Upper Ouachita National Wildlife Refuge

Habitat Management Plan

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Southeast Region

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Contents

Contents ..... *ii*

1.0 INTRODUCTION *1*

1.1 Planning Process **1**

1.3 Refuge Vision **3**

1.4 Relationship to Other Plans **3**

2.0 ENVIRONMENTAL SETTING AND BACKGROUND *7*

2.1 Location **7**

2.2 Management Units **7**

2.3 Physical Features **7**

2.3.1 Climate 7
2.3.2 Topography and Hydrology 7
2.3.3 Soils 12
2.3.4 Geomorphology 18

2.4 History of Refuge Lands **18**

2.4.1 Cultural and Refuge Land History 19
2.4.2 Pre-European Settlement Conditions 20
2.4.3 Current Conditions and Habitat Types 21
2.4.3.1 Bottomlands 22
2.4.3.2 Pine-Hardwood Uplands 23
2.4.3.3 Moist Soil – Agriculture 24
2.4.3 Habitat Changes from Historic to Current Conditions 25

2.5 Maps **30**

3.0 RESOURCES OF CONCERN *36*

3.1 Identification of Refuge Resources of Concern **36**

3.1.1 Wintering Waterfowl 36
3.1.2 Breeding Wood Ducks 37
3.1.3 Forest Interior Songbirds of Bottomland Hardwoods 37
3.1.4 Rafinesque's Big-eared Bat and Southeastern Bat 37
3.1.5 Upland Hardwood Forest 38
3.1.6 Red-cockaded Woodpecker 38
3.1.7 Louisiana Black Bears 38

3.2 Habitat Requirements of Resources of Concern **39**

3.2.1 Wintering Waterfowl 39
3.2.2 Breeding wood ducks 41
3.2.3 Forest Interior Songbirds 42
3.2.4 Rafinesque's Big-eared Bat and Southeastern Bat 43
3.2.5 Upland Hardwood Forest 44
3.2.6 Red-cockaded Woodpecker/Loblolly Pine Flatwoods 45
3.2.7 Louisiana Black Bears 46

4.0 HABITAT MANAGEMENT GOALS and OBJECTIVES *48*

4.1 Bottomland Hardwood Habitat Goal **48**

- *Objective 4.1.1:* 48
- *Objective 4.1.2:* 49
- *Objective 4.1.3:* 49

- *Objective 4.1.4:* 50
- *Objective 4.1.5:* 50
- *Objective 4.1.6:* 51
- *Objective 4.1.7:* 51
- *Objective 4.1.8:* 52

4.2 Upland Pine-Hardwood Habitat Goal 52
- *Objective 4.2.1:* 52

4.3 Species of Special Concern Goal 53
- *Objective 4.3.1* 53

5.0 HABITAT MANAGEMENT STRATEGIES 55

5.1 Moist Soil Management Strategies 55
5.1.1 Potential Strategies 55
5.1.2 Management Strategy Prescription 55

5.2 Chemical Management Strategies 56
5.2.1 Potential Strategies 56
5.2.2 Management Strategy Prescription 57

5.3 Prescribed Fire Management Strategies 58
5.3.1 Potential Strategies 58
5.3.2 Management Strategy Prescription 59

5.4 Beaver and Feral Hog Management Strategies 59
5.4.1 Potential Strategies 59
5.4.2 Management Strategy Prescription 60

5.5 Forest Management Strategies 60
5.5.1 Potential Strategies 60
5.5.2 Management Strategy Prescription 62

5.6 Waterfowl Sanctuary Management Strategies 65
5.6.1 Potential Strategies 65
5.6.2 Management Strategy Prescription 65

5.7 Farming Management Strategy 65
5.7.1 Potential Strategies 65
5.7.2 Management Strategy Prescription 66

6.0 LITERATURE CITED 67

7.0 APPENDIX A: THE COMMERCIAL SALE OF TIMBER 74

7.1 Execution of Timber Harvest 74
7.1.1 Cruising and Marking Timber 74
7.1.2 Logging Operations 78
7.1.3 Monitoring 79
7.1.4 Archeological and Cultural Resources 80
7.1.5 Aesthetics 81
7.1.6 Forest Openings 81
7.1.7 Insect and Disease 82
7.1.8 Timber Salvage and Unscheduled Harvesting 82
7.1.9 Threatened and Endangered Species 83

7.2 Administration of Sales 83
7.2.1 Conditions Applicable to Timber Harvesting Permits 83
7.2.2 Control Records 85
7.2.3 Sale Folders 85

7.2.4 Bid Invitations.....85
7.2.5 Bids and Performance Deposits.....86
7.2.6 Special Use Permit.....86
7.2.7 Payment for Forest Products and Administration of Receipts.....86

7.3 Exhibit 1: Upper Ouachita NWR Timber Sale 200x-xx 90

7.4 Exhibit 2: Bid Form 92

7.5 Exhibit 3: Bid Invitation 93

7.6 Exhibit 4: Certificate of Independent Price Determination 95

7.7 Exhibit 5: Equal Employment Opportunity Clause..... 97

8.0 APPENDIX B: ENVIRONMENTAL ACTION STATEMENT 99

LIST OF FIGURES

Figure 1. North Louisiana Refuges Complex……30
Figure 2. Twenty-seven Management units of Upper Ouachita NWR…..……..…....31
Figure 3. Extent of flooding at different water levels on Upper Ouachita NWR…....32
Figure 4. Elevation levels at Upper Ouachita NWR…….…….....33
Figure 5. Soil types present on Upper Ouachita NWR…….…….…….34
Figure 6. Vegetations types present on Upper Ouachita NWR…….……..…...35

LIST OF TABLES

Table 1. Description of 27 Management Units on Upper Ouachita NWR……..…9
Table 2. Historical timeline of Upper Ouachita National Wildlife Refuge establishment……..29
Table 3. Baldcypress and tupelo old-growth attributes…….……..43
Table 4. Order of Entry 2011-2025…….….74

1.0 INTRODUCTION

Throughout the century of its existence, the National Wildlife Refuge System has established a reputation as premier ground for the refinement of habitat management techniques. Ever since the establishment of Pelican Island National Wildlife Refuge in 1903, refuge employees have taken pride in developing the latest tools for wildlife conservation with limited resources. Some of the first examples of rocket nets and airboats, equipment now considered essential for wildlife management, were developed by refuge employees. The first prescribed fire on refuge lands was conducted in 1927 at a time when the benefits of this natural process were not well recognized and most federal agencies still considered fire to have "no place in any forest" (USFS 2004).

As the discipline of wildlife management evolved, largely through the efforts of Aldo Leopold with his publication of *Game Management* in 1933, it was recognized that a greater emphasis needed to be placed on making decisions that are based on the best science of the day, while retaining some of the artful intuition that comes from years of field experience. Sound wildlife and habitat management will always involve the skillful integration of science and art in disciplines as diverse as biology and sociology.

Habitat is defined as simply "the physical and biological surroundings of an organism" (Bolen and Robinson 1995). It includes all of the natural components of an ecosystem that are essential for survival including food, cover, and water. The processes that shaped features in northern Louisiana, including Upper Ouachita National Wildlife Refuge, are complex and dynamic. This Habitat Management Plan was developed to provide a clear, science-based outline for managing the Refuge in this challenging environment. To this end, a Habitat Management Plan was developed as a first step in closing the gap between the needs of Refuge wildlife and the knowledge of its stewards.

1.1 Planning Process

Habitat Management Plans (HMP) are dynamic working documents that provide refuge managers a decision making process; guidance for the management of refuge habitat; and long-term vision, continuity, and consistency for habitat management on refuge lands. Each plan incorporates the role of refuge habitat in international, national, regional, tribal, State, ecosystem, and refuge goals and objectives; guides analysis and selection of specific habitat management strategies to achieve those habitat goals and objectives; and utilizes key data, scientific literature, expert opinion, and staff expertise.

The statutory authority for conducting habitat management planning on National Wildlife Refuges 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 (Refuge 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." The Refuge Improvement Act provides the Service the authority to establish policies, regulations, and guidelines governing habitat management planning within the System (Service Manual 620 FW 1).

An HMP is a step-down management plan of the Refuge Comprehensive Conservation Plan (CCP). 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; 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; helps achieve the goals of the National Wilderness Preservation System, if appropriate; and meets other mandates. The CCP for Upper Ouachita National Wildlife Refuge (NWR) was finalized in 2008 (USFWS 2008).

HMPs comply with all applicable laws, regulations, and policies governing the management of National Wildlife Refuge System. The lifespan of an HMP is 15 years and parallels that of refuge CCPs. HMPs are reviewed every 5 years utilizing peer review recommendations, as appropriate, in the HMP revision process or when initiating refuge CCPs. Annual Habitat Work Plans (AHWP) are prepared annually to guide implementation and assessment of specific management prescriptions to meet habitat objectives established in the HMP.

1.2 Refuge Purposes

The purposes of a national wildlife refuge, as established by Congress or the Executive Branch, are the barometer by which all actions on that designated public land are measured. Habitat management, public use, and all other programs are conducted as required to fulfill the established purposes of the refuge.

Upper Ouachita NWR was established in November 1978. 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 "…the conservation of the wetlands of the nation in order to maintain the public benefits they provide and to help fulfill international obligations contained in various migratory bird treaties and conventions…" (16 U.S.C. 3901b).

In addition to the specific purposes that were established for each refuge, Congress passed the National Wildlife Refuge System Improvement Act in 1997. This legislation provides clear guidance for the mission of the Refuge System and prioritizes wildlife-dependent public uses. The Act states that each Refuge will:

- Fulfill the mission of the National Wildlife Refuge 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 Refuge System
- Maintain the biological integrity, diversity, and environmental health of the Refuge 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.

1.3 Refuge Vision

The Refuge vision was developed for the Comprehensive Conservation Plan for Upper Ouachita NWR (USFWS 2008).

Upper Ouachita NWR will conserve, enhance, and restore the integrity of bottomland hardwood forests, other wetlands, and upland mixed pine-hardwood habitats in the Upper West Gulf Coastal Plain. Moist-soil and cropland habitats will be managed to benefit a variety of migratory waterfowl, shorebirds, and associated species. A diversity of wildlife species will be fostered while maintaining opportunities for the public to enjoy wildlife-dependent recreation. Future resource protection will be strategically charted for establishing habitat conservation linkages in the Lower Mississippi River Ecosystem through partnerships and collaboration.

1.4 Relationship to Other Plans

A Comprehensive Conservation Plan (CCP) was finalized for Upper Ouachita NWR in 2008, which includes goals and objectives for Refuge management over a 15-year period (USFWS 2008). The Biological Review Report was instrumental in the development of the CCP (USFWS 2004). The purpose of the Habitat Management Plan is to provide more specific guidance that will facilitate the selection of prescriptions for implementing the goals and objectives of the CCP. In order to maintain consistent strategies for managing wildlife and habitats on the Refuge, several other planning documents were also used in the development of this Plan.

Refuge endangered and threatened species with approved Recovery Plans include the red-cockaded woodpecker (USFWS 2003) and Louisiana Black Bear (USFWS 1995). Whenever possible, priority actions identified in recovery plans were incorporated into goals, objectives and strategies of the Habitat Management Plan. The RCW Recovery Plan set the population goal for Upper Ouachita NWR as one family group. The refuge's population is not designated as a primary core, secondary core or support population. Upper Ouachita NWR is listed as an "Important Support" population, the lowest designation given in the Recovery Plan,

because of its extremely small size and its lack of potential for growth. Upper Ouachita NWR does not contain critical habitat for the Louisiana black bear. The refuge has only begun to have black bears utilizing it. To date no breeding population exists on the refuge; however, the sightings of bears have increased over the past several years. It is expected that the refuge will have a breeding population of bears in the future.

Other plans incorporated into the Habitat Management Plan include the North American Waterfowl Management Plan, Bird Conservation Plan for the West Gulf Coastal Plain (Rich *et al.* 2004), U.S. Shorebird Conservation Plan for the Lower Mississippi/Western Gulf Coast (Elliott and McKnight 2000), the Southeast United States Waterbird Conservation Plan (Hunter *et al*. 2006) and Louisiana Comprehensive Wildlife Conservation Strategy (Lester *et al*. 2005) as follows:

North American Waterfowl Management Plan (NAWMP)

Working under the direction of the NAWMP, the Lower Mississippi Joint Venture (LMVJV) strives to provide habitat for over-wintering waterfowl in the Mississippi Alluvial Valley (MAV) and West Gulf Coastal Plain (WGCP) Bird Conservation Region. As such, the LMVJV assumes that the availability of foraging habitat is the most important factor affecting the number of dabbling ducks that can be accommodated during winter. Diving duck habitat is not thought to be limiting in WGCP. Based on a step-down process, the LMVJV established habitat objectives that link continental waterfowl populations to on-the-ground habitat objectives. Habitat objectives are apportioned among three categories: public managed, private managed, and natural flooding within each state (in the LMVJV administrative boundaries) (USFWS 2004). By doing so, each National Wildlife Refuge (e.g., Upper Ouachita NWR) is responsible for contributing to some portion of the habitat objectives. This step-down process has been completed for the Mississippi Alluvial Valley and is nearing completion for the West Gulf Coastal Plain. That is, foraging habitat objectives have not been finalized nor allocated within the WGCP portion of Louisiana, in which Upper Ouachita NWR is located. When finalized, these objectives should be used as a guide in developing management objectives for individual refuges. However, Upper Ouachita NWR was originally included in the Mississippi Alluvial Valley step-down and allocation process, receiving a habitat objective of 563 acres (780,318 duck-use days) of moist-soil habitat and 118 acres of unharvested rice (3,464,952 duck-use days), which the refuge is providing.

Bird Conservation Plan for the West Gulf Coastal Plain

The West Gulf Coastal Plain includes Upper Ouachita NWR because it reaches to the northwestern most portion of the Mississippi Alluvial Basin. This section of the region is primarily mixed pine/hardwood types with bottomland hardwood forest species in the more mesic areas and on slopes.

These forests are of high conservation priority for conserving the natural communities and the bird populations within these habitats. The primary threats to these forests include reservoir construction; stream modifications; destructive timber harvesting practices; and conversion to pine plantations, pastures, and other land uses (Neal, http://www.lmvjv.org/wgcp). This Plan will define conservation strategies to foster support for the West Gulf Coastal Plain priorities. At this time, step-down objectives have not been finalized for the WGCP. Habitats found on Upper Ouachita NWR and associated bird species that are considered a priority in the West Gulf Coastal Plain include:

1) Loblolly/Shortleaf Pine: Henslow's sparrow, Bachman's sparrow, American kestrel, Le Conte's sparrow, chuck-will's-widow, hooded warbler, brown-headed nuthatch, prairie warbler, scissor-tailed flycatcher, red-cockaded woodpecker, and eastern wood-pewee.

2) Bottomland Hardwood Forest: Swainson's warbler, American woodcock, red-headed woodpecker, Eastern wood-pewee, Acadian flycatcher, white-eyed vireo, wood thrush, yellow-throated warbler, cerulean warbler, prothonotary warbler, Kentucky warbler, hooded warbler, and orchard oriole.

U.S. Shorebird Conservation Plan for the Lower Mississippi/Western Gulf Coast

The U.S. Shorebird Conservation Plan is a partnership effort throughout the United States to ensure that stable and self-sustaining populations of shorebird species are restored and protected. 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. This plan recommends that public lands provide as much fall shorebird habitat as possible to meet the goal of 520 ha (1,285 acres) of fall habitat in Louisiana. Although step-down objectives have not been created for the WGCP, the following species are considered high priority for the region: piping plover, American golden-plover, marbled godwit, ruddy turnstone, red knot, sanderling, buff-breasted sandpiper, American woodcock, and Wilson's phalarope.

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 North American Waterfowl Management Plan or the U.S. Shorebird Conservation Plan. Threats to waterbird populations include destruction of inland and coastal wetlands, introduced predators and invasive species, pollutants, mortality

from fisheries and industries, disturbance, and conflicts arising from abundant species. Particularly important habitats include pelagic areas, marshes, forested wetlands, and barrier and sea island complexes. The West Gulf Coastal Plain is considered to have "high responsibility and interest" for king rails, little blue herons and great blue herons. Step-down population objectives have been set in the WGCP for king rails and little blue herons: 2,000 breeding pairs of little blue herons for Louisiana and 1,000 pairs of king rails.

Little to no habitat exists on Upper Ouachita NWR for king rails. Callback surveys have been conducted in the past at the Mollicy Unit for breeding king rails but none were detected. Researchers from Louisiana State University attempted catching migrating and/or wintering king rails on the refuge with little success. Little blue herons are found on the refuge during the breeding season.

Louisiana Comprehensive Wildlife Conservation Strategy

The Louisiana Department of Wildlife and Fisheries (LDWF) is a critical partner in the effort to implement conservation strategies. In 2005, LDWF published the Louisiana Comprehensive Wildlife Conservation Strategy as required by Congress in association with federal funding. This Strategy is a "blueprint for guiding LDWF in the development of management actions for Louisiana's fish and wildlife species with emphasis on species of conservation concern and associated habitat they depend upon" (Lester *et al.* 2005). The state plan identifies all vegetation communities in the state along with species of concern and threats that are associated with each community. Upper Ouachita NWR would contain the Mixed Hardwood-Loblolly Forest, Bottomland Hardwood Forest and Cypress Swamp communities listed in the state plan.

This Habitat Management Plan also incorporates the recommendations of other approved station plans including the Fire Management Plan (USFWS 2011) and the Wildlife and Habitat Biological Review Report (USFWS 2005). Prescribed fire strategies detailed in this Plan will be incorporated into the next revision of the Fire Management Plan.

2.0 ENVIRONMENTAL SETTING AND BACKGROUND

2.1 Location

Upper Ouachita NWR is located in northeastern Louisiana. The northern boundary lies on the Louisiana-Arkansas state line. The refuge borders both sides of the Ouachita River running north-south for 13.7 miles and extends 3.3 miles to the east and up to 6 miles to the west. The southernmost point on the refuge is approximately 20 miles north of Monroe, Louisiana. The current acquisition area encompasses 61,633 acres, of which 42,594 acres have been purchased. An additional 3,905 acres within the acquisition boundary were purchased by The Conservation Fund (TCF) in 2010. The Service will be purchasing the property in parcels from TCF in the next few years as funding is available. Because the refuge currently manages The Conservation Fund property, these lands will be incorporated into this Plan's objectives, maps and narrative. Upper Ouachita NWR is administered by North Louisiana Refuges Complex (Figure 1).

2.2 Management Units

The refuge is delineated into 27 management units (Figure 2) delineated into manageable blocks of habitat that have the same habitat management objectives. The habitat type, size, soil type, current condition and past management history for each unit is described in Table 1.

2.3 Physical Features

2.3.1 Climate

Temperatures normally range between 20°F to 70°F during winter and 70°F to 95°F during the summer. The average annual growing season is 237 days. Mean annual precipitation is 49.6 inches. Thirty percent of the total occurs in the wettest months of February through April, and 15.7 percent in the driest months of August through October. Snowfall and ice storms are uncommon occurrences.

2.3.2 Topography and Hydrology

The refuge is part of the Lower Ouachita- Bayou de L'Outre watershed. The central physical feature of the refuge is the Ouachita River and includes an extensive system of bayous, sloughs, and lakes separated by woodlands and cleared bottomlands. The refuge borders both sides of the Ouachita River for 13.7 miles and extends 3.3 miles to the east and up to 6 miles to the west.

The Ouachita River originates in the Ouachita Mountains of west-central Arkansas, near the Oklahoma border. It flows south through northeastern Louisiana, drains into the Little River at Jonesville, Louisiana, joins the Tensas River to form the Black River, which empties into the Red River. The river has a drainage basin of

10,825 square miles at the refuge. The drainage basin in Arkansas is mostly forested, resulting in extremely high water quality when it flows through the refuge, even during flood periods. A series of three major reservoirs are located on the Ouachita River in Arkansas. The Corps has a lock and dam at Felsenthal, Arkansas, approximately two river miles north of the northern refuge boundary. The combined effects of the dams on the river exert considerable influence on river stages at the refuge. In northern Louisiana, the Ouachita River is a slow moving, muddy river that averages 300 feet wide when at pool stage. The permanent pool is comprised of the Ouachita River, Fish Lake, Moss Lake, Pierre Creek, Cecil Creek, Bayou DeButte, Big Lake, Finch Lake, Harrel Lake, and Boggy Bayou, for a total of 2,910 acres of permanent open water on the refuge. The normal low-water (pool stage) elevation of the Ouachita River during the dry summer months is 52.4 feet above MSL, a level maintained by a navigational lock and dam at the town of Columbia, approximately 98 river miles downstream from the refuge. Rainfall in the Ouachita Basin upstream from the refuge may produce river stage differences as great as 30 feet, causing various portions of the refuge to be flooded, depending upon river stage. When the river is at 70 feet MSL, approximately 80 percent of the refuge's western side is inundated (Figure 3). Duration of growing season flooding varies from one to five months. Flooding may begin as early as November but in some years may not occur until January or February. Floodwaters may persist until July, but usually recede in June. Thus the flood season is basically January through June. The maximum recorded water level is 85.8 feet MSL. Water levels of the Ouachita River are measured indirectly through the Felsenthal Gauge reading of the Ouachita River collected by the Corps of Engineers. The highest elevation on the refuge is approximately 150 ft above MSL (Figure 4).

Table 1. Description of 27 Management Units on Upper Ouachita NWR.

Management Unit	Size (ac)	Soil Type	Habitat Type	Current Condition	Refuge Treatment History
1A	257	Guyton, Groom, Wr	Loblolly Pine Flatwood	100% mature loblolly pine	257 ac pulpwood pine thinning in 1987; 207 ac pine pulpwood thinning in 1997
1B	2449	PF, Sg, Portland, Groom, Guyton	Bottomland Hardwood	70% mature willow oak-sweetgum 26% open water 4% mature loblolly pine-hardwood	115 ac pine pulpwood thinning in 1995; 298 ac hardwood thinning in 1996; burned during growing season 165 ac in 2001, 2004, and 2007, 15 ac in 1991, 94 ac in 1900; burned during dormant season 108 ac in 1993
2A	61	Groom	Upland Pine Hardwood	100% mature loblolly pine-hardwood	74 ac pine sawtimber thinning in 2007
2B	1757	Litro, Haggerty, Groom, PF, HB	Bottomland Hardwood	70% overcup oak-water hickory; 30% willow oak-sweetgum	97 ac sheared in 1998
3A	124	Frizzell, Groom, Ca, Guyton, Le	Upland Pine Hardwood	100% loblolly pine-hardwood	159 ac pine thinned in 1998
3B	2050	Leaf, Guyton, Haggerty, Litro, HB, Groom	Bottomland Hardwood	75% mature willow oak-sweetgum; 25% overcup oak-water hickory	none
4	2211	Groom, Haggerty, Portland, PF, Litro	Bottomland Hardwood	90% overcup oak-water hickory 10% willow oak-sweetgum	90 ac sheared in 1998
5	1970	Guyton, PR, PF, OS, HP	Bottomland Hardwood	20% mature willow oak-sweetgum; 80% mature overcup oak-water hickory	none
6	2039	Litro, PF	Bottomland Hardwood	100% mature overcup oak-water hickory	100 ac sawtimber thinning in 2007; 300 ac thinning in 2010

7A	98	Groom	Upland Pine Hardwood	100% loblolly pine-hardwood	none
7B	3285	Litro, HB, Haggerty, Groom, Guyton	Bottomland Hardwood	95% mature overcup oak-water hickory; 5% mature willow oak-sweetgum	none
8	2004	Litro	Bottomland Hardwood	100% mature overcup oak-water hickory	100 ac sawtimber thinning in 2007
9	2235	Litro, Groom	Bottomland Hardwood	100% mature overcup oak-water hickory	none
10	1662	Litro, HB, Haggerty, Groom, Guyton	Bottomland Hardwood	95% mature overcup oak-water hickory; 5% mature willow oak-sweetgum	none
11A	1106	Sg, Groom, Guyton, Wr	Loblolly Pine Flatwood	100% mature loblolly pine	230 ac wood gator <8” hardwoods in 2007; burned during growing season 190 ac in 2010, 624 ac in 2007, 129 ac in 2005, 155 ac in 2004, 296 ac in 2002, 179 ac in 2000; burned during dormant season
11B	506	Guyton, Groom, Leaf, Sg, PF	Bottomland Hardwood	100% mature sweetgum-willow oak	none
12	1166	Groom, Guyton, Wr, Or, Frizzell	Upland Pine Hardwood	70% 15 yr. loblolly pine plantation; 10% loblolly pine-hardwood; 20% baldcypress brake	none
13A	1561	Haggerty, Groom, Frizzel, HB, Sg	Upland Pine Hardwood	100% mature loblolly pine-hardwood	none
13B	300	Haggerty, Groom	Bottomland Hardwood	100% mature willow oak-sweetgum	none
14	3112	Hebert and Perry, Perry, Guyton, Groom, Portland, Groom-Mollicy	Bottomland Hardwood	100% reforested bottomland hardwood	Reforested in 1997

15*	1724	Perry, Gp, Groom	Moist Soil-Agriculture	100% agriculture	Rice farming since 1970s. Purchased by The Conservation Fund in 2010 but seller has farming rights for next two years. Then the refuge will continue farming and manage moist soil.
16*	685	Perry, Litro, Haggerty	Bottomland Hardwood	100% mature overcup oak-water hickory	Purchased in 2010 by The Conservation Fund. Green tree reservoir for the past 15 years. Water kept on too late into spring most years before refuge acquired and 30% of timber is dead.
17	2600	Portland, Perry Haggerty, Groom-Mollicy, Groom, Hebert and Perry	Bottomland Hardwood	100% 13 yr old reforested bottomland hardwood	Reforested in 1998. Flood of 2009 killed at least 30% of the saplings.
18	5854	Perry, Haggerty, Groom-Mollicy, Groom, Hebert and Perry, Litro	Bottomland Hardwood	75% 12 yr old reforested bottomland hardwood; 23% mature BHF; 3% reforested	Reforested in 1999-2001
19	5290	Litro, Haggerty, Groom, Groom-Mollicy	Bottomland Hardwood	80% 1 yr old reforested bottomland hardwood;16% 10 yr old reforestation; 4% 4 yr old reforestation	Reforested portions in 2011, 2007, and 2001
20*	879	Groom, Guyton	Bottomland Hardwood	100% 1 yr old reforested bottomland hardwood	Purchased by the Conservation Fund in 2010. Reforested in 2011
21*	606	Perry, Groom	Bottomland Hardwood	100% 1 yr old reforested bottomland hardwood	Purchased by the Conservation Fund in 2010. Reforested in 2011

* Management Units 15, 16, 20, and 21 are being acquired at the time of writing this Plan. Management on Units 16, 20 and 21 will be straightforward and the same as similar existing habitats on the refuge. However the management of Unit 15 is somewhat uncertain at this time. Although the Service knows the Unit will be managed for moist soil and agriculture primarily for the benefit of wintering waterfowl, the specifics of that management will be fleshed out within 2-5 years. Until 2013, the previous landowner has the right to farm Management Unit 15. At that time, the Service will take over the management of the Unit. Items that will need to be determined include: how to flood the area, which fields will need levees built, how many water control structures will be needed, etc. Therefore, in Section 5, the habitat management strategy for farming and moist soil management will not be as detailed as other strategies.

