HABITAT MANAGEMENT PLAN FOR

COLDWATER RIVER
NATIONAL WILDLIFE REFUGE

Quitman and Tallahatchie Counties, Mississippi

Southeast Region

Coldwater River National Wildlife Refuge

Habitat Management Plan

U.S. Department of the Interior
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CHAPTER I. INTRODUCTION

The National Wildlife Refuge System (System) comprises some of the most important areas for the conservation of native flora and fauna within North America. National wildlife refuges are designed to protect and enhance the trust wildlife resources (i.e., migratory birds, endangered and threatened species, and inter-jurisdictional fish) and the habitats on which these trust species are dependent.

The development of Comprehensive Conservation Plans (CCPs) for each refuge or complex has provided a basic framework for habitat management to benefit priority trust species.. The CCP describes the desired future conditions of a refuge or planning unit and provides long-range guidance and management direction to achieve the purpose(s) of the refuge. It helps fulfill the mission of the System; maintains and, where appropriate, restores the biological integrity, diversity, and environmental health of each refuge and the System; and meets other mandates. The CCP for North Mississippi Refuges Complex (Complex), which includes Coldwater River NWR, was approved in 2005.

This Habitat Management Plan (HMP) is a step-down plan from the CCP that aims to refine management, enhancement, restoration, and protection of important habitats for the selected resources of concern. The HMP relies on the best available scientific information and is designed to be flexibile to change (i.e., adaptive management) based on new information or unanticipated results.

SCOPE AND RATIONALE

Planning Process

Habitat Management Plans are dynamic working documents that provide refuge managers with a decision-making process and guidance for the management of refuge habitat. Their aim is to establish long-term vision, continuity, and consistency for habitat management on refuge lands. Each plan considers the establishing purpose of the refuge and the current habitat conditions, along with international, national, regional, tribal, State, and ecosystem plans, to establish refuge goals and objectives. The HMP planning process guides analysis and selection of specific habitat management strategies to achieve specific habitat and resources of concern goals and objectives by using refuge-level inventory and monitoring data, scientific literature, expert opinion, and staff expertise.

The statutory authority for conducting habitat management planning on National Wildlife Refuges (NWRs) is derived from the National Wildlife Refuge System Administration Act of 1966 (Refuge Administration Act), as amended by the National Wildlife Refuge Improvement Act of 1997 (Improvement Act), 16 U.S.C. 668dd - 668ee. Section 4(a) (3) of the Refuge Improvement Act states: "...With respect to the System, it is the policy of the United States that each refuge shall be managed to fulfill the mission of the System, as well as the specific purposes for which that refuge was established ..." and Section 4(a) (4) states: "...In administering the System, the Secretary shall monitor the status and trends of fish, wildlife, and plants in each refuge [and]...ensure that the biological integrity, diversity, and environmental health of the System are maintained." The Improvement Act provides the Service the authority to establish policies, regulations, and guidelines governing habitat management planning within the System.

Habitat management plans comply with all applicable laws, regulations, and policies governing the management of the System. The lifespan of an HMP is 15 years and parallels that of refuge CCPs. Habitat management plans are reviewed every five years using peer review recommendations, as appropriate, in the HMP revision process or when initiating refuge CCPs. Additionally, HMPs may be amended as needed to incorporate new management techniques as part of the adaptive management process. Annual Habitat Work Plans (AHWP) contain guidance for implementing specific management prescriptions in a single year to work towards accomplishing management objectives established in the HMP.

This HMP represents a combination of what could be done in an ideal situation tempered by what is likely to be accomplished over the next 15 years, given anticipated staffing and funding. The majority of the listed objectives and strategies require, at a minimum, maintaining the status quo in terms of staffing and funding. In several cases, an increase in staffing and funding will be required to accomplish the stated objectives.

Refuge Vision

The vision for Coldwater River NWR was developed from the broader vision statement for the North Mississippi Refuge Complex CCP (U.S. Fish and Wildlife Service 2005), which states:

Based on sound science, Coldwater River NWR will conserve, protect, enhance, manage, and where possible restore the ecological integrity of a bottomland hardwood forest, wetlands, wildlife, fisheries, and other plant communities within upper portions of the Mississippi Alluvial Valley for the benefits of present and future generations of Americans. Bottomland hardwood forest and agricultural/moist-soil habitats will be managed to benefit migratory birds and other indigenous fish, wildlife, and natural vegetative communities. Land resource protection, enhancement, restoration, and acquisition will be identified to support conservation plans and initiatives in the Lower Mississippi River Ecosystem.

LEGAL MANDATES

Coldwater River NWR was established in 1991as the Black Bayou Unit of the Tallahatchie NWR. It received designation as a "stand alone" refuge in 2001. The federally legislated purposes are: "...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds," (Migratory Bird Conservation Act, 16 U.S.C. 715d); and "...for conservation purposes." (Consolidated Farm and Rural Development Act, 7 U.S.C. 1926 et seq.). More specifically, the Tallahatchie [includes Coldwater River] NWR Environmental Assessment and Land Protection Plan (U.S. Fish and Wildlife 1991) states the refuge was proposed "…to preserve and manage wintering and migrating habitat for Canada geese, mallard, pintail, blue-winged teal, and wood duck and to provide production habitat for wood duck…."

In addition to the specific purposes that were established for each refuge, the Improvement Act provides clear guidance for the mission of the System and sets priorities for wildlife-dependent public uses. It states that each Refuge will:

- Fulfill the mission of the System;
- Fulfill the individual purposes of each refuge;
- Consider the needs of wildlife first;

- Fulfill requirements of comprehensive conservation plans that are prepared for each unit of the System;
- Maintain the biological integrity, biological diversity, and environmental health of the System; and
- Recognize that wildlife-dependent recreation activities, including hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation are legitimate and priority public uses; and allow refuge managers authority to determine compatible public uses.

RELATIONSHIP TO OTHER PLANS

The CCP for the Complex was finalized in 2005 and includes broad goals and objectives for refuge management over a 15-year period. The purpose of the HMP is to provide more specific guidance that will facilitate the selection of prescriptions for implementing the goals and objectives of the CCP. To maintain consistent strategies for managing wildlife and habitats on the refuge, several other planning documents were used in the development of this plan including:

North American Waterfowl Management Plan (NAWMP)
The North American Waterfowl Management Plan contains continent-wide goals and objectives for populations of waterfowl (USFWS 1986). The plan led to the development of Joint Ventures for various eco-regions, and step-down goals and objectives by eco-region. The Lower Mississippi Valley Joint Venture (LMVJV) developed habitat goals for migrating and wintering waterfowl in the Mississippi Alluvial Valley (MAV). Based on a step-down process, the LMVJV established habitat objectives that link continental waterfowl populations to on-the-ground habitat objectives. The habitat goal established in 1996 for Coldwater River NWR was approximately 190 acres of managed moist-soil. This habitat goal was incorporated into the CCP. Much of the management occurring on Coldwater River NWR relates directly to meeting this habitat goal.

Mississippi Alluvial Valley Bird Conservation Plan Physiographic Area #5
A major initiative of the Service and its partners over the last 10 years is the conservation of forest interior birds. Partners in Flight (PIF) has developed conservation plans for land birds for the different eco-regions throughout the United States, including the MAV. This plan does not have specific objectives for different agencies or public land areas, but it does set some minimum area requirements to achieve viable breeding populations for many of the species of concern. Based on these requirements, the LMVJV identified Bird Conservation Areas (BCAs) throughout the Delta (Twedt et al. 1999). These areas represent the highest priority areas for forest restoration. Coldwater River NWR is included in the O'Keefe BCA which has a core goal of 2,100 hectares (5,189 acres; core area is that area that is greater than 1000 meters from any edge.) Currently, the core acreage within the O'Keefe BCA is 112 hectares (276 acres). Although the core goal has not been met, it is achievable as new lands are acquired within the refuge acquisition boundary. Priority species have been identified within the plan based on species decline. Within the O'Keefe BCA, the high priority species are the Swainson's Warbler, Cerulean Warbler, Prothonotary Warbler, Red-headed Woodpecker, Painted Bunting, Northern Parula, Kentucky Warbler, Orchard Oriole, Yellow-billed Cuckoo, Wood Thrush, and White-eyed Vireo (Twedt et al. 1999).

Southeast United States Regional Waterbird Conservation Plan

This plan provides a framework for the conservation and management of waterbirds in the Southeast that are not covered by either the NAWMP or the U.S. Shorebird Conservation Plan (Hunter et al. 2006). Threats to waterbird populations include destruction of inland and coastal wetlands, predators, invasive species, pollutants, mortality from fisheries and industries and other disturbances. No wading bird rookeries exist on Coldwater River NWR at the present time, although they have been documented in the past. The refuge is typically used heavily by post-breeding wading birds, including wood storks. Several species of secretive marsh birds (sora rails, king rails, American and least bitterns, pied-billed grebes, and American coots) use Coldwater River NWR for breeding and/or during migration. (Scientific names provided in Appendix B.)

U.S. Shorebird Conservation Plan for the Lower Mississippi

The U.S. Shorebird Conservation Plan is a partnership effort to ensure that stable and self-sustaining populations of shorebird species are restored and protected (Elliot and McKnight 2000). The plan was developed by a wide range of agencies, organizations, and shorebird experts for separate regions of the country, and identifies conservation goals, critical habitat conservation needs, key research needs, and proposed education and outreach programs to increase awareness of shorebirds and the threats they face. Coldwater River NWR has the goal of providing 100 acres of mudflat habitat for use by migrating shorebirds. The moist soil units are well suited for management as shorebird habitat. Additionally, the reforested sites (~ 1,200 acres) on the refuge were planted with a mixture of hardwood seedlings on wide-row spacing during the past 15 - 20 years. These sites should provide structure favorable to woodcock for foraging and roosting.

Mississippi's Comprehensive Wildlife Conservation Strategy

In 2005, the Mississippi Department of Wildlife, Fisheries, and Parks developed a comprehensive plan to provide a "conservation blueprint" for agencies, organizations, industries, private landowners and academics across the state to advance sound management of all of the fish and wildlife resources (Mississippi Museum of Natural Science 2005). This broad-based plan is a guide to effective and efficient long-term conservation of Mississippi's biological diversity. This state plan has identified important wildlife species for which population declines have occurred or a significant threat to their habitat exists. These have been developed as a list of Species of Greatest Conservation Need. Many of these species exist presently or historically on Coldwater River NWR. In addition, the state plan has identified vegetative communities of conservation concern. The state plan has identified the bottomland hardwood system of the MAV as critically imperiled.

Gulf Coastal Plains and Ozarks Landscape Conservation Cooperative

Landscape Conservation Cooperatives (LCC) are public-private partnerships that recognize wildlife conservation challenges transcend political and jurisdictional boundaries and require a more networked approach to conservation—holistic, collaborative, adaptive and grounded in science—to ensure the sustainability of America's land, water, wildlife and cultural resources. The Gulf Coastal Plains and Ozarks LCC encompasses the Delta region and builds on a multitude of other initiatives to achieve common conservation goals; broader in scope than avian conservation driven efforts of the Joint Ventures. Many of the identified Resources of Concern are also identified within the Gulf Coastal Plains and Ozarks LCC.

Other Planning Documents

Other documents reviewed during development of the HMP included the Environmental Assessment and Land Protection Plan for Tallahatchie National Wildlife Refuge (U.S. Fish and

Wildlife Service 1991), the Complex biological review (U.S. Fish and Wildlife Service 2003), the North Mississippi Refuges Complex CCP (U.S. Fish and Wildlife Service 2005), and the CCP pulse check (U.S. Fish and Wildlife Service 2011b).

CHAPTER II. BACKGROUND, INVENTORY AND DESCRIPTION OF HABITAT

LOCATION

Coldwater River NWR is located in the Delta region of Mississippi in Quitman and Tallahatchie Counties, approximately 6 miles northwest of Charleston, Mississippi (Figure 1). The refuge consists of two tracts: the Schiele Tract (40 acres) and the main tract (2,356 acres). A total of 2,396 acres is owned in fee title. The approved acquisition boundary is approximately 8,550 acres. The refuge is administered by the North Mississippi Refuges Complex, with headquarters located in Grenada, Mississippi.

The main tract of Coldwater River NWR is bounded by the Army Corps of Engineers levee (Levee Road) to the east and a public road (Dry Bayou Road) to the west (Figure 2). The north end of the refuge is bisected by the Quitman-Tallahatchie County Line, and Dummy Line Road runs along the county line for approximately 1.5 miles. This road is in disrepair, but is still occasionally used by the public. All other access roads on the refuge are for staff use only, are gated, and consist of graveled levee tops.

The Schiele Tract is located approximately three-quarters of a mile north of the main tract of Coldwater River NWR. It is due east of Dummy Line Road and lies entirely within Tallahatchie County. There are no maintained access roads on this tract.

From a planning perspective, the refuge is located within the administrative boundaries of the LMVJV and is part of the O'Keefe Bird Conservation Area. It is part of the Gulf Coastal Plains and Ozarks LCC.

MANAGEMENT UNIT DESCRIPTIONS

The refuge is divided into 56 management units, based on habitat type, proximity of units to each other, and logistics (keeping units at a manageable size for the habitat type, splitting farm fields divided by drainage ditches, etc.). See Table 1 and Figure 3. Habitat types include: moist-soil units, natural regeneration, reforestation areas, agricultural fields, forest, borrow pits, sloughs, and ditches.

Table 1: Acreage, habitat type, most recent management, and water control capability for management units on Coldwater River NWR. (Water control capability: full – well and water control structure; partial – water control structure only; none – no well or water control structure. Units with wells that are known to function are indicated in bold under "Water Control Capability")

Unit	Size (acres)	Habitat Classification	Last Management Activity and Year of Occurrence	Water Control Capability
1	38	Natural Regeneration	Strip mowed in 2008 (45' wide with 90' between strips along contour)	None
2	88	Natural Regeneration	Strip mowed in 2008 (45' wide with 90' between strips along contour)	None
3	79	Natural Regeneration	Strip mowed in 2008 (45' wide with 90' between strips along contour)	Partial
4	79	Reforestation	Planted in 1999	Partial

5	48	Reforestation	Planted in 1999	Partial
6	51	Reforestation	Planted in 1999	Partial
7	50	Reforestation	Planted in 1999	Partial
8	66	Borrow pit	Drained in 2009	Partial
9	102	Reforestation	Planted in 1999	Partial
10	178	Reforestation	Planted in 1999; replanted in 2000	Partial
11	187	Reforestation	Planted in 1995; partial replant in 1999	Partial
12	95	Reforestation	Planted in 1995; partial replant in 2000	Partial
13	20	Reforestation	Planted in 1995; partial replant in 2000	Partial
14	33	Reforestation	Planted in 1995; partial replant in 2000	Partial
15	27	Reforestation	Planted in 1995; partial replant in 2000	Partial
16	26	Natural Regeneration	Strip mowed in 2008 (45’ wide with 90’ between strips along contour)	Partial
17	80	Natural Regeneration	Strip mowed in 2008 (45’ wide with 90’ between strips along contour)	Partial
18	98	Reforestation	Planted in 1999; replanted in 2000	Partial
19	17	Reforestation	Fallow since 1992	Partial
20	40	Slough/ditch	Cleared of debris in 2009	Partial
21	102	Slough/ditch (Hurricane Bayou)	Cleared of debris in 2009	Partial
22	26	Slough/ditch	Cleared of debris in 2009	Partial
23	9	Slough/ditch (Puncheon Bayou)	No actions taken	Partial
24	6	Slough/ditch	Cleared of debris in 2009	Partial
25	60	Reforestation	Reforested in 1992	Partial
26	7	Reforestation	Reforested in 2000	Partial
28	10	Slough/ditch	Cleared of debris in 2009	Partial
29	4	Moist soil	No actions taken	Partial
30	6	Natural Regeneration	No actions taken	Partial
34	38	Reforestation	Reforested in 1997	Partial
41	87	Agricultural field	Farmed in milo in 2012	**Full**
42	236	Agricultural field	Farmed in milo in 2012	Full (not whole acreage)
A	16	Moist soil	Sprayed willows in eastern half of unit in 2005	**Full**
B	15	Moist soil	Mowed eastern half in 2012	**Full**
C	20	Moist soil	Disked in 2013	**Full**
D	19	Moist soil	Disked in 2011, openings mowed in 2012 – 2014	**Full**
E	17	Moist soil	Disked in 2012, portions mowed in 2013	**Full**
F	18	Moist soil	Disked in 2010	**Full**
G	17	Moist soil	Sprayed with Habitat in 2014 (willows	**Full**

			and bermudagrass)	
H	17	Moist soil	Disked in 2010, portions mowed in 2013	**Full**
I	15	Moist soil	Sprayed with Habitat in 2014 (bermudagrass), except lowest area	**Full**
J	21	Moist soil	Disked in 2013	**Full**
K	19	Moist soil	Disked in 2010	**Full**
L	19	Moist soil	Disked in 2013	**Full**
M	21	Moist soil	Disked in 2008	Partial
N	22	Moist soil	No treatment within last 10 years	Partial
PP	19	Moist soil	No treatment within last 10 years	Partial
P	21	Moist soil	No treatment within last 10 years	Partial
Q	19	Moist soil	Disked in 2011	Partial
R	21	Moist soil	No treatment within last 10 years	Partial
S	19	Moist soil	Disked in 2011, northern half mowed in 2012	**Full**
T	20	Moist soil	Disked in 2013	**Full**
U	16	Moist soil	Disked in 2011, portions mowed in 2013	**Full**
V	17	Moist soil	Disked in 2013	**Full**
W	17	Moist soil	Mowed in 2013	Partial
X	16	Moist soil	No treatment within last 10 years	Partial

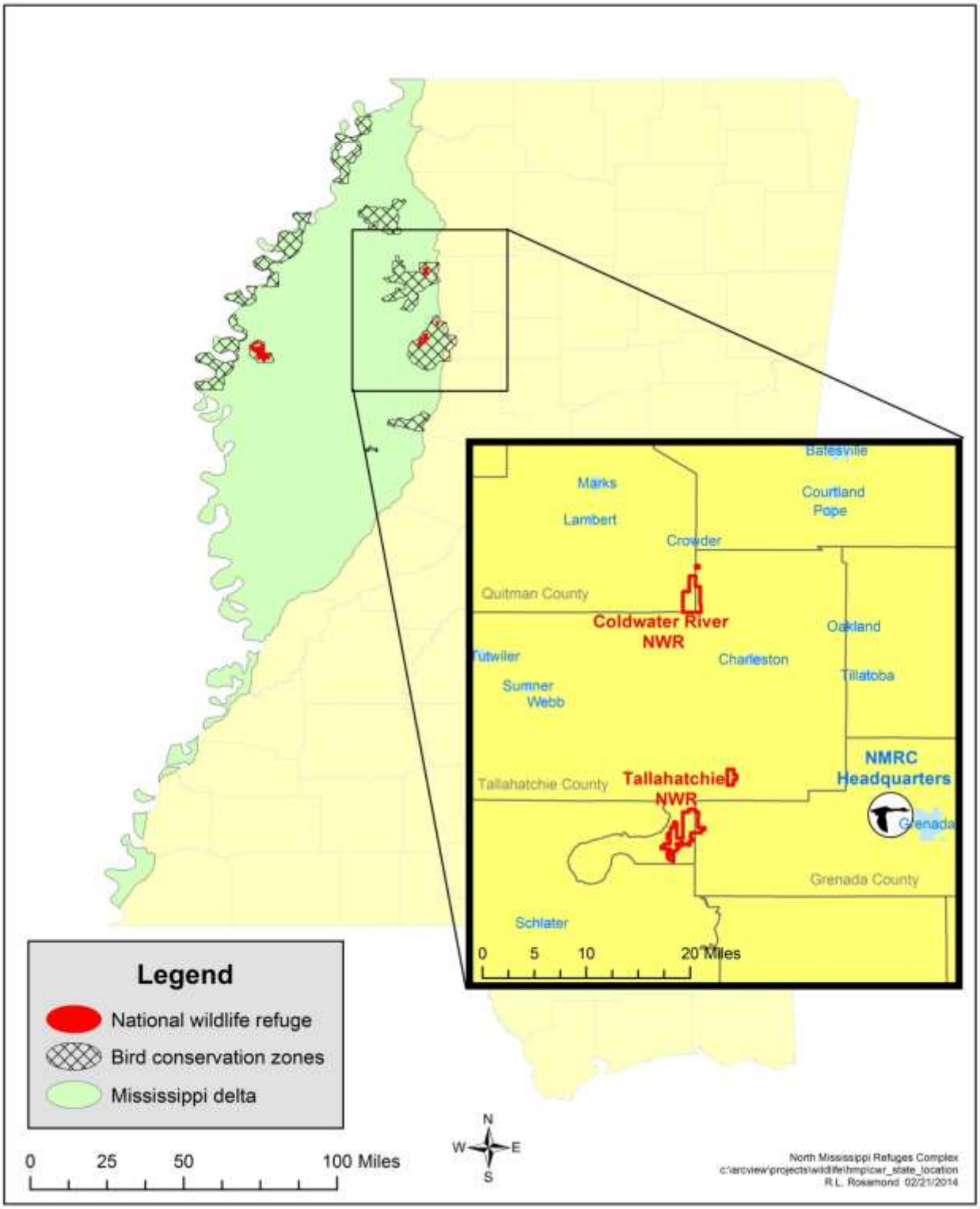

Figure 1: Location of Coldwater River National Wildlife Refuge (NWR) in the Delta region of Mississippi, in relation to the North Mississippi Refuges Complex office and Tallahatchie NWR.

