A year prior to restoration, the cooperative farmer and Farm Services Agency will be notified that a particular field or fields will be removed from the cooperative farming program. This will allow enough time for the tenant to prepare for the coming year and an acreage reduction. The following spring native seedlings will be planted on the selected site. Seedlings will be acquired from a local source and planted at a rate of 435 seedlings/acre.

Objective 3

Identify and employ best management practices that control erosion and sedimentation; maintains hydrologic flow (open drainage), and enhances wildlife habitat on acreage within the cooperative farming program (1,413 acres).

Rationale

Conservation and environmental farming involves practices that provide benefits to both agricultural production and wildlife habitat. These practices result in reduced energy consumption, reduced soil erosion, and reduced use of chemical with a result of improved soil fertility and biological diversity. These practices are incorporated into cooperative farming agreements for each individual farming on CCNWR. Within these agreements, best management practices are outlined as well as a 75%-25% share provision where the cooperator harvests 75% of the crop and leaves 25% of the crop for the benefit of migratory and resident wildlife.

Strategies

1) Develop native grass buffers and field borders between 30'-50' that provide habitat requirements for priority species and aids in minimizing runoff and erosion.

2) Avoid the introduction of habitat conditions suitable to cowbird propagation, i.e. forest fragmentation such as wide mowed roadsides, maintenance of large openings, etc.

3) Require cooperative farmers use chemicals from the USFWS Field Approved list and keep accurate records of chemical application.

4) Maintain diversity within cropland area to provide wildlife habitat; grasses, shrubs, forbs along road and field borders, buffers along ditches will contribute to wildlife food and cover requirements.

5) Use crop rotation to avoid or minimize potential adverse effects such as pest resistance (corn and soybeans).

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Prescription

Until restoration can take place, limited agriculture will be used to control invasive species and prepare the land for restoration to native habitat. The cooperative farming program on CCNWR includes 1,413 acres and employs best management practices (BMPs) to control erosion and minimize impacts to wildlife. Practices include incorporating 30' to 50' grass buffers around each field. Buffers will consist of a native grass/forb mix and be planted in either the spring or fall. Approximately 200 acres of grass buffers will be maintained through spot chemical treatment, mowing or intermittent burning to control invasive species, Other BMPs incorporated into each farm plan include crop rotation which will reduce plant diseases and increases soil nutrients and yields; this could include alfalfa, clover, and/or other legumes that are worked into the rotation to produce nitrogen, provide resources for insects, and increase nesting cover.

Timeline for Accomplishment

The above goals and objectives were developed to guide the habitat management of CCNWR for the next 15 years. As noted above, these goals and objectives were the result of discussions held with resource experts familiar with CCNWR and the habitat management planning process. The following goals and objectives are based on those discussions, as well as the goals and objectives set forth in the CCNWR CMP.

Below, in Table 13 is the annual timeline of accomplishment for the strategies and prescriptions that were created in order to accomplish those habitat goals and objectives.

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Table 13. Annual Schedule of Objective Completion at Cypress Creek NWR

HMP Objectives	Year														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Map Giant Cane Habitat	X	X													
Enhance 5 acres of Cane Habitat/Year	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Plant 2 Acres of Cane Habitat/Year	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Develop Cane Management Plan	X	X	X	X	X										
Map Herbaceous wetlands	X	X													
Develop Herbaceous wetland plan	X	X													
ID restoration areas of H. Wetlands	X	X													
Increase Herbaceous wetlands by 100 acres															X
Manage 270 acres MSU @ Bellrose	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Manage 300 MSU	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Map Baldcypress-Tupelo Swamp		X													
Map historical Baldcypress-Tupelo Swamp		X													
Restore 100 acres Baldcypress-Tupelo Swamp															X
Complete HGM Study	X	X													
HMP Objectives	**Year**														
Locate Bat Roost/Maternity Colonies	X	X	X	X											
Manage 1,600 acres for bat roost/maternity colony					X	X	X	X	X	X	X	X	X	X	X
Complete 10-15 permanent Forest Monitoring Plots	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Achieve Active management on 70-95% Bottomland Forest															X
Manage 1,500 acres Bottomland Forest for ducks															X
Reforest 100 acres Bottomland Forest/Year	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Enhance 100 acres of pulpwood plantation	X	X	X	X	X	X	X	X	X	X					

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