2.3.3 Soils

Upper Ouachita NWR consists of twenty-eight different soil associations. The vast majority of the north unit on the west side of the river is level, poorly drained, and its Litro, Perry, and Portland soils are subject to frequent flooding by the Ouachita River. Most of the south unit is a grayish-brown silt loam surface and a mottled reddish brown and brownish gray silty clay loam subsoil (Hebert). These soils are mixed in with well-drained soils with a brown silt loam surface and reddish-brown silty clay loam subsoil. The higher edges of the western edge include level to gently sloping acid, silty soils. Portions of these soils (Frizzel and Guyton) are somewhat poorly drained, while others (Ora) (are moderately well-drained. The east side of the refuge on the Mollicy Unit (Management Units 14-21) completely consists of poorly drained soils in the Perry-Portland, Litro-Haggerty, and Groom-Wrightsville associations.

The following is a listing and description of the soil series and association occurring on the refuge (Figure 5) according to the U.S Department of Agriculture, Soil Conservation Service as described in the *Soil Survey of Morehouse Parish, Louisiana* (1985) and the *Soil Survey of Union Parish, Louisiana* (1997).

1) Frizzell Series

Frizzell silt loam, (Fr). This is a somewhat poorly drained, silty soil found on level, broad terraces which can be flooded on occasion for short periods after heavy rainstorms. The surface layer is a brown silt loam with light brownish gray mottling in the upper portion. The lower part is a gray and brown silty clay loam or silt loam. The soil is low in natural fertility and very strongly acid. It has slow permeability and runoff. It has a high potential productivity for hardwoods and loblolly pine up to site index 90. Use of heavy equipment on these soils is only moderately limited because of excess water.

2) Guyton Series

Guyton silt loam (Gu). This soil is level and poorly drained, present on broad flats and in depressions on high and low terraces. The surface is light brownish gray, mottled silt loam. It has a natural low fertility with slow water runoff. Guyton soils have high levels of exchangeable aluminum in the root zone that are potentially toxic to crops.

Guyton silt loam, frequently flooded (GY) This poorly drained soil is found in low positions on flood plains of major streams. The surface layer is dark grayish brown and dark brown silt loam. It has low fertility and high levels of aluminum. Water runs off slowly.

3) Groom-Mollicy Series

Groom-Mollicy Complex (Gp). This complex consists of poorly drained Groom soils and somewhat poorly drained Mollicy soils. These are found on low stream terraces along the Ouachita River. The landscape is typically undulating with the Groom soils on broad level areas and the Mollicy soils are on low knolls and ridges. Groom soils make up 70 percent and Mollicy soils make up 20 percent of the complex. Both soils have low fertility but are used mostly for cultivated crops. They are poorly suited to crops, only soybeans and rice can be planted.

Groom-Mollicy Complex (Gs). This complex consists of poorly drained Groom soils and somewhat poorly drained Mollicy soils. These are found on low stream terraces along the Ouachita River. They are subject o flooding by backwaters of the Ouachita River for long periods of time. The landscape is typically undulating with the Groom soils on broad level areas and the Mollicy soils are on low knolls and ridges. Groom soils make up 70 percent and Mollicy soils make up 20 percent of the complex. Both soils have low fertility but are used mostly for cultivated crops. They are poorly suited to crops, only soybeans and rice can be planted.

4) Libuse Series

Libuse silt loam, occasionally flooded (Le). This moderately well drained soil is gently sloping and found on ridgetops on high terraces. The surface layer is dark grayish brown silt. It has low fertility and slow water runoff. Mainly this soil is woodland, with some pastureland and homesites. This soil is well suited for production of loblolly pine.

This soil is used mainly as woodland.

Libuse silt loam, 5 yo 8 percent slopes (LF). This soil is strongly sloping and moderately well drained. It is found on side slopes on high terraces. The surface layer is dark grayish brown silt loam. It has low fertility and high levels of exchangeable aluminum. The water runoff is medium.

This soil is used mainly as woodland.

5) Cahaba Series

Cahaba fine sandy loam, 1 to 5 percent slopes (Ca) This soil is well drained and found on low stream terraces. The surface layer is dark brown fine sandy loam. It has low fertility and has moderately high levels of exchangeable aluminum. Water runoff is medium and water capacity is low to moderate. The most common use of this soil is woodland but it is well suited to crops. The potential for production of loblolly pine is high.

6) Perry Series

Perry clay, frequently flooded (Pc). This is a level or depressional, poorly drained, clayey soil that is subject to frequent flooding by backwater in winter and late in spring of most years.

The surface layer is a dark-gray clay, and the subsoil is gray clay underlain at a depth of 20 to 30 inches by reddish-brown clay. This soil is often intermingled with Alligator and Portland soils.

Perry clay has a moderately low natural fertility and is slightly acid to very strongly acid in the upper 20 inches. Permeability and runoff are slow and available water capacity is moderate.

This soil has a moderately high potential productivity and is best suited to southern bottomland hardwoods; potential site index is 80 for most hardwoods, except cottonwood which is 90. Poor trafficability severely limits equipment use, and severe seedling mortality is liable because of excess water.

Perry clay, frequently flooded (PF). This soil is level and poorly drained. It is found on backswamp areas of the Ouachita River. The surface layer is dark gray, mottled clay. It has medium fertility and moderately high levels of exchangeable aluminum. The water runs off at a very slow rate. This soil is subject to long periods of flooding.

This soil is moderately well suited to use as woodland, mainly hardwoods.

7) Portland Series

Portland silt loam (Po). This soil is found in the bottomland in long, moderately wide areas at intermediate elevations. The surface layer consists of a brown silt loam about 8 inches thick, and the subsoil is reddish-brown silty clay or clay about 24 inches thick. The soil is moderately low in natural fertility and is medium acid to very strongly acid. Permeability and surface runoff are slow. Available water capacity is moderate.

This soil has a high potential productivity and best suited for southern bottomland hardwoods. The potential site index for most hardwoods is 90, except cottonwood which is 100. Excess water causes severe equipment limitations and moderate seedling mortality. The soil is also well suited for cultivated crops and pasture.

Portland clay, frequently flooded (PR). This soil is level and somewhat poorly drained. It is found on broad flats on the floodplains of the Ouachita River. The surface layer is grayish brown, mottled clay. It has medium fertility with moderately high levels of exchangeable aluminum. This soil is frequently flooded for very brief to long periods. Floodwaters are 5 feet or more deep.

This soil is used mainly as woodland, mainly hardwoods.

Perry clay, occasionally flooded (Pg). This level, poorly drained soil is in backswamp areas on floodplains of the Ouachita River. The surface layer is dark grayish brown, mottled, strongly acid clay. It has medium fertility and water runs off very slowly and stands in place after heavy rains. Flooding can occur in winter and spring.

This soil is moderately well suited to woodland and has a high potential for the production of water oak, water hickory, cottonwood and sweetgum.

8) Hebert and Perry Series

Hebert and Perry soils, frequently flooded (HY). This unit consists of somewhat poorly drained Hebert soils and poorly drained Perry soils on floodplains of rivers and bayous. They are subject to frequent flooding for long periods and medium fertility.

These soils are moderately well suited to hardwood production.

9) Ora Series

Ora fine sandy loam, 1 to 5 % (Or). This soil is found on the upland portions of the refuge and is a well drained, loamy, gently sloping to moderately sloping soil. It is found on ridgetops on high terraces. The surface layer is dark grayish brown fine sandy loam about 4 inches thick. Fertility is low. It has high levels of exchangeable aluminum that are potentially toxic to crops. The available water capacity is low to moderate. Water runs off at a medium rate.

This soil is well suited for woodlands, loblolly pine production, pastureland and homesites.

Ora fine sandy loam, 5 to 12% slopes (OS). This soil is found on strongly sloping and moderately well drained uplands. The Surface layer is dark grayish brown fine sandy loam about 5 inches thick. The soil has low fertility, due to aluminum levels, has a low to moderate water capacity and quick water runoff.

This soil is well suited for woodlands and loblolly pine production. It is poorly suited for cultivated crops because of slopes and erosion.

10) Litro Series

Litro clay, frequently flooded (LT). This soil is nearly level and poorly drained in backswamp areas on the floodplain of the Ouachita River. It is subject to frequent overflow from the river. The Surface layer is dark gray, mottled clay about 6 inches thick. It is low in fertility, permeability, and the water capacity is moderate to high. Floodwaters typically are 5 to 15 feet deep, but can exceed

20 feet in some areas and is frequently flooded for brief to long periods between November and July.

This soil is used almost entirely as woodland, especially hardwoods.

11) Groom Series

Groom silt loam, occasionally flooded (Gm). This soil is level, poorly drained and found on broad flats on low stream terraces adjacent to the floodplain of the Ouachita River. The surface layer is grayish brown silt loam about 3 inches thick. It has low fertility, slow water runoff, and a high water capacity.

This soil is used mainly as woodland and in some areas, pastureland.

Groom silty clay loam, frequently flooded (GO). This soil is similar to the Groom (Gm) silt loam in fertility, water capacity and run off. The surface layer is grayish brown silty clay loam about 6 inches thick. This soil is frequently flooded for long periods by overflow from streams at depths of less than 5 feet.

This soil is used mainly as woodland.

12) Sacul Series

Sacul very fine sandy loam, 5 to 12 percent slopes (SB). This soil is strongly sloping, moderately well drained and found on slopes in uplands. The surface layer is dark grayish brown very fine sandy loam about 4 inches thick. It has low fertility, slow permeability, and a rapid rate of water runoff.

This soil is moderately well suited for woodland.

13) Haggerty Series

Haggerty fine sandy loam, frequently flooded (HA). This soil is level and somewhat poorly drained. It is on low terraces that are former beaches on relict lakes. The areas of this soil are mainly along the western edge of the floodplain of the Ouachita River. The surface layer is dark grayish brown, mottled fine sandy loam. It has low fertility and contains high levels of exchangeable aluminum. Water runoff is very slow. It is subject to very long periods of flooding during November through July with a depth of 2 to 10 feet.

This soil is moderately well suited to use as woodland, mainly hardwoods.

Haggerty silty clay loam, frequently flooded (HB). This soil is level and somewhat poorly drained. It is found on low terraces that are former beaches of relict lakes along the western edge of the Ouachita River. The surface layer is dark grayish brown, mottled silty clay loam. It has low fertility and contains high levels of exchangeable aluminum. Water runs off the surface very slowly.

It is subject to very long periods of flooding that can exceed 15 feet some years.

This soil is used as woodland, mainly hardwoods.

Haggerty silty clay (He). This level, somewhat poorly drained soil is found on former beaches of relict lakes along the extreme eastern edge of the floodplain of the Ouachita River. The surface layer is dark grayish brown, mottled, and very strongly acid. It has low fertility and high levels of exchangeable aluminum. Water runs off at a very slow rate. Flooding is rare but can occur during unusually high flood levels.

This soil is used mostly for cultivated crops.

Haggerty loamy fine sand, frequently flooded (Hg). This level somewhat poorly drained soil is in areas of a floodplain that are former beaches of relict lakes along the eastern edge of the floodplain of the Ouachita River. The surface layer is dark grayish brown and grayish brown, mottled and extremely acid. The fertility is low and contains high levels of exchangeable aluminum. Water runs off at a very slow rate. The depth of flooding ranges from 5 to 10 feet.

This soil is used mostly for hardwood tree production.

Haggerty silty clay, frequently flooded (Hh). This level, somewhat poorly drained soil is in areas that are former beaches of relict lakes along the eastern edge of the floodplain of the Ouachita River. The surface layer is dark gray and gray, mottled and extremely acid. The fertility is low and contains high levels of exchangeable aluminum. Water runs off at a very slow rate. The depth of flooding ranges from 2 to 10 feet, but sometimes exceeds 20 feet.

This soil is moderately well suited to woodlands.

14) Savannah Series

Savannah fine sandy loam, 1 to 5 percent slopes (Sg). This soil is gently sloping and moderately well drained. It is found on ridgetops and side slopes on high terraces. The surface layer is dark grayish brown fine sandy loam. The soil has low fertility and water runs off at a medium rate.

This soil is moderately well suited as woodlands, especially pine trees.

15) Wrightsville Series

Wrightsville silt loam, occasionally flooded (Wr). This soil is level and poorly drained. It is on low stream terraces adjacent to the floodplain of the Ouachita River. The surface layer is grayish brown silt loam. It has low fertility and

water runs of the surface at a slow rate. This soil is occasionally flooded. This soil is moderately well suited to use as woodland.

2.3.4 Geomorphology

Upper Ouachita NWR is located within the West Gulf Coastal Plain (WGCP) which extends from south-central and southwestern Arkansas over to the extreme southeastern portion of Oklahoma and down into eastern Texas east to parts of northeastern Louisiana.

Refuge land is all composed of Recent- and Pleistocene-age alluvial soils in the floodplain of the Ouachita River. These lands are subject to annual flooding by stream overflow or backwater. The Recent alluvium exists in a band generally within one to one and a half miles of the present river channel. The Recent alluvium is mostly point bar deposits consisting of "tan to gray clays, clayey silts, and fine sands in the ridges, and soft, gray clays and silty clays in the swales (USFWS 1988)." Water and organic contents are high in the swales but usually lower in the ridges. The top strata of the Recent deposits are mostly between 50 and 70 feet above mean sea level (MSL). The bulk of the refuge land consists of point bar and abandoned channel Pleistocene-age deposits known as the Deweyville Terrace formation. The somewhat older alluvial soils of the Deweyville Terrace are mostly "gray to light-brown silty to sandy clay." Elevation of the Deweyville Terrace formation is between 60 and 80 feet MSL. On the western edge of the refuge is another Pleistocene-age formation known as the Prairie Terrace. Prairie terrace soils are similar to those of the Deweyville Terrace, but higher in elevation, generally between 80 and 150 feet MSL. Whereas the Recent alluvial land and Deweyville Terrace are relatively flat, the Prairie Terrace is gently rolling, due to differential erosion. The Pleistocene and Recent deposits are underlain by much older Tertiary-age formations. The tertiary deposits outcrop beyond the Prairie Terrace several miles west of the refuge boundary, generally above 150 feet MSL. Soils of the Tertiary Uplands generally contain more sands and gravels than do the Recent and Pleistocene soils. These soils are also more acidic than the Pleistocene and Recent alluvial soils.

2.4 History of Refuge Lands

The purpose of habitat management is often to restore an area to the historical conditions that were present before the land was substantially altered by European settlement. Most habitat loss in northern Louisiana occurred within the last 100 years when development, especially in the past 40 years, increased. There are other human effects on the environment that are less conspicuous than development but can result in severe degradation of habitat. For example, alterations to the natural hydrology, such as levees, channelization of rivers, locks and dams, etc, have severe negative effects on bottomland hardwood systems and other wetlands. Fire suppression in a fire-adapted plant community can cause a succession of habitat types that eventually leads to the exclusion of wildlife that depend on the ecosystem for their survival. Lands managed for timber are harvested at an early age. When the forest is not allowed to mature, the ecosystem does not function naturally.

Although these factors do not cause the dramatic die-off of animals that can be readily observed, the subsequent gradual downward trend in wildlife reproduction can result in the extirpation of a species from its native range.

In order to define objectives for habitat management on the Refuge, a substantial effort was made to determine the historical condition of Refuge lands and their surrounding areas. Historical literature, aerial photographs, General Land Office surveys, and consultations with botanical ecologists were used during the development of this Plan.

2.4.1 Cultural and Refuge Land History

Between 10,000 BC and 1400 AD, Native Americans inhabited northeastern Louisiana. The Paleo-Indian people developed regional culture groups; along the Ouachita River, the Caddo people were becoming defined. French explorers, hunters, and trappers traveled through the areas. After the United States acquired Louisiana, American settlers established farms in the uplands around the lower Upper Ouachita throughout the first half of the 19th century. In 1806, the first permanent European settlement in Union Parish was established on the southern end of the present day refuge. In 1861, Louisiana seceded from the United States. . The same year, a major flood occured on the Ouachita River. The state sent aid to the victims in Union Parish indicating the area was well populated at the time. Most of the uplands after the Civil War were cleared and planted in cotton and corn. By the early 1900s the croplands reverted to forest and Breece Lumber Company acquired much of the refuge. The bottomlands were logged during the early 1900s when baldcypress were largely sought after. Natural gas was also discovered in the area. In 1930 Breece Lumber Co. sold some of the refuge land to United Gas Company who then sold it to Union Producing Company (later named Pennzoil). Pennzoil managed their timber on a single-tree selection basis with a diameter limit. Pine sawtimber and pulpwood were harvested from those stands which contained sufficient volume per acre to permit an economical operation. Since no market for hardwood pulpwood existed at that time, only sawtimber size trees were removed, consisting mostly of overcup oak and bitter pecan. Pennzoil harvested between 600-900 acres per year. In 1955, United Gas created some of the permanent water features the refuge has today, including Moss Lake and Fish Lake by damming Steep Bank Creek. In 1958, the Union Parish Police Jury and Louisiana Dept of Wildlife & Fisheries created Finch Lake by damming Finch Bayou. In 1969 Union Producing Company changes its name to Pennzoil Producing Company. In 1977, Pennzoil decided to sell its holdings which are eventually purchased by the Service in 1978 (Table 2). The Mollicy Unit (Units 14-21), which totals 16,191 acres, was purchased from one landowner in parcels from 1997-1999. Plum Creek Timber Company sold 4,939 acres to the Service on the western edge of the refuge (from 1999 to 2004). In 2010, the Service began managing inholdings at the Mollicy Unit purchased by the Conservation Fund. These 3,905 acres of inholdings will eventually be purchased by the Service. Because this document is a Habitat Management Plan and these inholdings, although not

refuge fee title yet, are managed by the Service, all maps and narrative within this Plan treat these inholdings as refuge lands.

2.4.2 Pre-European Settlement Conditions

Bottomlands

Bottomlands in northern Louisiana consist of bottomland hardwood forest, baldcypress/tupelo swamps, sloughs, shrub-scrub wetlands, forested and emergent lakes, ponds, rivers and bayous. Because rivers, bayous and lakes are not generally managed, this section will focus on bottomland hardwood forests. These forests are forested wetlands that are found along rivers and streams. The extent of impact on bottomland forests by Native Americans is disputed. Early explorers, such as DeSoto, reported extensive tracts of forest with cleared fields and villages dispersed unevenly in the Lower Mississippi Alluvial Valley (King *et al.* 2005). Generally the first terrace was cleared for agriculture by natives, but the backswamps were left untouched. Although Native Americans had altered the forest somewhat, many European explorers, such as Bartram and Nuttall, described the area as having vast tracts of pristine, untouched forest.

Bottomland hardwood forest composition is driven by hydrology. Very slight changes in elevation result in different plant communities. Prior to Europeans making drastic alterations to the hydrology of these forests in an effort to drain them, these forests were intact, pristine wildernesses.

Researchers have studied General Land Office surveys in an attempt to characterize bottomland hardwood forests before European settlement. Ouchley *et al.* (2000) found that oaks were not the dominant species during presettlement times on nearby Bayou Cocodrie NWR. Rather, sweetgum made up the largest amount of basal area, was the dominant species, and had the second largest trees, next to baldcypress. In another study, Ouchley *et al*. (1999) synthesized three studies from the early 1900s by U.S. Forest Service employees describing these forests in Louisiana. Two of these early reports were conducted within 60 miles of Upper Ouachita NWR where Tensas NWR is located. Results showed that bottomland forests during the early 1900s had 75 to 150 trees per acre. Sweetgum was the dominant species but there was a high tree diversity present including 25 other species. Sweetgum lived longer (up to 350 years), was larger in diameter and was taller than the oaks present. Ouchley *et al*. (1999) described these old-growth forests in Louisiana as being diverse in species, size and age with 2-3 trees per acre being extremely large. They also found that small gaps created by single trees falling were distributed across the landscape causing a mosaic of different age and size classed trees.

Uplands

Bragg (2003) analyzed General Land Office surveys from 1818-1855 in Ashley Co., Arkansas which is just north of the refuge. He found that pine was often underrepresented in the GLO records by surveyors probably because their large size

was not favored as a witness tree. The surveyors often described the forests as open pine with grassy understories that were subject to flooding. Several surveyors descriptions included observations of areas burned over by fire. The pine flatwoods adjacent to the Ouachita River were extensive and the largest pine recorded in the GLO record was a Loblolly Pine with a dbh of 72 inches (Bragg 2003).

Catastrophic events, such as tornadoes, created openings where loblolly pine would come into a disturbed area. If that area burned regularly, then the loblolly overtook the hardwoods or if it burned frequently and intensely, shortleaf pine would overtake the loblolly. The land could stay in this state for a few hundred years, but eventually hardwoods would succeed. Hardwood trees would then remain in the stand until another catastrophe occurred causing disturbance which allowed loblolly to reestablish. If fire was frequent, loblolly would stay dominant and keep reestablishing itself. However lower, wetter areas would not have burned as frequently allowing hardwoods to establish. Therefore, these uplands contained both hardwoods and pine; but, the hardwoods were not regularly distributed but grew in patches where fire had not occurred. These forests were dynamic, changing spatially and temporally across the landscape due to the influence of disturbance, mostly fire (Tom Foti, *pers. comm.*, Ark. Nat. Heritage, USFWS 2004).

The "History of Louisiana" was written by Le Page Du Pratz in the early 1720s and is one of the best references to what Native Americans were doing at that time. He explored the Red, Ouachita, Mississippi, and St. Francis Rivers using Native American guides. He described the Ouachita River just south of the Ouachita Mountains as a vast prairie with trees only along the streams. He states that natives would set the forest on fire in the autumn and that during summer the forest was too rank with grass to travel through. Natives burned the forest into November which is a little later than natural fires, which occurred in September and October.

2.4.3 Current Conditions and Habitat Types

The refuge is situated on the western edge of the Mississippi River Delta. In this region, hydrology plays a very important role in determining the composition and character of floodplain plant communities because each species has a different level of tolerance to flooding. Upper Ouachita NWR is predominately mature bottomland hardwood forest. The typical gradient of forest species relative to flooding in response to elevation is seen in Figures 3, 4 and 6. As one moves from permanent water up and out of the terraces to uplands, it turns from a baldcypress/tupelo, to overcup oak-water hickory, to willow oak, to upland pine-hardwood forest.