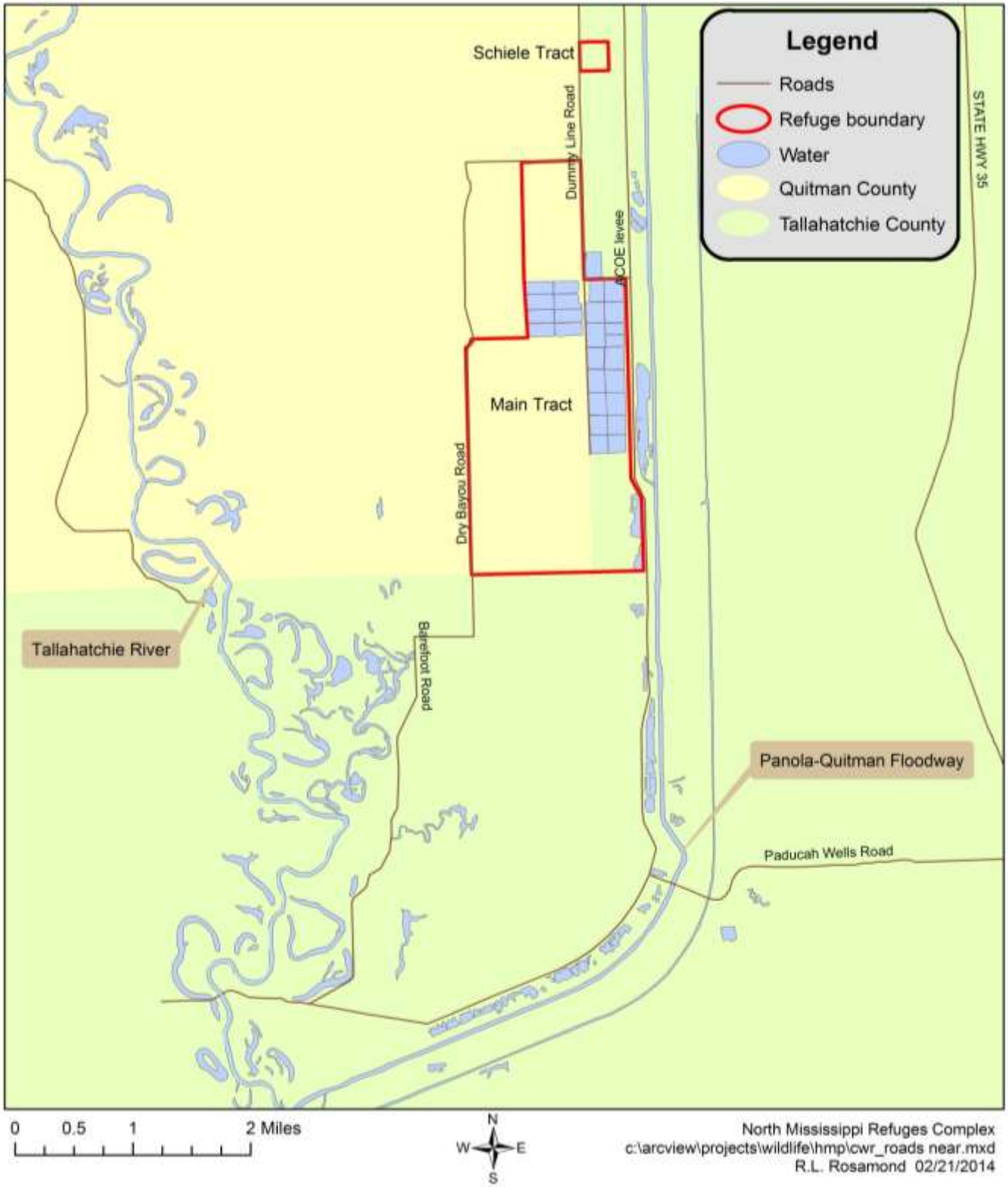

Figure 2: Location of Coldwater River National Wildlife Refuge in relation to roads and waterways.

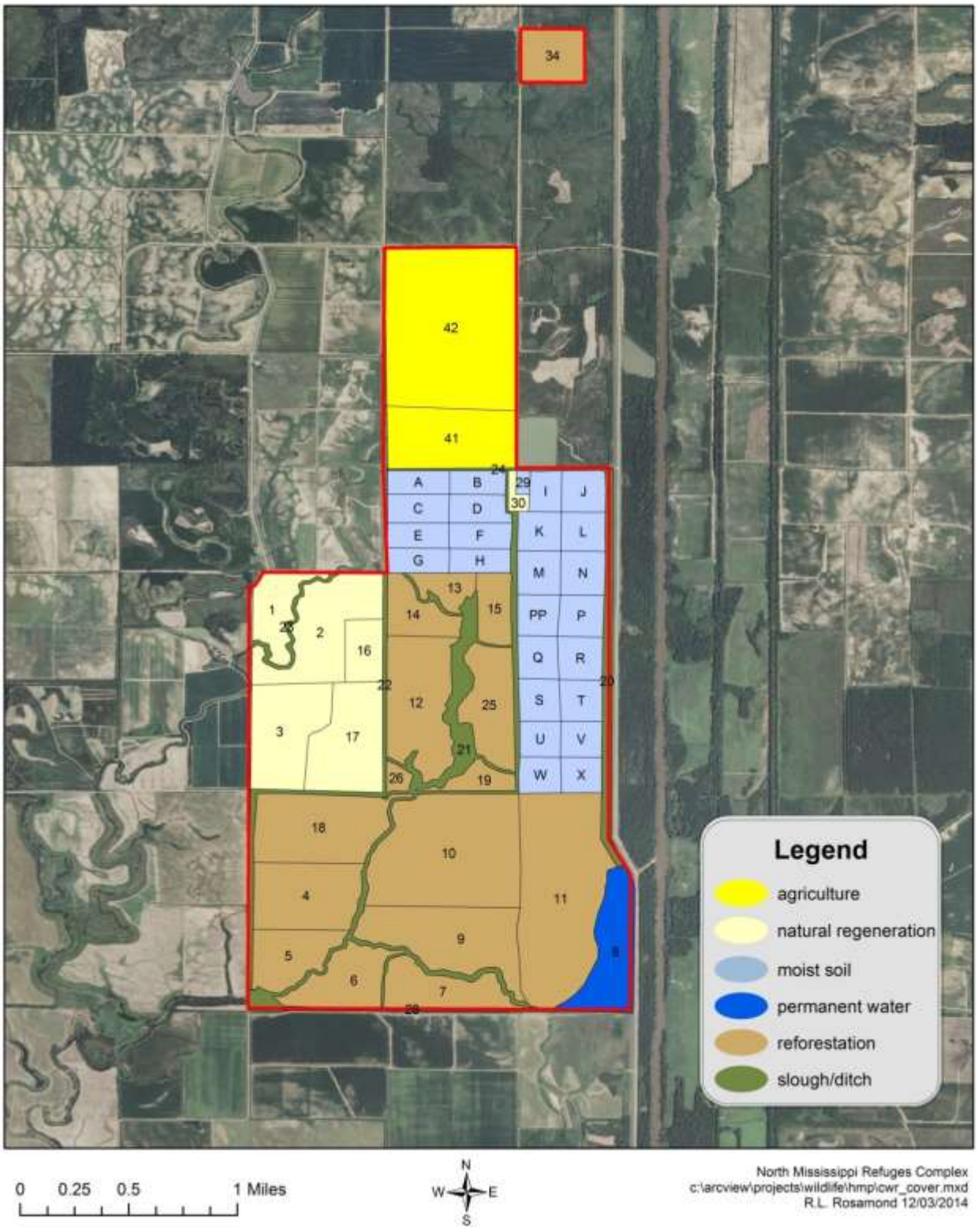

Figure 3: Habitat types present on Coldwater River National Wildlife Refuge. Numbers and letters indicate separate management units.

Physical or Geographic Setting

Water and Water Quality

Coldwater River NWR is located within the MAV in the Yazoo River drainage basin, a portion of the historic floodplain of the Mississippi River. Primary tributaries on or adjacent to the refuge include Puncheon Bayou, Dry Bayou, and Hurricane Bayou (Figure 4). Ditches and spoil banks occur throughout the area, altering the historic flow of water through these drainsand speeding the flow of water off the landscape.

The Panola-Quitman Floodway, a diversionary canal off the Little Tallahatchie River, is adjacent to the eastern boundary of Coldwater River NWR (Figure 5). It is kept separate from the main tract of the refuge by Levee Road. The Tallahatchie River lies less than 3 miles to the west of the main tract.

The refuge is located approximately 1.5 miles from the western edge of the Loess Hills. Historically, runoff from the Loess Hills would have drained through this area, prior to flowing into the Tallahatchie River. With the construction of the Panola-Quitman Floodwayand adjacent Army Corps of Engineers levee, water drains directly into the Floodway and joins the Tallahatchie River at its junction with Tillatoba Creek, due west of Charleston (Charleston, Mississippi Quadrangle 1982). The Floodway allows water to drain more quickly from tributaries in the hills, resulting in increased sediment loads and higher turbidity in the Floodway and the Tallahatchie River.

Historically, the area would have been subject to seasonal flooding. Flooding still occurs but timing and duration do not reflect historic patterns. In most winters, water will back-up from the confluence of the Tallahatchie River and the Panola-Quitman Floodway and spread north, resulting in much of the refuge being underwater from November through March. With the exception of man-made levees, spoil banks, and ponds, elevation across the refuge is fairly uniform at 147 feet above mean sea level (MSL) (Fishhook Lake, Mississippi Quadrangle 1982).

Soils

Soils in this area reflect the hydrological history of the area, consisting primarily of Waverly-Calhoun and Pearson-Brittain-Waverly Associations (U.S. Dept. of Agriculture 1958, 1970). In general, these are poorly drained acidic soils that are generally too wet in the winter and spring to be suitable for residential and industrial development. They may be suitable for crops, provided adequate drainage. The soils were formed, at least in part, from silty alluvium deposited by the Tallahatchie River. This area is also characterized by a high water table, slowing drainage in the spring. Several artesian wells are found throughout the property.

Temperature and Precipitation

The 30-year average temperature (minimum – maximum) ranges between 30 degrees Fahrenheit (^{0}F) and 57^0 F during winter months and between 66^0 F and 91^0 F during the summer (temperatures recorded in Grenada). The relatively warm and humid weather allows for greater than 220 days of agricultural growing in the Delta. Annual precipitation averages 58 inches. Rainfall occurs relatively uniformly throughout the year with slightly more rain during the winter months. Driest conditions occur in August through October. (NOWData for Grenada,

MS, http://www.nws.noaa.gov/climate/xmaxis.php?wfo=jan). During the winter and spring, most precipitation falls over an extended period. During the summer months, precipitation is generally in the form of localized thunderstorms with heavy rainfall (U.S. Dept. of Agriculture 1970).

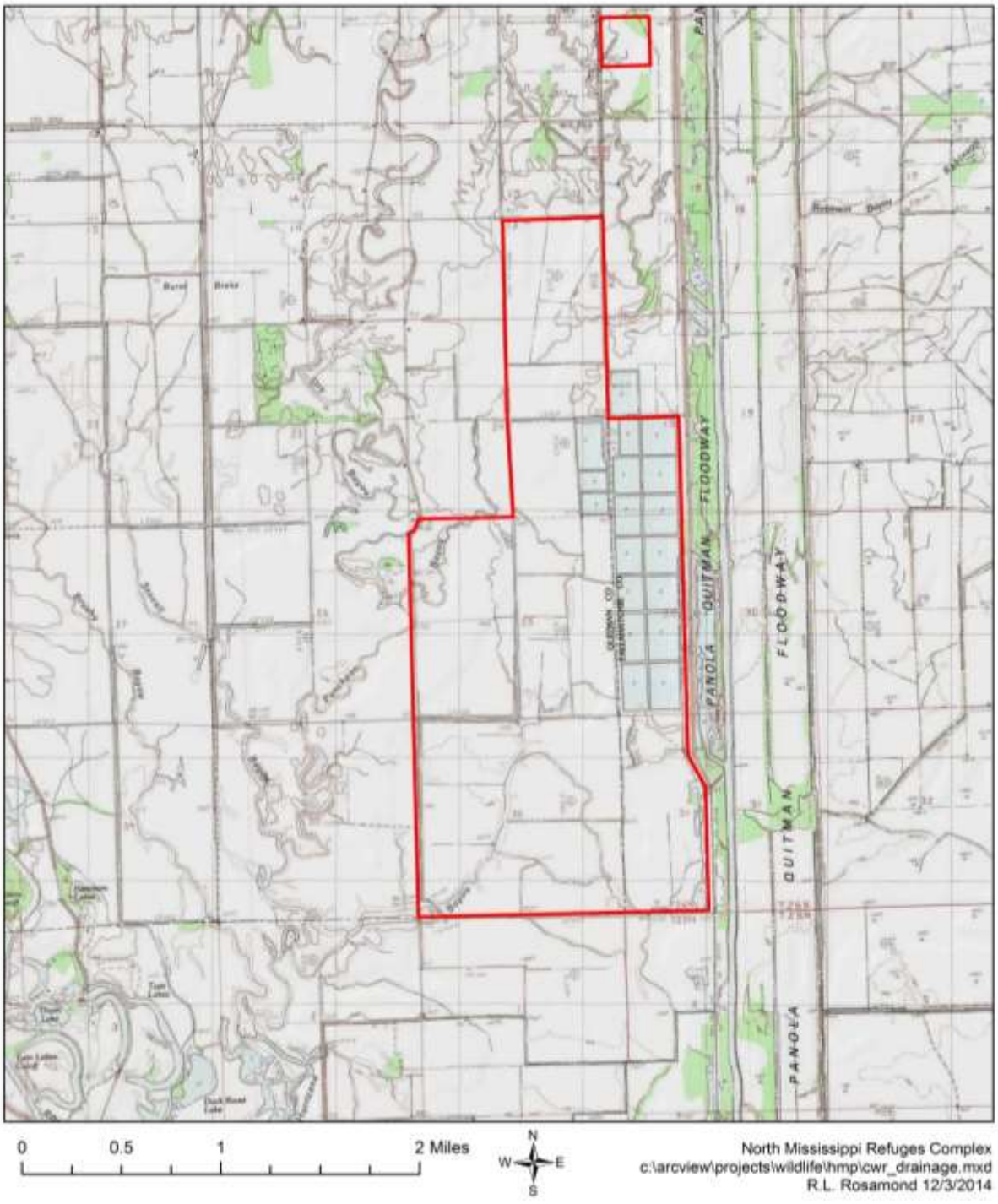

Figure 4: Major waterways on or adjacent to Coldwater River National Wildlife Refuge (shown in red).