The refuge (including The Conservation Fund lands) currently consists of 4,540 acres of pine and pine/hardwood mix; 22,407 acres of bottomland hardwood forest; 13,405 acres of reforested bottomlands; 2,910 acres of open water, 1,724 acres of agricultural fields; and 1,516 acres of fallow fields, levees, roads, and facilities (Figure 6).

2.4.3.1 Bottomlands

Unlike the bottomland hardwood forest of the past, the refuge's bottoms have been altered severely by man. A dramatic effect on the refuge's bottomland hardwoods was the construction of the Columbia Lock & Dam on the Ouachita River. This increased the level of the Ouachita River by seven feet. The dam also causes backwater flooding more frequently and for longer periods during the growing season.

The hydrology of the area suppresses understory growth and the forest is often inundated during the growing season. Closed canopy conditions also contribute to the lack of growth in the understory. Budget and staff constraints have also caused timber cutting rotations to fall behind; thus, creating many acres of bottoms needing sunlight to reach the ground. Vertical diversity within a bottomland hardwood forest is critical for providing wildlife cover and food. The term vertical diversity refers to the structure of the forest, indicating that plants are present at all vertical levels, including ground level, understory, mid-story and canopy. A thick understory provides deer browse and cover, nesting substrate for songbirds, cover for young fish during spring flooding, and thermal cover for wintering waterfowl. Woodcock and Swainson's warbler also prefer thick understories with limited ground cover.

No virgin timber is known to occur on the refuge as most was cut by the early 1900s.

Bottomland hardwood forest accounts for the majority of refuge land cover and can be classified into three primary habitat types: 1) Baldcypress-Water Tupelo, 2) Overcup Oak-Water Hickory, and 3) Sweetgum-Willow Oak (Figure 6).

Baldcypress-Water Tupelo

Baldcypress and water tupelo together make up the majority of stocking in this forest type, which occurs in swamps, deep sloughs, and very low, poorly drained flats. The sites are always very wet, and surface water stands well into or throughout the growing season. Soils are generally mucks, clays, or fine sand. Common trees associated with this type are black willow, water locust, overcup oak, green ash, and persimmon. Among the shrub species are swamp privet, buttonbush, and planertree. Woody vines include red vine. A variety of herbaceous plants will be commonly seen and take the form of flotants, emergents, and submergents. Frequently, a variety of mosses and lichens adorn the exposed tree trunks, and the crowns may be draped with Spanish moss.

Overcup Oak- Water Hickory

This type usually occurs in low, poorly drained flats and sloughs with tight clay or silty clay soils. These sites are the lowest within the first bottoms and are subject to

late spring inundations. Overcup oak and water hickory together constitute the majority. Associates include willow oak, Nuttall oak, cedar elm, green ash, and water locust. Minor associates include black willow, persimmon, and sweetgum. Common shrub species include swamp privet, hawthorn, buttonbush, planertree, and possumhaw. Woody vine species often associated include redvine, peppervine, trumpet-creeper, dewberry, and possibly greenbrier. Panicums, asters, annual grasses, and cocklebur may occur in openings within the stand.

Sweetgum-Willow Oak

The low ridges in the broad slackwater areas of the first bottom are typically occupied by this forest type. Willow oak and sweetgum comprise the largest proportion of the stocking in stands of this type. There are extensive areas of this type on the poorly drained willow oak flats on the refuge. These stands are strongly dominated by willow oak because of the heavy clay soils. Sweetgum often forms only a minor proportion of the stocking. A major associate on higher clay ridges and flats is nuttall oak, which may represent 30 - 50 percent of the composition. Other trees associated with this forest type are sugarberry, green ash, overcup oak, water oak, water hickory, cedar elm, persimmon, and sometimes baldcypress. Common shrubs include swamp privet, American snowbell, possumhaw, hawthorn, and dull-leaf indigo. Woody vines occasionally present are greenbrier, peppervine, and redvine.

2.4.3.2 Pine-Hardwood Uplands

The upland forest on the refuge currently is composed of loblolly pine flatwoods and upland mixed pine-hardwoods. Most of these uplands are a mix of loblolly pine and hardwoods with some inherited pine plantation. Areas that have been managed for red-cockaded woodpeckers in the past have fewer hardwoods present. The burning program during the past decade has increased the herbaceous, grassy understory in some areas and has somewhat limited hardwood understory and mid-story.

Portions of the refuge that consist mostly of upland hardwoods are few. Upland hardwood forests are rare today and greatly diminished from their historic distribution in north Louisiana. Unfortunately little attention seems to be given to their decline (mostly due to the focus on bottomland hardwood forested wetlands) even though upland hardwood forests in Louisiana are threatened (Lester *et al*. 2005). Species associated with this habitat type include wood thrush, worm-eating warbler, eastern spadefoot toad, Louisiana slimy salamander, Louisiana waterthrush, and Chuck-will's-widow. Conversion of hardwood forest into pine plantations by commercial timber companies is the number one threat (Lester *et al.* 2005). For these reasons upland hardwood forest will be retained and promoted as much as possible on Upper Ouachita NWR outside of the red-cockaded woodpecker foraging habitat. The red-cockaded woodpecker habitat coincides with the loblolly pine flatwoods, which burned frequently. Still, within red-cockaded woodpecker habitat, the maximum percentage of hardwoods (35%) allowed by the RCW Recovery Plan (USFWS 2004) will be maintained.

Loblolly Pine

Loblolly pine forest type can be found on almost all soil types above 70 feet in elevation in the general locale of the refuge. It is found mostly on sites with abundant soil moisture, which also promotes the development of rich undergrowth. This forest type is dominated by loblolly pine as the overstory with sweetgum associated, as well as shortleaf pine, southern red oak, and post oak. On moderately to poorly drained sites, common associates include red maple, blackgum, and water oak. Midstory trees include flowering dogwood, American holly, black cherry, hawthorn, eastern hophornbeam, sassafras, and red mulberry. Common woody vines include Carolina jessamine, Alabama supplejack, greenbrier, grape, Japanese honeysuckle, and blackberry. Among the shrubs associated with this type are American beautyberry and *Viburnum spp*.

Loblolly Pine/Hardwood

Hardwoods are predominant in this type with loblolly pine making up at least 20 percent of the stocking. On wet sites, loblolly pine is associated with sweetbay, blackgum, sweetgum, water oak, willow oak, red maple, and American elm. Species associated on drier sites are southern red oak, white oak, post oak, hickory, shortleaf pine, and persimmon. Generally, many of the same shrub, vine, and herb species found with the loblolly pine type are also common associates in stands of the loblolly pine/hardwood type.

Invasives

Until recently, invasive plants have not been a large problem on the refuge. As a routine part of general forest management, foresters eliminated scattered clumps of Chinese privet, mimosa, tree-of-heaven, etc. Most of the invasives found on the refuge occur in the upland areas instead of the deep overflow bottoms; therefore, this topic is placed in the upland habitat section. Two species that have moved northward into this area and are of primary concern are Chinese tallow (*Sapium sebiferum*) and Japanese climbing fern (*Lygodium japonicum*). Japanese climbing fern is well established on the refuge and may be beyond the point of control, much less eradication. This invasive fern can increase in cover to form mats, smothering shrubs and trees (Miller 2003). The second problem species, Chinese tallow tree, is increasing exponentially and is an imminent threat to wetland and upland habitats. This species causes large-scale ecosystem disruption by replacing native vegetation, which reduces native species diversity, which in turn has a negative impact on wildlife. Tallow can quickly become the dominant plant in disturbed areas and invade bottomland forests, such that it earned a spot on the "America's Least Wanted-The Dirty Dozen" list of The Nature Conservancy (Flack and Furlow 1996). Other invasive plants that have been found on the refuge include princess tree and chinaberry.

2.4.3.3 Moist Soil – Agriculture

1,724 acres are currently managed as moist soil / agriculture. Usually, half of the acreage is farmed while the other half is managed as moist-soil. Then in the following year, the areas

are swapped, keeping this rotation so that the land is farmed (disked) every two years. Agriculture usually consists of rice or millet or a combination of the two. Moist soil and agriculture is used to provide habitat for wintering waterfowl and migrating shorebirds.

2.4.3 Habitat Changes from Historic to Current Conditions

The Monroe Gas Field (MGF) underlies portions of Ouachita, Union, and Morehouse parishes in northeast Louisiana. At the time of initial discovery and development, during the second decade of the 1900s, it was the largest known gas field in the U.S. Gas pressure initially exceeded 1,000 psi. Unlike other Louisiana gas fields, the Office of Conservation, the state regulatory agency, never promulgated minimum spacing requirements for wells in the MGF. Average well depth is around 2,300' and most wells could be drilled within 36 hours. The size of drilling pads varied from one company to another, but approximately ½ acre would be cleared for each well. This allowed room for the drilling rig, mud pits (bentonite clay/water slurry) and service vehicles. Following well completion, only a small area around the well head would be maintained by the gas company. Brine, which contains about three times as much salt as sea water, is a by-product of most gas wells.

Until the mid 1970's, economics generally restricted wells to one per 40 acres. However, tax laws and a dramatic, though short lived, increase in natural gas prices combined to spur a rash of drilling which lasted until about 1986. During this period, the number of wells in the MGF more than doubled. In some instances, wells were drilled within 600' of each other. This rapidly depleted gas reserves, reduced the average gas pressure to about 30psi, and caused production at many wells to cease.

Mineral rights were not obtained when the refuges were acquired. From a refuge management standpoint, the main problems associated with natural gas production have been 1) habitat/wildlife disturbance, 2) improperly covered mud pits, 3) abandoned/poorly maintained wells and facilities, 4) mercury contamination, and 5) brine. Habitat disturbance has included clearing potential nesting and foraging trees within red-cockaded woodpecker clusters and drilling during nesting season. Prior to 1991, there were no regulations relating to pit closure. Often, soil was pushed into mud pits, leaving several feet of mud under a thin shell of soil. Such pits are a hazard since equipment, once it breaks through the soil layer, will sink to the bottom of the pit, a distance of up to seven feet. Until the 1970's, most meters used to measure gas production contained mercury. Often mercury was carelessly handled and significant amounts of mercury could be found below about 80% of the mercury type meters. All known refuge mercury meter sites have been remediated and the meters replaced with the non-mercury containing type. High levels of mercury have been documented in refuge fish and fish-eating wildlife. However, it is likely that this contamination is related to the levels of methyl mercury in the Ouachita River and its tributaries. Many refuge acres have been sterilized by the release of brine. This has resulted from poorly maintained or abandoned wells, the use of salt water disposal pits (now prohibited) and ruptured brine pipelines. Areas

which had significant brine releases over 50 years ago still show signs of those releases.

The Service purchased most of the refuge lands from Pennzoil. They managed their timber on a single-tree selection basis with a diameter limit. Pine sawtimber and pulpwood were harvested from those stands which contained sufficient volume per acre to permit an economical operation. Since no market for hardwood pulpwood existed at that time, only sawtimber size trees were removed, consisting mostly of overcup oak and bitter pecan. Pennzoil harvested between 600-900 acres per year.

Prior to the time the aforementioned corporation entitled the land, much of it was either leased or owned by other forest-product companies back to and possibly before 1900. Historical information on the area which is now the refuge before this time is not readily available. However, it is generally known that the early 1800s was a period of settlement by pioneers, and the latter part of the century was a period of reconstruction and industrial development. Steer (1948) indicated that Louisiana's lumber production went from the lowest in the South in 1869 to the greatest in the nation in 1914. It is evident that the forest resources of Louisiana were much exploited during this area. Sawmills would spring up where timber was in great abundance, then move on after the timber had been exhausted from an area. It was this period of exploitation which led to the cutting of the last virgin timber on the refuge between 1912 and 1925.

Other changes to the refuge occurred in the mid-1900s when permanent water bodies were formed by damming bayous and creeks. Fish Lake, Moss Lake, and Finch Lake are the products of damming.

The Mollicy Unit of the refuge was once a mature bottomland hardwood forest. In 1935, it was leased, along with other land, by the Louisiana Department of Conservation (now the Louisiana Department of Wildlife and Fisheries) from private timber companies. This area was known as Terzia Refuge. Later, in 1964, the Mollicy land became a part of the leased Georgia Pacific Wildlife Management Area. A private landowner purchased Mollicy in 1966 and in 4 years completely cleared the area for the production of soybeans. A 30-foot high, 16-mile long ring levee was constructed on the east, north and south sides of the Mollicy Unit in the early 1970s to keep out the Ouachita Rive when it flooded. Approximately 13,700 acres were farmed inside of the levee and an additional 2,500 acres outside of the levee.

The Service purchased Mollicy in parcels from 1997-99. Reforestation efforts began immediately; over 10,000 acres were planted by 2001. General Land Office (GLO) records and historical accounts were used, along with elevation and soil survey maps, to determine which tree species historically occurred on the unit. Efforts were made to plant trees at appropriate elevations to withstand historical flood regimes. Tree species planted include but not limited to baldcypress, overcup oak, willow oak, Nuttall oak, sweetgum, sugarberry, slippery elm, and green ash. The Service planned on breaching the levee strategically to reconnect the Ouachita

River to its natural floodplain (Mollicy). However, in 2010 the river reached record heights and breached the ring levee in two places. The Service continues to this day in removing the levee in pieces in a long-term effort to restore the hydrology at the Mollicy Unit. This restoration is the largest in the country. In 2011, an additional 2,979 acres were reforested on Mollicy.

Since the acquisition of the Mollicy Unit, farming was conducted on the north end. Rice and millet were planted and rotated on 3,000 acres with moist soil management. After the levee breaching, farming became near to impossible and reforestation of the area commenced. The farming will now be conducted on 1,724 acres owned by The Conservation Fund.

The surrounding landscape is of course changed within northern Louisiana. Development and population spread from Bastrop southeast of the refuge has caused habitat conversion from forests to residential neighborhoods and businesses. The landscape is dotted by small private landowners that are mostly home sites. Another recent trend is conversion of bottomland hardwood forest to pine plantation. Timber companies accomplish this by raising the site slightly with machinery which alters the hydrology of the area forever. This has occurred substantially to the lands adjacent to and east of the refuge. However, the refuge itself is more forested now than before it was purchased by the Service. Reforestation at the Mollicy Unit is the largest contiguous reforestation of bottomland hardwood forest in the country.

The installation of the Columbia Lock & Dam on the Ouachita River in the 1970s has changed the flooding regime substantially. Flooding occurs later into the growing season, for longer duration and greater depth.

As mentioned earlier, invasive plant species are present on the refuge, especially in the upland communities, that would not have been present or as well established in the past.

In the future, the effects of global climate change will gradually increase at Upper Ouachita NWR over the next 100 years. Within the 15 year time-frame of this plan, smaller impacts may be seen. According to the report “Global Climate Change Impacts in the United States” (2009), it is expected there will be higher temperatures, less rainfall, particularly in winter and spring, increased storm intensity and frequency, and more drought throughout the Southeast. It is anticipated that temperatures will increase by at least 4.5^{o}F by 2080 and fire severity will increase 10 to 30 percent within the next 50 years. Within the next 15 years, increasing impacts of higher temperatures will likely cause the spread of invasive species and small changes to native plant and animal distributions. Migratory birds will probably breed and winter a little further north. More southern, tropical species, (i.e. black-bellied whistling ducks, wood storks, etc.) will extend their ranges into Louisiana. Invasive species such as *Salivinia*, water hyacinth, tallowtree, etc. will become more established and extend their ranges further north. The source of these impacts are difficult to isolate as caused either in

part or in fully by global climate change, but are anticipated nevertheless. This plan addresses these short-term anticipated impacts of invasive species and community shifts through habitat management objectives. Impacts including increased drought, fire severity, and storm intensity cannot be influenced by the scope of this plan.

Table 2. Historical timeline of Upper Ouachita National Wildlife Refuge establishment

1541 – 1542 *Hernando de Soto followed the Ouachita River in his exploration of the southern United States. He found Ouachita Indians living along the river. Village site or sites may have existed on the refuge area.*	*1806* *Ouachita City, at the southern end of the refuge becomes the first permanent European settlement in the present-day Union Parish.*
1682 *La Salle claims lower Mississippi Valley area for France.*	*1812* *Territory of Orleans became the State of Louisiana. The county of Ouachita was established.*
1718 *Several French settlements established along the Ouachita River. Trappers, hunters, and traders probably utilized the refuge area.*	*1839* *Union Parish was established from part of the old Ouachita County. One of the Police Jury's first actions was to enact a law allowing free-ranging domestic animals in the parish.*
1729 *Natchez uprising disrupts French control of northeast Louisiana; French settlements along the Ouachita abandoned.*	*1840-1845* *This was the period of influx of settlers from Alabama, Georgia, and Mississippi. Most of these people disembarked at Alabama Landing, located on the present refuge. Towns of Marion, Haile, and Linville resulted from this wave of immigration. Most of these people were small farmers—not slaveholders. The town of Marion was named after Marion, Alabama, which was named for Francis Marion, the "Swamp Fox" of the American Revolution.*
1734 *Most of the Ouachita Indians had been decimated by European diseases and raids by Chickasaw war parties from Mississippi.*	*1861* *Louisiana secedes from the United States. A major back-water flood occurs on the Ouachita River. The state sends aid to the victims in Union Parish. This indicates that the floodplain and refuge area were probably substantially populated at that time, probably by trappers, fishermen, subsistence, and commercial hunters.*
1762 *France loses French and Indian War. Louisiana Territory is ceded to Spain.*	*1865-1930* *Louisiana re-entered the United States. Between the Civil War and the 1940s, agriculture was the parish's major economic base. Most of the Tertiary uplands were cleared and planted in cotton and corn. By the 1930s and 1940s, much of the cropland was allowed to revert to forest. Lumber, paper, and mineral companies began buying much of the parish land. Breece Lumber Company acquired much of the refuge land prior to 1930. During this period also, natural gas was discovered in the refuge area.*
1791 *Fort Miro was established at a small Spanish settlement that would eventually become the city of Monroe. European trappers and hunters lived in the refuge area.*	*1930* *Breece Lumber Company sold some of the refuge land to the United Gas Company. Much of this land was subsequently sold to Union Producing Company.*
1803 *Louisiana was re-acquired by France. The United States bought it from France. Choctaw Indians from Mississippi replaced the Ouachita Caddoans along the river. Congress established Territory of Orleans south of 33° N latitude.*	*1969* *Union Producing Company changed its name to Pennzoil Producing Company. Pennzoil began leasing the land to private hunting clubs and continued selective harvest of overcup oak and pecan sawtimber.*

2.5 Maps

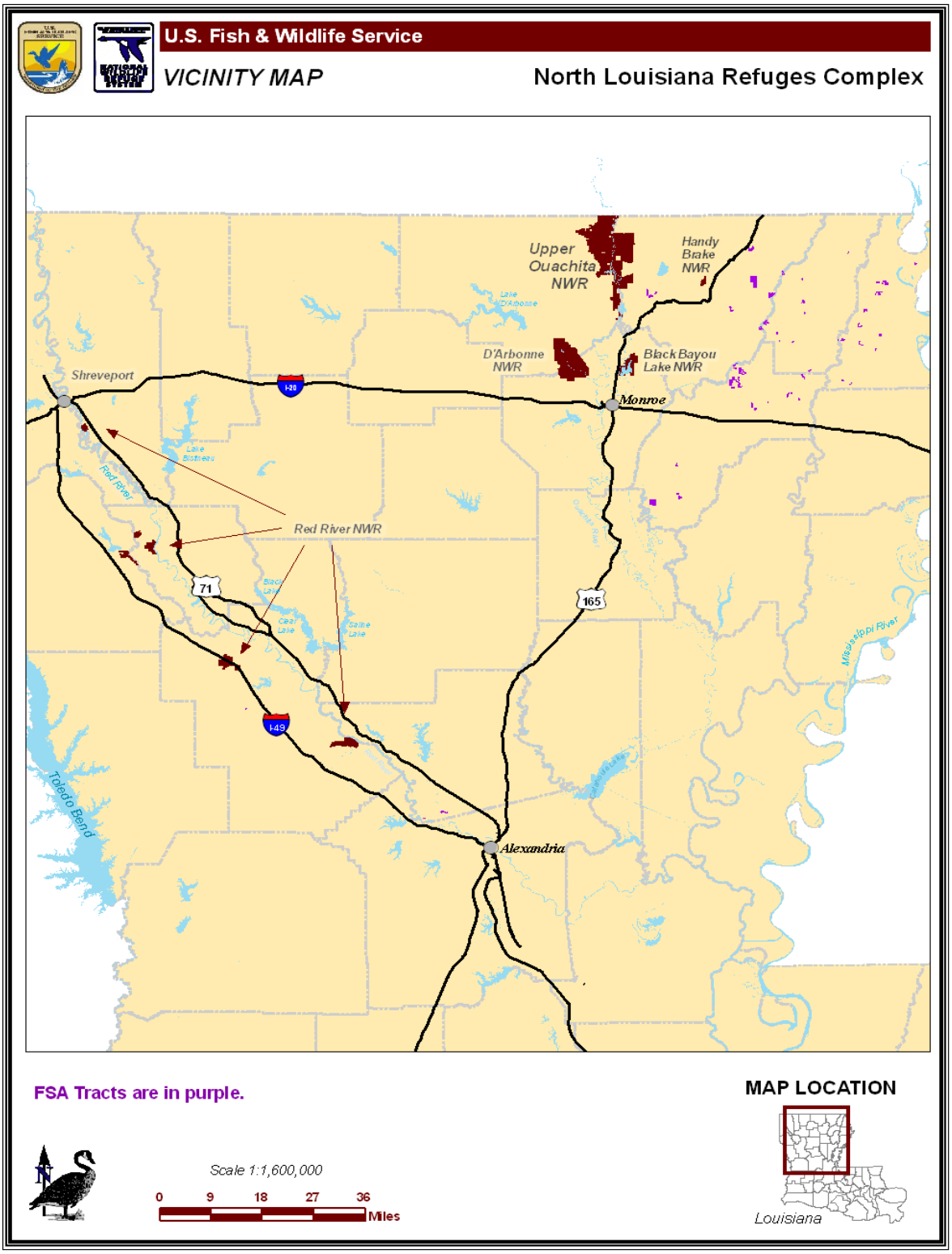

Figure 1. North Louisiana Refuges Complex.

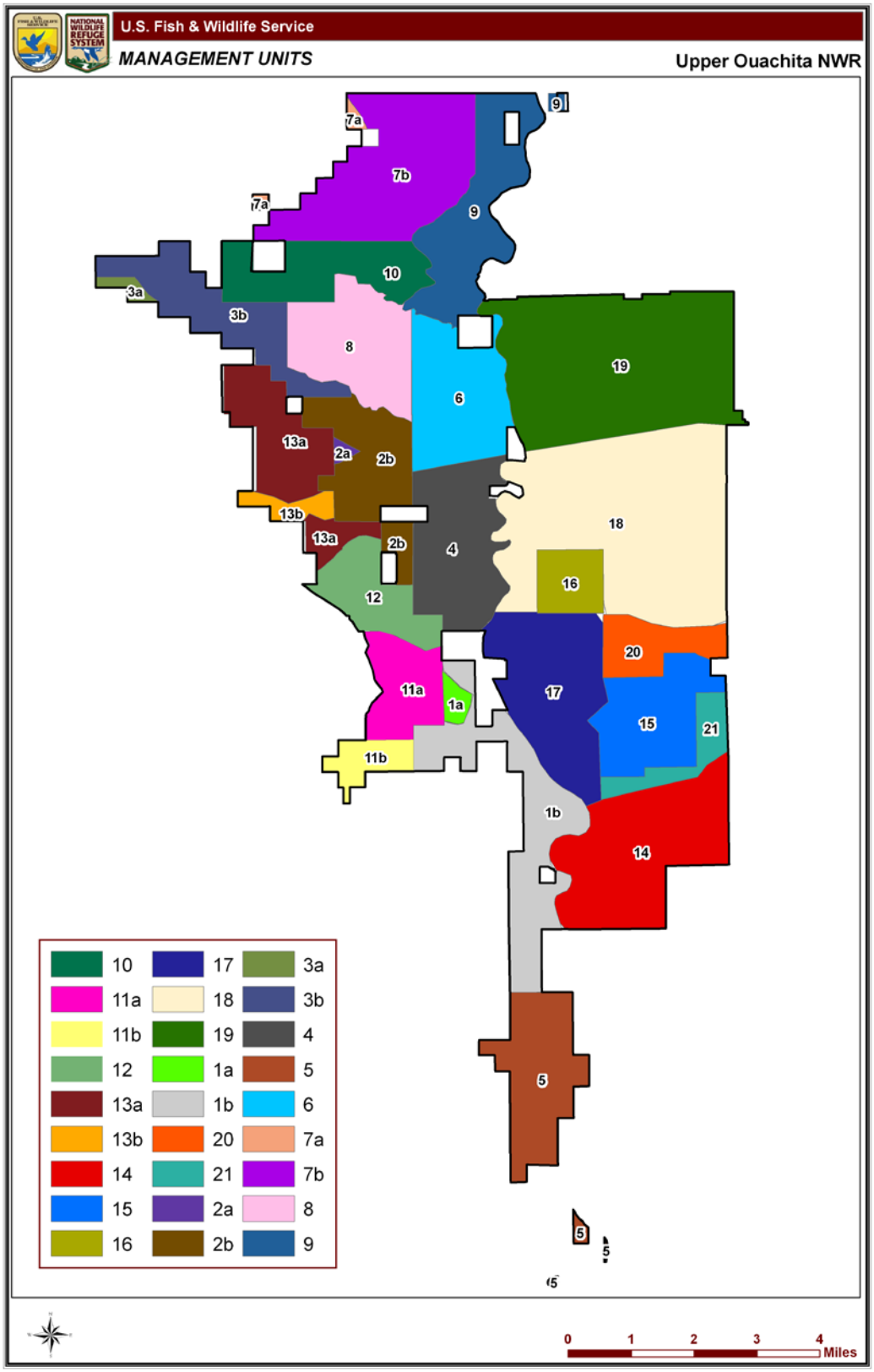

Figure 2. Twenty-seven management units of Upper Ouachita NWR.

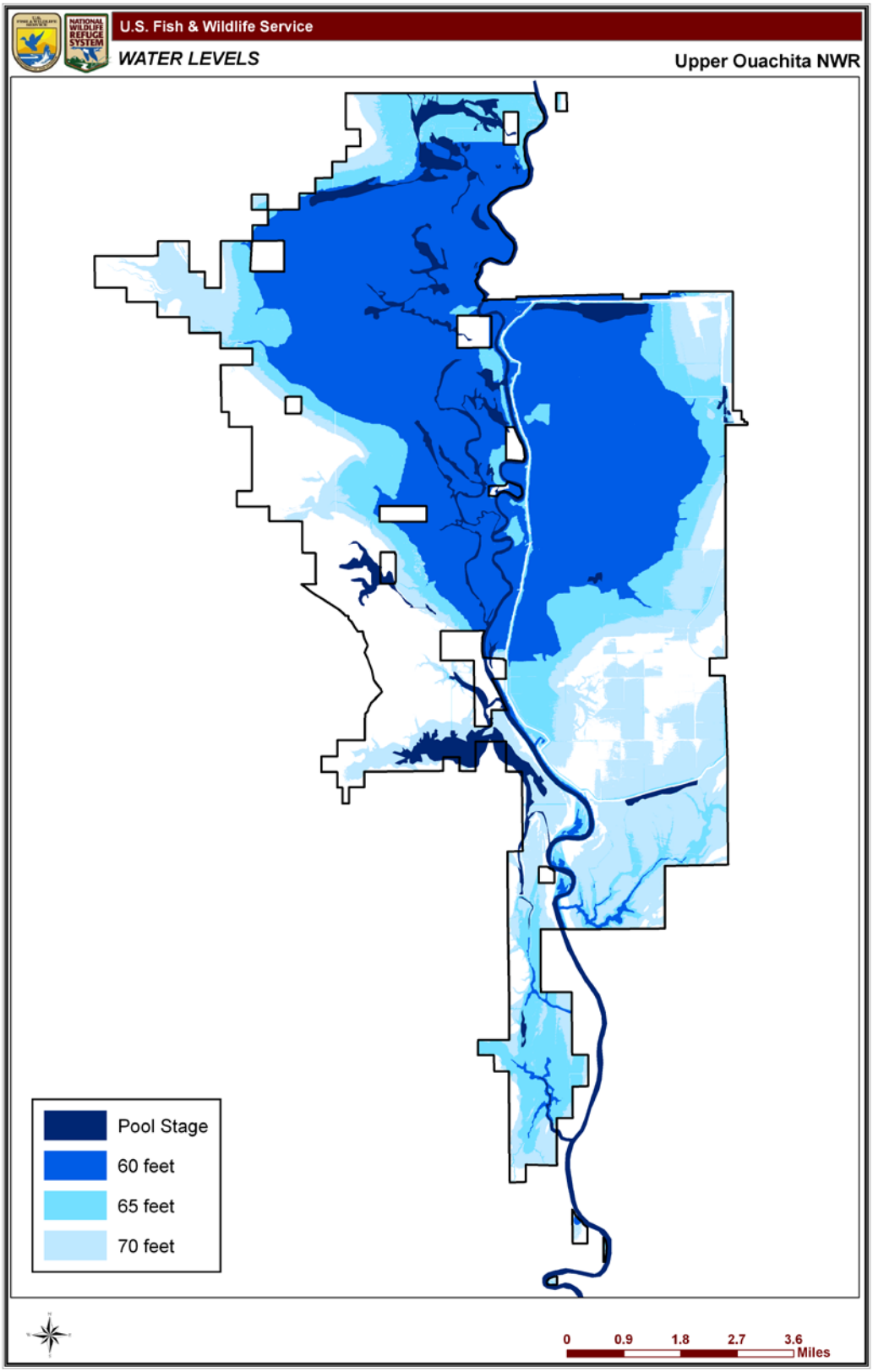

Figure 3. Extent of flooding at different water levels on Upper Ouachita NWR.

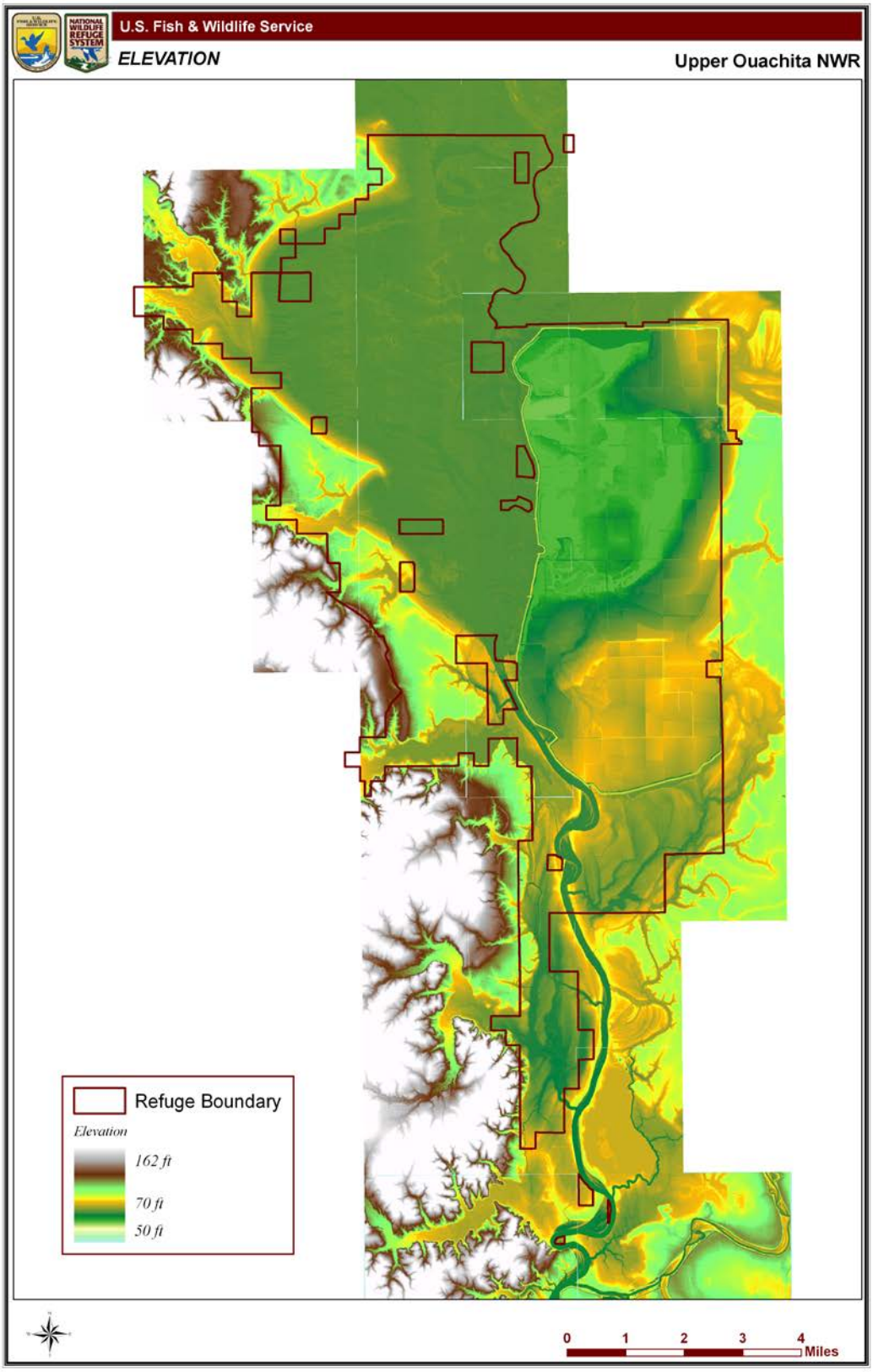

Figure 4. Elevation levels at Upper Ouachita NWR.

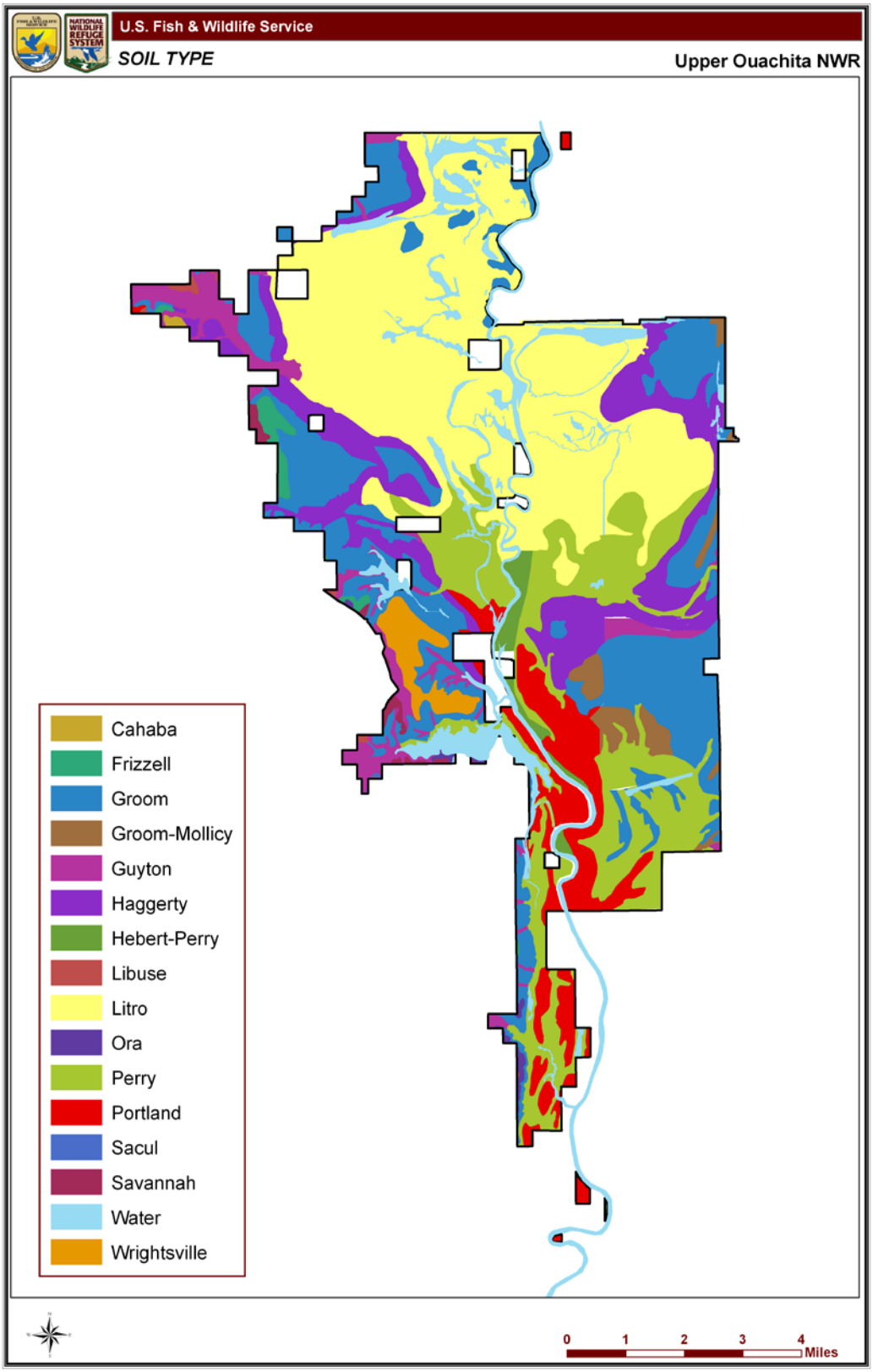

Figure 5. Soil types present on Upper Ouachita NWR.

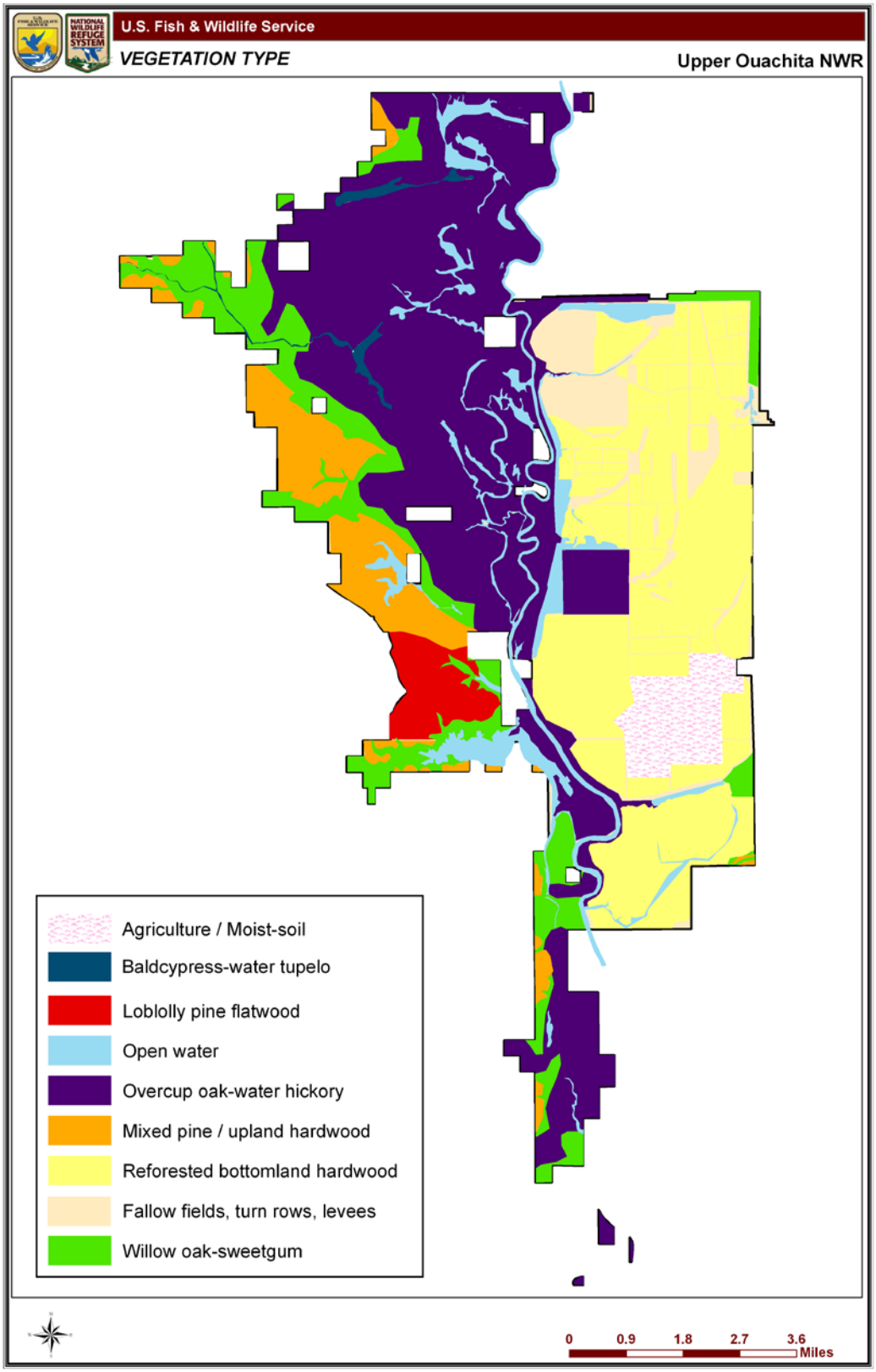

Figure 6. Vegetation types present on Upper Ouachita NWR.

3.0 RESOURCES OF CONCERN

3.1 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 include species, species groups, and/or communities that support refuge purposes as well as FWS trust resource responsibilities (including 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, restored on a refuge (601 FW 3.10B[1]).

Resources of concern for Upper Ouachita 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; recovery plans for threatened and endangered species; and previously approved refuge resource management plans as identified in the Comprehensive Conservation Planning Process policy [602 FW 3.4C[1][e]) as well as Section 1.3 of this HMP. The species/communities selected as resources of concern from these plans support the following NWRS mandates:

- Support refuge purposes and the NWRS mission;
- conserve biological integrity, diversity, and environmental health (giving special consideration to rare, declining or unique natural communities, species, and ecological processes within the refuge boundary and the West Gulf Coastal Plain); and
- fulfill FWS trust resource responsibilities

Resources of concern identified for Upper Ouachita NWR include:

- Wintering waterfowl and breeding wood ducks
- Forest interior songbirds
- Rafinesque's big-eared and southeastern bats
- Upland hardwood forest
- Red-cockaded woodpeckers
- Louisiana black bears

3.1.1 Wintering Waterfowl

Upper Ouachita NWR is located in the Mississippi Flyway, which is a critical ecoregion for migrating and wintering dabbling ducks, wood ducks, and geese in North America (Reinecke *et al.* 1989), as well as southern breeding populations of wood ducks. Until step-down objectives for the WGCP become established, Upper Ouachita NWR was given the MAV step-down objective of 563 acres (780,318 duck-use days) of moist-soil habitat and 118 acres of unharvested rice (3,464,952 acres) by the LMVJV (USFWS 2005). The refuge attracts tens of thousands of mallards, teal, gadwall and wood ducks during the winter. Waterfowl utilize not

only the moist soil habitat and agricultural fields but also the bottomland hardwood forest on the refuge. Davis *et al.* (2008) found that female mallards spent the majority of their time in bottomland hardwood forest, much more so than in moist soil habitat, on Upper Ouachita NWR, underscoring the importance of these forests to wintering waterfowl.

3.1.2 Breeding Wood Ducks

Wood ducks are year round residents in the forest lands of the United States, including Upper Ouachita NWR. Although wood duck numbers declined to drastically low numbers in the early 20th century due to market hunting, liberal hunting seasons, and habitat loss, today wood duck populations appear stable (Dugger and Fredrickson 2001). However, our grasp on the population status of this species is shaky. Population estimates are inaccurate due to aerial surveys being ineffective in forested habitats. Wood ducks rank high among species harvested in the Mississippi flyway and are popular with hunters, especially when other waterfowl species are not present in large numbers (Dugger and Fredrickson 2001).

Because wood ducks depend upon forested wetlands for breeding and wintering habitat (Dugger and Fredrickson 2001), Upper Ouachita NWR has the opportunity to provide excellent habitat for breeding wood ducks. The Wildlife and Habitat Review (USFWS 2005) for Upper Ouachita NWR suggests wood ducks are an important resource of the refuge.

3.1.3 Forest Interior Songbirds of Bottomland Hardwoods

Due to the loss of approximately 80% of the bottomland hardwoods in the Lower Mississippi River Alluvial Valley (Tiner 1984), Upper Ouachita NWR can play an important role in providing bottomland hardwood habitat for forest interior songbirds. Over 19,000 acres of such habitat in a largely forested landscape are available on the refuge. The LMVJV (2007) considers forest interior songbirds that utilize bottomland hardwood forests a priority resource, particularly Kentucky, Swainson's and cerulean warblers. Priority Partners in Flight species in the WGCP are listed in Section 1.4.

3.1.4 Rafinesque's Big-eared Bat and Southeastern Bat

Bottomland hardwood systems seem to be important to Rafinesque's big-eared bat (Clark 1990; Clark *et al*. 1998; Cochran 1999) and southeastern bats (Cochran 1999; Hoffman 1999) as both roosting and foraging habitat. Due to the loss of approximately 80% of the bottomland hardwoods in the Lower Mississippi River Alluvial Valley (Tiner 1984), both bat species have probably been negatively affected. Declines in numbers of southeastern bats (Harvey *et al*.,1999) might be due to the loss of bottomland hardwood forests, and Rafinesque's big-eared bats populations might be declining in Arkansas (Cochran 1999). Both species are

designated federal species of concern (Martin *et al.* 2002) and southeastern bats are a state species of concern (Lester *et al.* 2005).

Again, the opportunity exists for Upper Ouachita NWR with its extensive bottomland hardwood forest to provide important habitat for these two species of bats. Furthermore, known roost locations have been found on the refuge for both species (Rice 2009).

3.1.5 Upland Hardwood Forest

Upland hardwood forests in Louisiana are a threatened community, given an S3/S4 rank (Lester *et al.* 2005). The primary threat to these forests is conversion to pine plantation. Little focus has been given to this declining community due to it not being a wetland habitat in an area where wetlands are given primary attention. Timber companies and private landowners have been stripping away upland hardwoods in favor of the more profitable loblolly pine. Pine monocultures lack the species and structural diversity of an upland hardwood forest.

Upper Ouachita NWR still has small remnants of intact mature upland hardwood forest. The refuge has the opportunity to provide this declining habitat type that may in the future be gone. Areas outside of the loblolly pine flatwoods/red-cockaded woodpecker habitat present the opportunity for upland hardwood management.

3.1.6 Red-cockaded Woodpecker

Red-cockaded woodpeckers, a federally endangered species, are found in small numbers on the west side of the refuge within the loblolly pine flatwoods. They were chosen as a resource of concern because of their conservation status and they are a trust species. Currently, there is only one active group on the refuge. The RCW Recovery Plan has a goal of one group listed for Upper Ouachita NWR (USFWS 2003). Four recruitment clusters are managed in addition to the active cluster on 1,100 acres of loblolly pine flatwoods. This population is within 11 miles of the Felsenthal NWR population and 6 miles of the Plum Creek population on the other side of the Ouachita River.

3.1.7 Louisiana Black Bears

The Louisiana black bear, a federally threatened species, has increased in numbers on the refuge over the past several years. This is mostly due to black bear re-introduction into Felsenthal NWR from White River NWR in Arkansas. Although the black bears in Arkansas are not listed, as soon as a bear crosses into Louisiana, it is considered threatened because of similarity in appearance. The black bears re-introduced into Felsenthal NWR are within 20 miles of Upper Ouachita NWR and many of the radio-collared females have been tracked onto the refuge. Currently, there is not a breeding population of black bears on the refuge; however, occasionally a collared female dens on the refuge. It is expected the population will

continue to grow because the habitat is suitable. The Louisiana Black Bear Recovery Plan does not specifically address Upper Ouachita NWR and no critical habitat has been designated for the refuge. Habitat will be managed for the benefit of Louisiana black bears, hopefully contributing to the breeding population in the future.

3.2 Habitat Requirements of Resources of Concern

3.2.1 Wintering Waterfowl

Upper Ouachita NWR is considered to be located within the West Gulf Coastal Plain (WGCP). Until step-down objectives for the WGCP become established, Upper Ouachita NWR was given the MAV step-down objective of 563 acres (780,318 duck energy days) of moist-soil habitat and 118 acres of unharvested rice (3,464,952 duck energy days (DEDs)) by the LMVJV (USFWS 2005). North American waterfowl have seasonally dynamic life-cycle needs that are fulfilled by use of a diversity of habitats and foods throughout their annual range, which, for most species, is continental in scale in contrast to resident wildlife. Indeed, habitat (*both* its quantity and quality) is the primary template for ecological strategies of waterfowl (and all wildlife) and a critical determinant of their survival and productivity. Hence, sustaining viable and harvestable populations of waterfowl depends on conservation and management of habitats throughout the Flyways of North America. Concerning wintering habitat, dabbling ducks need a diversity of wetlands including the following: (1) natural wetlands (both moist soil and bottomland hardwood forest), (2) flooded crop land, and (3) refuge (i.e., sanctuary) (Reinecke *et al.* 1989).