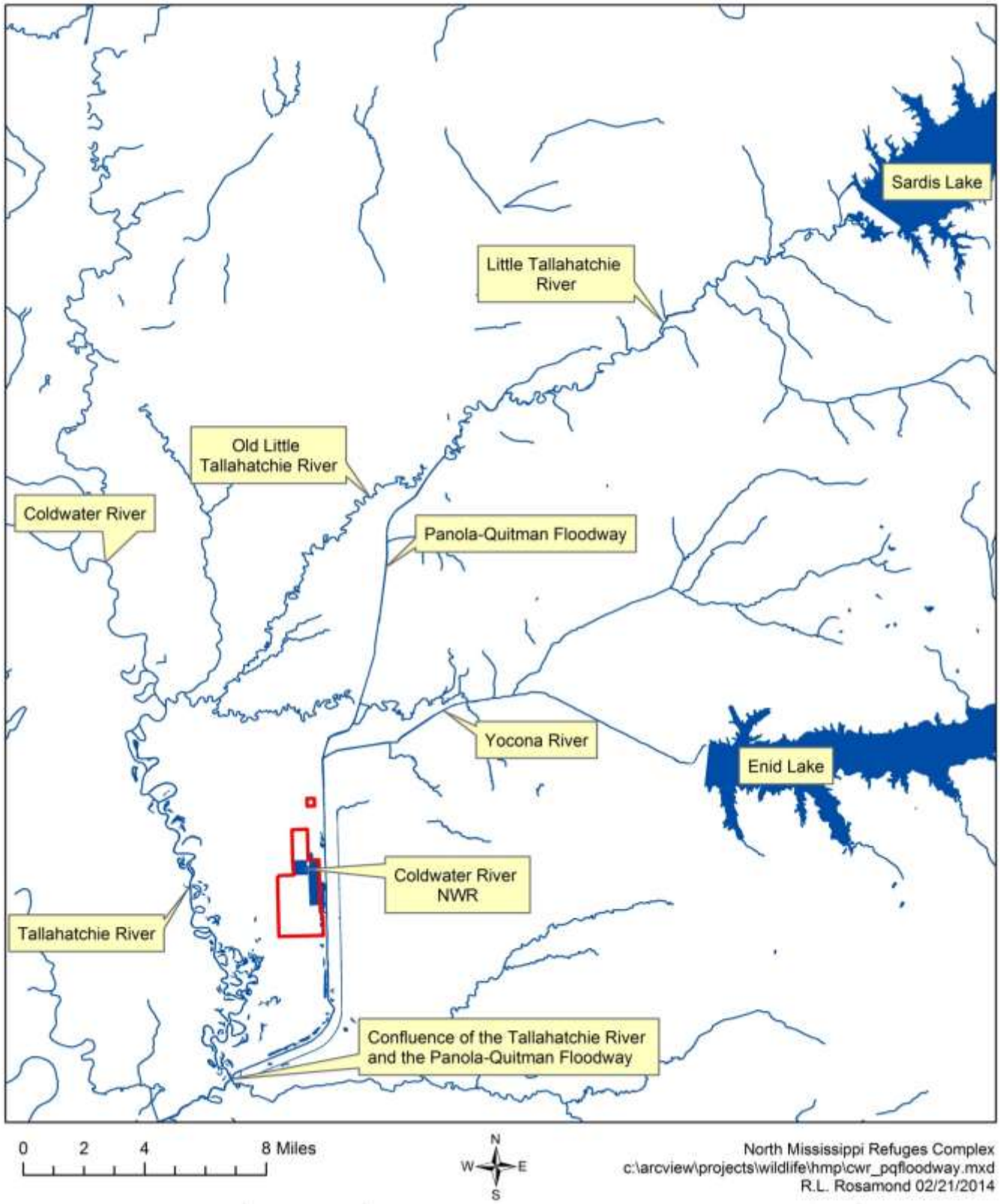

Figure 5: Relationship of the Panola-Quitman Floodway and associated rivers surrounding Coldwater River National Wildlife Refuge.

HISTORIC HABITAT CONDITIONS

The refuge is located east of the Mississippi River in the area commonly referred to as the Delta. The Delta was formed over millions of years as unconsolidated sediments were deposited and the floodplain shifted. The alluvial soils were the product of sediments from the annual overflow and inundation of the Mississippi River across the Delta. The recurrence of soil deposits created relatively young soils geologically. The Delta is relatively flat with elevation changes of less than 5 feet within a mile and considerably less as one moves further from the river to the Loess Hills. Elevations of 100 to 160 feet typically occur within the region.

The Delta is located within the MAV, a vast floodplain that stretches from southern Illinois down to Louisiana. It covers approximately 25 million acres and, prior to human colonization was covered with an extensive bottomland hardwood forest. The bottomland hardwood ecosystem of the MAV was the largest in the United States (Tiner 1984). It developed under an extremely complex interaction of the vegetative community and abiotic factors.

The area surrounding Coldwater River NWR is a part of this system. Historically, it had several drainages running through it that would have received runoff from the adjacent Loess Bluffs and carried it into the Tallahatchie River and ultimately to the Yazoo then the Mississippi River. Much of the area would have received seasonal flooding. The flooding was likely of short duration and largely a result of the rapid runoff from the hills flowing into the nearly flat Delta and slowing. This seasonal flooding replenished nutrients in the bottomland area and allowed the formation of a bottomland hardwood forest, probably dominated by oaks, sweetgum, and sugarberry. The lowest areas were likely flooded most of the year and would have been dominated by cypress and tupelo. In dry years, these areas would have likely supported annual grasses and sedges, which would provide additional seeds for waterfowl in the winter.

CURRENT HABITAT CONDITIONS

The bottomland hardwood forest of the MAV is a patchwork of forest blocks fragmented by massive areas of agriculture with few forest blocks outside the batture of any significant size (Twedt and Loesch 1999). The most important ecological process, annual flooding from the Mississippi River of the bottomland forest ecosystem, has been nearly halted through a century and a half of flood abatement projects. Long-term conservation exists on a limited acreage of state and federal ownership in the MAV, but many are small in size and highly fragmented. In general, the wettest sites are composed of bald cypress and water tupelo, slightly less wet sites contain water hickory and overcup oak, and many of the other red oaks and their associates are found on the driest sites. Ouchley and others (2000) suggest that sweetgum, not oaks, historically dominated much of the bottomland hardwood forest within the MAV. Timber harvesting and land clearing for development and agriculture resulted in an approximately 80 percent reduction in the amount of forested land by the 1980s. Additionally, various timber management practices had likely changed the composition of much of the remaining forest. In the mid-1980s, various conservation programs began reclaiming marginal agricultural fields and planting them in trees. Since then, over one million acres have been reforested within the MAV. The current bottomland hardwood forest is a patchwork of reforestation areas and smaller wooded tracts reflecting the history of previous timber harvests, flood control measures, and silvicultural techniques that favor high value trees, such as oaks.

Coldwater River NWR currently consists of 2,396 acres which includes approximately 420 acres of moist-soil units, 300 acres of natural regeneration, 250 acres of borrow pits, 328 acres of agricultural fields, over 1,000 acres of reforestation areas, and several sloughs and ditches (Figure 3). The majority of the refuge is within a levee, with additional interior levees throughout. Most water that moves through the refuge is contained within ditches, rather than natural water ways. Four electric wells are available to flood the moist-soil units and one electric and one diesel well are present on the agricultural fields. Additionally, artesian wells are present in units 1, 10, and 29.

Moist-soil Units

The 420 acres of moist soil units include 24 ponds (units A – X) that were previously managed for commercial catfish production (Figure 3). These ponds range in size from 14 to 21 acres, and are now managed for shorebirds, migratory and wintering waterfowl, and water birds. Successful management of these units requires the ability to remove water from the ponds as well as the ability to reflood. Although, every unit has a water control structure, only 16 of the 24 units have distribution pipes to allow pumping and reflooding. Another four units can be reflooded using gravity flow via pipes connecting them to units that are flooded by pumping. Two of these units and the four remaining units that have no capability for reflooding (other than rainwater) are typically not drained during the growing season. Water in these units slowly evaporates during the summer time. Although they don't typically dry completely, the water that is retained is shallow and becomes very hot. In spite of this, fish, tadpoles, and other aquatic organisms persist. Overall, water in the moist soil units is clear, without the turbidity issues present in nearby large ditches.

In 2004 and 2005, the levees surrounding these ponds were lowered and widened to create gradual slopes on the sides of the levees. This required ponds to be drained early in the spring and prevented management from occurring in those years. Additionally, when the levees were lowered, existing vegetation from the tops and sides of the levees was removed and put in the units, resulting in slash piles. Much of the slash has since decomposed, but there are still remnants in several of the units.

Natural Regeneration

The 300 acres of natural regeneration (a.k.a. "western fields") on Coldwater River NWR (units 1, 2, 3, 16, 17) are located west of the moist soil units (Figure 3). These fields were mowed in 2005 to maintain open habitat. In 2007 and 2008, these fields were strip-mowed with one third of the total area mowed each year. They have not been mowed since. Typically, fields such as these rapidly undergo succession. However, probably due to poor soils in the area, as well as the fact that approximately 25 to 75 percent of this area has some degree of flooding every winter, succession is slowed considerably.

In 2011, beavers dammed the water control structure located in the southwest corner of this area. This resulted in prolonged flooding of most of unit 17 and the southern portion of units 3 and 16. As a result, this area currently contains aquatic species such as buttonbush, frogbit and mud plantain, as well as moist-soil vegetation such as smartweeds and various grasses. Willow have encroached from the east, though most of that encroachment likely occurred before the area flooded. Currently, approximately 25% of the area is flooded year-round with over 75% of the area flooded during the winter months.

Although water quality has not been evaluated, most of the standing water is clear. Additionally, small areas have been colonized by parrotfeather, an invasive species.

Reforestation Areas

The reforestation areas are located south of the moist-soil units and western fields and extend to the southern boundary of the main tract of Coldwater River NWR in what is commonly referred to as the "sump" (Figure 3). They were planted from 1992 to 2000 with a variety of bottomland hardwood species. Both bare-root seedlings and acorns were used and some areas were replanted after the initial plantings failed. This area is drained by Hurricane Bayou, which has been highly altered over the years. Numerous ditches exist throughout the area, changing historic flow regimes. In years with at least average rainfall, water accumulates in the area between the Panola-Quitman Floodway and the Tallahatchie River (Figure 5). This water will back-up (move north) from the confluence of these two water bodies, onto the refuge, and continue north into Hurricane Bayou to the southern levee surrounding the ponds. It will continue to flow up the drainage ditches and frequently backs into the ponds. The "sump" typically floods in November and may not dry until June, making seedling establishment difficult. An Army Corps of Engineers report cites this area as one of the wettest in the state.

In addition to the sump area, the Schiele Tract has also been reforested (Figure 3). The reforestation effort was supplemented by natural colonization by green ash and black willow. This tract is not as low-lying as the sump area and a good stand of mixed hardwoods is developing.

Agricultural fields

Coldwater River NWR currently has two agricultural fields comprising 328 acres. The southern field is approximately 80 acres (unit 41) and the northern field is approximately 240 acres (unit 42) (Figure 3). These lands were purchased in 2007 and had previously been farmed. The fields are located on the northern end of the refuge and are surrounded by levees, although the bulk of the western most levee is located just off refuge. The two fields are separated from one another by an east-west ditch. The fields each contain a well (an electric well on unit 41 and a diesel well on unit 42) and numerous water control structures to facilitate drainage. The northern field is bisected by a north-south ditch that runs the length of the field. Since acquiring the property, it was cooperatively farmed each year in milo, sometimes with a portion planted in soybeans. The refuge share was approximately 75 acres of standing milo (approximately 25 percent of the total acreage). This portion was typically left in the lowest portions of each field to facilitate flooding. The fields were last farmed in 2012 and alternatives to cooperative and or force-account farming are being considered given the discontinued use of genetically modificed crops and seeds coated with neonicotinoids by the Service.

Borrow pits

The borrow pits are located in the southeast corner of the main tract of Coldwater River NWR (Figure 3). No active management occurs on the borrow pits because there is currently no mechanism for water control on these areas. Typically, these areas dry somewhat during the summer, allowing a fairly dense stand of smartweed to develop around the edges. In most winters, the borrow pits will flood to full pool and are lightly used by waterfowl. The highest waterfowl use occurs when temperatures drop below freezing. These areas provide thermal cover and open water during these periods. These areas also are heavily used during dry winters as they are often one of the few areas that retain water during droughts. No current information on water quality is available, although these units have a higher turbidity than the moist soil units.

Sloughs/Ditches

Numerous sloughs and ditches are located throughout the property and reflect the history of the area (Figure 3). Puncheon Bayou is located between units 1 and 2 and contains primarily cypress and water tupelo trees and buttonbush. It appears to be largely unaltered on the refuge and joins Dry Bayou just west of the refuge.

The main refuge drain is Hurricane Bayou. Historically it would have flowed through the area now containing the western moist-soil units, as well as possibly the agricultural fields. A tributary to it would have drained the area of the eastern moist-soil units. However, much of this land was cleared in the mid-1970s as the soybean boom hit Mississippi. This land was considered marginal, low-lying and subject to flooding. This necessitated digging numerous ditches to allow drainage and constructing levees to control flooding. The entire refuge is surrounded by drainage ditches with numerous ditches crisscrossing the property. All that remains of the historic drainage of Hurricane Bayou is in the southern reforestation area, where it retains much of its original shape. Much of the Bayou is unvegetated, particularly on the southern half. Water temperatures in the summer time are typically hot enough that dissolved oxygen levels drop to less than one part per million (C. Bacon unpub. data). Stream monitoring gauges were installed during August of 2014 at either end of Hurricane Bayou on the refuge to monitor water temperatures year-round.

Most refuge ditches are bordered by willows and present a constant managerial challenge to maintain drainage. Beaver frequently use the ditches and construct dams, hindering management of the moist soil units. Many of the perimeter ditches drain agricultural fields off-refuge. Based on studies of other waterways that drain agricultural areas in Mississippi, these ditches likely contain agro-chemicals and would be considered impaired (Shea et al. 2001).

HABITAT CHANGES FROM HISTORIC TO CURRENT CONDITION

Historically, the area was dominated by bottomland hardwood forest, consisting of oaks, sugarberry, sweetgum and hickories, with the sloughs dominated by cypress and tupelo. In 1908, the Lamb-Fish Lumber Company built a sawmill in Charleston, which was hailed as “the largest hardwood mill in the world,” and was equipped with “the most complete and up-to-date” machinery. The mill had an average daily capacity of 150,000 feet of one-inch lumber. Much of the land in the general area was cleared, beginning around this time (Saikku 2005).

Historically, this area would have received periodic flooding, mainly through the winter months and into the spring. These floods would have been of relatively short duration. In 1924, the Panola-Quitman Floodway was constructed as a diversionary canal of the Little Tallahatchie River (Figure 5). It receives discharge from both Sardis and Enid Lakes, two flood control reservoirs built in 1940 and 1952, respectively. Rather than the Little Tallahatchie joining the Coldwater River and forming the Tallahatchie River, the flow is diverted into the Panola-Quitman Floodway. The Floodway joins the Tallahatchie River much further downstream, approximately 13 miles south of the mouth of the Little Tallahatchie River. Levee Road, a large Army Corps of Engineers levee, lies immediately west of the Floodway and north of its confluence with the Tallahatchie River. As a result of this construction, water will flow north from the confluence, resulting in sheet water covering the land between the Tallahatchie River and Levee Road from late fall through early spring.

Coldwater River NWR and the area to the south, remained mostly forested until the soybean boom of the mid-1970s, probably due largely to the fact the area was low-lying and extremely prone to flooding. Southern landowners began constructing private levees to protect their

agricultural lands from severe flooding. This exacerbated conditions for landowners to the north, who were then forced to construct their own levees, compounding the problem.

The land currently known as Coldwater River NWR was cleared prior to 1978 when it was sold to The Travelers Insurance Company, Inc. Travelers leased the land to local farmers. Twenty-four ponds were constructed in 1981, ranging in size from 10 to 21 acres, and in 1990, Alred Fish Farms (later known as Duck Pond Fish Farm) purchased 12 of the ponds. (Portions of two additional ponds were included in the purchase but the property line bisected those ponds and they were not managed for catfish.) In 1991, the U.S. Fish and Wildlife Service purchased approximately 1,730 acres from Travelers Insurance Company for the establishment of the Black Bayou unit of Tallahatchie NWR . (This unit was converted to a stand-alone refuge and renamed Coldwater River NWR in 2001.) The bulk of this area (1,500 acres) was agricultural fields currently being leased for farming. In 1995, the Service purchased the 40-acre Schiele Tract, located north of the main portion of the refuge. In 1996, the Service purchased the remaining catfish ponds (230 acres) from Duck Pond Fish Farm.

The most recent purchase, 328 acres north of the catfish ponds, was made in 2007. This was agricultural land that had most recently been farmed in soybeans and milo. Much of this acreage is low-lying and subject to flooding.

As mentioned, the bulk of the refuge lands were purchased in 1991 and consisted of 10 catfish ponds and approximately 1,500 acres of agricultural lands. The agricultural lands were gradually taken out of production and reforested beginning with 83 acres planted in 1992. By 2000, all agricultural lands had been planted in trees with the exception of approximately 300 acres along the northwestern border which was set aside for grassland management. Table 2 shows the number of acres in agricultural production and the running total of reforestation acres for the period 1992 – 2000.

Table 2: Number of farmed acres and reforested acres by year (1992 – 2000) at Coldwater River NWR.

Year	Farmed acres	Crop	Reforested acres (Running Total)
1992	1443	unknown	83
1993	1443	unknown	108
1994	1065	unknown	344
1995	577	soybeans	694
1996	577	soybeans	694
1997	667	soybeans	828
1998	523	soybeans	828
1999	523	soybeans, milo	828
2000	0	n/a	1225

In summary, this area was historically characterized by bottomland hardwood habitat and experienced frequent flooding events of generally short duration. The area currently is a highly altered mosaic of agricultural fields, forest regeneration, willow thickets, and drainage ditches. It experiences annual flooding events of a much longer duration.

POTENTIAL EFFECTS ASSOCIATED WITH GLOBAL CLIMATE CHANGE

Over the last 50 years, researchers have documented an increase in the global annual average temperature (Karl et al. 2009). This observation, coupled with observed increases in sea level, changes in precipitation patterns, and decreases in glacial ice, have led to an increase in research in the field of global climate change. Much of this research involves modelling to predict potential changes in various parts of the country.

In the southeast, and specifically the MAV, most of the models indicate that over the course of the next 70 years, there will be an increase in the number of days each year over 90 degrees Fahrenheit and changing patterns of precipitation (Faulkner 2010). Most predictions support the idea that precipitation events will be heavier and less frequent, resulting in a higher incidence of both flooding and drought. These changes in temperature and precipitation have the potential to have direct impacts on species present on the refuge, as well as affect the phenology of various life history events of various species (Rosenzweig et al. 2007).

If these trends continue as predicted, we are likely to have more difficulty in managing Coldwater NWR for waterfowl. It will be more difficult to produce quality moist-soil habitat or productive stands of grain crops for waterfowl due to more extreme precipitation events. Additionally, drought conditions may make in impossible to provide flooded habitat during migration. A decrease in the number of freezing days (another predicted effect) may cause an increase in weeds or other pest species, as they no longer experience winter mortality. Additionally, some species of plants may not be able to germinate, depending on the number of days of cold temperatures required to prepare the seed for germination. Many of the aquatic vertebrates currently present on the refuge, may not be able to persist if the water levels of those units cannot be maintained. Changes in weather patterns may affect migratory patterns of waterfowl. It's possible that waterfowl will not come as far south as they currently do, reducing the need to provide wintering habitat for them.

CHAPTER III. RESOURCES OF CONCERN

IDENTIFICATION OF REFUGE RESOURCES OF CONCERN

Priorities associated with wildlife and habitat management for the NWRS are determined through directives, policies, and legal mandates. Resources of concern can include individual species, species guilds (e.g., waterfowl, shorebirds), and/or habitat communities that support refuge purposes as well as Service trust resource responsibilities (i.e., threatened and endangered species, and migratory birds). Resources of concern are also native species and "natural" functional communities such as those found under historic conditions that are to be maintained and, where appropriate and possible, restored on a refuge (U.S. Fish and Wildlife Service 2011a).

Resources of concern for Coldwater River NWR were selected after taking into account the conservation needs identified within international, national, regional, or ecosystem goals/plans; state fish and wildlife conservation plans; and the goals for the refuge set forth in the North Mississippi Refuges Complex CCP. The CCP specifically identified several priority groups that were grouped into the broad categories of migratory birds, state and federally listed threatened and endangered species, and the overall ecological integrity of bottomland hardwood habitat (U.S. Fish and Wildlife Service 2005). The refuge vision attempts to combine these concerns into an overall direction for the future management of the refuge. While there are other wildlife, fish, and plant resources which the refuge directly or indirectly affects, the resources of concern and the refuge vision determine management actions outlined within the HMP for Coldwater River NWR.