Two natural wetland habitats that ducks have used historically in the Mississippi Delta are bottomland hardwood forests and moist-soil habitats (i.e., early successional grass-sedge and other herbaceous vegetated wetlands). These natural wetlands are critical foraging and resting habitats. Both hardwood bottomlands and moist-soil habitats are rich in high-energy natural seeds (e.g., acorns in oak bottomlands; grass-sedge seeds, roots, tubers, etc. in moist-soil areas) and aquatic invertebrates. Trees significant as acorn producers are members of the red oak family, chiefly Nuttall oak, willow oak, water oak, and cherrybark oak. Soft mast important to ducks includes pecans, tupelo, elms, and ashes. Invertebrates associated with the litter layer in forests provide an invaluable food source for waterfowl (Heitmeyer 1988). Several species of waterfowl heavily utilize flooded forested habitat in winter for resting and foraging for acorns, other fruits, various seeds, and invertebrates. Wood ducks seek these habitats almost exclusive of other habitats. Mallards, gadwall, and wigeon all utilize flooded forested habitat as one of the complex of preferred habitats (Fredrickson and Heitmeyer 1988). These areas are vital to waterfowl for pair bonding, loafing, sanctuary, thermal cover and feeding (Reinecke *et al.* 1989). Ducks like openings in the woods to allow them easy access. Small groups of trees (3-5) that dominate canopy coverage can be removed to provide the openings that ducks prefer for landing (USFWS 2005).

Moist-soil habitats historically occurred in bottomland hardwood forests where openings created by disturbance allowed sunlight to reach the ground floor. Native plants such as smartweed, millets, and others provide a wide array of basic nutritional components for waterfowl. Most research has focused on estimating seed production and studies have shown that, under intensive management, species of barnyard grass (*Echinochloa* spp.), sprangletop (*Leptochloa* spp.), flatsedge (*Cyperus* spp.), smartweed (*Polygonum* spp.) and panicum (*Panicum* spp.) can produce more than a 1,000 lbs/ac of seed (Fredrickson and Taylor 1982). However, we know far less about production that might be occurring under current conditions in the Lower Mississippi Valley. Reinecke *et al.* (1989) suggested an average of 450 kg/ha (400 lb/ac) of seed might be reasonable because of site and staff limitations. More recently, the LMVJV Waterfowl Working Group used available moist-soil seed estimates of nearly 500 pounds per acre reported by Kross (2006) to increase the value of this habitat to 1,883 DEDs per acre. Regardless of the quantity of seed produced, moist-soil impoundments are highly recommended as a means of diversifying habitat (Fredrickson and Taylor 1982, Reinecke *et al*. 1989) and supplying food with nutrients not generally available in agricultural grains. Dabbling ducks, such as mallards, teal, gadwall, and pintails, prefer foraging in water depths of 0.5 to 12 inches, and foods covered by more than 18 inches of water are inaccessible to ducks (Strader and Stinson 2005). Migrating and wintering waterfowl concentrate in the Mississippi Alluvial valley from September through early April (Strader and Stinson 2005); therefore, the refuge will provide habitat during this critical period.

Only 20% of bottomland hardwood forests remain today (Tiner 1984). Due to significant landscape level loss of natural wetlands, farming for waterfowl is extremely important. Because waterfowl populations today are unable to acquire all of their nutritional requirements from natural wetlands, high carbohydrate crops provide vital energy to sustain ducks throughout the winter. High-energy foods such as corn, rice, milo, and millet are critically important to waterfowl during cold periods and for migration and subsequent reproduction. Nesting dates and clutch size are thought to be directly correlated with the amount of nutrition obtained on the wintering grounds (Ringelman 1990).

Waterfowl need sanctuary from human disturbance. Winter is an important season in the life of waterfowl. It is a biological preparatory period during which many ducks and geese pair and perform other life functions (e.g., females of some species [e.g., mallard] undergo a prebasic molt to acquire their breeding-season plumage) in readiness for reproduction. Disturbance-free habitat enables some species of waterfowl to prepare biologically for spring migration and reproduction (Reinecke *et al.* 1989, Strickland and Tullos 2009). Disturbance can interrupt resting and feeding bouts resulting in a loss of energy and lowering of body weight (Henry 1980; Heitmeyer and Raveling 1988; Kahl 1991). In Louisiana, Paulus (1984) found that increased foraging time by gadwalls was insufficient to counterbalance disturbance factors.

3.2.2 Breeding wood ducks

Preferred habitats include forested wetlands, wooded and shrub swamps, tree-lined rivers, streams, sloughs and beaver ponds. Wood ducks seek food in the form of acorns, other soft and hard mast, weed seeds and invertebrates found in shallow flooded timber, shrub swamps and along stream banks. They loaf and roost in more secluded areas and dense shrub swamps (Dugger and Fredrickson 2001).

Wood ducks are cavity nesters, seeking cavities in trees within a mile of water. Brood survival is higher in situations where nests are close to water. Due to the loss of forested wetlands and competition for nest sites from a host of other species, natural cavities are the primary limiting factor to reproduction. Nest boxes are commonly used to supplement natural cavities and increase local production of wood ducks. Box programs are not an end to all nesting problems. They require time to clean and repair at least annually. Production can be increased by more frequent checks and cleaning of boxes, but this must be weighed with other time constraints.

Recent guidelines, entitled "Increasing Wood Duck Productivity: Guidelines for Management and Banding, USFWS Lands (Southeast Region) 2003 (update)" by the Division of Migratory Birds, provide direction for the use of Wood Duck nest box programs on refuges. Boxes should be placed in, or adjacent to, good brood habitat in areas where they are not subject to flooding. It is critical that boxes have functional predator guards and are checked and repaired annually; otherwise, boxes are considered traps for the hen and her clutch. Conical predator guards should be maintained on all of the boxes to more effectively keep rat snakes from climbing into the boxes. Some reports indicate that, if rat snakes learn there is a meal of eggs in the nest box, it becomes very difficult to exclude them from the boxes. If boxes cannot be properly maintained, they should be boarded up until sufficient effort can be put toward operating an effective nest box program. Cleaning the boxes after the initial peak of nesting (about mid-April) will significantly improve annual production if competition for nest sites increase.

Adequate brood habitat can seriously affect duckling survival and reproductive success. McGilvrey (1968) described preferred brood habitat as 30 to 50% shrubs, 40 to 70% herbaceous emergents and 25% open water. Overhead cover within 1 to 2 feet of the water surface is vital for wood duck broods. Optimum habitat should have 75% cover and 25% open water, with a minimum of 1/3 cover to 2/3's open water. Placement of boxes in or adjacent to good brood cover will significantly improve duckling survival to flight age.

Wood ducks depend heavily on acorns during winter, even up to 75% of their diet (Dugger and Fredrickson 2001). During the spring, an increase in animal foods can be seen in both sexes. Aquatic insects become an important part of the egg-laying female's diet (Dugger and Fredrickson 2001).

3.2.3 Forest Interior Songbirds

Priority species such as Swainson's, hooded and Kentucky warblers and white-eyed vireos require dense understory growth (Rich *et al*. 2004), 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). Timber 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% 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. Timber harvest can have negative effects on canopy dwelling and forest interior songbirds (Pashley and Barrow 1993) when forest are fragmented. Nest parasitism by brown-headed cowbirds and predation can occur at higher rates in fragmented forests (Brittingham and Temple 1983). Norris *et al.* (2009) found that individual selection and group selection harvests benefitted most avian species in a bottomland hardwood forest in Louisiana.

Both Acadian flycatchers and tree fall gap species such as the Kentucky, Swainson's, and hooded warblers utilize Upper Ouachita NWR; however, Acadian flycatchers and prothonotary warblers are detected during landbird surveys at much higher rates (USFWS *unpub. data*). The refuge is currently in a mid-successional, closed canopy condition which causes a very sparse understory. Because most bottomland hardwood forests are in this condition (LMVJV 2007), the refuge should work to provide a more structurally diverse forest. However, even with heavy timber thinnings, the local flooding regime suppresses understory growth to some extent and will always be a management constraint.

The management challenge, of course, is to provide the correct balance of closed canopy forest and harvested stands that allow for denser understory growth. Fortunately, the LMVJV (2007) has already incorporated the different needs of forest interior songbirds along with other priority wildlife species (i.e. bears, bats, waterfowl) into the desired forest guidelines for bottomland hardwood forests. These guidelines recommend reduction in canopy cover, retention of snags and den trees and increase in understory vegetation. Twedt and Somershoe (2008) conducted a study on nearby Tensas River NWR to test the effects of selective harvesting that followed the LMVJV guidelines on priority forest birds. They found that the priority species Eastern wood-pewee, Kentucky warbler, orchard oriole, red-headed woodpecker, white-eyed vireo, hooded warbler and Swainson's warbler were present in higher densities in thinned stands than unthinned. There was not a significant difference in densities of prothonotary warblers between the two treatments. Densities of Acadian flycatchers were less in treated stands than in untreated; however, they were present in treated stands and overall remained one of the most abundant species in the forest.

Forest interior songbirds partially conflict in habitat needs with wintering waterfowl. The management of moist soil for waterfowl in a forested landscape could increase the

brood parasitism rate by brown-headed cowbirds and predation rate of songbirds by fragmenting forests (Brittingham and Temple 1983, Robinson *et al*. 1995). The biological review (USFWS 2004) suggested monitoring the amount of forest within a 75,000-acre landscape centered on the refuge. If the amount of forest declined below 75%, the review team recommended studying the productivity of priority bird species to determine if the moist soil management is having a deleterious effect. Currently, the landscape is 80% forested; therefore, no avian productivity research has been initiated.

3.2.4 Rafinesque's Big-eared Bat and Southeastern Bat

Rice (2009) conducted research on both Rafinesque's big-eared bat and southeastern bat on Upper Ouachita NWR. All but two of the 33 roost trees of both bat species on the refuge were found in water tupelo (*Nyssa aquatica*) (Rice 2009). All 44 roost trees of both bat species on nearby D'Arbonne NWR were also found in water tupelo (Gooding and Langford 2004). Water tupelos apparently are important roost trees for these species (Mirowsky and Horner 1997, Clark *et al*. 1998; Cochran 1999, Hoffman 1999; Hofmann et al. 1999, Gooding and Langford 2004, Rice 2009), although they have been found to utilize other tree species such as black gum (*Nyssa sylvatica*) (Mirowsky and Horner 1997), swamp tupelo (*Nyssa nigra*) (Hobson 1998), baldcypress (*Taxodium distichum*) (Clark 1990), water hickory (*Carya aquatica*) (Hoffman 1999), American beech (*Fagus grandifolia*) (Mirowsky and Horner 1997), sycamore (*Platanus occidentalis*) (Clark 1990), and others.

Large diameter trees with large interior cavities within mature bottomland hardwood forests have been found to be important to both bat species (Gooding and Langford 2004, Rice 2009). Management should be directed towards retention of large snags, promotion and regeneration of baldcypress/tupelo stands (Table 3), and management for mature bottomland hardwood forests (LMVJV 2007). During the Biological Review, it was made mention that fire could possibly be the agent that produced basal cavities in the water tupelo stand on the refuge (USFWS 2004). Fire may have been the cause; however, *Nyssa* species tend to develop heart rot and form cavities (Burns and Honkala 1990, Mirowsky and Horner 1997). One would also expect if a historic fire was the agent that the direction of the cavity openings would be similar; however, the aspect of 44 bat roost cavities was not found to be significantly different from random (Gooding and Langford 2004). No young tupelo stands exist on the refuge to manage experimentally with fire.

Table 3. Baldcypress and tupelo old-growth attributes (modified from Devall 1998)

Species	***Attribute***	***Reference***
	Stand Density	
Baldcypress	≥ 1 in d.b.h. target 240 live trees /ac	Hall and Penfound 1939
Tupelo	> 10 cm d.b.h. target 7-12 live trees/ha	Martin and Smith 1991

	d.b.h. of largest trees	
Baldcypress	35- 60 in	Sargent 1965, Harlow and Harrar 1969
Tupelo	25- 48 in	Martin and Smith 1991, Sargent 1965
	Stand basal area	
Baldcypress	33.5 ft^2/ac	Hall and Penfound 1939
Tupelo	30 ft^2/ac	
	Height	
Baldcypress	100-120 ft	Harlow and Harrar 1969
Tupelo	80-90 ft	Harlow and Harrar 1969
	Need several standing snags and downed logs of baldcypress and tupelo	Martin and Smith 1991

3.2.5 Upland Hardwood Forest

Upland hardwood forest in this Plan is used to describe those habitats that are not subject to flooding where pine is not the dominant overstory species. Lester *et al.* (2005) describe this type of community as a hardwood slope forest. These forests were estimated to have occupied 100,000 to 500,000 acres historically with only 25-50% remaining today (Smith 1993).

In hardwood slope forest, canopy dominants are American beech (*Fagus grandifolia*), water oak (*Quercus nigra*), white oak (*Q. alba*), swamp chestnut oak (*Q. michauxii*), sweetgum (*Liquidambar styraciflua*), mockernut hickory (*Carya tomentosa*), cherrybark oak (*Q. pagodifolia*), black gum (*Nyssa sylvatica*) and southern red oak (*Q. falcata*). Understory and midstory associates include silverbell (*Halesia dipteral*), bigleaf snowbell (*Styrax grandifolia*), sweetleaf (*Symplocos tinctoria*), flowering dogwood (*Cornus florida*), black cherry (*Prunus serotina*), ironwood (*Carpinus aroliniana*), holly (*Ilex americana*), Elliott's blueberry (*Vaccinium elliottii*), hoary azalea (*thododendron canescens*), witch hazel (*Hamammelis virgini*), huckleberry (*Vaccinium arboretum*), eastern hophornbeam (*Ostrya virginiana*), and service-berry (*Amelanchier arborea*). Herbaceous plants found in this community type include broad beech-fern (*Phegopteris hexagonoptera*), Christmas fern (*Polystichum acrostichoides*), jack-in-the-pulpit (*Arisaema spp.*), violets (*Viola spp.*), and may-apple (*Podophyllum peltatum*).

The primary threat to this community is invasion by invasive species, particularly Chinese tallowtree, Chinese privet and Japanese climbing fern. On private lands,

conversion to pine plantation is another major problem. However, on the refuge, focus should be on promoting biological integrity, environmental health and diversity by maintaining a high diversity of native plant species and by minimizing invasive species.

3.2.6 Red-cockaded Woodpecker/Loblolly Pine Flatwoods

The red-cockaded woodpecker (RCW) is confined to old pine stands in the southeastern United States. This species evolved in a fire-maintained ecosystem and consequently prefers open, park-like pine stands with little or no hardwood midstory and herbaceous groundcover (USFWS 2003). These woodpeckers excavate only live pine trees that are 75 years or older and usually have been infected with heartwood fungus. Habitat loss from development and fire suppression are the primary cause of their endangerment (USFWS 2003). In north Louisiana where longleaf pine does not grow, red-cockaded woodpeckers historically existed in loblolly pine flatwoods and shortleaf pine forests.

After researching General Land Office records, reviewing soil and geological maps, and consulting with botanist Tom Foti of the Arkansas Natural Heritage Program, it was determined that loblolly pine flatwoods are the habitat type that exists on the west side of the refuge where the red-cockaded woodpeckers clusters are present. Mr. Foti explained that catastrophic events, such as tornadoes, created openings where loblolly pine would come into a disturbed area. If that area burned regularly, then the loblolly overtook the hardwoods or if it burned frequently and intensely, shortleaf pine would overtake the loblolly. The land could stay in this state for a few hundred years, but eventually hardwoods would succeed. Hardwood trees would then remain in the stand until another catastrophe occurred causing disturbance which allowed loblolly to reestablish. If fire was frequent, loblolly would stay dominant and keep reestablishing itself. However lower, wetter areas would not have burned as frequently allowing hardwoods to establish. Therefore, these flatwoods contained both hardwoods and pine; but, the hardwoods were not regularly distributed but grew in patches where fire had not occurred. In a historical context these flatwoods were dynamic, changing spatially and temporally across the landscape due to the influence of disturbance, mostly fire (Tom Foti, *pers. comm.*, Ark. Nat. Heritage, USFWS 2004).

Based on this understanding of the historical conditions, objectives were then established in the CCP (USFWS 2008) to manage the loblolly flatwoods as close to historic conditions as possible, with emphasis on allowing prescribed fire to burn in a patchy way as opposed to ensuring a 100% burn across a unit. After consulting with Ecological Services, it was determined that red-cockaded woodpeckers could be managed within these objectives without violating RCW Recovery Plan guidelines. Good quality foraging habitat for red-cockaded woodpeckers is defined in the RCW Recovery Plan (USFWS 2004) as the following:

- $\geq$ 18 stems/acre of pines that are $\geq$ 60 years in age and 14 in. dbh. Minimum basal area of these pines is 20 ft^2/acre.
- Basal area of pines 10-14 in. dbh is between 0 and 40 ft^2/acre

- Basal area of pines < 10 in. dbh is < 10ft ^{2}/ac *and* < 20 stems/acre.
- Basal area of all pines ≥ 10 in. dbh is at least 40 ft ^{2}/acre
- Sparse to no hardwood midstory greater than 7-ft in height.
- Canopy hardwoods are less than 30% of the canopy trees.
- Groundcover is of fire-tolerant, herbaceous plants that cover > 40% of the ground and are dense enough to carry a growing season fire every 5 years.
- All of the above habitat is within 0.5 miles of the center of the cluster and preferably, 50% within 0.25 miles of the cluster center
- Foraging habitat is not separated by more than 200 ft of non-foraging areas which include hardwood forest, pine forests < 30 years of age, cleared lands, clear cuts, bodies of water, rights of way and roadways.

Historic characteristics of loblolly pine flatwoods would have met RCW Recovery Plan guidelines. This inherently makes sense due to the long-time presence of red-cockaded woodpeckers in north Louisiana and their evolution with fire-maintained ecosystems.

3.2.7 Louisiana Black Bears

Bears are opportunistic feeders and typically omnivorous (Pelton 2001). Large tracts of bottomland hardwood forest communities having high species and age class diversity typically provide for the foraging needs of Louisiana black bear. The Louisiana black bear diet varies seasonally, and includes primarily succulent vegetation during spring, fruits and grains in summer, and hard mast during fall (BBCC 2005). After den emergence in the spring, bears utilize remaining fat reserves (Pelton 2001) and may continue to lose weight while taking advantage of succulent vegetation and any protein rich food sources. Beetles and colonial insects found in rotting and decaying wood on the forest floor are heavily used in the spring (Benson and Chamberlain 2006) when other resources are limited. Soft mast, such as blackberries, grapes, mulberry, and paw-paw (Rogers 1976, Benson and Chamberlain 2006) become a primary food source during summer and forest openings, spoil banks, and open areas adjacent to forest areas therefore become a seasonally important habitat component. Food availability during late summer and fall is critical as bears enter a hyperphagic stage in preparation for winter dormancy and reproduction (Pelton2001). Extreme physiological need causes bears to forage extensively and sometimes travel great distances in search of the food needed (Pelton 2001). High energy hard mast (e.g. acorns, hickory nuts, pecans) is heavily used during this period (Pelton 2001, Benson and Chamberlain 2006). Agricultural crops may also be used if available (Benson and Chamberlain 2006).

Black bear reproductive success is closely associated with fall food availability. Cub mortality rates and female infertility are typically greater in single or successive years of poor mast production or failure (Rogers 1976, Elowe and Dodge 1989). During periods of food shortages bears range further in search of food, substantially increasing their chances for human encounters and human related mortality (Rogers 1976, Pelton 2001). This encumbers more risk in fragmented habitats with high interspersion of roads, development and human activity.

Prime black bear habitat is characterized by relatively inaccessible terrain, thick understory vegetation, abundant hard and soft mast foods, and den sites (BBCC 2005). Louisiana black bears den in heavy cover or tree cavities during winter (Weaver and Pelton 1994) and den type may vary depending on the habitat. Understory vegetation such as palmetto, green briars, black berry, dewberry and downed trees can provide important cover for Louisiana black bear. Dense understory that limits visibility provides escape cover and den sites (LMVJV 2007).

Habitat fragmentation can result in increased mortality as bears are forced to forage on less protected sites, travel farther to forage, or cross barriers such as roads (Pelton 2001). In a fragmented landscape, provision of high quality habitat with a mixture of habitat components and seasonal resource needs is increasingly important, so that individual bears can survive within smaller home ranges and limit exposure to potential mortality factors associated with travel between fragments (e.g. road crossings) and use of alternate habitats (e.g. agricultural fields, neighborhoods for human food) (BBCC 2005). Telemetry data on Louisiana black bear movements have demonstrated that habitat linkages should be considered in management plans intended to ensure Louisiana black bear population viability in fragmented habitats. (Weaver 1999).

Louisiana black bears generally enter dens in early December and emerge in mid-April (Weaver and Pelton 1994). They may remain somewhat active during this period and have been observed changing den sites and foraging, although home range sizes are greatly reduced (Weaver and Pelton 1994, Hightower *et al*. 2002). Although Louisiana black bear males and non-reproductive females can maintain limited activity during the den season, females bearing cubs are constrained to the den. Bears use trees, brush piles, and ground nests for denning (Weaver and Pelton 1994, Hightower *et al.* 2002). Ground dens can be vulnerable to flooding and so high spots protected from flooding may be an additional important site characteristic (Hightower *et al*. 2002). Large cavity trees are important for denning, with cavity trees of greater than 36” dbh considered potential den trees (USFWS 1992). Den trees are typically large bald cypress, although bears use other species such as overcup oak and American sycamore (Weaver and Pelton 1994). Ground nests are typically protected by thick ground cover and constructed against a backdrop such as a felled log, tree top, or base of tree (Weaver and Pelton 1994). Secure den sites are particularly important as young cubs will not survive if the adult female abandons the den due to disturbance.

4.0 HABITAT MANAGEMENT GOALS and OBJECTIVES

For habitats that require active management, goals and objectives were developed in the Refuge CCP, which are expanded upon or combined in this Plan to fulfill the refuge purposes. A habitat management goal is a broad, qualitative statement that is derived from the established purposes and vision for the refuge. Goals and objectives pertain to resources of concern identified in Section 3.0.

4.1 Bottomland Hardwood Habitat Goal

Restore, enhance, and maintain healthy, deciduous bottomland habitat to support a natural diversity of plant and animal species and foster the ecological integrity of the Lower Mississippi River Ecosystem.

- *<u>Objective 4.1.1</u>:*
  In Management Units1B, 2B, 3B, 4, 5, 6, 7B, 8, 9, 10, 11B, 13B, 14, 16, 17, 18, 19, 20, and 21implement adaptive management to maintain and work towards 35-50% of 20,407 acres of bottomland hardwood forest at any given time at a basal area of 60-90 ft^2/acre, for a canopy cover between 60-80 percent, 30-60 percent mid-story cover, 30-40 percent understory cover, and 20-50 percent ground cover, with regeneration of hard mast producing species (e.g., oaks and water hickory) present on 30-50 percent of inventory plots (LMVJV 2007)supporting CCP Objective: B-1)

  Resource of Concern: Forest interior songbirds, wintering waterfowl and breeding wood ducks, bats, Louisiana black bears

  Rationale: This objective will achieve a diverse forest with a thick understory, well developed midstory, and plenty of canopy dominants to produce hard and soft mast, provide snags, and regeneration. Forest interior songbirds and black bears benefit from the vertical structure provided. Wintering waterfowl, wood ducks, and bears benefit from the mast produced. Bats will be provided foraging and roost habitat.

  Adaptive Management Monitoring Elements:

1° Habitat Response Variables	Probable Methods
▪ Forest overstory structure and composition ▪ Forest mid- and understory structure ▪ Bottomland hardwood forest health and productivity for wildlife	▪ Forest cruise/inventory sampling (traditional parameters, e.g. BA, overstory CC, stocking, species composition, midstory cover) ▪ Annual hard mast survey
1° Wildlife Response Variables	Probable Methods
▪ Forest breeding bird species composition & abundance	▪ Breeding landbird survey (point counts)

- *Objective 4.1.2:*
  In Management Units1B, 2B, 3B, 4, 5, 6, 7B, 8, 9, 10, 11B, and 16, where regeneration is highly likely, maintain < 60 percent canopy cover on 5-10 percent of the bottomland hardwood forest at any point in time to allow regeneration of shade intolerant trees (e.g., sweetgum, nuttall oak, and willow oak), and leave 4 to 6 super-emergent trees per acre as a seed source (LMVJV 2007)supporting CCP Objective B-1)

  Resource of Concern: Forest interior songbirds, wintering waterfowl and breeding wood ducks, bats, Louisiana black bears

  Rationale: Promoting regeneration of the forest ensures the perpetuity of bottomland hardwood forest for resources of concern.

  Adaptive Management Monitoring Elements:

1° Habitat Response Variables	Probable Methods
▪ Forest overstory structure ▪ Area (acres) in condition ▪ Hardwood regeneration within target treated areas	▪ Forest cruise/inventory sampling (traditional parameters, e.g. BA, overstory CC, stocking) ▪ GIS stand maps & harvest records ▪ Regeneration sample plots
1° Wildlife Response Variables	**Probable Methods**
▪ Forest breeding birds (species composition & abundance)	▪ Breeding landbird survey (point counts)

- *Objective 4.1.3:*
  In Management Units1B, 2B, 3B, 4, 5, 6, 7B, 8, 9, 10, 11B, 13B, 14, 16, 17, 18, 19, 20, and 21maintain and work towards 2 to 4 logs/acre to provide coarse woody debris, 4 to 6 cavity trees >4" in dbh per acre, and 1 to 4 large den trees or "unsound cull" trees per 10 acres in bottomland hardwood forest to increase habitat for resident wildlife, such as amphibians, reptiles, bats, bears, and cavity-nesting birds (LMVJV 2007)supporting CCP Objective(s): B-1)

  Resource of Concern: Forest interior songbirds, breeding wood ducks, bats, and Louisiana black bears

  Rationale: Tree cavities are important for breeding wood ducks, bats, and some species of forest interior songbirds, such as prothonotary warblers and great crested flycatcher. Den trees and coarse woody debris are important to bears.

Adaptive Management Monitoring Elements:

1° Habitat Response Variables	Probable Methods
▪ Forest structure components (snag, CWD, cavities)	▪ Forest cruise/inventory sampling (including target parameters)
1° Wildlife Response Variables	**Probable Methods**
▪ Forest breeding birds (species composition & abundance) ▪ Reptile and amphibian community (species composition & abundance)	▪ Breeding landbird survey (point counts) ▪ Anuran call survey (3 times/year/every 3 years) ▪ Herpetofauna survey (1/x years, drift fence or cover board methods)

➢ *Objective 4.1.4:*
In Management Units1B, 2B, 3B, 4, 5, 6, 7B, 8, 9, 10, 11B, 13B, 14, 16, 17, 18, 19, 20, and 21 retain and enhance all baldcypress and water tupelo stands towards old-growth attributes including basal area >30 ft^2/acre, dbh > 25 inches, and > 80 feet tree height and in mixed hardwood bottomland habitat favor baldcypress and tupelo supporting CCP Objective: A-22).

Resource of Concern: bats and Louisiana black bears

Rationale: Bats such as Rafinesque's big-eared bat and southeastern bat roost in large trees, particularly water tupelo and baldcypress (Clark *et al*. 1998, Gooding and Langford 2004). Bears utilize hollow baldcypress and water tupelo trees for dens (USFWS 1992).

Adaptive Management Monitoring Elements:

1° Habitat Response Variables	Probable Methods
▪ Area (acres) is cypress/tupelo stands ▪ Tree size distribution within stand	▪ GIS stand maps (GPS stand edges 1/x years) ▪ Stand inventory (1/x years)
1° Wildlife Response Variables	**Probable Methods**
▪ Bat use of cavity trees	▪ Cavity checks (note high variability in response variable may limit interpretation)

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➢ *Objective 4.1.5:*
In Management Unit 15, starting in mid-August, flood some impoundments gradually to < 18" (Fredrickson 1991) and draw down no later than mid-June to provide wintering waterfowl habitat. Continue a staggered flooding and drawdown for all impoundments so that there will be new water at all times through the winter (supporting CCP Objective(s): C-1).

Resources of concern: wintering waterfowl

Rationale: Dabbling ducks prefer to forage in water less than 18 inches in depth (Fredrickson 1991). Water will be provided on different

impoundments at all times from August to April to provide for blue-winged teal migrations in spring and fall and wintering habitat for other species of dabblers. Stinson and Strader (2005) recognize that concentrations of waterfowl in the Mississippi Alluvial Valley occur from September through early April. The pumping of water in August should allow sufficient water to be available in September for blue-winged teal. An April drawdown will ensure water available for spring migrating teal and still allow for preferred plants to germinate including millet, smartweed and chufa (Stinson and Strader 2005).

Adaptive Management Monitoring Elements:

1° Habitat Response Variables	Probable Methods
▪ Water level by date	▪ Staff gauges (1/xdays)
1° Wildlife Response Variables	**Probable Methods**
▪ Wintering waterfowl use	▪ Waterfowl Counts (bi-weekly Sept15-Apr01)

➢ *Objective 4.1.6:*
Maintain and enhance one-half of the acreage in Management Unit 15 with a grass/sedge composition of 70-80 percent cover (e.g., sprangletop, panicum, millet, toothcup, smartweed, and Carex spp.), and keep non-desirables (e.g., coffeeweed and cocklebur) to less than 20 percent to support foraging habitat for wintering waterfowl to meet or exceed current LMVJV DED refuge step down objectives (780,000 DEDs for moist-soil) (Strader and Stinson 2005) (supporting CCP Objective(s): C-1).

Resources of Concern: wintering waterfowl

Rationale: Moist soil management will be directed towards managing for preferred foods by waterfowl.

Adaptive Management Monitoring Elements:

1° Habitat Response Variables	Probable Methods
▪ % herbaceous cover (desirable/non-desireable)	▪ Herbaceous cover plots (x samples/season)
1° Wildlife Response Variables	**Probable Methods**
▪ Wintering waterfowl use	▪ Waterfowl Counts (bi-weekly Sept15-Apr01)

➢ *Objective 4.1.7:*
In Management Unit 15, plant millet or rice to annually meet or exceed current LMVJV DED refuge step down objectives (3.5 million DEDs for unharvested crops) (supporting CCP Objective(s): C-1).

Resources of Concern: wintering waterfowl

Rationale: Foods that are high in carbohydrates, such as rice, millet, and

milo, are essential for providing the energy wintering ducks need to arrive on the breeding grounds in good condition (Ringelman 1990).

Adaptive Management Monitoring Elements:

1° Habitat Response Variables	Probable Methods
▪ Acres planted by crop	▪ GIS Mapping (annual records)
1° Wildlife Response Variables	**Probable Methods**
▪ Wintering waterfowl use	▪ Waterfowl Counts (bi-weekly Sept15-Apr01)

➢ *Objective 4.1.8:*
Maintain 7,844 acres (17 percent) of refuge as waterfowl sanctuary and use adaptive management for yearly regulations, delineations, and modificationssupporting CCP Objective(s): A-2).

Resources of Concern: wintering waterfowl

Rationale: Disturbance-free habitat enables some species of waterfowl to prepare biologically for spring migration and reproduction (Reinecke *et al.* 1989, Strickland and Tullos 2009). Disturbance can interrupt resting and feeding bouts resulting in a loss of energy and lowering of body weight (Henry 1980; Heitmeyer and Raveling 1988; Kahl 1991). In Louisiana, Paulus (1984) found that increased foraging time by gadwalls was insufficient to counterbalance disturbance factors.

Adaptive Management Monitoring Elements:

1° Habitat Response Variables	Probable Methods
▪ Area (acres) in sanctuary ▪ Level (frequency/degree) of disturbance events	▪ GIS mapping (annual records) ▪ Law Enforcement logs
1° Wildlife Response Variables	**Probable Methods**
▪ Wintering waterfowl use	▪ Waterfowl Counts (bi-weekly Sept15-Apr01)

4.2 Upland Pine-Hardwood Habitat Goal

Enhance and maintain a mixed coniferous and deciduous habitat that historically occurred on the uplands of the West Gulf Coastal Plain for indigenous migratory birds, species of concern, and other associated wildlife.

➢ *Objective 4.2.1:*
In Management Units 3A, 7A, 12, and 13A, maintain 3,231 acres with loblolly pine comprising 20-40 square feet and hardwoods comprising 80-120 square feet of the total basal area; hardwoods should have a high species diversity, including sweetgum, blackgum, swamp chestnut oak, water oak, cherrybark oak, southern red oak, post oak, white oak, mockernut hickory; with midstory species including

flowering dogwood, persimmon, eastern hophornbeam, ironwood, and hawthorne; with total basal area for pine and hardwoods at 120 square feet ± 10 square feet; and with an understory that is > 30% cover and includes woody shrub and vine species, such as American beautyberry, serviceberry, red buckeye, rusty blackhaw, sumac, Carolina Jessamine, blackberry, and poison ivy (supporting CCP Objective(s): A-21 and B-3).

Resources of Concern: Upland hardwood forest

Rationale: Upland hardwood forests are diverse in species and structure. Very little of this forest type still exists today in Louisiana due to conversion to pine plantation. The refuge has the opportunity increase biological integrity by managing for this habitat type.

Adaptive Management Monitoring Elements:

1° Habitat Response Variables	Probable Methods
▪ Forest overstory structure and composition ▪ Forest mid- and understory structure ▪ BLH health and productivity for wildlife	▪ Forest cruise/inventory sampling (traditional parameters, e.g. BA, overstory CC, stocking, species composition, midstory cover) ▪ Hard mast survey
1° Wildlife Response Variables	**Probable Methods**
▪ Forest breeding birds (species composition & abundance)	▪ Breeding landbird survey (point counts)

4.3 Species of Special Concern Goal

Contribute to the long-term protection and recovery of threatened, endangered, and species of special concern populations in Upper Ouachita Refuge and the Lower Mississippi River Ecosystem.

➢ *Objective 4.3.1*

In Management Units1A and 11A, provide minimum habitat for red-cockaded woodpeckers by maintaining according to red-cockaded woodpecker guidelines: (minimum basal area for pines ≥ 60 years in age and ≥ 14" in dbh at 20 feet/acre; basal area of pines 10-14 in. dbh is between 0 and 40 ft ^{2}/acre, basal area of pines < 10 in. dbh is < 10ft ^{2}/ac and < 20 stems/acre, basal area of all pines ≥ 10 in. dbh is at least 40 ft ^{2}/acre, canopy hardwoods < 30 percent of number of canopy trees; no or sparse hardwood midstory; and > 40 percent of ground and midstory plants are native bunchgrasses and native, fire-tolerant, fire-dependent herbs. This habitat should be within 0.5 miles of the center of the cluster and preferably, 50% within 0.25 miles of the cluster center and should not be separated by more than 200 ft of non-foraging areas which include hardwood forest, pine forests < 30 years of age, cleared lands, clear cuts,

bodies of water, rights of way and roadways. (USFWS 2004). (supporting CCP Objective A-21)

Resources of Concern: Red-cockaded woodpecker/loblolly pine flatwoods

Rationale: The RCW Recovery Plan states that the above parameters are characteristic of high quality habitat for red-cockaded woodpeckers (USFWS 2004).

Adaptive Management Monitoring Elements:

1° Habitat Response Variables	Probable Methods
▪ Forest overstory structure and composition ▪ Percent of hardwood cover in mid- and understory	▪ Forest cruise/inventory sampling (traditional parameters, e.g. BA, overstory CC, stocking, species composition, midstory cover) ▪ Fire effects monitoring plots (point intercept and cover plots for mid- and understory) ▪ Fire effect monitoring (annual photo points in each cluster)
1° Wildlife Response Variables	**Probable Methods**
▪ No. of Red-cockaded Woodpecker potential breeding groups ▪ Red-cockaded Woodpecker annual nest success	▪ Red-cockaded Woodpecker annual cluster activity checks (see RCW Recovery Plan) ▪ Surveys for new cavity trees (1/10years) (see RCW Recovery Plan) ▪ Red-cockaded Woodpecker nest checks (see RCW Recovery Plan)

5.0 HABITAT MANAGEMENT STRATEGIES

5.1 Moist Soil Management Strategies

5.1.1 Potential Strategies

Preferred moist-soil plants for foraging waterfowl are typically heavy seed producing annuals, such as wild millets, smartweeds, sprangletop, other grasses and sedges. Soil disturbance and moisture are critical for the production of these desirable plants. Failure to disturb the soil (i.e. disking) will allow the invasion of perennials, both herbaceous and woody, that out-compete annual plants and greatly reduce waterfowl food production. Therefore, it is critical that the moist-soil areas be maintained using whatever means available if the refuge is to meet its waterfowl foraging objectives (Strader and Stinson 2005).

Moist-soil habitat management generally requires active management of soil and hydrology to promote productive and diverse stands of moist-soil plants. Management actions include draw down timing and duration, mowing, disking or chemicals to keep units in early successional stages (Strader and Stinson 2005). These actions are used to maximize waterfowl food production and usage. Desirable moist-soil vegetation at Upper Ouachita NWR consists mostly of *Leptochloa*, *Echinochloa*, *Polygnum*, toothcup, and some *Cyperus* species.

Regarding flooding, drawdowns and flooding should be spaced out over time across the impoundments in order to provide habitat for shorebirds and waterfowl throughout fall and winter. This variable timing of drawdowns will also produce different moist soil plants. Some impoundments should be flooded from late July through early September to provide water for migrating blue-winged teal and shorebirds, and drawdown should be conducted no later than April 15th on any impoundment (Strader and Stinson 2005). Ideal depths for foraging dabbling ducks are less than 12 inches; if water depths exceed 18 inches, food will be out of reach (Strader and Stinson 2005).

5.1.2 Management Strategy Prescription

To meet Objectives 4.1.5 and 4.1.6 in Management Unit 15 for wintering waterfowl, the following strategies will be used to manage moist soil habitat:

- Every 2 years disk/mow impoundments (when sufficiently dry to drive tractor) to reduce succession by woody plants.
- Annually, place boards in water control structures in August-October to hold water or if not sufficient rainfall, pump water to achieve < 18 inches depth.
- Begin drawdown from Feb-June
- Monitor vegetation growth throughout the summer for percent cover of undesirable plants. If undesirables exceed 20% cover, manipulate vegetation through mechanical (mowing) or chemical (Section 5.2) means.
- Maintain records by date for water management actions, water elevations, vegetation and wildlife response.

- Use sampling techniques in Strader and Stinson (2005) to determine percent cover of plant species and seed production to determine if management actions need to be changed to meet objectives.

5.2 Chemical Management Strategies

5.2.1 Potential Strategies

The presence of exotics and invasive plant species can alter the function of ecosystems due to the loss of wildlife habitat, displacement of native species, change in carrying capacity from reducing native forage production, lower plant diversity, and increase soil erosion and soil sedimentation. These negative effects decrease the biological integrity, diversity and environmental health of the refuge; and therefore, require a management strategy that will control, and if possible, eradicate the exotic species.

Two invasive species are on the verge of significantly impacting the biological integrity of the refuge: Chinese tallow tree and Japanese climbing fern. Tallow tree is a small, fast-growing tree with high reproductive capability. The tree grows in a variety of habitats, is extremely invasive, and can form monoculture stands quickly. Japanese climbing fern is a fast-growing woody vine that can completely shroud everything in its path. It has the ability to kill trees directly by blocking sunlight and adds extra mass to trees acting as a sail, which causes uprooting during high winds. This species is a relatively new invader in the United States, and is now becoming widespread throughout Louisiana and the southeast. This fern is fairly dense in the uplands on the refuge and does not respond well to control methods. Both the tallow and climbing fern will not be eradicated from the refuge, but extensive measures should be made to control their spread. Other invasive species that the refuge has good opportunity to control with conventional methods are Chinese mimosa, royal palownia, Chinese privet, and chinaberry. All of these species have been found in both the uplands and bottomlands on the refuge.

Invasive plant control is a common management action for many national wildlife refuges, but is labor intensive and costly. Significant resources should be focused on determining the extent of each invasive species on the refuge and to controlling their spread. Successful control requires careful planning, implementation, and monitoring.

Chemical pesticides will be used primarily to supplement, rather than as a substitute for, practical damage control measures of other types. Whenever a chemical is needed, the most narrowly specific pesticide available for the target organism in question should be chosen, unless considerations of persistence or other hazards would preclude that choice (7 RM 14). All chemicals will be approved through the Pesticide Use Proposal process and will follow Integrated Pest Management Policy (569 FW 1).

The refuge has aggressively been treating exotic plants in the past few years. The mechanical removal of exotic trees has shown to be very ineffective due to stump sprouting and in the case of climbing fern, promoting its spread by machinery. Monitoring efforts have shown some chemicals to be more effective than others. The Global Species Invasive Database (http://www.issg.org/database/species/ecology.asp?si=999&fr=1&sts=sss&lang=EN) recommends using Rodeo for treatment of climbing fern, reporting an efficacy of 95% compared to 0% for Garlon 3A, Garlon 4, and Pathfinder II. The refuge has been using this technique for two growing seasons and has been seeing a 95% efficacy. Element 4 has been 97% effective against Chinese tallowtree using proper applications.

Management of the moist soil habitat in Management Unit 15 may require the use of chemicals periodically to control undesirable vegetation, such as red vine, buttonbush, *Sesbania*, etc.

Management of farming in Management Unit 15 will require the use of chemicals to farm rice, millet and/or milo to control competitive weeds, pests and/or fungus.

Although these chemicals have proven to be effective, the refuge is always striving for better methods. If over time, these chemicals are shown through monitoring to lose their efficacy, other chemicals will be tried through the adaptive management process.

5.2.2 Management Strategy Prescription

To meet all objectives in all Management Units for all resources of concern, the following strategies will be used to control exotic plants:

- Map new areas of infestation by exotics annually.
- Treat new or re-sprouted Japanese climbing fern with a foliar spray of Rodeo or other approved chemical once per year from May-October.
- Treat Chinese tallowtree, mimosa, chinaberry, royal palownia, Chinese privet, and other woody exotics once per year anytime except during leaf-out with 20% Element 4 with surfactant to trees > 8 in. dbh by cut-spray application. Treat trees < 8 in. dbh but taller than 5 ft, with basal spray application 12-18 in. from ground. Treat trees shorter than 5 ft with a foliar spray of 5% glyphosate.
- If current processes becomes ineffective, use adaptive management process to find more efficient ways of treating invasives.

To meet Objective 4.1.6 in Management Unit 15 for wintering waterfowl, the following strategies will be used to control undesirable vegetation in moist soil habitat:

- When red vine covers greater than 20% of management unit, treat with RoundUp after disking in late fall.
- When *Sesbania* covers greater than 20% of management unit, treat with 0.5 qts/acre of Blazer before plants flower and/or reach 3 ft in height.

- Other undesirable plants such as cocklebur and buttonbush are to be treated with 2-4D when coverage exceeds 20% of management unit.

To meet Objective 4.1.7 in Management Unit 15 for wintering waterfowl, the following strategies will be used to control undesirable vegetation and/or organisms while farming:

- Depending on crop, utilize those chemicals that have been approved through the PUP process.
- Spray chemical when target threshold has been achieved outlined in PUP

5.3 Prescribed Fire Management Strategies

5.3.1 Potential Strategies

Prescribed burns can be applied in multiple ways by varying the season and intensity of the burn. The intensity of the burn can be manipulated by using flanking, backing or head fires. Other variables that can affect the results of a burn include weather, fuel loads, fuel type, and fuel moisture.

Use of prescribed fire is the most cost-effective method of controlling mid-story hardwoods. To comply with the guidelines for management of red-cockaded woodpeckers, succession of pine stands toward a climax condition must be interrupted (USFWS 2004). If this action is not taken, habitat for this endangered species will deteriorate and eventually disappear. Moderate to high intensity from March to June on a 3 to 5 year cycle tend to control small diameter hardwoods, increase the amount of grasses, and promote other vegetative growth by increasing the amount of sunlight that reaches the forest floor (USFWS 2004). Annual growing season burns will significantly reduce or eliminate hardwoods over time and tend to promote the production of grasses. The RCW Recovery Plan calls for growing season burns to maintain RCW habitat. Dormant season fires are acceptable to reduce hazardous fuels when re-introducing fire and then growing season fires implemented thereafter (USFWS 2004).

Prescribed fire will be used in a way that mimics the natural wildfire fire as much as possible. As stated in Section 3.2.6, fires would not have burned as frequently in lower, wetter areas allowing hardwoods to establish. Therefore, these flatwoods contained both hardwoods and pine; but, the hardwoods were not regularly distributed but grew in patches where fire had not occurred. These flatwoods were dynamic, changing spatially and temporally across the landscape due to the influence of disturbance, mostly fire (Tom Foti, *pers. comm.*, Ark. Nat. Heritage, USFWS 2004). On Upper Ouachita NWR, prescribed fires will be applied to create a mosaic pattern. To mimic the patchiness of wet and drier areas based on soil and soil moisture, the loblolly pine flatwoods have been divided into three elevation categories that basically coincide with geomorphology. Elevation dictates how wet the areas are and thus, how often they would have burned historically. Also, while timber types have been altered by man over the past two hundred years, elevation

has been unchanged (USFWS 2008). Fire management will be applied according to protocols established in the Fire Management Plan (2010).

5.3.2 Management Strategy Prescription

To meet Objective 4.3.1 in Management Units 1A and 11A for red-cockaded woodpeckers, the following strategies will be used:

- Unit 1A and 11A should be burned every 1-3 years during the growing season using backing and flanking fires to allow slow, low intensity burns. The fire should be allowed to burn patchy without efforts made to re-light areas not burned. RCW trees should be raked around and backfired to prevent trees burning.

5.4 Beaver and Feral Hog Management Strategies

5.4.1 Potential Strategies

Beavers have the potential to significantly adversely affect bottomland hardwood forests by damming sloughs and brakes (Mahadev *et al.* 1993). Forests inundated into the growing season quickly show signs of stress and trees eventually die. Beavers also kill trees by girdling and felling. One study in Mississippi showed beavers on average damaged $164/ac (1985 values) of timber by girdling and felling (Bullock and Arner 1985).

Historically, beaver numbers were controlled by trapping for the demanding fur trade. In the 1980s, annual harvests exceeded 1 million beaver pelts across the nation (Hill 1982). Recently due to cultural and societal changes, furs are not in demand and therefore, little trapping is conducted causing beaver numbers to be high (Hill 1982).

Methods for control include removing beaver dams manually, with heavy equipment or by explosives and trapping and shooting by Service employees. Dams that are small enough to remove by hand within an hour will be removed manually. Also, when trapping, dams will be broke by hand to provide locations for trap sites. If a dam is so large it cannot be removed manually within an hour, it can either be removed by machinery or explosives. If the surrounding area is too wet to use heavy equipment such as an excavator, then explosives can be used. Explosives are used only by certified employees and all state and local laws are followed.

Feral hogs are one of the most invasive, destructive, exotic species in North America. Hogs compete with turkeys, deer, and squirrels for mast (Seward *et al*. 2004). Hogs depredate birds and their nests, reptiles and amphibians, and deer fawns (Hellgren 1993). The rooting of hogs causes widespread damage to ecosystems including plant trampling, spread of exotic plants, erosion, and water pollution (Mungall 2001). Feral hogs are known to carry brucellosis and pseudo rabies, both of which can be transmitted to native wildlife and humans (Witmer *et*

al. 2003). Because they are prolific, hog populations grow at an explosive rate (Seward *et al.* 2004).

Methods for control/eradication include trapping and shooting by Service employees.

5.4.2 Management Strategy Prescription

To meet Objectives 4.1.1, 4.1.2, 4.1.3, and 4.1.4 in Management Units1B, 2B, 3B, 4, 5, 6, 7B, 8, 9, 10, 11B, and 16 for bats, bears, breeding wood ducks, wintering waterfowl and forest interior songbirds, the following strategies will be used to control beaver damage in bottomland hardwood forest:

- When water recedes in spring/summer, inspect refuge for areas where water is not draining, including all areas known to have beaver dams in the past
- GPS locations of all beaver dams for future reference
- Determine best method for removal of located dams and remove immediately.
- During winter when refuge is flooded, remove beavers
- If time permits, set traps for beavers

To meet all objectives in all management units for all resources of concern, the following strategies will be used to control feral hog damage:

- Remove all hogs at every opportunity by using trapping and shooting by Service employees.

5.5 Forest Management Strategies

5.5.1 Potential Strategies

In this section, the methods and procedures for implementing strategies to harvest timber are specified. This Plan now incorporates what was formerly considered the Forest Management Plan.

The purpose of the forest habitat management strategy is to establish and maintain the desired forest conditions specified in the objectives (Section 4.0). Both commercial and non-commercial silvicultural treatments can be utilized to produce the desired forest conditions. Commercial timber harvest operations are more economical and will be used to meet the forested habitat objectives of the refuge. The cost to the refuge associated with non-commercial treatments is higher than commercial treatments in terms of manpower and funding. However, non-commercial treatments will be used when commercial operations cannot meet refuge objectives and sufficient funding is available. Forest management strategy details associated specifically with administration of commercial application of timber removal are addressed in Section 7.0.