The species/communities selected as resources of concern from these plans support the following NWRS mandates:

- Refuge Purpose(s);
- Refuge System Mission;
- Conserve Biological Integrity, Diversity, and Environmental Health; and
- Fulfill Service Trust Resource Responsibilities (e.g., migratory birds, threatened and endangered species.

Resources of concern identified for Coldwater River NWR include:

- Migrating and Wintering Waterfowl;
- Breeding Wood Ducks;
- Shorebirds;
- Waterbirds;
- State and Federally Listed Species and Species of Special Concern; and
- Birds of Bottomland Hardwood Forests.

MIGRATING AND WINTERING WATERFOWL

SIGNIFICANCE

Coldwater River NWR was one of the five initial refuges acquired to support wintering waterfowl habitat needs within the Lower MAV as outlined in the NAWMP. The MAV historically provided

a vast expanse of flooded forested wetlands for wintering waterfowl (Reinecke et al. 1989) nearly 80 percent of which has been lost to agricultural conversion and much of the remainder unavailable due to flood abatement practices along the major river systems. The reliance on smaller parcels (i.e., State Wildlife Management Areas and NWRs) to mitigate the losses through intensive habitat management is critical to achieving population goals.

IDENTIFICATION OF HABITAT REQUIREMENTS

Waterfowl undergo several physiological processes that result in significant energy and nutrient demands while migrating or wintering in the MAV. Energy requirements are expressed in duck-use days (DUDs) and duck-energy days (DED). Duck-use days represent the number of ducks that can obtain daily energy requirements from an acre (ac) of foraging habitat for a day. A DED is the amount of food necessary to sustain daily energy requirement of one duck for one day.

Waterfowl arrive as early as September (e.g., migrating blue–winged teal) and may stay on the wintering ground through March (Strader and Stinson 2005). Therefore, resources need to be available over an extended period of 120 to 150 days. Energy requirements during fall or spring migration are enormous and must be replenished daily to sustain long-distance flights. In addition, cold weather conditions can significantly increase energy demands, which may affect migration. Finally, waterfowl undergo courtship and molt prior to and during spring migration which requires shifts in diets and habitat requirements. Collectively migrating and wintering waterfowl need a mosaic of habitat conditions consisting of shallow emergent wetlands with an abundance of moist-soil plants, shallow flooded bottomland hardwood forested areas, supplemental agricultural foods, and escape cover or sanctuary from disturbance (Reinecke et al. 1989).

Historically, the MAV provided this diversity of habitats across the vast landscape. The reduction of the forested system by 80 percent (Tiner 1984), has dramatically increased the importance of providing the habitat complex for wintering waterfowl on a very limited conservation footprint. Natural habitats that afford food and cover resources for waterfowl within the Delta consist of naturally flooded or irrigated bottomland hardwood forests and native emergent wetlands (i.e., moist-soil vegetation). Shallow flooded bottomland hardwood forest (less than18 inches) provide food resources in the form of acorns, other soft mast, and aquatic invertebrates. These are heavily used when available by mallards, wood ducks and gadwall. The principle food resource within these areas is small acorns from Nuttall, willow, water, and certain other less common red oaks that are high in energy (Kaminski et al. 2003).

Ducks also use other soft mast tree species like ash, maple, and blackgum. Bottomland hardwood systems also provide an abundance of aquatic invertebrates (Bateman et al. 2005, Heitmeyer 1988) which are an important protein source for female dabbling ducks during late winter as they undergo the prebasic molt. Finally, forested wetlands provide important sources for thermal cover during extreme cold weather, and provide opportunity for isolation of birds for pair bond formation and resting (Reinecke et al. 1989).

Moist-soil habitat provides a 10-fold increase in food resource abundance in comparison to bottomland hardwoods (Strickland et al. 2010). These natural plant communities exist in areas of semi-permanent water that dry during the growing season and stimulate annual plant growth and seed production. When naturally or artificially inundated in fall and winter, dabbling ducks rely extensively on the seeds to meet energy demands (Fredrickson and Taylor 1982, Reinecke

et al. 1989, Strader and Stinson 2005). The seed produced from smartweed, millet, sedges and many other moist-soil plants provide both energy and other micro-nutrients often lacking in cereal grains. Although moist-soil habitats have limited duck-energy days (~1900 DED/acre), this habitat in connection with others provides the complex to support the nutritional requirements of foraging waterfowl.

Agricultural grain crops (rice, corn, milo, and millet) provide much higher DEDs per acre than natural habitats (i.e., moist-soil or bottomland forest). Refuges and State wildlife management areas are much more likely to meet goals of the NAWMP if they are able to provide flooded agricultural grains. These high-energy foods are rich in carbohydrates but lack some of the nutrients available in natural food sources. Therefore, a mixture of natural vegetation and grain crops are best able to meet the nutritional and energy requirements of over-wintering waterfowl.

As previously mentioned, waterfowl during winter are subject to increased energy demands as a function of weather, disturbance from hunting, and other behavior aspects related to courtship and prebasic molt. Providing opportunities for waterfowl to have access to sanctuary is especially important during this period. With the exception of the agricultural fields and the borrow pits, all of Coldwater River NWR is currently closed to public use and thus provides a true sanctuary.

POTENTIAL REFUGE CONTRIBUTION TO HABITAT NEEDS

The LMVJV established habitat targets on federal, state, and private conservation areas. In setting habitat objectives, it was agreed that foraging habitat was the limiting factor. Objectives were set based on food production and acres by habitat type for a complex of habitats, including harvested and unharvested cropland, moist-soil areas, and flooded forest land. At the time of objective development, Coldwater River NWR was still considered the Black Bayou tract of Tallahatchie NWR, so separate objectives were not developed. However, considering the resources available, it was determined that the refuge could provide 700 acres of flooded forested wetlands, and 190 acres of moist-soil habitat annually (U.S. Fish and Wildlife Service 2005). These objectives are currently being revised and should be available in the near future. The mosaic of habitats created by the actively and passively managed moist-soil units allows waterfowl to fulfill other food resource requirements and provides sites for loafing and courtship behaviors. During the winter months, the refuge supports thousands of dabbling ducks, diving ducks, and white-fronted geese.

RECONCILING CONFLICTING HABITAT NEEDS

Coldwater River NWR was established specifically to provide habitat for migrating and wintering waterfowl. As such, management for this group will generally be the top priority for the refuge. In many cases, management for waterfowl will also promote other resources of concern and all efforts should be made to provide management that can encompass both. At minimum, the refuge should provide 700 acres of flooded forested wetlands and 190 acres of moist-soil habitat. Additional acreages of these habitat types may be provided if other resources are available and it is not detrimental to other resources of concern.

BREEDING WOOD DUCKS

SIGNIFICANCE

The wood duck is an iconic waterfowl species of North America. In the Mississippi Flyway the species represents the second most harvested duck. Wood ducks populations were decimated during the late 19th and early 20th century through market hunting and significant modifications to breeding habitat (Bellrose 1990). Within the MAV, agricultural clearing and commercial forestry has drastically reduced the natural availability of cavities for nesting. Additionally, in many areas, good brood rearing habitat is also lacking. Providing breeding habitat for wood ducks is listed as one of the purposes of the establishment of Coldwater River NWR.

IDENTIFICATION OF HABITAT REQUIREMENTS

Wood ducks require two major habitat components to sustain populations: suitable nest sites in the form of natural cavities or artificial nest boxes and wetlands to provide abundant food resources for brood rearing, concealment from predators, cover from extreme weather, and loafing sites (Bellrose and Holm 1994). The reliance on cavities for nesting makes this species unique among North American waterfowl species.

Within Mississippi bottomland hardwood forested systems, suitable natural cavities have been found to be limited (Lowney and Hill 1989, Lee 1991) and nest box programs may serve as a means to support and expand local wood duck production. If nest box programs are used to supplement natural cavities, boxes should be erected in direct proximity to slow moving rivers and streams with abundant vegetative cover along the banks, scrub-shrub swamps/sloughs, and other wetlands with an abundance of aquatic invertebrates. These areas will provide important brood rearing sites during the first two to four weeks when duckling mortality is highest (Bellrose and Holm 1994). Recommended brood habitat includes 30 to 50 percent shrubs, 40 to 70 percent herbaceous emergent vegetation, 0 to 10 percent trees, and 25 percent open water containing a minimum of 10 loafing sites (18 inches by 18 inches, 2 to 5 inches above water) per acre (McGilvrey 1968). Protection of nest boxes by installation of a metal shield below is necessary to prevent recurring depredation of nests and hens from raccoons and snakes. After wood duck broods have reached flight stage, dietary shifts begin to influence habitat use. Birds utilize more natural seed production and by fall rely heavily on hard mast (acorns) when hardwoods are shallowly flooded in fall and winter. The retention of shallowly flooded emergent wetlands and forested areas into early spring provides important microhabitats for aquatic invertebrates which are critical to female wood ducks during egg laying.

POTENTIAL REFUGE CONTRIBUTION TO HABITAT NEEDS

Coldwater River NWR provides suitable brood rearing habitat in several portions of the refuge already. Additional brood habitat exists along the major drainages directly adjacent to the refuge. Targeted management on several of the units could produce additional brood habitat. Additionally, allowing the development of snags or placing nest boxes adjacent to these habitats would provide both nesting and brood rearing habitat in close proximity to each other. At the present time, few if any natural cavities exist on Coldwater River NWR. Until such cavities develop, which is likely to be at least 25 years, this species will rely on artificial cavities for nesting.

RECONCILING CONFLICTING HABITAT NEEDS

In addition to providing habitat for migrating and wintering waterfowl, Coldwater River NWR was established to provide breeding habitat for wood ducks. As such, management for this species

will also be top priority for the refuge. Management for wood ducks will also provide habitat (in the form of forested wetlands) for migrating and wintering waterfowl. Additionally, it will promote habitat for other resources of concern, specifically several of the state species of concern (Mississippi Museum of Natural Science 2005).

SHOREBIRDS

SIGNIFICANCE

Historically, shorebirds would have used sandbars, mudflats, and drying oxbows along the Mississippi River as feeding areas during migration. However, various hydrological projects along the river have resulted in a highly altered water regime and likely an overall reduction of habitat. Clearing the forests and the resulting agricultural lands provided increased feeding areas for these species during spring migration. However, very little naturally occurring foraging and resting area is available in the fall. As a group, these birds make long migrations each year, with many species breeding in the Arctic and overwintering in Central and South America. Stopover spots for resting and feeding are critical to the survival of these species. The U.S. Shorebird Conservation Plan identifies the need for shorebird habitat, particularly from July to October as these birds migrate south in the fall. Although not specifically named in the establishment purposes of Coldwater River NWR, the document does list providing habitat for other migratory birds as a secondary purpose.

IDENTIFICATION OF HABITAT REQUIREMENTS

Shorebirds primarily use the MAV during spring and fall migration, as they move between the wintering grounds in Central and South America and the breeding grounds in Canada and the Arctic. Historically, shorebirds would have utilized mudflats formed along rivers as floodwaters receded in the spring and during the summer due to reduced flow. They would have also used areas around oxbows and sloughs as they dried during summer and fall droughts (Elliott and McKnight 2000).

Shorebirds typically migrate through the MAV from mid-March to May and July to mid-September (Helmers 1992). Studies at Coldwater River NWR revealed peak use of the refuge by shorebirds typically occurred in late April to early May, and again in late July to August (F. Broerman unpub. data). Within the MAV, the combination of slowly receding floodwater in the spring and the practice of shallowly flooding rice fields during late spring, likely provides sufficient foraging habitat during spring migration. However, during the fall migration, this area typically experiences dry conditions and foraging habitat for shorebirds is lacking (Twedt et al. 1998). The LMVJV has determined that providing shorebird habitat from July 15 to September 30 is the most critical need (Loesch et al. 2000).

Shorebird habitat is characterized by water depths of less than 18 centimeters (7 inches) and vegetative cover less than 25 percent. For most species, vegetation present should be short, less than half the height of the bird (Helmers 1992). Shorebirds forage primarily on invertebrates that are either extracted from the substrate, swimming in the water column, or picked off the surface of the water/soil. During migration, most shorebird species make multiple stopovers, as individuals “hop” from site to site along the migration route. They frequently spend up to 10 days at a site before moving on to the next stopover point (Lehnen and Krementz 2005). This behavior requires shorebird habitat be available along the length of the migration route.

Management techniques for shorebirds need to take into account water level, vegetation presence, and timing and duration of flooding, but also must factor in development of the invertebrate prey base prior to arrival of shorebirds. Because timing of migration varies by species, it is important to have habitat available during the entire migratory period and along the entire migration route.

POTENTIAL REFUGE CONTRIBUTION TO HABITAT NEEDS

From 1997 to 2000, several of the ponds at Coldwater River NWR were intensively managed for shorebirds with a large degree of success. With the development of the U.S. Shorebird Conservation Plan for the Lower Mississippi Valley/Western Gulf Coastal Plain (Elliott and McKnight 2000), the refuge adopted the objective of providing 220 acres of mudflat habitat for migrating shorebirds. However, as these ponds age, it is increasingly difficult to provide the high quality mudflats that are available immediately after taking ponds out of catfish production. For that reason, the acreage of the former objective has been reduced to provide 100 acres of mudflats.

RECONCILING CONFLICTING HABITAT NEEDS

Managing units for mudflat habitat for shorebirds would appear to be directly counter to managing units for moist-soil habitat for waterfowl. However, mudflat habitat management can be incorporated into the moist-soil management cycle to work in conjunction with managing for waterfowl. Additionally, blue-winged teal, the earliest migrants, appear to preferentially forage on shallowly flooded mudflats over more heavily vegetated moist soil units. Management for shorebirds will be considered a secondary priority.

WATERBIRDS

SIGNIFICANCE

For the purpose of this plan, waterbirds include storks, grebes, bitterns, egrets, herons, ibises, rails, and coots. These groups can be generally lumped into long-legged waders (storks, egrets, herons, ibises) and secretive marsh birds (grebes, bitterns, rails, coots). Both these groups historically have not received much consideration for management. Secretive marsh birds pose a problem from a monitoring perspective due to the difficulty in detecting their presence, making it difficult to define preferred habitat and evaluate the success of management efforts. Most species of rail that occur within the MAV and American coots are currently hunted, although in general, population data are lacking (Perkins et al 2009). Long-legged waders are more visible and more easily monitored, but three species in the group, wood storks, little blue herons, and white ibis, are state species of special concern (Mississippi Museum of Natural Sciences 2005). These groups can also be included under managing for other migratory birds as a secondary purpose for the establishment of Coldwater River NWR.

IDENTIFICATION OF HABITAT REQUIREMENTS

Secretive marsh birds and long-legged waders represent a very diverse group and use habitats within the MAV at a variety of times, for various aspects of their life histories. Several species breed in the emergent wetlands and swamps, while others use it primarily during post-breeding

movements or during spring and fall migration. A few species, (e.g., American coots and pied-billed grebes), are present throughout the year.

In general, secretive marsh birds require sites with little-to-no woody vegetation and a high degree of open water/herbaceous vegetation interspersion. Darrah and Krementz (2009) found that king rail occupancy was negatively impacted by the presence of woody vegetation. Likewise, Bolenbaugh and others (2011) found occupancy by rails, least bitterns, and open water birds (coots and grebes) was also negatively impacted by the presence of woody vegetation. Perkins et al (2009) found that rails used habitats with a variety of herbaceous vegetation, but generally only if the vegetation was shallowly flooded. Sora rails have been detected at Coldwater River NWR during fall migration using units with shallowly flooded dense stands of smartweed and during spring migration using shallow areas of water interspersed with rush (B. Rosamond, pers. obs.). This agrees with observations by Sayre and Rundle (1984) that sora and Virginia rails use flooded stands of rank vegetation during migration.

For nesting habitat, secretive marsh birds prefer denser vegetation, generally at least a 70:30 ratio of vegetation to open water (Lor and Malecki 2006). Grebes will frequently nest at the edge of a stand of dense vegetation, building a floating nest that is anchored to emergent plants. Rails and American bitterns typically build nests at the bases of tall emergent vegetation, while least bittern weave their nest into standing vegetation and suspend it over water (Lor and Malecki 2006). Emergent wetlands 10 to 70 acres in size appear to have the highest avian species diversity (Brown and Dinsmore 1986)

Of the three species of long-legged waders under consideration, wood storks do not breed in Mississippi. Little blue herons and white ibis are colonial nesters that require woody vegetation for nesting, typically building their nests over water in buttonbush, water-elm, black willow, and swamp-privet (Turcotte and Watts 1999). Little blue herons are often found nesting communally with cattle egrets, an introduced species. Cattle egrets typically initiate nesting later in the season than little blue herons, but will out-compete the herons for nesting material and space (Turcotte and Watts 1999).

All three species of long-legged waders will travel some distance to find good foraging sites (Bryan et al. 1995; Kushlan 1986). Although wood storks forage almost exclusively on fish, it appears that they preferentially feed on sunfish, particularly those in the 40 to 100 millimeter size range (Depkin et al. 1992, Ogden et al. 1976). White ibis, however, forage largely on invertebrate prey, though they will consume some fish and amphibians (Kushlan 1979). Little blue heron are considered generalists in terms of their diet, feeding on amphibians, fish, and invertebrates, often depending on what food items are most abundant (Kent 1986; Miranda and Collazo 1997; Smith 1997).

Secretive marshbirds tend to be more sedentary than wading birds, typically foraging in the same area as they nest (Bogner and Baldassarre 2002). As a group, rails tend to forage along the edges of openings, feeding on plant material (seeds, tubers) as well as vertebrate and invertebrate prey items. Crayfish are an important component in the diet of king rails, Virginia rails consume a larger proportion (62 percent) of insects, while soras feed largely on seeds (75 percent) (Horak 1970; Meanley 1956). Pied-billed grebes forage largely in open water, diving after their prey. They consume small fish, amphibians, crayfish, and other aquatic invertebrates. American coots are largely vegetarian, feeding on aquatic plants, seeds, and grasses. American and least bitterns feed on a variety of vertebrates including amphibians, fish,

and small mammals, but will also eat invertebrates (Byers 1951; Turcotte and Watts 1999; Weller 1961).

POTENTIAL REFUGE CONTRIBUTION TO HABITAT NEEDS

On Coldwater River NWR, long-legged waders typically use the ponds and ditches for foraging, while secretive marsh birds may use the same habitat for breeding, foraging, stopovers during migration, and over-wintering. Breeding has been confirmed on the refuge for pied-billed grebes, little blue herons, and king rail. Least bitterns and white ibis nests have been found within the general area. For the purposes of this plan, we will consider the habitat requirements for secretive marsh birds and the above mentioned three species of long-legged waders. The habitat requirements for other species of long-legged waders will likely be provided as a by-product of this and other management.