A combination of silvicultural methods will be utilized to meet the uneven-aged forest management objectives described in the refuge CCP/HMP for bottomland hardwood forest. The silvicultural methods are:

1. Thinning - Intermediate cuttings that are aimed primarily at controlling the growth of stands by manipulating stand density. The objective of thinning on the refuge will be to open the forest canopy, release trees from competition, improve regeneration, and improve species composition within a stand.

2. Single-Tree Selection - Removal of a single mature individual tree or small clumps of several such trees. Openings created with this method are generally about ¼ acre in size. This is an uneven-aged silvicultural method that will allow for the development of a new age class of trees within the forest structure. This method favors the regeneration and development of plant species with higher shade tolerances.

3. Group-Selection - Removal of trees from a stand in groups to create openings in the forest canopy. These openings are generally about ½ acre in size. The increased size of the openings will encourage the regeneration of more shade intolerant plant species such as sweetgum, red oaks, pecan, green ash, etc.

4. Patchcuts - Patchcuts are small clearcuts that vary in size from 1 to 3 acres. Dependent upon the shape of the patchcuts, forest openings of this size will eliminate the effects of shading throughout most of the opening. This will benefit the regeneration of even the most shade intolerant plant species. A few cavity trees may be left within each patchcut to provide perches and nest locations for some bird species. Patchcuts will provide small areas of even-aged forest scattered across an uneven-aged forested landscape that will benefit many species that need even-aged stand conditions to regenerate successfully such as sweetgum, red oaks, cottonwood, sycamore, pecan, etc.

5. No Cut – This method would be equivalent to passive management. Areas under this management would be left to grow without silvicultural manipulations. The bottomland forest guidelines (LMVJV 2007) recommend 5-35% of the forest to be passively managed. Although no entire management unit will be passively managed in this Plan, patches of pure baldcypress and water tupelo within stands will not be cut. Baldcypress brakes are throughout the refuge and comprise more than 5% of refuge acres.

A combination of silvicultural methods will be utilized to meet the even-aged and uneven-aged forest management objectives described in the refuge CCP/HMP for upland hardwood and pine flatwood forest. The silvicultural methods to be used are:

1. Thinning - Intermediate cuttings that are aimed primarily at controlling the growth of stands by manipulating stand density. The objective of thinning on the refuge will be to open the forest canopy, release trees from competition, improve regeneration, and improve species composition within a stand.

2. Single-Tree Selection - Removal of a single mature individual tree or small clumps of several such trees. Openings created with this method are generally about ¼ acre in size. This is an uneven-aged silvicultural method that will allow for the development of a new age class of trees within the forest structure. This method favors the regeneration and development of plant species with higher shade tolerances.

3. Shelterwood – The shelterwood methods will be used to regenerate pine stands, mainly for the perpetuation of red-cockaded woodpecker habitat. It is reliable in ensuring sufficient seed production and dispersal and uniform stocking of reproduction. Using this even-aged method, the pine stand would be thinned to within 25-40 square feet of basal area per acre up to 10 years prior to the final cutting. The selection of those trees to be left as seed trees depends on the existing species composition and the past seed productivity of the individual trees. As a rule, trees with a large number of cones have been good producers in the past. Two to three pine seed trees per acre will be left after the final cutting to provide nest sites and snags for future and additional seed for regeneration if needed.

The hydrology on the refuge greatly affects the vegetation type, structure and wildlife communities present. The natural flooding regime occurs anywhere from November to July, but generally the refuge is flooded to some extent between January and June. The bottomland hardwood forest on the refuge is limited in vertical structure and tree diversity due to flooding. Water present on stands late into the growing season restricts understory growth and the number of species that can tolerate such wet conditions. Management activities are limited to late summer and autumn when soils are drier. On occasion flooding can occur during late summer due to hurricane rains, which can and often will shut down timber harvesting operations. It is very possible and even likely that the order of entry schedule will become back logged due to those years when unusually high water precludes timber harvests.

5.5.2 Management Strategy Prescription

To meet all objectives on all units:

- The forester will cruise management units according to the entry schedule (Section 7.1) to assess conditions and a site and time specific forestry prescription (as per Section 7.1.1) will be written.
- Timber harvest operations can occur anytime of the year. However logging will be restricted to dry periods of the year to keep soil disturbance and damage to residual vegetation at a minimum.

- Permanent roads for commercial timber harvest operations will be limited to existing roads only. This will help reduce fragmentation of the habitat and limit disturbance to soil and plants throughout the refuge. Road edges that receive direct sunlight may provide substantial amounts of soft mast (fruit), where otherwise closed canopy forests make this important food source rare (Perry et al, 1999). Edge habitats along roads may be important for reasons stated above, but should still be limited because of concerns of increased predation and parasitism of bird nests (Robinson et al. 1995), and effects of roads on amphibian movements (Gibbs 1998, deMaynadier and Hunter 2000).
- Upon completion of prescribed timber harvest operations, each treatment area will be monitored the next year and every 5 years after to see if desired results of the management unit prescription have been met.
- To monitor the impact of timber management activities on migratory birds, a bird-monitoring program has been developed in cooperation with the Lower Mississippi Valley Joint Venture office.
- All forest management operations on the refuge will leave a 200-foot buffer along the banks of the Ouachita River.
- Logging is restricted to dry times of the year to reduce soil compaction and erosion potential. Logging access roads will be limited to existing woods roads left over from previous ownership whenever possible. New road construction will be kept to a minimum and must be approved by the refuge manager.
- The 200-foot buffer along major waterways and permanent water areas will help keep logging debris out of water channels. These buffer areas will also serve as filtration strips to reduce sediment loads that may be caused by logging activities. Treetops and other logging debris will be kept out of brakes and swales to minimize any impacts that logging activities may have on drainage. The number of crossings through swales and brakes will be kept at a minimum to prevent damage to the natural drainage of water. These crossings will be maintained and any structures, such as culverts, will be removed as soon as logging activities are completed.
- Loader sets are areas opened up by the logging contractor for the loading of forest products onto trucks. Loader sets usually range in size from ¼ to ½ acre in size and soil disturbance is greater in these areas than any other areas within the timber sale. In an effort to lessen the risk of soil erosion during wet periods in loader sets, these areas may be planted with winter grasses to serve as a temporary vegetative cover until normal vegetation has a chance to reclaim the site.
- Logging within the area of red-cockaded woodpecker clusters (200 feet from the nearest cavity tree) will be limited to August through February. Cluster areas will be indicated on sale area maps when appropriate.

Additional constraints on commercial timber management can be found in Section 7.0.

To meet Objective 4.2.1 in Management Units 3A, 7A, 12, and 13A for Upland Hardwood Forest, the following forest management strategies will be used:

- Determine present composition and canopy cover of pines and hardwoods, and percent cover and composition of understory cover
- Thin accordingly to meet parameters specified in Objective 4.2.1.

To meet Objective 4.3.1 in Management Units 11A and 1A for red-cockaded woodpeckers, the following forest management strategies will be used:

- Determine present composition and canopy cover of pines and hardwoods, and percent cover and composition of understory cover
- Thin accordingly to meet parameters specified in Objective 4.3.1.
- Timber management for RCW nesting and foraging habitat will be even-aged.
- Rotations intervals will be 100 years.
- Regeneration areas will be 25 acres or less with a minimum of 6-10 pines/acre retained.
- Regeneration cuts (seed-tree or shelterwood) will be placed and timed in such a way to ensure an even distribution of age classes across the landscape. This will guarantee the presence of old pine stands in perpetuity.

To meet Objectives 4.1.1, 4.1.2, 4.1.3, and 4.1.4 in Management Units 1B, 2B, 3B, 4, 5, 6, 7B, 8, 9, 10, 11B, and 16 for wintering waterfowl, breeding wood ducks, bats, bears, and forest interior songbirds within bottomland hardwood forests, the following forest management strategies will be used:

- Apply 1- to 3-acre patchcuts on 5 to 10 percent of management unit leaving 4 to 6 large trees per acre within the small clearcuts (LMVJV 2007).
- Apply thinnings bottomland hardwood forest to meet parameters specified in Objectives 4.1.1, 4.1.2, and 4.1.3 by reducing basal area by 40 to 50 percent with variable rate of removal throughout management units to allow significant sunlight penetration to the understory (LMVJV 2007).
- No timber removal or management in pure baldcypress and water tupelo stands. This would be a passive management strategy.
- Favor baldcypress in spots of regeneration.
- Conduct light thinning of small (14”) baldcypress trees when mixed in hardwood stands to create larger (24”) trees, and select thinning of hardwoods to release baldcypress to grow to old, large trees.
- Try to establish 2 to 4, 2-acre experimental aforestation plots of baldcypress/tupelo stands where possible to promote this rare, old-growth habitat.
- Favor retention of snags and cavity trees

5.6 Waterfowl Sanctuary Management Strategies

5.6.1 Potential Strategies

Sanctuary can be applied to waterfowl habitat in different ways. Sanctuary can mean that no public use is permitted in waterfowl habitat at any time or that no waterfowl hunting can occur but other public uses are permitted. Some refuges limit waterfowl hunting to only a certain number of days per week to limit disturbance to ducks. The size or percentage of waterfowl habitat that is sanctuary varies also. Sanctuary can be in moist soil habitat and/or in flooded bottomland hardwood forest. Strickland and Tullos (2009) recommend 20-25% of waterfowl habitat be in sanctuary to reduce disturbance. Sanctuary should be available in all habitat types, including moist soil, agriculture and bottomland hardwood forest (USFWS 2004).

Seventeen percent (7,635 acres) of the refuge is currently not open to waterfowl hunting. 4,635 of these acres consist of mature forest and open water in which other public uses are permitted. The remaining 3,000 acres consists of agriculture, moist soil and young reforested bottomland hardwoods, in which no public use is permitted from Sept 1 through Feb 28.

5.6.2 Management Strategy Prescription

To meet Objective 4.1.8 in Management Units 15, 20, 21, 5, 1B and 11B for wintering waterfowl, the following management strategies will be used:

- Keep sanctuary boundary posted and continue to enforce no waterfowl hunting in the sanctuary. Maintain current types (hunting/all uses), levels (days/week), and distribution (locations) of sanctuary.

5.7 Farming Management Strategy

5.7.1 Potential Strategies

As described in Section 3.2.1, agricultural crops can significantly contribute to the nutrition and fitness of wintering waterfowl, a resource of concern on Upper Ouachita NWR. Cooperative farming is an important component of the refuge meeting its waterfowl foraging habitat objective. The refuge has started to conduct some force account farming but, it is depended on funding. Cooperative farming has been and will continue to be a cost-effective mechanism to provide the high-quality “hot foods” required by wintering waterfowl. Management of a cooperative farming program reduces dependence on refuge staff and equipment.

Rice, milo, and corn are the top choices as grain crops for ducks in the Mississippi Alluvial Valley. Rice is particularly resistant to decomposition even under flooded conditions. Milo and corn also provide high-energy resources for waterfowl and can generally be kept above the water surface, but problems arise from depredation prior to flooding, as well as seed degradation after flooding.

Management Unit 15, consisting of 1,724 acres, will be farmed on a rotational basis with moist soil management. Ideally one half of the acreage (850 ac) would be farmed one year and the other half the next year; keeping the idle half as moist soil. This ensures that the management unit is disked every two years to reduce undesirable vegetation. Cooperative farming and/or force account farming will be used determined by costs, staff resources, equipment available etc. The adaptive management process will be used to determine which method of farming (force account versus cooperative farming or both) is best to meet habitat objectives.

LMVJV DED refuge step down objectives listed in the CCP (USFWS 2008) are as follows: 780,318 DEDs for moist-soil, 266,208 DEDs for unharvested rice, and 3,464,952 DEDs for harvested rice, for a total of 4,511,478 DEDs. At the time step down objectives were established, refuges were asked by the LMVJV to report the number of acres they were capable of managing for wintering waterfowl. The step down objectives were then generated from this report; however, since that time, Upper Ouachita NWR's management capability has increased with the acquisition of Management Unit 15 Management Unit 15 will be replacing the refuge's former agriculture fields which have now been reforested. The maximum number of duck energy days (DEDs) produced on Management Unit 15 could be 6.7 million DEDs. This figure is obtained assuming that half of the unit is farmed in rice and the other half managed as moist soil. Assuming a refuge share of 25%, 212.5 acres of unharvested rice would be available for waterfowl. Unharvested rice yields 24,025 DEDs/acre and moist soil produces 1,883 DEDs/acre for a total of 5.1 million DEDs from the unharvested rice and 1.6 million DEDs from the moist soil. Again, it is stressed this is the maximum number of DEDs that could be accomplished. This number is 2.2 million more (equivalent to 91.5 additional acres of unharvested rice) than that established by the LMVJV when the refuge was managing the former agriculture fields.

5.7.2 Management Strategy Prescription

As stated in Section 2.3.2 on page 12 of this Plan, Management Unit 15 has just been acquired by the Service; however, the previous owner still has the farming rights for another two years. The Service at that time will have to determine how to pump water onto the unit, which fields will need levees built, how many impoundments will be retained, etc. Therefore, it is impossible at this time to discuss the specific strategies of the future farming program.

To meet Objective 4.1.7 in Management Unit 15 for wintering waterfowl, the following management strategies will be used:

- Annually meet with Coop Farmers to sign and review placement of crops and locations of Refuge share.
- Maintain half of 1,721-management unit in crop production to provide a diversity of high-carbohydrate (hot) foods as flooded habitat required by wintering waterfowl.
- Farm unit in rice, millet, and/or milo.

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7.0 APPENDIX A: THE COMMERCIAL SALE OF TIMBER

7.1 Execution of Timber Harvest

7.1.1 Cruising and Marking Timber

Each management unit is assigned a year of entry. The year of entry is assigned to distribute forest management activities across the refuge throughout the duration of this habitat management plan. Following the Order of Entry (Table 4), a habitat and timber cruise will be conducted for each management unit. The cruise may be conducted using fixed plot and point sampling techniques. Most cruise sampling will be done using a fixed radius plot of 1/5th acre for saw timber, 1/20th acre plots for pulpwood, and 1/100th acre plots for regeneration and herbaceous ground cover. Point samples utilizing 10, 15, or 20 factor prisms may be used at various times for collecting timber volumes. The following data will be collected during each management unit cruise:

1. Timber volumes including basal area for sawtimber and pulpwood
2. Species composition of woody vegetation
3. Tree ages
4. Canopy conditions
5. Presence of vines, Spanish moss, and switchcane
6. Herbaceous ground cover
7. Number and size of den, cavity, and cull trees per acre
8. Tree and shrub species regeneration
9. Species composition of each canopy layer (overstory, midstory, understory, and ground cover)
10. Presence of woody debris

Volume tables for each management unit will be expressed in 2-inch diameter classes for both sawtimber and pulpwood. Doyle form class 80 will be used to express volume sawtimber (MBF) and pulpwood (cords) volumes for pine. Doyle form class 76 will be used to express volume sawtimber (MBF) and pulpwood (cords) volumes for bottomland hardwoods. The exception will be green ash and water tupelo volumes, which will utilize Doyle form class 70.

Table 4. Order of Entry 2011-2025

Year to Enter	Management unit
2011	Management Unit 1&2
2012	Management Unit 3&4
2013	Management Unit 5&6
2014	Management Unit 7&8

2015	Management Unit 9&10
2016	Management Unit 11&12
2017	Management Unit 13&14
2018	Management Unit 16&17
2019	Management Unit 18&19
2020	Management Unit 20&21
2021	Allow for Backlog/Revisits
2022	Allow for Backlog/Revisits
2023	Allow for Backlog/Revisits
2024	Evaluate additional acreages added to Refuge during HMP
2025	Write new CCP and HMP

* Acreage values expressed in this table are GIS acreage estimates.

Cruise data will be compared to target conditions (habitat objectives) for the unit, and a condition specific treatment prescription will be developed. Treatment prescriptions will contain the following information:

1. Management Unit map
2. Stand map designating various timber stands within the management unit
3. Description of management unit including vegetation profile, soil types, hydrology, and other physiological features
4. Timber data including tree species composition, sawtimber and pulpwood volumes, stocking, age, condition, and basal area.
5. Wildlife habitat parameters including plant composition of overstory and understory; number of cavity and den trees; presence of vines, Spanish moss, and switchcane; number of dead snags; presence of woody debris; and evidence of wildlife activity (e.g. bird nests, browsing of plants, wildlife tracks, etc.)
6. Composition of woody plant regeneration
7. Prescription of silvicultural treatment to be conducted in the management unit
8. Description of desired results
9. Map of Treatment Area
10. Timber data for the Treatment Area showing what is to be removed during treatment
11. Management of roads, invasives and hydrological conditions will be addressed

After the Prescription is written, it will be submitted to the Regional Office for approval. Copies of Prescriptions and all other information will be kept on file in the refuge office.
During the timber marking activities, many factors are considered before selecting a tree for removal. These include species composition of the management unit, tree health and vigor, present regeneration, potential regeneration, canopy structure, number of cavities within the area, habitat value of the tree, mast production, and objectives of the management unit prescription. The management unit prescription designates how much timber volume or basal area to remove during a treatment, but the application of the prescription occurs during timber marking.

To determine which trees are designated for removal, the forester will follow sound silvicultural procedures prescribed in the management unit prescription. As the forester determines which trees are to be removed, paint will be applied at breast height and at the base of trees to be removed. These two marks allow for the contractor to distinguish which trees are designated for removal during logging operations and help the forester identify the stumps of marked trees during administration of the logging contract.

Timber marking is very subjective and varies from one timber marker to another. Though the management unit prescription gives the timber marker guidelines to follow, each individual timber marker has a different opinion on how to reach the desired results of the management unit prescription. To ensure forest diversity and avoid bias, more than one person should be involved with the timber marking of treatment areas on the refuge.

The timber sale must satisfy certain conditions to be operable by a contractor. For present market conditions, the following guidelines apply to timber sales open to formal competitive bidding; adjustments may be necessary if significant changes in the economy occur. Total sale volumes could be less in the case of a negotiated sale; however, the average volumes per acre would remain essentially unchanged.

Pine saw timber must have a minimum DBH of 11.0 inches and a minimum merchantable length of 12 feet. The upper limit of merchantability is defined as:

1. A minimum top diameter inside bark of 7.0 inches, or

2. The point in the upper stem at which excessive taper occurs. Excessive taper is generally associated with these limits:

    a. A stem defect
    b. A limiting whorl. A limiting whorl is branches, at least 1 inch in diameter, radiating from 3 or more faces and situated within a 6-inch vertical span, where the sum of their diameters equals or exceeds ½ of the outside stem diameter at the point of occurrence. The term “branch” shall mean live branches or dead branches that still show remnants of branch endings

c. If a usable 8-foot or longer section occurs above either (a) or (b), take the merchantable height to the top of this section. A usable section is one not having the characteristics of (a) or (b) and not limited by diameter.
d. Occasionally, there may be two limiters with a usable 8-foot or longer section above them. If the two limiters occur within a vertical 4-foot span, take the merchantable height to the top of the next usable section. Otherwise, measure to the first limiter.

Hardwood saw timber must have a minimum DBH of 11.0 inches and minimum merchantable length of 12 feet. The diameter of swell-butted species, such as baldcypress and water tupelo, shall be measured 1-½ feet above swell, when the swell is more than 3 feet high, instead of at DBH.

The upper limit of merchantability is defined as:

1. A minimum top diameter inside bark of 8 inches, or

2. The point at which the tree breaks into forks containing no merchantable saw logs, or

3. One or more live limbs occurring within a vertical span of 1 foot, whose sum of diameter equals or exceeds 1/3 of the stem diameter outside the bark at that point, or

4. A stem deformity

Pine pulpwood must have a minimum DBH of 5.0 inches and a minimum merchantable length of 10 feet. The upper limit of merchantability is defined as:

1. A minimum top diameter inside bark of 3.0 inches, or

2. That point at which stem deformity prevents utilization. If at least a full 5-foot usable section occurs above this point, take the merchantable height to the top of this section. A usable section is one that is reasonable straight and sound and whose small-end diameter equals or exceeds 3.0 inches inside bark.

Hardwood pulpwood must have a minimum DBH of 7 inches and minimum merchantable length of 10 feet. The upper limit of merchantability is defined as:

1. A minimum top diameter inside bark (DIB) of 4.0 inches, or

2. That point at which stem deformity prevents utilization. If at least a full 5-foot section occurs above this point, take the merchantable height to the top of this section. A usable section is one that is

reasonably straight and sound and whose small end diameter equals or exceeds 4.0 inches diameter inside bark.

Trees that fork immediately above DBH will be measured below the swell resulting from the double stem. The longest utilizable stem shall be measured for the merchantable height. Trees that fork below DBH shall be considered as two separate trees, and the diameters shall be measured or estimated 3 ½ feet above the fork.

Timber harvest operations can occur anytime of the year. However, logging will also be restricted to dry periods of the year to keep soil disturbance and damage to residual vegetation at a minimum.

7.1.2 Logging Operations

Permanent roads for commercial timber harvest operations will be limited to existing roads only. Temporary roads will be abandoned and rehabilitated if required. Rehabilitation can include the installation of water bars and/or the redistribution of disturbed soil. This will help reduce fragmentation of the habitat and limit disturbance to soil and plants throughout the refuge. Road edges that receive direct sunlight may provide substantial amounts of soft mast (fruit), where otherwise closed canopy forests make this important food source rare (Perry *et al*. 1999). Edge habitats along roads may be important for reasons stated above, but should still be limited because of concerns of increased predation and parasitism of bird nests (Robinson *et al.* 1995), and effects of roads on amphibian movements (Gibbs 1998, deMaynadier and Hunter 2000).

Logging operations will be allowed to use skidders, crawler tractors, and wheeled tractors to skid logs to loading areas where they are loaded onto trucks. Tree-length skidding will be allowed, but the trees must have the tops and all limbs removed before skidding. Removal of tops and limbs will reduce chances of damage to residual trees. If possible, harvest should be conducted outside of breeding season for birds (April-June), but management can be conducted during this period if necessary. Other special conditions and/or restrictions, as determined by refuge staff, may be stated in the Timber Sale Bid Invitation (Exhibit 3) and Special Use Permit awarded to the highest bidder for the Timber Sale Bid.

In order to confirm harvest procedures and address any questions, a pre-entry conference will be held between the Refuge Manager and/or Refuge Forester, Permittee, and the logging contractor, if different than the Permittee. The Permittee is to notify the Refuge when harvesting operations begin and are completed.

Close inspection and supervision of all timber sales is necessary to ensure that harvesting operations meet the conditions of the Special Use Permit and refuge objectives. Frequent inspections of harvesting operations will ensure that only designated trees are cut, and problems are rectified before becoming major issues. Timber harvesting operations may be suspended or restricted any time that

continued operation might cause excessive damage to the forest stands, soil, wildlife habitat, or cultural resources. Reasons for suspension or restriction may include, but are not limited to: periods of high wildfire potential, insects or disease hazard, times when harvesting may interfere with essential refuge operations, during periods of heavy rains or wet conditions which may cause rutting and erosion of soils, when harvesting operations present a safety hazard, or when harvest operations reveal new or may damage existing cultural resources. Furthermore, operations may be suspended or terminated if the Permittee violates the conditions of the Special Use Permit.

When harvesting is complete, the Refuge Forester or designated Refuge Staff will inspect the site for compliance with all requirements of the contract. If any deficiencies are found, the Permittee will be notified and given reasonable time to achieve compliance. If full compliance is achieved, the Permittee's performance deposit will be returned in full. If not, an amount to mitigate damages will be deducted from the performance deposit and the remaining amount returned.

7.1.3 Monitoring

Upon completion of prescribed timber harvest operations, each treatment area will be monitored the next year and every 5 years after to see if desired results of the management unit prescription have been met. Monitoring will consist of the forester walking through the treated area and taking basal area measurements at several points. This will help the refuge staff to determine what changes, if any, may be needed for future forest management prescriptions.

To monitor the impact of timber management activities on migratory birds, a bird-monitoring program has been developed in cooperation with the Lower Mississippi Valley Joint Venture office. The information gathered from the bird-monitoring system assists in identifying the impacts of timber harvest on bird populations, as well as other wildlife species, before and after treatment. This information will help adapt timber management activities to the needs of the many plant and animal species utilizing the forested habitat of the refuge.

A Geographical Information System (GIS) and Global Positioning System (GPS) database is currently being developed on the refuge. The current refuge GIS database consists of various image files including Digital Orthophoto Quarter Quads (DOQQ's), Digital Raster Graphs (DRG's) of USGS topographic quad maps, and 10- 15- 30-meter resolution satellite images. Feature classes, from a variety of different state and federal agencies provide mapping layers for federal and state highways, local roads, parish boundary lines, powerline and pipeline rights-of-way, reforestation projects on private and public lands, public land boundaries, and various other layers providing information about the area surrounding the refuge.