RECONCILING CONFLICTING HABITAT NEEDS

In general, management for waterbirds will occur on units that are not being managed for wintering waterfowl. This will eliminate potential conflicts for management of these two groups. However, potential conflicts could arise between management for these groups and management for wood ducks. In some cases there is overlap, but there are some differences in habitat requirements. Management for waterbirds will be considered a secondary priority and will be focused on units that are deemed unnecessary or unsuitable for management for wood ducks.

FEDERAL AND STATE LISTED SPECIES AND SPECIES OF SPECIAL CONCERN

SIGNIFICANCE

The only confirmed federally listed species that occurs regularly on Coldwater River NWR is the wood stork, which is found during its post-breeding migration, foraging in the ponds and borrow pits on the refuge. Additionally, there are several species that are either State listed or are considered by the State as species of greatest conservation need. For the purpose of this plan, we will consider State Species of Special Concern as those species listed as Tier 1 or Tier 2 species in Mississippi's Comprehensive Wildlife Conservation Strategy (Mississippi Museum of Natural Science 2005). Species with incidental occurrences on the refuge (usually due to being at the edge of the current range) will not be considered any further in this plan. Table 3 below lists species that are: Federal or State listed, or State Species of Special Concern; their conservation status; and their occurrence on Coldwater River NWR.

Table 3: Species that are Federal or State listed and Species of Special Concern that potentially could occur on Coldwater River National Wildlife Refuge.

Species	Status*	Occurrence on Coldwater River NWR
Wood stork	Federal Threatened: GA, FL, SC, AL, MS;State:Tier 2, Endangered	Frequent, post-breeding
Rafinesque's big-eared bat	State: Tier 2	Unknown
Hoary bat	State: Tier 2	Unknown
Southeastern myotis	State: Tier 1	Unknown

Northern long-eared bat	Federal Threatened	Unknown
Indiana bat	Federal Endangered	Unknown
American black bear **	State: Tier 2	Incidental
Little blue heron	State: Tier 2	Frequent, breeding and post-breeding
White ibis	State: Tier 2	Frequent, post-breeding
King rail	State: Tier 2	Occasional, breeding season
Bald eagle	State: Tier 2	Occasional, nesting nearby, foraging
Common ground dove	State: Tier 2	Incidental
Short-eared owl	State: Tier 2	Occasional, wintering
Painted bunting	State: Tier 2	Frequent, breeding season
LeConte's sparrow	State: Tier 2	Occasional, wintering
Rusty blackbird	State: Tier 2	Occasional, wintering
Grasshopper sparrow	State: Tier 2	Occasional, breeding season
Alligator snapping turtle	State: Tier 2	Unknown
Prairie kingsnake	State: Tier 2	Unknown
Red milk snake	State: Tier 2	Unknown
Chestnut lamprey	State: Tier 2	Unknown
Blue sucker	State: Tier 2	Unknown
Northern starhead topminnow	State: Tier 2	Captured in Hurricane Bayou and several drainage ditches
Pondberry	Federal Endangered	Unknown

*Tier 1 – Species that are in need of immediate conservation action and/or research because of extreme rarity, restricted distribution, unknown or decreasing population trends, specialized habitat needs and/or habitat vulnerability. Some species may be considered critically imperiled and at risk of extinction/extirpation.
Tier 2 – Species that are in need of timely conservation action and/or research because of rarity, restricted distribution, unknown or decreasing population trend, specialized habitat needs or habitat vulnerability or significant threats.
**Louisiana black bear (*Ursus americanus luteolus*) are federally listed as Threatened, but by definition cannot occur north of Hwy 82 in Mississippi, so therefore cannot occur on Coldwater River NWR. By definition, the only species which could occur on the refuge is the American black bear (U. americanus americanus). In 2010, a radio-collared bear from south Mississippi (U. a. *luteolus*) moved through north Mississippi crossing the refuge, before returning to south Mississippi.

IDENTIFICATION OF HABITAT REQUIREMENTS

Table 4 shows the general habitat needs for the state and federal species of special concern that potentially could occur on Coldwater River NWR. In general, habitat requirements for many of these species overlap with requirements of other resources of concern. As a result, management objectives targeting habitat for other resources of concern are likely to benefit species listed below as well. These species were taken into account when making the habitat management decisions outlined in this document. Due to specific habitat requirements, a few species (i.e., chestnut lamprey, blue sucker) are not likely to ever occur on Coldwater River NWR, without additional land acquisition, and thus will not be considered further.

Table 4: General habitat requirements for species that are Federal or State listed and Species of Special Concern that potentially could occur on Coldwater River National Wildlife Refuge.	
Species	Habitat
Wood stork	Wetlands; see 3.2.4 for more details
Rafinesque's big-eared bat	Bottomland hardwood forests, cavity trees, artificial roosts (Stevenson 2008)
Hoary bat	Hardwood forests (Harvey et al. 2011)
Southeastern myotis	Bottomland hardwood forests, cavity trees, artificial roosts (Stevenson 2008)
Northern long-eared bat	Summer roosts in trees and snags, under loose bark or in cavities or crevices; Winter roosts in caves and mines (Foster and Kurta 1999)
Indiana bat	Summer roosts in snags under loose bark or in crevices; Winter roosts in caves and mines (Carter and Feldhamer 2005).
Little blue heron	Wetlands; see 3.2.4 for more details
White ibis	Wetlands; see 3.2.4 for more details
King rail	Wetlands; see 3.2.4 for more details
Bald eagle	Typically forage over water, nest in large trees, in or near sloughs, rivers, etc. (Turcotte and Watts 1999)
Short-eared owl	Winter only: Open areas around sloughs, rice fields, and marshes (Turcotte and Watts 1999)
Painted bunting	Thickets, edges of woods, hedgerows, streams, reforestation areas. (Turcotte and Watts 1999)
LeConte's sparrow	Wintering only: rank, tall grasses, damp weedy fields, stands of broomsedge, panicum, cattails (Beadle and Rising 2002)
Grasshopper sparrow	Fallow agricultural fields, pasturelands, dense growths of broomsedge (Turcotte and Watts 1999)
Rusty blackbird	Wintering only: open swampy woodlands (Turcotte and Watts 1999)
Alligator snapping turtle	Deeper water of large rivers, oxbows, swamps, ponds, and bayous (Ernst and Lovich 2009)
Prairie kingsnake	Grasslands, hardwood forests (Tennant 2003)
Red milk snake	Open woodlands, fallow fields, pastures, farmlands (Tennant 2003)
Chestnut lamprey	Main channel of moderately large rivers. Ammocoetes in swifter water with fine substrata or slower areas with vegetation. (Ross 2001)
Blue sucker	Deep channels of moderate to large, free-flowing rivers. (Ross 2001)
Northern starhead topminnow	Open water in quiet areas of streams or ponds. (Ross 2001)
Pondberry	Bottomland hardwood forests with a seasonal high water table confined to late winter and early spring. (Hawkins et al. 2009)

POTENTIAL REFUGE CONTRIBUTION TO HABITAT NEEDS

Coldwater River NWR currently provides habitat for many of the above mentioned species. With proper management, the reforestation areas have the potential to provide important roosting habitat for all three of the mentioned bat species and the bald eagle. They currently provide habitat for painted buntings. The moist-soil units, slough, ditches, permanent water, and wet meadow habitats currently provide habitat for wood storks, short-eared owls, LeConte's sparrows, rusty blackbirds, alligator snapping turtles, little blue herons, white ibis, and king rail. The presence of the remaining species on the refuge has yet to be verified, but the habitat is available.

RECONCILING CONFLICTING HABITAT NEEDS

Many of the above mentioned species occur on the refuge already under the current management regime. With the continuation of current management practices, these species should continue to occur on Coldwater River NWR. Because they are not specifically listed in the establishment purposes, most of these species will be considered as tertiary priorities. However, if conflicts arise between Federally listed species and other resources of concern, the federally listed species will be considered a higher priority. Where conflicts exist, every effort will be made to accommodate state species of special concern, though not to the detriment of a higher priority resource of concern.

BIRDS OF BOTTOMLAND HARDWOOD FORESTS

SIGNIFICANCE

The decline of many forest interior bird species is of major concern and is the basis for many research and management activities within the MAV and other bottomland hardwood systems in the southeastern United States. Many of the identified species of greatest conservation priority are dependent on a complex understory and vertical structure within a hardwood forest block of sufficient size to support viable source populations (Twedt et al. 1999). Priority bird species for the MAV were identified by Twedt and others (1999) and are listed in Table 5. All of these species are neotropical migrants wintering in Central American and breeding in North America.

IDENTIFICATION OF HABITAT REQUIREMENTS

As a group, hardwood forest birds are extremely diverse. Within the MAV bottomland hardwood forest, well over 100 species can be found including hawks, owls, passerines and many neotropical migratory species. Many of the species are resident, while others are more transient, returning each year either to breed or simply use the area as a temporary stop-over for migration. Because of the high bird species richness within the forested landscape, the habitat requirements for them can be equally diverse. Small separations between niches allow species to minimize competition and coexist. Table 5 summarizes the potential use of Coldwater River NWR and general habitat requirements for the priority bird species within the MAV.

Table 5: Priority bird species of the Mississippi Alluvial Valley, Partners In Flight rank, potential seasonal use of Coldwater River NWR and general habitat required (Turcotte and Watts 1999).

Species	PIF Rank	Breeding	Migration	Wintering	Habitat
Swainson's warbler	29	X	X		Nearly closed canopy, dense understory, near water
Cerulean warbler	28		X		Tall deciduous trees
Swallow-tailed kite	28				Restricted to south Delta
Prothonotary warbler	24	X	X		Tree cavities near water
Painted bunting	24	X	X		Scrub-shrub or edge habitat, reforestation areas
Red-headed woodpecker	22	X	X	X	Open habitat with dead trees, wooded swamps
Bell's vireo	23				Only occasional sightings in Mississippi
Northern parula	23	X	X		River swamps and hardwood forests, beard or Spanish moss
Worm-eating warbler	23		X		Forested slopes with dense understory
Kentucky warbler	22	X	X		Moist deciduous forest, with dense understory, along swamp edges and bottoms
Orchard oriole	22	X	X		Edge habitat, reforestation areas
Yellow-billed cuckoo	22	X	X		Wet forests
Wood thrush	22	X	X		Moist hardwoods, dense understory for nesting
White-eyed vireo	22	X	X		Stream bottoms with brushy thickets

The swallow-tailed kite and Bell's vireo are not likely to occur on Coldwater River NWR or even nearby. Similarly, cerulean warblers and worm-eating warblers would simply use the habitat for migration. Both the orchard oriole and the painted bunting are largely edge or scrub-shrub species. Although habitat is currently present in the form of large areas of reforestation, this habitat is not likely to be perpetuated over the long term. The remaining eight species will be the focal species for management in the remainder of this plan

Priority species such as Swainson's warblers, Kentucky warblers, and white-eyed vireos require dense understory growth that is often associated with tree fall gaps (Pashley and Barrow 1993), in forests with large block sizes (> 5,200 acres) in a largely forested landscape (> 60%) (LMVJV 2007). Forest thinning can increase canopy gaps, thereby increasing understory and midstory growth (Robinson and Robinson 1999). Thatcher (2007) found that most Partners in Flight priority species had higher densities in thinned hardwood forest than unthinned. Heltzel and Leberg (2006)

also found that Swainson's, Kentucky and hooded warblers increased by 200 percent in bottomland hardwood forest where selective timber harvest had occurred. However, this study also showed that Acadian flycatcher and prothonotary warbler declined in abundance in harvested stands. Norris and others (2008) found that both Acadian flycatchers and prothonotary warbers were most abundant in unharvested stands and in those stands with individual selection cuts. Likewise, Nuttle and Burger (2005) found prothonotary warblers primarily in stands that were older than 21 years and most abundant in older natural forest stands (greater than 60 years old). In the same study, they only detected Swainson's warblers in naturally regenerated forest greater than 60 years old.

Twedt and Somershoe (2008) conducted a study on Tensas River NWR in Louisiana to test the effects of selective harvesting on priority forest birds. They found that the priority species Kentucky warbler, orchard oriole, red-headed woodpecker, white-eyed vireo, and Swainson's warbler responded favorably to variable-retention clustered thinning silvicultural treatments, although those responses were often delayed several years post-harvest. In fact, the extrapolated data indicate that Swainson's warblers would likely reach their highest densities approximately 16 years after the thinning operation. Conversely, prothonotary warblers responsed negatively to the same treatments, reaching their lowest population in stands seven years post-harvest and potentially returning to pre-harvest densities 13 years post-harvest. In addition to direct removal of habitat, timber harvest can have negative effects on canopy dwelling and forest interior songbirds (Pashley and Barrow 1993) by fragmenting forests. Forest fragmentation often increases nest parasitism by brown-headed cowbirds and predation by mesopredators such as raccoons.

Cooper and others (2009) studied prothonotary warblers on White River NWR in Arkansas to test the effects of patch cuts and thinning on breeding success. They found that prothonotary warblers favored areas with a high density of available cavities. Silvicultural treatments reduced the density of available cavities and reduced the density of breeding males. Overall reproductive success (fledlings per plot and fledglings per hectare) was not influenced by treatment but was impacted by hydroperiod. They cautioned that timber harvest should be minimized in areas where prothonotary warblers prefer to nest and that long-term management plans should consider using forest management techniques that mimic natural disturbances. They also suggested that prothonotary warblers are an appropriate indicator species for the bottomland hardwood forest ecosystem.

The PIF Bird Conservation Plan for the MAV proposed minimum forest sizes to support viable populations for priority species (Twedt et al. 1999). For the species listed above, these forest sizes range from 2,700 hectares (6,672 acres) for the prothonotary warbler to over 40,000 hectares 98,842 acres) for swallow-tailed kites. Swainson's warblers are listed as requiring patches of 4,700 hectares (11,614 acres). Additionally, the Bird Conservation Plan identifies the MAV as supporting 34.8 percent of the breeding population of prothonotary warblers and 20.8 percent of the breeding population of Swainson's warblers. While prothonotary warblers are frequently observed on the refuge during the spring and summer months, there are no records of Swainson's warblers over a 15-year period (F. Broerman, B. Rosamond, unpublished data).

POTENTIAL REFUGE CONTRIBUTION TO HABITAT NEEDS

Coldwater River NWR is included in the O'Keefe Bird Conservation Area (BCA) (Twedt et al. 1999). The O'Keefe BCA encompasses a total of nearly 82,000 acres and includes both O'Keefe Wildlife Management Area (State managed) and Coldwater River NWR. Approximately 15,000 acres within this area currently contains mature forest. However, the existing "core" forest area (area forested that is not impacted by edge effects) is less than 300 acres. The O'Keefe BCA is currently ranked as the highest priority BCA for reforestation efforts. As the

Coldwater River NWR reforestation areas mature, they will contribute to the “core” forest goal of 5,200 acres. This area will then potentially be able to support viable populations of several of the priority bird species listed above. Additional efforts should focus on working with landowners between Coldwater River NWR and O’Keefe WMA to reforest the acreage between these two sites and increasing the core area for forest interior birds.

Several of the priority bird species currently use the early successional habitat provided by hardwood reforestation areas, as well as the forested sloughs. The reforested areas presently or in the near future will likely support wintering and breeding woodcock as well. This early successional habitat will eventually disappear as the stands age.

As these reforestation stands mature, it is important to manage them to develop uneven-aged stands with complex vertical structure. This may require thinning the stands. However, many of the stands on Coldwater River NWR had variable initial survival, so stands will need to be evaluated to determine the extent of thinning necessary. Once uneven-aged stands are established, additional forest management should be conducted cautiously to avoid further fragmentation and creation of additional edge habitat, which would benefit species such as brown-headed cowbirds.

RECONCILING CONFLICTING HABITAT NEEDS

In general, management for birds of bottomland hardwood forests will occur on the reforestation units. Much of the management that will benefit these species will also be beneficial to wintering waterfowl and wood ducks, although some conflicts could arise. Additionally, some management activities could conflict with management for Indiana bats, northern long-eared bats, and pondberry, all listed as Federally Endangered or Threatened. In these cases, management for birds of bottomland hardwood forests will be considered a secondary priority.

CHAPTER IV. HABITAT GOALS AND OBJECTIVES

Habitat management goals and objectives were developed from the North Mississippi Refuges Complex CCP. A goal expresses a broad, qualitative statement that supports the establishing purposes and vision of the refuge. The step-down objectives are quantitative statements which provide more specific, measurable and time sensitive habitat direction for accomplishing the goals. The goals in the CCP were created to cover the three refuges and Farm Service Agency properties administered by the Complex and based on wildlife populations rather than the habitat. Therefore, it was necessary to modify the goals to more appropriately reflect the habitat for Coldwater River NWR while still retaining the intent of the goals in the CCP. This allowed for more specific objective(s) from the CCP to be expanded upon or combined to address the resources of concern identified the HMP **(Chapter 3).**

Below each objective, are the primary resources of concern and a rationale for how this supports the objective or goal**.** In order to be responsive to meeting goals and objectives, it is important to evaluate progress through research and inventory and monitoring and alter strategies as appropriate (adaptive management). Therefore, adaptive management monitoring elements are identified for evaluation of habitat and wildlife response. Specific inventory and monitoring of wildlife species may occur based on a station-level inventory and monitoring plan.

GOAL 1. BOTTOMLAND HARDWOOD FOREST HABITAT
Restore, enhance, and maintain healthy, bottomland hardwood forest habitat to support a natural diversity of plant and animal species and foster the ecological integrity of the Mississippi Alluvial Valley Ecosystem (CCP Goals 1, 3, and 4 combined, pages 60, 78, 80).

OBJECTIVE 1.1. REFORESTATION

By 2028 at least 35 percent of the area of the reforestation units (4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 18, 19, 25, 26, 34) should contain a diverse assemblage of both hard mast and soft mast producing hardwood species of at least two age classes and characterized by a minimum of 60 to 70 percent overstory canopy cover, 25 to 40 percent midstory cover, and 60 to 70 square feet per acre basal area (with over 25 percent in older age classes)(CCP Objective 4-2) to provide suitable habitat for the resources of concern.

Resources of Concern: Migrating and Wintering Waterfowl State and Federally Listed Species and Species of Special Concern, Birds of Bottomland Hardwood Forests

Rationale: Sixteen stands containing a total of 1,090 acres have been planted in trees and range from 10 to 20 years old. To speed development into a functioning bottomland hardwood forest, the LMVJV Forest Resource Conservation Working Group (2007) recommends management towards the above-mentioned desired forest conditions, recognizing that no more than 35 to 50 percent of stands on the landscape are likely to meet those conditions at any given point in time. This translates into six of the current reforestation stands (approximately 380 acres), meeting this criteria during the life of this plan. The ultimate outcome of this restoration is to provide 700 acres of functioning bottomland hardwood forest to meet waterfowl objectives established by the LMVJV as well as contribute to the O'Keefe BCA core acreage goal of 5,200 acres.

Adaptive Management Monitoring Elements:

Primary Habitat Response Variables	Probable Assessment Methods
• Overstory canopy cover • Midstory canopy cover • Basal area	• Forest cruise/inventory sampling (traditional)
Primary Wildlife Response Variables	**Probable Assessment Methods**
• Songbird species composition • Successful use by breeding prothonotary warblers (use as a surrogate species for bottomland hardwood forest birds)	• Breeding bird survey (point counts) • Monitoring nesting success of prothonotary warblers

OBJECTIVE 1.2. GREENTREE RESERVOIR

In all reforestation units (units 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 18, 19, 25, 26, 34) annually retain 6 to 24 inches of water over at least 50 percent of the area (545 acres) from December 1 to March 1 to provide waterfowl foraging habitat, thermal cover, and sites for pair formation to support habitat objectives developed by the LMVJV. (CCP Objective 1-1, page 60).

Resources of Concern: Migrating and Wintering Waterfowl, Breeding Wood Ducks

Rationale: The availability of naturally flooded bottomland hardwood forest in winter within the MAV has been drastically reduced as a result of permanent land conversion to agriculture, short-rotation commercial hardwood management, and massive flood abatement projects. Greentree reservoirs provide a means to mimic similar habitat conditions to support migrating, wintering and breeding waterfowl resource needs on a more structured time interval. Waterfowl will benefit from these wetlands along with other non-game wildlife.

Adaptive Management Monitoring Elements:

Primary Habitat Response Variables	Probable Assessment Methods
• Acres of flooded hardwood • Water level by date	• GIS mapping of extent of water • Record water level at fixed point (gauge at wcs)
Primary Wildlife Response Variables	**Probable Assessment Methods**
• Winter waterfowl use • Wood duck use	• Waterfowl counts • Wood duck pair counts

OBJECTIVE 1.3. CAVITY TREE

By 2028, evaluate at least 35 percent of all reforestation units (units 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 18, 19, 25, 26, 34) for the potential development of a minimum of one tree greater than

26 inches diameter at breast height (dbh) per acre with a visible cavity sufficient to provide a nest site for wood ducks or roost for bats or provide an equivalent artificial structure (CCP Objective 1-2).

Resources of Concern: Breeding Wood Ducks, State and Federally Listed Species and Species of Special Concern

Rationale: The limited availability of natural cavities for wood ducks to nest has been well documented in the MAV (Lowney and Hill 1989, Lee 1991). Local populations of wood ducks and hooded mergansers can be increased dramatically by providing appropriate nesting habitat and/or artificial nest structures. Likewise, both Rafinesque's big-eared bats and southeastern myotis use cavities in large diameter trees for roosting and reproduction. The reforestation stands will still be too young (less than 60 years old) to have trees large enough to support large cavities, but can be evaluated to determine that such cavities may develop in the near future.

Adaptive Management Monitoring Elements:

Primary Habitat Response Variables	Probable Assessment Methods
• DBH of trees • Cavities present/acre • Artificial nesting/roosting structures	• Forest cruise/inventory sampling • Mapping of cavity locations
Primary Wildlife Response Variables	**Probable Assessment Methods**
• Wood duck use of nestbox/cavities • Prothonotary warbler use of cavities • Bat use of cavities	• Nest checks • Cavity checks

GOAL 2. WETLAND HABITAT
Maintain a mosaic of wetland habitat types to provide foraging, roosting, nesting, and over-wintering habitat for migratory birds, including waterfowl, shorebirds, wading birds, and secretive marsh birds and State and Federal Species of Special Concern (CCP Goals 1, 2, 3, and 4 combined, pages 60, 72, 78, 80).

OBJECTIVE 2.1 MOIST-SOIL MANAGEMENT

On an annual basis within the pond complex (units A – X) and/or the western fields (units 1, 2, 3, 16, 17) provide 190 acres of herbaceous vegetation with a minimum of 75 percent cover of desirable moist soil plants (e.g., sprangletop, panicum, millet, toothcup, smartweed, Carex spp.), keeping non-desirables (e.g., coffeeweed and cocklebur) to less than 20 percent, and eliminating any invasive species (e.g., parrotfeather, alligatorweed) and flooded with 6 to 24 inches of water from October – March to support foraging habitat objectives for wintering waterfowl developed by the LMVJV (CCP Objectives 1-1, 4-1).

Resources of Concern: Migrating and Wintering Waterfowl, Water Birds, State and Federally Listed Species and Species of Special Concern

Rationale: Moist-soil management will be directed primarily towards managing for those plants preferred by waterfowl, contributing to the total DEDs provided by the refuge. However, management activities will also provide habitat for migrating secretive marshbirds and long-legged waders.

Adaptive Management Monitoring Elements:

Primary Habitat Response Variables	Probable Assessment Methods
• Dominant species present • Percent cover by species	• Annual herbaceous cover plots (m^2)
Primary Wildlife Response Variables	**Probable Assessment Methods**
• Waterfowl use during winter • Rail use during migration	• Waterfowl counts/unit • Rail surveys (callback)

OBJECTIVE 2.2 MUDFLAT

On an annual basis within the pond complex (units A to X) provide 100 acres of mudflat habitat with less than 10 percent cover of vegetation and less than 6 inches of water (Elliott and McKnight 2000) between mid-July and October to support foraging habitat for fall migrating shorebirds to fulfill in part the habitat objectives for migrating shorebirds developed by the LMV/WGCP Working Group (Elliott and McKnight 2000) (CCP Objective 1-6).

Resources of Concern: Shorebirds, Water Birds

Rationale: Mudflat management will be directed primarily towards providing foraging habitat for shorebirds to meet the objectives developed by the LMVJV. Initial stages of drawdowns will also concentrate food resources and provide feeding opportunities for long-legged waders.

Adaptive Management Monitoring Elements:

Primary Habitat Response Variables	Probable Assessment Methods
• Percent mudflat exposed • Number of acres of mudflat	• Plots (m^2)
Primary Wildlife Response Variables	**Probable Assessment Methods**
• Shorebird use during fall migration	• Shorebird counts

OBJECTIVE 2.3 EMERGENT WETLAND

On an annual basis in the western fields (units 1, 2, 3, 16, 17), the drainage ditches (units 20, 22, 23, 24, 28), and/or the pond complex (units N, P, PP, R, X) provide a minimum of 40 acres of emergent wetland habitat in 10 acre (minimum) blocks, characterized by 50 to 70 percent emergent herbaceous vegetation (cattails, soft rush), interspersed with 30 to 50 percent open water habitat, containing less than 10 percent woody vegetation and no invasive aquatic

species (e.g. parrotfeather, alligatorweed) to support secretive marsh bird nesting and foraging requirements (CCP Objectives 1-4, 2-3, 3-1, 4-3).

Resources of Concern: Migrating and Wintering Waterfowl, Water Birds, State and Federally Listed Species and Species of Special Concern

Rationale: Providing emergent marsh vegetation with a high degree of open water interspersion will provide migrating, nesting, and foraging habitat for secretive marsh birds. Permanently flooded units will provide habitat for other aquatic species, and will be used by waterfowl during the winter.

Adaptive Management Monitoring Elements:

Primary Habitat Response Variables	Probable Assessment Methods
• Acres of emergent vegetation:open water • Presence of invasive vegetation	• Plots (m^2) • Visual survey (presence/absence)
Primary Wildlife Response Variables	**Probable Assessment Methods**
• Secretive marsh bird presence/use • Waterfowl use	• Marsh bird counts (playbacks, nest searches) • Bimonthly waterfowl surveys

OBJECTIVE 2.4 FLOODED CROPLAND

On an annual basis, provide a minimum of 75 acres of grain crops (millet, rice, corn, or milo) and flood to a depth of no more than 18 inches, for a mininmum of 60 days from November 1 to March 15 to support habitat objectives for migrating and wintering waterfowl developed by the LMVJV (CCP Objective 1-1).

Resources of Concern: Migrating and Wintering Waterfowl

Rationale: Grain crops provide a high energy food for migrating and wintering waterfowl. Providing this habitat will provide DEDs to help meet waterfowl foraging objectives provided by the LMVJV.

Adaptive Management Monitoring Elements:

Primary Habitat Response Variables	Probable Assessment Methods
• Acres of floodable grain crops	• GIS Mapping
Primary Wildlife Response Variables	**Probable Assessment Methods**
• Waterfowl use	• Waterfowl surveys

OBJECTIVE 2.5 SHRUB SWAMP

On an annual basis in sloughs and borrow pits (units 8, 21, 29, 30) and/or the pond complex (units N, P, PP, R, X), provide 100 acres of shrub swamp habitat characterized by 30 to 50 percent shrubs, 40 to 70 percent herbaceous emergent, 0 to 10 percent trees, no invasive aquatic species (e.g. parrotfeather, alligatorweed), and 25 percent open water and containing a minimum of 10 loafing sites (18 inches by 18 inches, 2 to 5 inches above water) per acre in close proximity to nest boxes or natural cavities to provide brood rearing habitat for wood ducks (CCP Objectives 1-2, 1-4, 1-5).

Resources of Concern: Migrating and Wintering Waterfowl, Breeding Wood Ducks, Water Birds, State and Federally Listed Species and Species of Special Concern

Rationale: Providing shrub swamp habitat will provide brood habitat for breeding wood ducks and potential breeding habitat for long-legged waders. Additionally, this habitat is critical for pair-bond formation and thermal cover for wintering waterfowl. Permanently flooded units will also provide habitat for other aquatic species and potential foraging areas for bats.

Adaptive Management Monitoring Elements:

Primary Habitat Response Variables	Probable Assessment Methods
• Percent herbaceous cover • Percent woody vegetation • Percent open water • Number of loafing sites • Presence of invasive vegetation	• Plots (m^2) • Visual survey (presence/absence)
Primary Wildlife Response Variables	**Probable Assessment Methods**
• Wood duck brood use • Establishment of rookeries • Waterfowl use	• Monthly brood counts • Annual rookery counts • Bimonthlywaterfowl surveys

CHAPTER V. HABITAT MANAGEMENT STRATEGIES

Habitat management strategies are specific treatments that can be implemented to achieve the goals and objectives in this plan. In many cases, strategies will be dynamic based in part on resource constraints, timing considerations, weather, or other unforeseen circumstances. Staff will incorporate new strategies as new scientific information is obtained through adaptive management or assumption-based reseach, or from inventories and monitoring conducted on the refuge.

BOTTOMLAND HARDWOOD FOREST HABITAT

Management to meet the reforestation, green tree reservoir, and cavity tree objectives are intimately tied together and in many cases will occur concurrently on the same units. For that reason, potential strategies and management prescriptions to achieve those objectives will be included together.

REFORESTATION, GREENTREE RESERVOIR, AND CAVITY TREE MANAGEMENT (OBJECTIVES 1.1, 1.2, AND 1.3)

POTENTIAL MANAGEMENT STRATEGIES

The purpose of the forest habitat management strategy is to develop the areas replanted in the late 1990s into a more natural functioning hardwood forest. A large part of this development will depend on the time it takes to grow trees to maturity. However, it will be important to provide treatments at key times in order to guide the forest in the desired direction, as defined by the "Desired Forest Conditions" and specified by objective 1.1. However, before taking any action, it is important to know the current condition of each stand. Therefore the first step in the process of management of these forests will be evaluating the stand condition, followed by selection of which stands are most in need of manipulation. If any of the following conditions are met, then treatment may be considered: overstory canopy cover greater than 80 percent; midstory cover less than 20 percent or greater than 50 percent; or tree stocking is less than 50 percent or greater than 90 percent.

Due to differential survival in the reforestation areas, many of the traditional silvicultural techniques likely do not apply to these stands. The most typical problem encountered in reforestation stands is the development of dense, even-aged stands, with low species diversity and little to no herbaceous layer. In stands in this condition, possible strategies to counter this include thinning the stand and underplanting with additional species. Thinning can be accomplished either through mechanical or chemical methods. If mechanical methods are used, some degree of stump sprouting should occur, which would help in the formation of an uneven aged stand. Chemical methods would allow complete replacement of the treated tree which could presumably be replaced with a seedling of a different species, introducing diversity into the stand, as well as a new age class. If the stand is too dense, a heavy thinning and no underplanting would be recommended. Underplantings can be used to introduce additional species to the stand and can be accomplished either through the use of bare root seedlings or simply allowing natural succession to occur in openings that are created.

An important aspect of a functioning bottomland hardwood forest ecosystem is the hydrology. Though it is near impossible to restore the natural hydrology, flooding during the winter months

would provide many benefits. Much of the area already floods during all by the driest winters. The key management features would be to get the water off the trees in a timely manner to limit stress during the growing season. There are several techniques to consider which would accomplish this. Along the south boundary of the refuge is a large relift pump. This could be used to remove water from the forested units at the start of the growing season. Additionally, it could also be used to regulate the extent of flooding during the winter months, to provide either more shallowly flooded areas, or to decrease the duration of flooding. There are also numerous drainage ditches through these areas. To ensure prompt removal of water from the reforestation units, these ditches will need to be kept clear of beaver debris and log jams. The alternative is to allow the trees on a certain percent of the area to die, or grow more slowly.

Many of the reforestation stands occur along the boundary of drainages. As such, some remnant forest still exists. These trees will likely be the first to develop cavities for wildlife use. However, the trees will need to be evaluated to see if any suitable cavities exist. If insufficient natural cavities exist, the simplest recourse is to erect artificial structures, which are readily used by wood ducks.

Feral hogs are increasingly becoming a problem throughout Mississippi. They reproduce rapidly, feed on a wide variety of animal and plant material, and disturb large areas of soil while foraging. Additionally, their foraging activities provide avenues for the colonization of other invasive species (primarily plants). If feral hogs begin using the reforestation areas, control measures should be initiated. Options for controlling feral hogs include shooting and trapping. Although both methods are time intensive, trapping is likely the most efficient and effective.

SELECTED MANAGEMENT STRATEGIES

The following strategies will be used to meet all objectives under the Bottomland Hardwood Forest Goal:

- Conduct standard cruises of each stand to assess condition and presence of cavities. Oldest reforestation stands should be evaluated first (Table 1) and stands should be visited every 10 years.
- Thin stands as needed to promote development toward suggested desired forest conditions. Initial thinings on reforestation stands may open units up to as low as 60% canopy coverage. Successive harvesting should consist of individual selection cuts, mimicking natural disturbance.
- If thinnings occur, leave individual trees that show early stages of cavity development.
- Replant hardwood species in areas where plantings failed; supplement stands by planting more seedlings in areas with low stocking rates.
- Release existing hardwood stands by cutting/removing baccharis and willows.
- Allow flooding on reforestation areas according to rainfall November 1 to April 1.
- As needed, use the relift pump to move water off of the refuge.
- Clean critical drainage ditches throughout area of beaver debris and log jams to allow water to move freely through the area during dewatering periods.
- If feral hogs begin using the area, initiate control measures (trapping and shooting) to minimize the damage this invasive species will cause in the developing hardwood stands.

The following strategies will be used to meet the Cavity Tree Objective (1.3):

- Where natural cavities are lacking, erect additional wood duck boxes, in close proximity to suitable brood habitat.

- By February 15 each year, insure boxes are prepped with sawdust, are in good condition, have predator guards in place, and that any encroaching vegetation is trimmed.
- Evaluate boxes to clean as needed and collect data on use and hatching success.

MANAGEMENT STRATEGY PRESCRIPTIONS FOR UNITS 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 18, 19, 25, 26, 34

Units will be evaluated in the fall of the previous year to determine which of the above mentioned strategies will be applied the following spring. Management prescriptions for individual units will be detailed in the Annual Habitat Work Plan each year, which should be prepared no later than March 1 each year.

WETLAND HABITAT

The area under consideration for management as wetland habitat includes the pond complex (units A – X), the western fields (units 1, 2, 3, 16, 17), drainage ditches (units 20, 22, 23, 24, 28), sloughs and borrow pits (units 8, 21) and the agricultural fields (units 41, 42). Each of these units has traditionally been managed for one or several of these habitat types. As time progresses, these units may be diverted to different wetland habitats than previously managed for, depending on the succession of individual units, changing staff availability, changing regional directives, and variation in environmental conditions on an annual basis. For those reasons, specific units will not be identified in the prescriptions below. Rather, it is the responsibility of the manager to annually evaluate the units and determine which would best work to meet the objectives in a given year.

MOIST-SOIL MANAGEMENT
(OBJECTIVE 2.1)

Moist-soil management will be conducted primarily to provide food for wintering waterfowl of sufficient quality and quantity to meet the objective set forth by the LMVJV. Often, management for quality moist-soil habitat will result in habitat for migrating rails as well.

POTENTIAL MANAGEMENT STRATEGIES
Moist-soil management involves maintaining moist soil conditions during the growing season to promote the natural production of beneficial plants. Seeds produced by these plants often attract and concentrate waterfowl and other wetland wildlife species. The decomposing vegetation also provides substrate for invertebrates, which are critical for many wetland species. Although small grain crops (“hot-foods”) provide high energy for migrating waterfowl, these artificial foods do not provide the same nutrients found in these natural foods. By varying the timing of disturbance, drawdowns, and reflooding, it is possible to create a mosaic of habitats that provide foraging for wintering waterfowl.

A key component of moist-soil management is maintaining early successional plant communities and controlling undesirable plants by disking, herbicides, water level manipulation, or periodically rotating agricultural crops. The Delta region of Mississippi already receives a huge influx of agrochemicals. Most moist-soil management can be successfully accomplished through mechanical manipulations, monitoring, and quick reactions to undesirable conditions. When herbicide use is unavoidable, only the lowest rate necessary of the appropriate chemical for the target species should be used.

It is important to keep in mind the hydrology of these moist-soil units. Due to a high water table and annual flooding, it is unlikely that any mechanical manipulations could be done prior to mid-June. Additionally, heavy rains or water backfilling from ditches can quickly make units inaccessible, even at the height of the summer. Although it is possible in dry years to access these units in June, September, and October, it's best to restrict mechanical manipulations to July and August.

SELECTED MANAGEMENT STRATEGIES

- Conduct early drawdowns (begin on or about March 1) to promote growth of moist-soil plants while limiting growth of coffeeweed and cocklebur.
- Additional drawdowns can be initiated after willows have seeded (usually after May 15). Later drawdowns may have issues with coffeeweed, but are more likely to promote sprangletop and toothcup.
- Disk units every two to three years to restrict willow colonization of units. Disking should be done June to August and be followed by a one to two week drying period to kill exposed willow roots. Following the drying period, the unit should be reflooded and, after a period of at least two weeks, can be drawndown again for shorebird use if desired. Note: waiting too long to reflood appears to allow for stump sprouting and may be counter-productive.
- In the year after disking, conduct an early drawdown. This seems to promote millet and smartweed germination. Early drawdowns tend to reduce germination by coffeeweed and cocklebur.
- Even if willow colonization is not an issue, disk at least every third year to promote annual vegetation and limit perennial vegetation.
- Use water to control undesirable vegetation. (Cocklebur is quickly killed by flooding. Coffeeweed must be overtopped to kill, so not as effective for that species.)
- Use mowing to control undesirable vegetation. In units with dense coffeeweed stands, mow coffeeweed when it begins to flower (before seed set). This will release any grasses underneath and can result in a very productive unit.
- In units with dense vegetation, strip mow or roll vegetation to create landing areas for ducks.
- Using a standard protocol, evaluate moist soil vegetation every year beginning in June for those units with early drawdown.
- Limit use of agrochemicals. When necessary to use, choose the appropriate chemical for the target species and apply at the lowest rate possible. Use techniques that minimize overspray and exposure to non-target organisms.
- Begin flooding a proportion of the units with dense vegetation in late August, to insure habitat availability for rails when migration begins (September).
- Stagger fall pumping to ensure a continuous supply of food throughout the winter.
- Flood to a depth of no more than 18 inches. Depths of 12 inches or less are preferred by dabblers.

MANAGEMENT STRATEGY PRESCRIPTIONS FOR UNITS A – M, Q, S – W, 1, 2, 3, 16, 17
Units will be evaluated in the fall of the previous year to determine which of the above mentioned strategies will be applied the following spring. Management prescriptions for individual units will be detailed in the Annual Habitat Work Plan each year, which should be prepared no later than March 1 each year.

MUDFLAT MANAGEMENT
(OBJECTIVE 2.2)

Mudflat management will be conducted primarily to provide food for fall migrating shorebirds of sufficient quality and quantity to meet the objective set forth by the Shorebird Conservation Plan. Depending on the history of the unit, drawdown activities may provide foraging opportunities for long-legged waders as well.

POTENTIAL MANAGEMENT STRATEGIES

The ability of a unit to provide quality habitat for shorebirds is dependent on several factors including the depth of the water, the presence of invertebrates for foraging, and the absence of vegetation. The specific combination of conditions required by shorebirds has to be available during the height of the summer, especially July to September. Water depth is the easiest factor to control. Replacing the standard six inch boards in the water control structures with two inch boards, allows for a slow drawdown with much finer water level control. Frequently during summer drawdowns, evaporation occurs so rapidly that periodic pumping is required just to maintain shallow water in the unit.

To develop the prey base (invertebrates) the shorebirds feed on, the unit must hold water at least two weeks prior to beginning a drawdown. This allows insects to colonize the unit and begin reproducing. Often, more food is available if units are flooded the previous fall or winter and then managed the following summer. Alternatively, units can be drained, lightly disked then reflooded, providing additional food resources for the invertebrates to colonize. Once the unit has held water for several weeks, it can be slowly drained.

The most difficult feature to control is vegetation. When these units were first taken out of catfish production and drained, they provided pristine mudflats, lacking in vegetation. However, as the years progress, this condition is harder and harder to replicate. As water is drained from units during the summer, germination and growth of vegetation often occurs as fast or faster than pond drying. If the unit was only shallowly flooded, it typically is already vegetated by the time the water is at a depth where it could be used by the shorebirds. In many cases, the only viable solution is to disk a unit in the fall then flood and hold deep water until July 1 in the hope of restricting plant colonization.

SELECTED MANAGEMENT STRATEGIES

- Hold water from previous fall/winter as deep as possible until time for drawdowns.
- Start one drawdown each month (July, August, September, October). Attempt to prolong each drawdown as much as possible through pumping or opportunistically capturing rainwater.
- When vegetation becomes too thick for shorebirds use, drain remaining water from unit and disk (if staff available). Unit can then be reflooded and drawdown can begin again (hold water for a minimum of two weeks prior to beginning drawdown). If unable to disk, evaluate for use as moist-soil habitat.

MANAGEMENT STRATEGY PRESCRIPTIONS FOR UNITS A – M, Q, S – W

Units will be evaluated in the fall of the previous year to determine which of the above mentioned strategies will be applied the following spring. Management prescriptions for individual units will be detailed in the Annual Habitat Work Plan each year, which should be prepared no later than March 1 each year.

EMERGENT WETLAND MANAGEMENT

(OBJECTIVE 2.3)

Emergent wetlands will be managed to provide habitat primarily for migrating, breeding, and foraging secretive marsh birds. This management will also benefit wintering waterfowl, and will provide permanent aquatic habitat for species of special concern, such as the northern starhead topminnow.

POTENTIAL MANAGEMENT STRATEGIES

If moist-soil units are not disturbed on a regular basis and not drained, one habitat that will develop is the emergent wetland. These wetlands are characterized by perennial vegetation, a high degree of herbaceous vegetation/open water interspersion, and a lack of woody vegetation. Additionally, these are areas of permanent water. Since moist-soil units naturally progress to this state, one strategy for developing this habitat is to stop manipulating moist-soil units and just maintain shallow water levels. This will prevent germination by woody vegetation and allow colonization by rushes, cattails, and sedges. If woody vegetation does develop, it can be treated chemically or mechanically.

As with moist-soil management, certain units are more likely to develop naturally into this habitat type. Units with low areas, an extremely high water table, or issues with backflow from drainage ditches are likely to be good choices for this habitat. Several years without manipulation are required to fully develop this habitat, so units should be carefully selected. If vegetation becomes too dense, openings can be created through mechanical or chemical means, or through the use of prescribed fire. However, due to staffing, prescribed fire is not likely to be a viable option.

Blocks of emergent wetlands greater than 10 acres are more likely to be used by secretive marsh birds. Drainage ditches can provide this habitat, but are more likely to be used as temporary habitat and not for nesting. However, they can be important as travel corridors between patches and should not be ignored.

Because this is a permanent aquatic habitat, it has the potential to be colonized by several exotic species. Nutria are an aquatic mammal, originally introduced from South America. They out-compete native muskrats and damage levees. They can be effectively controlled through a combination of trapping and shooting. Units may also be colonized by alligatorweed and parrotfeather. These are two floating aquatic plants that tend to form monocultures. They provide very few benefits to wildlife and out-compete the native vegetation. They can be controlled by mechanical removal (using care not to break the plants) or through the use of chemicals. American lotus, though native, can also form monocultures and may need to be controlled if it dominates a unit.

SELECTED MANAGEMENT STRATEGIES

- Maintain water across the unit year round.
- If woody vegetation encroaches, treat with Imazapyr or other approved herbicide.
- To create additional openings, selectively spray small areas with approved herbicide appropriate to species present.
- Immediately control any exotic species occurring in units, using all methods available.
- Limit disturbance to ditches to the minimum required to insure drainage. Do not clean all ditches in the same time period (e.g., alternate years).

MANAGEMENT STRATEGY PRESCRIPTIONS FOR UNITS M – R, X, 17, 20, 22, 23, 24, 28
Units will be evaluated in the fall of the previous year to determine which of the above mentioned strategies will be applied the following spring. Management prescriptions for individual units will be detailed in the Annual Habitat Work Plan each year, which should be prepared no later than March 1 each year.

FLOODED CROPLAND MANAGEMENT
(OBJECTIVE 2.4)

Flooded cropland will provide a high energy food source for migrating and wintering waterfowl and help meet the waterfowl foraging habitat objectives set forth by the LMVJV.

POTENTIAL MANAGEMENT STRATEGIES
There are two primary methods used to provide "hot foods" or grain crops for waterfowl consumption on refuges. The most commonly used method is through the use of cooperative farming. The standard cooperative farming agreement requires the farmer using refuge lands leave 25 percent of the crop standing as the refuge share. This percent may vary, depending on the agreement, but traditionally has not dropped below 25 percent. The refuge staff works with the farmer to determine the crops that will be planted, the chemicals that can be used on the crops, and which portion will constitute the refuge share. Typically, the refuge share will consist of millet, rice, corn, or milo, and will be left in a floodable area.

The second means of providing grain crops is through "force-account" farming. This is farming conducted by the refuge staff. The benefit of this method is that less land is devoted to farming and 100 percent of the crop is left for waterfowl. This method is the most efficient use of the land and in general requires fewer chemicals, but requires more staff time and likely results in less food produced per acre farmed. Variants on this involve contract farming (paying a farmer to farm just the portion you want in crops) or contracting with a cropdusting service to fly rice seed onto drying impoundments. These can be viable options, depending on the availability of staff and/or funds.

SELECTED MANAGEMENT STRATEGIES
- Cooperatively farm approximately 300 acres per year in millet, rice, corn, milo, or soybeans. (Only 75 percent of the farmed acreage can be in soybeans, to insure the refuge share is left in millet, rice, corn, or milo.)
- If the cooperative farming program becomes unavailable (due to restrictions on the use of GMO's or agro-chemicals), contract with a local cropdusting service to seed approximately 75 acres of floodable land with rice or millet.
- If farming of all types becomes unavailable (due to restrictions, funding or staffing) manage the above units to produce moist-soil vegetation.
- Flood standing crops in fall to provide waterfowl access to grain.

MANAGEMENT STRATEGY PRESCRIPTIONS FOR UNITS 1, 2, 3, 16, 17, 41, 42
Units will be evaluated in the fall of the previous year to determine which of the above mentioned strategies will be applied the following spring. Management prescriptions for individual units will be detailed in the Annual Habitat Work Plan each year, which should be prepared no later than March 1 each year.

SHRUB SWAMP MANAGEMENT

(OBJECTIVE 2.5)

Shrub swamps will be managed to provide habitat primarily for breeding wood ducks (brood and nesting habitat). This management will also benefit wintering waterfowl, potentially provide rookery areas for long-legged waders, provide permanent aquatic habitat for species of special concern, such as the alligator snapping turtle and northern starhead topminnow, and provide foraging areas for bats.

POTENTIAL MANAGEMENT STRATEGIES

Shrub swamps are the most permanent of the wetland habitats managed for on Coldwater River NWR. Although management is geared to the development of shrub species and not necessarily trees, it still represents making a commitment of more than10 years to that habitat for that management unit. These units should have water for most of the year, though initially may require some dry period to enable woody vegetation to germinate. Woody species to promote include primarily buttonbush and swamp privet, with black willow and water-elm to a lesser extent. As with the emergent wetlands, some managed moist-soil units will have a tendency to develop toward this habitat if not disturbed. However, due to the infrastructure in place on the pond complex, this habitat is probably best developed in the borrow pits and sloughs, or ponds without full water management capability.

To meet criteria for wood duck brood habitat, loafing sites should be available. If necessary, logs or slash piles can be added to portions of the units. Those areas that are likely to support wood duck broods, will be more effective if they are shallowly flooded and do not support populations of any large predatory fish (largemouth bass, large catfish, etc.).

Because this represents a more permanent wetland type, it will also be more likely to be colonized by invasive species. As with emergent wetlands, nutria, parrotfeather, and alligatorweed are all potential invaders. The strategies mentioned above for controlling these species would be effective in this habitat type as well.

SELECTED MANAGEMENT STRATEGIES

- Strive to maintain water across the unit year round. If necessary, can dry in late August/September if need to remove predatory fish or promote development of buttonbush and swamp privet. (Units are generally dependent on rainwater to reflood.)
- Immediately control any exotic species occurring in units, using all methods available.
- Add loafing structures (logs, slash piles) to areas best suited for wood duck broods.

MANAGEMENT STRATEGY PRESCRIPTIONS FOR UNITS N – P, R, X, 8, 21, 29, 30

Units will be evaluated in the fall of the previous year to determine which of the above mentioned strategies will be applied the following spring. Management prescriptions for individual units will be detailed in the Annual Habitat Work Plan each year, which should be prepared no later than March 1 each year.

MANAGEMENT UNIT PRESCRIPTIONS

Table 6: A summary of habitat objectives and management strategies by unit.

Unit	Size (acres)	Current Habitat Classification	Habitat Objective(s)	Management Strategies
4	79	Reforestation	Objective 1.1: Reforestation By 2028 at least 35 percent of the area of the reforestation units should contain a diverse assemblage of both hard mast and soft mast producing hardwood species of at least two age classes and characterized by a minimum of 60 to 70 percent overstory canopy cover, 25 to 40 percent midstory cover, and 60 to 70 square feet per acre basal area (with over 25 percent in older age classes)(CCP Objective 4-2). Objective 1.2: Greentree Reservoir In all reforestation units annually retain 6 to 24 inches of water over at least 50 percent of the area (545 acres) from December 1 to March 1 to provide waterfowl foraging habitat, thermal cover, and sites for pair formation to support habitat objectives developed by the LMVJV. (CCP Objective 1-1, page 60).	• Conduct standard cruises of each stand to assess condition and presence of cavities. Oldest reforestation stands should be evaluated first (Table 1) and stands should be visited every 10 years. • Thin stands as needed to promote development toward suggested desired forest conditions. Initial thinings on reforestation stands may open units up to as low as 60% canopy coverage. Successive harvesting should consist of individual selection cuts, mimicking natural disturbance. • If thinnings occur, leave individual trees that show early stages of cavity development. • Replant hardwood species in areas where plantings failed; supplement stands by planting more seedlings in areas with low stocking rates. • Release existing hardwood stands by cutting/removing baccharis and willows. • Allow flooding on reforestation areas according to rainfall November 1 to April 1. • As needed, use the relift pump to move water off of the refuge. • Clean critical drainage ditches throughout area of beaver debris and log jams to allow water to move freely through the area during dewatering periods. • If feral hogs begin using the area, initiate control measures (trapping and shooting) to
5	48	Reforestation		
6	51	Reforestation		
7	50	Reforestation		
9	102	Reforestation		
10	178	Reforestation		
11	187	Reforestation		
12	95	Reforestation		
13	20	Reforestation		
14	33	Reforestation		
15	27	Reforestation		

18	98	Reforestation		minimize the damage this invasive species will cause in the developing hardwood stands.
19	17	Reforestation	Objective 1.3: Cavity Tree By 2028, evaluate at least 35 percent of all reforestation units for the potential development of a minimum of one tree greater than 26 inches diameter at breast height (dbh) per acre with a visible cavity sufficient to provide a nest site for wood ducks or roost for bats or provide an equivalent artificial structure (CCP Objective 1-2).	• Where natural cavities are lacking, erect additional wood duck boxes, in close proximity to suitable brood habitat. • By February 15 each year, insure boxes are prepped with sawdust, are in good condition, have predator guards in place, and that any encroaching vegetation is trimmed. • Evaluate boxes to clean as needed and collect data on use and hatching success.
25	60	Reforestation		
26	7	Reforestation		
34	38	Reforestation		
A	16	Moist soil	Objective 2.1: Moist-soil Management On an annual basis within the pond complex and/or the western fields provide 190 acres of herbaceous vegetation with a minimum of 75 percent cover of desirable moist soil plants (e.g., sprangletop, panicum, millet, toothcup, smartweed, Carex spp.), keeping non-desirables (e.g., coffeeweed and cocklebur) to less than 20 percent, and eliminating any invasive species (e.g., parrotfeather, alligatorweed) and flooded with 6 to 24 inches of water from October – March to support foraging habitat objectives for wintering waterfowl developed by the LMVJV (CCP Objectives 1-1, 4-1). (cont. from previous	• Conduct early drawdowns (begin on or about March 1) to promote growth of moist-soil plants while limiting growth of coffeeweed and cocklebur. • Additional drawdowns can be initiated after willows have seeded (usually after May 15). Later drawdowns may have issues with coffeeweed, but are more likely to promote sprangletop and toothcup. • Disk units every two to three years to restrict willow colonization of units. Disking should be done June to August and be followed by a one to two week drying period to kill exposed willow roots. Following the drying period, the unit should be reflooded and, after a period of at least two weeks, can be drawndown again for shorebird use if desired. Note: waiting too long to reflood appears to allow for stump sprouting and may be counter-productive.
B	15	Moist soil		
C	20	Moist soil		
D	19	Moist soil		
E	17	Moist soil		

F	18	Moist soil	page)	• In the year after disking, conduct an early drawdown. This seems to promote millet and smartweed germination. Early drawdowns tend to reduce germination by coffeeweed and cocklebur. • Even if willow colonization is not an issue, disk at least every third year to promote annual vegetation and limit perennial vegetation. • Use water to control undesirable vegetation. (Cocklebur is quickly killed by flooding. Coffeeweed must be overtopped to kill, so not as effective for that species.) • Use mowing to control undesirable vegetation. In units with dense coffeeweed stands, mow coffeeweed when it begins to flower (before seed set). This will release any grasses underneath and can result in a very productive unit. • In units with dense vegetation, strip mow or roll vegetation to create landing areas for ducks. • Using a standard protocol, evaluate moist soil vegetation every year beginning in June for those units with early drawdown. • Limit use of agrochemicals. When necessary to use, choose the appropriate chemical for the target species and apply at the lowest rate possible. Use techniques that minimize overspray and exposure to non-target organisms. • Begin flooding a proportion of the units with dense vegetation in late August, to insure habitat availability for rails when migration begins (September).
G	17	Moist soil		
H	17	Moist soil		
I	15	Moist soil		
J	21	Moist soil		
K	19	Moist soil		
L	19	Moist soil		
Q	19	Moist soil		

S	19	Moist soil	(cont.)	• Stagger fall pumping to ensure a continuous supply of food throughout the winter. • Flood to a depth of no more than 18 inches. Depths of 12 inches or less are preferred by dabblers.
T	20	Moist soil	Objective 2.2: Mudflat On an annual basis within the pond complex provide 100 acres of mudflat habitat with less than 10 percent cover of vegetation and less than 6 inches of water (Elliott and McKnight 2000) between mid-July and October to support foraging habitat for fall migrating shorebirds to fulfill in part the habitat objectives for migrating shorebirds developed by the LMV/WGCP Working Group (Elliott and McKnight 2000) (CCP Objective 1-6).	• Hold water from previous fall/winter as deep as possible until time for drawdowns. • Start one drawdown each month (July, August, September, October). Attempt to prolong each drawdown as much as possible through pumping or opportunistically capturing rainwater. • When vegetation becomes too thick for shorebirds use, drain remaining water from unit and disk (if staff available). Unit can then be reflooded and drawdown can begin again (hold water for a minimum of two weeks prior to beginning drawdown). If unable to disk, evaluate for use as moist-soil habitat.
U	16	Moist soil		
V	17	Moist soil		
W	17	Moist soil		
N	22	Moist soil	Objective 2.3: Emergent Wetland On an annual basis in the western fields, the drainage ditches, and/or the pond complex provide a minimum of 40 acres of emergent wetland habitat in 10 acre (minimum) blocks, characterized by 50 to 70 percent emergent herbaceous vegetation (cattails, soft rush), interspersed with 30 to 50 percent open water habitat, containing less than 10 percent woody vegetation and no invasive aquatic species (e.g. parrotfeather,	• Maintain water across the unit year round. • If woody vegetation encroaches, treat with Imazapyr or other approved herbicide. • To create additional openings, selectively spray small areas with approved herbicide appropriate to species present. • Immediately control any exotic species occurring in units, using all methods available. • Limit disturbance to ditches to the minimum required to insure drainage. Do not clean all ditches in the same time period (e.g., alternate years).
PP	19	Moist soil		

P	21	Moist soil	alligatorweed) to support secretive marsh bird nesting and foraging requirements (CCP Objectives 1-4, 2-3, 3-1, 4-3). Objective 2.5: Shrub Swamp On an annual basis provide 100 acres of shrub swamp habitat characterized by 30 to 50 percent shrubs, 40 to 70 percent herbaceous emergent, 0 to 10 percent trees, no invasive aquatic species (e.g. parrotfeather, alligatorweed), and 25 percent open water and containing a minimum of 10 loafing sites (18 inches by 18 inches, 2 to 5 inches above water) per acre in close proximity to nest boxes or natural cavities to provide brood rearing habitat for wood ducks (McGilvrey 1968) (CCP Objectives 1-2, 1-4, 1-5).	• Strive to maintain water across the unit year round. If necessary, can dry in late August/September if need to remove predatory fish or promote development of buttonbush and swamp privet. (Units are generally dependent on rainwater to reflood.) • Immediately control any exotic species occurring in units, using all methods available. • Add loafing structures (logs, slash piles) to areas best suited for wood duck broods.
R	21	Moist soil		
X	16	Moist soil		
1	38	Wet meadow	Objective 2.1: Moist-Soil Management (see above) Objective 2.4: Flooded Cropland On an annual basis, provide a minimum of 75 acres of grain crops (millet, rice, corn, or milo) and flood to a depth of no more than 18 inches, for a mininmum of 60 days from November 1 to	See above • Cooperatively farm approximately 300 acres per year in millet, rice, corn, milo, or soybeans. (Only 75 percent of the farmed acreage can be in soybeans, to insure the refuge share is left in millet, rice, corn, or milo.) • If the cooperative farming program becomes unavailable
2	88	Wet meadow		
3	79	Wet meadow		

16	26	Wet meadow	March 15 to support habitat objectives for migrating and wintering waterfowl developed by the LMVJV (CCP Objective 1-1).	(due to restrictions on the use of GMO's or agro-chemicals), contract with a local cropdusting service to seed approximately 75 acres of floodable land with rice or millet. • If farming of all types becomes unavailable (due to restrictions, funding or staffing) manage the above units to produce moist-soil vegetation. • Flood standing crops in fall to provide waterfowl access to grain.
17	80	Wet meadow		
41	87	Agricultural field	Objective 2.4: Flooded Cropland (see above)	See above
42	236	Agricultural field		
M	21	Moist soil	Objective 2-1: Moist-soil Management (see above) Objective 2-2: Mudflat (see above) Objective 2-3: Emergent Wetland (see above)	See above See above See above
20	40	Slough/ditch	Objective 2-3: Emergent Wetland (see above)	See above
22	26	Slough/ditch		
23	9	Slough/ditch		
24	6	Slough/ditch		
28	10	Slough/ditch		
8	66	Borrow pit	Objective 2.5: Shrub	See above

21	102	Slough/ditch	Swamp (see above)	
29	4	Moist soil		
30	6	Wet meadow		

CHAPTER VI. LITERATURE CITATIONS

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APPENDICES

APPENDIX A. ENVIRONMENTAL ACTION STATEMENT

Within the spirit and intent of the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act (NEPA), and other statutes, orders, and policies that protect fish and wildlife resources, I have established the following administrative record and determined that the following proposed action is categorically excluded from NEPA documentation requirements consistent with 40 CFR 1508.4, 516 DM 2.3A, 516 DM 2 Appendix 1, and 516 DM 6 Appendix 1.4.

PROPOSED ACTION AND ALTERNATIVES.

The proposed action is the approval and implementation of the Habitat Management Plan (HMP) for Coldwater River National Wildlife Refuge (NWR). This plan is a step-down management plan providing the refuge manager with specific guidance for implementing goals, objectives, and strategies identified in the North Mississppi Refuges Complex Comprehensive Conservation Plan (CCP) (2005).

The proposed CCP action was the preferred alternative among four alternatives considered in the Environmental Assessment (EA) (Draft CCP and EA 2005). In the CCP, the proposed action was to manage the refuge to provide high quality habitat for wildlife, particularly migratory birds (focus on waterfowl). Management would focus on waterfowl through a continuation of cooperative farming, force-account farming, and moist-soil management to meet established wintering waterfowl foraging habitat goals of the Lower Mississippi River Valley Joint Venture (North Mississippi Refuges Complex CCP 2005).

The CCP has defined goals, (i.e., Goals 1 and 4) and their corresponding objectives and strategies to achieve the stated action. The actions further detailed in the HMP have been identified, addressed, and authorized by the North Mississippi Refuges Complex CCP and accompanying Environmental Assessment (2005). These include:

- Bottomland Hardwood Forest Management Strategy: Manage the reforestation areas on the refuge for the collective benefit of resources of concern. For the duration of the HMP reforestation areas will be manipulated as needed to move them towards “Desired Forest Conditions” as defined by the Lower Mississippi Valley Joint Venture Forest Resource Conservation Working Group (CCP Objectives 1-1, 1-2, 4-2).

- Moist-soil Management Strategy: Manipulate water levels and vegetative cover in moist soil units to provide wintering waterfowl habitat (CCP Objectives 1-1, 4-1).

- Mudflat Management Strategy: Manipulate water levels and vegetation in selected units to provide migrating shorebird habitat (CCP Objective 1-6).

- Emergent Wetland Management Strategy: Maintain conditions on selected units to provide habitat for secretive marsh birds. Use chemical or mechanical means to prevent colonization by woody vegetation or exotic species (CCP Objectives 1-

4, 2-3, 3-1, 4-3).

- Flooded Cropland Management Strategy: Utilize a cooperative farm program to grow high energy cereal grains to provided needed foods for migrating and wintering waterfowl (CCP Objective 1-1).

- Shrub Swamp Management Strategy: Maintain and promote conditions on selected units to provide habitat for wading birds and brood habitat for wood ducks (CCP Objectives 1-2, 1-4, 1-5).

CATEGORICAL EXCLUSION(S).

Categorical Exclusion Department Manual 516 DM 6, Appendix 1 Section 1.4 B (10) is applicable to implementation to the proposed action. It states: "The issuance of new or revised site, unit, or activity-specific management plans for public use, land use, or other management activities when only minor changes are planned.

The HMP is a step-down management plan consistent with the above-referenced Categorical Exclusion. It provides guidance for implementating the general goals, objectives, and strategies established in the CCP, particularly those components specific to habitat management. Minor changes or refinements to the CCP in this activity-specific management plan include:

- Habitat management goals and objectives are restated so as to provide improved clarity in the context of the HMP.

- Habitat management objectives are further refined by providing numerical parameter values that more clearly define the originating objective statement.

- Specific habitat management guidance, strategies, and implementation schedules to meet the CCP goals and objectives are included (e.g., the location, timing, frequency, and intensity of applications).

- All details are consistent with the CCP and serve to provide the level of detail necessary to guide the refuge supporting the resources of concern and goals and objectives.

PERMITS/APPROVALS.

Endangered Species Act, Intra-Service Section 7 Consultation was conducted and signed August 21, 2015 as part of the HMP preparation process. The determination was a concurrence that the HMP may affect, but is not likely to adversely affect, pondberry and the northern long-eared bat.

PUBLIC INVOLVEMENT/INTERAGENCY COORDINATION.

The proposed HMP is a step-down of the approved CCP for North Mississippi Refuges Complex, which included (Coldwater River NWR. The development and approval of the CCP included appropriate NEPA documentation and public involvement. An Environmental Assessment was developed (USFWS 2005) which proposed and addressed management alternatives and environmental consequences.

Public involvement included notification in the local Grenada and Cleveland, Mississippi newspapers that the Draft CCP and EA were available for public review and comment. Two public meetings were held but unattended. Written comments were received from four sources: a private citizen, a state agency, a federal agency, and a Mississippi State University professor. Refer to CCP (Chapter 3 and Appendix H) for specific comments and Service response.

SUPPORTING DOCUMENTS.

Supporting documents for this determination include relevant office-file materials, the references cited in Chapter VI, and the following key references:

U.S. Fish and Wildlife Service. 2005. North Mississippi National Wildlife Refuges Complex Draft Comprehensive Conservation Plan and Environmental Assessment. U.S. Fish and Wildlife Service, Southeast Region. Atlanta, Georgia. 270 pp.

U.S. Fish and Wildlife Service. 2005. North Mississippi National Wildlife Refuges Complex Comprehensive Conservation Plan. U.S. Fish and Wildlife Service, Southeast Region. Atlanta, Georgia. 269 pp.

Refuge Manager — Date: 8/21/15

Project Leader — Date: 8/21/15

Regional Refuge NEPA Coordinator — Date: 10/7/2015

for Regional Chief, Southeast Region — Date: 10/16/15

APPENDIX B – COMMON AND SCIENTIFIC NAMES OF SPECIES REFERENCED IN THIS DOCUMENT

Common Name	**Scientific Name**
Bass, largemouth	*Micropterus salmoides*
Catfish spp.	*Ictaluridae* (multiple species)
Lamprey, chestnut	*Ichthyomyzon castaneus*
Sucker, blue	*Cycleptus elongatus*
Sunfish spp.	*Lepomis spp.*
Topminnow, northern starhead	*Fundulus dispar*
Turtle, alligator snapping	*Macrochelys temminckii*
Kingsnake, prairie	*Lampropeltis calligaster calligaster*
Milksnake, red	*Lampropeltis triangulum syspila*
Bittern, American	*Botaurus lentiginosus*
Bittern, least	*Ixobrychus exilis*
Blackbird, rusty	*Euphagus carolinus*
Bunting, painted	*Passerina ciris*
Coot , American	*Fulica americana*
Cowbird, brown-headed	*Molothrus ater*
Cuckoo, yellow-billed	*Coccyzus americanus*
Dove, common ground	*Columbina passerina*
Duck, wood	*Aix sponsa*
Eagle, bald	*Haliaeetus leucocephalus*
Egret, cattle	*Bubulcus ibis*
Flycatcher, Acadian	*Empidonax virescens*
Gadwall	*Anas strepera*
Goose, Greater white-fronted	*Anser albifrons*
Grebe, pied-billed	*Podilymbus podiceps*
Heron, little blue	*Egretta caerulea*
Ibis, white	*Eudocimus albus*
Kite, swallow-tailed	*Elanoides forficatus*
Mallard	*Anas platyrhynchos*
Oriole, orchard	*Icterus spurius*
Owl, short-eared	*Asio flammeus*
Rail, king	*Rallus elegans*
Rail, sora	*Porzana carolina*
Rail, Virginia	*Rallus limicola*
Sparrow, grasshopper	*Ammodramus savannarum*
Sparrow, LeConte's	*Ammodramus leconteii*
Stork, wood	*Mycteria americana*
Teal, Blue-winged	*Anas discors*
Thrush, wood	*Hylocichla mustelina*
Vireo, Bell's	*Vireo bellii*
Vireo, white-eyed	*Vireo griseus*
Warbler, cerulean	*Dendroica cerulea*
Warbler, Kentucky	*Oporornis formosus*

Warbler, northern parula	*Parula americana*
Warbler, prothonotary	*Protonotaria citrea*
Warbler, Swainson's	*Limnothlypis swainsonii*
Warbler, worm-eating	*Helmitheros vermivora*
Woodcock, American	*Scolopax minor*
Woodpecker, red-headed	*Melanerpes erythrocephalus*

Bat, hoary	*Lasiurus cinereus*
Bat, Indiana	*Myotis sodalis*
Bat, northern long-eared	*Myotis septentrionalis*
Bat, Rafinesque's big-eared	*Corynorhinus rafinesquii*
Bat, southeastern myotis	*Myotis austroriparius*
Bear, American black	*Ursus americanus americanus*
Bear, Louisiana black	*Ursus americanus luteolus*
Beaver	*Castor canadensis*
Hog, feral	*Sus scrofa*
Muskrat	*Ondatra zibethicus*
Nutria	*Myocastor coypus*
Raccoon	*Procyon lotor*

Alligatorweed	*Alternanthera philoxeroides*
Ash, green	*Fraxinus pennsylvanica*
Bermudagrass	*Cynodon dactylon*
Blackgum	*Nyssa sylvatica*
Buttonbush	*Cephalanthus occidentalis*
Cattail	*Typha latifolia*
Cocklebur	*Xanthium strumarium*
Coffeeweed	*Sesbania herbacea*
Cypress, bald	*Taxodium distichum*
Frogbit	*Limnobium spongia*
Grass species	*Poaceae*
Grass, sprangletop	*Leptochloa fusca*
Grass, panic	*Panicum spp.*
Grass, millet	*Echinochloa spp.*
Hickories	*Carya spp.*
Hickory, water	*Carya aquatica*
Lotus, American	*Nelumbo lutea*
Maple	*Acer spp.*
Mud plantain	*Heteranthera spp.*
Oaks	*Quercus spp.*
Oak, Nuttall	*Quercus nuttallii*
Oak, overcup	*Quercus lyrata*
Oak, willow	*Quercus phellos*
Oak, water	*Quercus nigra*
Parrotfeather	*Myriophyllum aquaticum*
Pondberry	*Lindera melissafolia*
Rush, soft	*Juncus effuius*
Sedges	*Carex spp.*
Smartweed	*Polygonum spp.*
Sugarberry	*Celtis laevigata*

Swamp-privet	*Forestiera acuminata*
Sweetgum	*Liquidamber styraciflua*
Toothcup	*Ammannia auriculata*
Tupelo, water	*Nyssa aquatica*
Water-elm	*Planera aquatica*
Willow, black	*Salix nigra*

APPENDIX C – LIST OF ABBREVIATIONS USED IN THIS DOCUMENT

AHWP – Annual Habitat Work Plan

BCA – Bird Conservation Area

CCP - Comprehensive Conservation Plan

Complex – North Mississippi Refuges Complex

FSA – Farm Service Agency

HMP – Habitat Management Plan

Improvement Act – National Wildlife Refuge Improvement Act of 1997

LCC – Landscape Conservation Cooperatives

LMVJV – Lower Mississippi Valley Joint Venture

MAV – Mississippi Alluvial Valley

NAWMP – North American Waterfowl Management Plan

NWR – National Wildlife Refuge

PIF – Partners in Flight

Refuge Administration Act – National Wildlife Refuge System Administration Act of 1966

Refuge System – National Wildlife Refuge System

SARP – Southeast Aquatic Resources Partnership

Service - U.S. Fish and Wildlife Service

System – National Wildlife Refuge System

APPENDIX D – INTRA-SERVICE SECTION 7 BIOLOGICAL EVALUATION FORM

INTRA-SERVICE SECTION 7 BIOLOGICAL EVALUATION FORM

Originating Person: Becky Rosamond
Telephone Number: 662-226-8286 x114
E-Mail: becky_rosamond@fws.gov
Date: 08/20/2015

PROJECT NAME: Coldwater River National Wildlife Refuge Habitat Management Plan

I. Service Program:
___ Ecological Services
___ Federal Aid
___ Clean Vessel Act
___ Coastal Wetlands
___ Endangered Species Section 6
___ Partners for Fish and Wildlife
___ Sport Fish Restoration
___ Wildlife Restoration
___ Fisheries
_X_ Refuges/Wildlife

II. State/Agency: USFWS

III. Station Name: North Mississippi Refuges Complex

IV. Description of Proposed Action
The U.S. Fish and Wildlife Service, North Mississippi Refuges Complex, has developed a Habitat Management Plan for Coldwater River National Wildlife Refuge (NWR) to guide the management of the refuge for the next 15 years.

The plan identifies resources of concern (ROCs) for Coldwater River NWR and details habitat goals and objectives related to these ROCs. Resources of concern for Coldwater River NWR include: migrating and wintering waterfowl, breeding wood ducks, shorebirds, waterbirds, Federal and State listed species and Species of Special Concern, and birds of bottomland hardwood forests. For each ROC, the plan addresses the habitat needs and management options, then identifies the strategies that will be used to manage habitat for the ROC. Additionally, the plan addresses potential conflicts between management for other ROCs. Where conflicts occur between Federal and State listed species and other ROCs, the listed species will be given priority.

V. Pertinent Species and Habitat:

A. Include species/habitat occurrence map:

B. Complete the following table:

SPECIES/CRITICAL HABITAT	STATUS[1]
Pondberry (*Lindera melissafolia*)	E
Northern long-eared bat (*Myotis septentrionalis*)	T

[1]STATUS: E=endangered, T=threatened, PE=proposed endangered, PT=proposed threatened, CH=critical habitat, PCH=proposed critical habitat, C=candidate species, S/A=Similar Appearance

VI. Location (attach map):

A. Ecoregion Number and Name: Region4/Gulf Coast Ozark LCC

B. County and State: Quitman and Tallahatchie Counties, Mississippi

C. Section, township, and range (or latitude and longitude: N 34.0937583, W 90.1400083

D. Distance (miles) and direction to nearest town: Approximately 6 miles northwest of Charleston, MS

E. Species/habitat occurrence: There are no local records for either pondberry or northern long-eared bats on Coldwater River NWR.

VII. Determination of Effects:

A. Explanation of effects of the action on species and critical habitats in item V. B:

SPECIES/ CRITICAL HABITAT	IMPACTS TO SPECIES/CRITICAL HABITAT
Pondberry (*Lindera melissifolia*)	Neutral. There is no expected impact to this species.
Northern long-eared bat (*Myotis septentrionalis*)	Neutral. There is no expected impact to this species.

B. Explanation of actions to be implemented to reduce adverse effects:

SPECIES/ CRITICAL HABITAT	ACTIONS TO MITIGATE/MINIMIZE IMPACTS
Pondberry (*Lindera melissifolia*)	No forest cutting, herbicide spraying, or hydrological manipulation will occur where this species is present.
Northern long-eared bat (*Myotis septentrionalis*)	No habitat manipulation will occur within ¼ mile of any occupied roost for this species.

VIII. Effect Determination and Response Requested:

SPECIES/CRITICAL HABITAT	DETERMINATION[1]			REQUESTED
	NE	NA	AA	
Pondberry (*Lindera melissifolia*)		X		Concurrence
Northern long-eared bat (*Myotis septentrionalis*)		X		Concurrence

DETERMINATION/ RESPONSE REQUESTED:
NE = no effect. This determination is appropriate when the proposed action will not directly, indirectly, or cumulatively impact, either positively or negatively, any listed, proposed, candidate species or designated/proposed critical habitat. Response Requested is optional but a "Concurrence" is recommended for a complete Administrative Record.

NA = not likely to adversely affect. This determination is appropriate when the proposed action is not likely to adversely impact any listed, proposed, candidate species or designated/proposed critical habitat or there may be beneficial effects to these resources. Response Requested is a" Concurrence".

MA = likely to adversely affect. This determination is appropriate when the proposed action is likely to adversely impact any listed, proposed, candidate species or designated/proposed critical habitat. Response Requested for listed species is "Formal Consultation". Response requested for proposed and candidate species is "Conference".

Thomas J. Carpenter — 8/20/2015
Signature (originating station) — **Date**

Deputy Project Leader
Title

IX. Reviewing Ecological Services Office Evaluation:

A. Concurrence ✓ **Nonconcurrence** _____

B. Formal consultation required _____

C. Conference required _____

D. Informal conference required _____

E. Remarks (attach additional pages as needed):

Kathryn Thurman — 08/21/2015
Signature — **Date**

Fish and Wildlife Biologist — MS ES FO Jackson, MS
Title — **Office**