For this plan, GIS data have been developed on a local scale to reflect the refuge management activities. To enhance the development of a GIS database that is

specific to the refuge, GPS technology has and will continue to be used to establish management unit boundaries, maps, cruise lines, treatment area maps and boundaries, monitoring programs, refuge roads, beaver activity, forest cover types, and all other management activities related to the refuge.

To ensure the refuge is in compliance with the Forestry Best Management Practices (FBMP) manual regulations (http://www.ldaf.state.la.us/portal/Portals/0/FOR/for%20mgmt/BMP.pdf) concerning Natural and Scenic Rivers, all forest management operations on the refuge will leave a 200-foot buffer along the banks of the Ouachita River. Logging is restricted to the summer and early fall, which are generally the driest times of the year, to reduce soil compaction and erosion potential. Logging access roads will be limited to existing woods roads left over from previous ownership whenever possible. New road construction will be kept to a minimum and must be approved by the refuge manager.

The 200-foot buffer along major waterways and permanent water areas will help keep logging debris out of water channels. These buffer areas will also serve as filtration strips to reduce sediment loads that may be caused by logging activities. Treetops and other logging debris will be kept out of brakes and swales to minimize any impacts that logging activities may have on drainage. The number of crossings through swales and brakes will be kept at a minimum to prevent damage to the natural drainage of water. These crossings will be maintained and any structures, such as culverts, will be removed as soon as logging activities are completed.

7.1.4 Archeological and Cultural Resources

The Archeological Resources Protection Act of 1979 obligated the refuges to protect all sites of archeological and historical significance. In 1980, a cultural resources survey of pre-selected portions of the refuge was conducted by New World Research, Inc., a private cultural resource management firm (New World Research 1981). It was an intensive survey of road easements, a pipeline corridor, and several land tracts projected as locations for various refuge support and recreational facilities. As a result of the survey, three prehistoric sites, all apparently dating to the Late Woodland (A.D. 800-1000) and Mississippian (A.D. 1000-1750) periods were identified. Two of the sites yielded both lithic and ceramic artifacts. The third was composed solely of prehistoric lithic artifacts. One site yielded not only artifacts, but evidence of a midden and two shell concentrations. It is likely that more prehistoric sites exist on the refuge, especially on deposits of Pleistocene age.

It is possible that forest management activities on the refuge could disturb some unknown archeological site. Thus to minimize the chance of such disturbances the following actions will be taken:

1. All forest management prescriptions will be submitted to the Regional Archeologist for approval prior to the start of any logging activities.

2. Logging will be limited to dry soil conditions, thus limiting soil disturbance and erosion.
3. Limit new road construction to reduce the chance of disturbance.
4. Cease logging operations and flag any suspected archeological sites that may be discovered during logging operations
5. Contact the Regional Archeologist if any suspected archeological sites are discovered and follow instructions given by the Regional Archeologist to protect the site until a thorough investigation of the site can be conducted.

7.1.5 Aesthetics

Aesthetic values fall under the category of wildlife observation, which is one of the six priority public uses of refuges designated in the National Wildlife Refuge System Improvement Act of 1997. Although aesthetic values vary from person to person, forest management activities will use the following guidelines to ensure that wildlife observation opportunities for the public are not impeded:

1. Keep logging loader sets at least 100-feet away from designated hiking trails.
2. Maintain a 200-foot buffer along the boundary of all major waterways where logging will not be allowed. Road construction, loader sets, and skidding of logs will also be prohibited within this buffer. All logging debris will be removed from within the buffer boundary.
3. Keep logging slash piles away from designated hiking trails.
4. Limit height of slash piles to less than 4 feet in logging areas and loader sets, unless otherwise directed for wildlife habitat improvement purposes.
5. Ensure all logging access roads are maintained and free of litter and debris while logging activities are in progress.

7.1.6 Forest Openings

Forest openings on the refuge will be managed as temporary openings. These are openings created during logging operations either as patchcuts or loader sets. The patchcuts, 1-3 acres in size, are designated during timber marking to develop temporary openings in the forest canopy large enough to encourage the development of shade intolerant plant species. Loader sets are areas opened up by the logging contractor for the loading of forest products onto trucks. Loader sets usually range in size from ¼ to ½ acre in size and soil disturbance is greater in these areas than any other areas within the timber sale. In an effort to lessen the risk of soil erosion during wet periods in loader sets, these areas may be planted with winter grasses to serve as a temporary vegetative cover until normal vegetation has a chance to reclaim the site. Rotation of timber harvest areas between the forest management units will allow for temporary openings to be created throughout the refuge on a continual basis to replace older forest openings as they close up.

7.1.7 Insect and Disease

Insects and diseases that may affect the forested habitat on the refuge can be most effectively controlled by promoting stand conditions favoring healthy vigorous trees. Trees stressed by overstocking, flooding, drought, overmaturity, fire, etc., have an increased susceptibility to insects and diseases. Forest management activities such as thinnings and group selection cuts will help promote tree health and vigor by reducing competition and stocking as well as maintaining tree species diversity.

Most of the disease and insect damage found on the refuge presently is limited to individual trees or small groups and should not pose a threat to the health of the forest. The presence of tree diseases and insects is a normal occurrence in the forest. Many Neotropical bird species forage on insects that damage trees, while other wildlife species forage on the conks and other fruiting bodies of various diseases. Portions of trees damaged by insects and diseases may eventually develop into cavities available for wildlife use.

Upon entry into a management unit, insect and disease damage will be evaluated and taken into consideration as part of the management unit cruise. In situations where insect and/or disease conditions are considered severe, the refuge forester will try to identify the problem and consult with the Forest Health Unit of The United States Forest Service Southern Region State and Private Forestry Division in Pineville, Louisiana for advise on how to effectively control the problem.

In the event of extensive disease or insect infestation, the refuge manager or forester may request an expedited treatment. This request must be approved at the Regional level and should eliminate most of the formal prescription approval process, though sound biological and silvicultural principals will still apply. The formal bidding process for such treatments may be scaled back in order to expedite the treatment.

7.1.8 Timber Salvage and Unscheduled Harvesting

Salvaging damaged timber, dead, or down trees following natural events such as ice storms, tornadoes, disease/insect outbreaks, windstorms, wildfires and etc. is a common practice in forest management. Forest management on Upper Ouachita NWR will only consider salvaging timber to reduce fire hazards or prevent the likelihood of insect or disease outbreaks. These natural events usually provide wildlife species with many habitat needs such as snags for cavities, new denning locations, diversifying the canopy structure, increased plant diversity on the forest floor, etc. Unscheduled harvesting may need to occur to prevent the loss of timber due to outbreaks of insects or disease. If an outbreak of insects or diseases should occur, it may be necessary to enter into a management unit ahead of the entry cycle to stop or slow the outbreak.

7.1.9 Threatened and Endangered Species

The refuge currently has the endangered red-cockaded woodpecker on the west side in the upland pine forests. The threatened Louisiana black bear is a transient on the refuge. An Intra-service Section 7 Consultation will be conducted for any timber operation that may negatively affect either species.

7.2 Administration of Sales

7.2.1 Conditions Applicable to Timber Harvesting Permits

1. A pre-entry conference between the Refuge Forester and the designated Permittee representative will be a requirement before the purchaser starts logging operations. The purpose of the pre-entry conference is to ensure that the purchaser completely understands what is expected of him, thus avoid misunderstanding or serious conflict.

2. If requested, satisfactory scale tickets for timber products shall be submitted to the Refuge Forester.

3. Bottomland hardwood species will be cut so as to leave a stump not more than 18 inches high for sawtimber and pulpwood. Upland hardwood stump height shall not exceed 18 inches for sawtimber and 12 inches for pulpwood. Stump height for pine shall not exceed 12 inches for sawtimber and 6 inches for pulpwood-sized trees. All stump heights are measured at the side adjacent to the highest ground. In the case of swell-butted species or trees with metal objects in the butt, stumps may be higher.

4. Whole tree skidding in sawtimber sales is prohibited, unless special conditions are permitted.

5. Ground level paint spots must remain visible after the tree has been cut. All marked trees are to be cut, unless otherwise approved by the Refuge Forester.

6. Trees and tops shall not be left hanging or supported by any other tree and shall be pulled down immediately after felling.

7. Tops and logging debris shall be pulled back 20 feet from public roads and lopped within 150 feet.

8. All roads, right-of-ways, fields, openings, streams, and firebreaks must be kept clear of tops and debris. Permittee shall also repair all damage to same resulting from operations conducted under this permit.

9. Littering in any manner is a violation of the Code of Federal Regulations. The entire work area shall be kept free of litter at all times. Repairs and cleanup work will be accomplished to the satisfaction of the Refuge Manager and/or Refuge Forester.

10. Additional trees removed to prepare loading sites will be paid for at bid prices. Unmarked trees, which are cut or injured through carelessness, shall be paid for at **double** the bid price.

11. The Permittee will remove temporary plugs, dams, and bridges, constructed by the Permittee, upon completion of the contract. There are areas on the refuge where temporary plugs or dams in an intermittent stream would not be allowed. These areas will be indicated on sale maps.

12. Loading sets will be determined cooperatively between the Refuge Forester and Permittee.

13. Ownership of all products remaining on a sale area will revert to the U.S. Government upon termination of the permit.

14. Logging within the area of red-cockaded woodpecker clusters (200 feet from the nearest cavity tree) will be limited to August through February. Cluster areas will be indicated on sale area maps when appropriate.

15. The Refuge Manager and/or Forester shall have authority to temporarily close down all or any part of the harvest operation during a period of high fire danger, wet ground conditions, or for any other reason deemed necessary. An equal amount of additional time will be granted to the Permittee.

16. The U. S. Government accepts no responsibility to provide right-of-way over private lands for materials sold under this contract.

17. The Permittee and his employees will do all within their power to prevent and suppress wild fires.

18. The decision of the Refuge Manager shall be final in the interpretation of the regulations and provisions governing the sale, cutting, and removal of the timber covered by this permit.

19. When a timber sale area is adjacent to private land, all logging debris will be pulled back onto the refuge to avoid damage to private property.

20. Permittee and his employees shall not build fires on the refuge.

7.2.2 Control Records

The primary purpose of records is to show progress made in fulfilling the habitat management plan objectives. These records include but are not limited to: management unit prescriptions, management unit geographical information system (GIS) maps, sale area GIS maps, timber sale contracts and special use permits, management unit timber volume tables, order of entry plan and progress reports, non-commercial treatments, wildlife information gathered by management unit, and data collected from bird counts conducted throughout the length of the HMP.

7.2.3 Sale Folders

A sale folder will be prepared and maintained for each individual timber sale. The folder shall contain copies of all data collected for the sale. This includes tally sheets, volume estimates, maps, bid invitation, Special Use Permits, payment records, correspondence with permittee, sale compliance inspection notes, copies of deposit checks, payment transmittal forms, etc. The sale folder shall be kept in a separate folder within the management unit folder for each individual management unit, thus keeping all information pertaining to a management unit within a single file.

7.2.4 Bid Invitations

Commercial timber sales are the most practical method available for creating and maintaining desired forest habitat conditions. All timber sales will be conducted in accordance with the requirements listed in the Refuge Manual, and the guidelines and specifications detailed in the Upper Ouachita NWR CCP, Upper Ouachita NWR Habitat Management Plan, and management unit prescriptions.

Small sales (estimated receipts less than $2,500) will be negotiated as authorized by U. S. Fish and Wildlife Service policies. The Refuge Forester will make a reasonable effort to obtain at least three bids from potential buyers. These bids will be documented and a permit will be issued to the successful bidder.

Larger timber sales (estimated receipts more than $2,500) will be conducted through a formal bid procedure. Invitations to bid will be prepared and administered by refuge personnel. Formal bid invitations will be mailed to all prospective bidders **(**Exhibit 2**).** Bid invitations will contain the following information:

1. A Formal Bid Information Form containing sales and estimated volume information.
2. A bid form, which the bidder fills out, signs, and returns to the refuge.
3. Maps giving general sales location information and detailing all sales units.
4. General conditions applicable to harvest of forest products.
5. Special conditions applicable to the timber sale.
6. Certificate of Independent Price Determination.

7. Equal Employment Opportunity Clause (Form 3-176).
8. Information on dates when prospective bidders can evaluate sales areas before bid opening.

7.2.5 Bids and Performance Deposits

For all bid sales, a bid opening date and time will be set to occur at the refuge headquarters. All bids received prior to the opening time will be kept, unopened and locked in the Refuge Cashier's safe until the specified opening time. Any bids received after the specified opening time will not be accepted. The refuge retains the right to reject any and all bids, particularly those that are incomplete or otherwise unacceptable.

A deposit of $5,000 to $10,000 in the form of a cashier's check or money order made out to the U. S. Fish and Wildlife Service, must accompany all bids received through the formal bid process. The deposit amount will reflect the size of the sale and potential for damage. The amount of the deposit will be stipulated in the bid invitation. This deposit is to ensure the sincerity of the bidder's intention to purchase the offered sale at the bid price. In the event the successful bidder chooses not to purchase the offered timber, the bid deposit will be forfeited to the government. When the successful bidder is named, all unsuccessful bidders' deposits will be immediately returned. The successful bidder's deposit will then become his performance guarantee deposit and will be retained by the government as such. Before the completion of the operation, the successful buyer will repair any and all damages caused by his operation. The performance guarantee deposit may be used to cover any un-repaired damages caused by the successful bidder, their agents, employees, or their contractors. The balance of the deposit will be refunded to the successful bidder when the sale and all related repairs are completed.

Small sales through the negotiated process will also require a performance guarantee deposit to be received by the government prior to any timber harvest.

7.2.6 Special Use Permit

Upon selection of a successful bidder by the Refuge Manager or designated representative, a Special Use Permit will be issued containing information relevant to the timber sale, such as terms of payment, authorized activities, General and Special Conditions, and location map. The Refuge Manager or designated representative, upon receipt of payment, signs the Permit, if the value is within their warranted authority. If the value is above that amount, an authorized representative of the Regional Director signs the Special Use Permit.

7.2.7 Payment for Forest Products and Administration of Receipts

The permittee will have 10 business days after notification of award of bidding to make total or partial payment (according to what is specified in the Special Use

Permit). Under no circumstances will harvest operations begin prior to receipt of payment. The purpose of an advance payment is to encourage the permittee to begin harvesting operations as quickly as possible. All payments will be in the form of a cashier's check or money order payable to the U. S. Fish and Wildlife Service.

For pay-as-cut sales, the buyer shall provide weekly scale totals and/or scale tickets along with a weekly payment. All receipts for forest products along with proper documentation will be forwarded the same day received to the Fish and Wildlife Service Finance Center. Any receipts, that cannot be processed the same day received, will be stored in the Refuge Cashier's safe until processing can be completed. Presently, receipts for the sale of products of the land are deposited into the Revenue Sharing account at the Finance Center. Other arrangements can only be made in accordance with policy, regulations, and laws.

Refuges are authorized to enter into Timber for Land Exchanges. In this process, land within the approved Refuge Acquisition Boundary may be purchased indirectly through exchange of normal timber sale volumes. Requirements for timber for land exchange sales are as follows:

1. Authority, which allows the Service to exchange timber for lands: National Wildlife Refuge System Administration Act of 1966 (16 USC 668dd-ee).

2. Lands acquired must be located within the approved refuge acquisition boundary. No Preliminary Project Proposal or any other studies are required. The merit of the acquisition is a judgment call by the Refuge Manager.

3. Forest management plans are followed, and no deviation from planned schedules should be considered. No additional timber harvest is considered for the sole purpose of acquiring land.

4. The land is conveyed to the United States in exchange for refuge timber or other refuge products. The timber is transferred via Special Use Permit, much the same as a timber sale. If timing requires the timber to be harvested prior to closing on the land, the permittee can make a performance deposit equal to the value of the deed. That deposit is refunded upon completion of the deed transfer.

5. The Service receives compensation for the timber when the third party acquires the subject property and conveys it to the United States.

6. The value of the land to be acquired, and the timber exchanged should be approximately equal or the value of the timber higher than the land. Any excess value of the timber can be made as a payment to the Service for the difference.

7. The Division of Realty will be responsible for land appraisals, title insurance, reimbursement of relocation costs, and recording fees resulting from the conveyance of the property to the United States. These miscellaneous costs will be paid from Division of Realty funds.

A sequence of steps for a hypothetical timber for land exchange is as follows:

1. Refuge Manager identifies areas within the approved refuge acquisition boundary for acquisition.

2. Refuge Manager and Division of Realty determine if landowner(s) are willing sellers.

3. If seller is willing to sell, the Refuge Manager notifies the Regional Office (District Manager and Division of Realty).

4. Division of Realty contacts the landowner, orders the appraisal, and makes an offer to the landowner.

5. If the landowner is willing to sell, Realty advises the Refuge Manager.

6. The Refuge Manager and refuge staff shall determine which upcoming timber sales, awaiting the timber sale bid process, to use in the exchange.

7. Timber Sales bids are sent out with a description of the responsibilities of the winning bidder pertaining to the timber for land exchange. This gives the bidders an opportunity to determine if they are willing to participate in the timber for land exchange. This also ensures that bidding for the timber is competitive.

8. The Refuge Manager selects the winning bidder following the normal timber sale bid process. The winning bidder is now referred to as the third party.

9. Division of Realty advises the landowner that the third party will intercede to acquire the subject property on the Service's behalf.

10. Division of Realty obtains an exchange agreement with the third party. The agreement (1) identifies and states the price of the subject property and (2) stipulates the volume and value of timber involved in the refuge's timber sale.

11. The third party acquires the subject property at the appraised value.

12. The third party conveys the subject property to the United States via a warranty deed. A Special Use Permit is issued by the Refuge Manager, which specifies the requirements that must be followed by the third party

while cutting on the refuge. The Special Use Permit becomes part of the closing documents.

13. The third party completes logging operation within the specified time frame, as detailed in the Special Use Permit.

7.3 Exhibit 1: Upper Ouachita NWR Timber Sale 200x-xx

SPECIAL CONDITIONS APPLICABLE TO TIMBER HARVESTING

Before starting logging operations, the refuge forester, the permit holder and his logging contractor will discuss the following special conditions. The goal of the following conditions is to protect the refuge forest from unnecessary damage. If the forest is logged carefully, it will look like a job well done which will in turn lessen the chance of public disagreement with refuge forest management philosophy.

1. All timber marked with two spots of blue paint will be cut, except as otherwise agreed by both parties. The permit holder is subject to paying $700 per MBF for leave pine saw timber trees which are cut or excessively damaged through carelessness. The penalty for cut or excessively damaged hardwood leave trees will be $500 per MBF on saw timber and $25 per cord on pulpwood-sized trees.

2. Trees are to be cut so as to leave a stump not more than 12 inches high. In the case of swell-butted trees or trees with metal objects in the butt, stumps may be higher. The lowest practicable stumps that can be left are preferred on all trees.

3. Trees and tops shall not be left hanging or supported by any other living or dead tree and shall be pulled down immediately after felling. This applies especially to pines to lessen the chance for pine beetles.

4. Access roads for the removal of trees shall be coordinated with the refuge forester. See management unit 2 map for present road locations. Roads, rights-of-way, and stream beds must be routinely kept clear of tops and logging debris. The permit holder shall provide and install any necessary culverts in the sale area. Roads will be maintained regularly. To avoid excessive damage following heavy rains, loggers should be prepared to stop all hauling for at least one day. Excessive or extended rains may result in overly wet ground conditions that would prevent logging for an undetermined period of time. The refuge forester expects close cooperation from all logging crews. At the completion of sale, roads will be left in at least as good as original condition. Location of additional roads must be pre-approved by the refuge forester. Leave trees cannot be removed for access or loading sets without prior approval from the refuge forester. The permit holder shall promptly repair all damage resulting from operations conducted under this permit to the refuge forester's satisfaction.

5. There are a significant number of leave trees which can be protected by careful logging activity. Logging will be restricted to ground conditions dry enough to minimize rutting. Besides being unsightly, rutting will often damage the root systems of leave trees. Soft spots (springs, wet creek bottoms, etc.) will be avoided whenever possible. The majority of the area has ample room for skidding between leave trees without damaging leave trees. Skinning butts and damaging roots of all leave trees will be avoided as much as practicable. Whole tree skidding will be allowed where minimal damage to leave trees would be expected. Skidding of

hardwoods with large crowns – potentially more damaging to leave trees – will be strictly controlled where excessive damage to leave trees is likely to occur. In general, hardwoods or pines with large crowns will be lopped prior to skidding.

6. The entire work area shall be kept free of litter at all times. Petroleum products must be properly disposed of and may not be dumped on the ground. **Note: The logger agrees to remove soil contaminated by petroleum product spills from the refuge when directed by the refuge forester.**

7. The refuge forester shall have the authority to temporarily close down all or part of the operation during a period of high fire danger or wet ground conditions. An equal amount of additional time will be given to the permit holder when necessary.

8. Should the permit holder's logging operation expose any archaeological or cultural resources, the logger will immediately cease operations in that area and notify the U.S. Fish and Wildlife Service.

9. Logging contractors will do all in their power to prevent and suppress forest fires, and will be held liable for damages and suppression costs resulting from logging contractor-caused fires, except as may otherwise be allowed under State or Federal laws.

10. Failure by the permit holder to meet any applicable conditions may result in penalties levied against the performance bond. The decision of the Deputy Project Leader shall be final in interpreting regulations and provisions governing the sale, cutting, and removal of forest products under this permit.

7.4 Exhibit 2: Bid Form

BID FORM

Upper Ouachita NWR Timber Sale 200x-xx

The following is my bid for the stumpage offered in this invitation.

Lump sum bid for management unit x
$_____

Reminder: Don't forget to include the $10,000 good faith deposit with your bid. Without the good faith deposit, the bid will have to be automatically rejected.

I have inspected the sale area and trees designated for removal. If I am adjudged the successful bidder, I agree to accept the terms and special conditions of the permit-agreement. I also agree to give at least two weeks' notice of my desire to move on site to start cutting. However, entry onto the area with logging equipment will <u>not</u> be allowed until the ground is sufficiently dried out as determined by the refuge forester.

Name of Firm:
_____

Address:
_____

_____Zip Code: _____

Signature of Bidder: _____Date: _____

Telephone:
_____

Comments:
_____

7.5 Exhibit 3: Bid Invitation

North Louisiana Refuge Complex
11372 Highway 143
Farmerville, LA 71241
Telephone: 318-726-4222
FAX: 318-726-4667
[Date]

Upper Ouachita National Wildlife Refuge
Management Unit x
Timber Sale 200x-xx

BID INVITATION

The purpose of this sale is to thin the forested area in a portion of management unit x to promote general forest health and understory/midstory development for wildlife.

To locate the sale area, see maps (Figures x and x). All trees to be cut were marked with blue paint. This will be a general thinning of [insert whether it is for pine or hardwood pulpwood or sawtimber] products on +/- xx acres. [Pine or hardwood] saw timber estimates are xxx MBF and [pine or hardwood] pulpwood estimate is xx cords (not including top wood). Close merchandising of timber products could cause the pine saw timber volume to be greater than the estimate.

NOTE: Much of the sale area has flat woods which are very wet much of the year because of a high water table. Dry ground conditions will be necessary to support logging equipment and log trucks.

A permit will be issued for cutting until [insert date]. Unusually wet summers and falls may allow for an extension. The extension, if granted, would be at the discretion of the Deputy Project Leader and Refuge Forester.

Prospective buyers can contact Refuge Forester [insert forester's name] at the above phone number if they want to arrange a visit to the sale area. There is a parking lot on the western edge of the sale area. **ATV access will be allowed in the sale area for timber inspection purposes only.** Otherwise, buyers are free to go look at the timber unescorted.

Formal sealed bids will be accepted at the refuge office until 3:00 p.m., [date], for the sale of the marked timber. Bids will be opened at 3:05 p.m., [same date] at the refuge office which is located 2.5 miles south of Rocky Branch, Louisiana on HWY 143. The U.S. Fish and Wildlife Service (Service) reserves

the right to reject any and all bids**.** The refuge may take up to five (5) working days before determining whether any of the bids will be accepted.

Each bidder will submit with their bid a CERTIFIED OR CASHIER'S CHECK in the amount of $10,000 made payable to the U.S. Fish and Wildlife Service as a good faith deposit. The successful bidder's deposit will be retained by the Service and may be forfeited to the government if that bidder fails to accept and agree to execute the Special Use Permit agreement. After the permit agreement is finalized, the deposit will be retained by the Service as a performance guarantee to cover any damages or claims the Service may have against the permit holder as a result of the logging operation. The balance will be returned to the permit holder upon satisfactory completion of the operation. In the past most operators have been refunded the entire bond. The Special Use Permit will be issued as a sale document to the buyer. The Service does not issue "timber deeds." All subsequent payments will also be made to the U.S. Fish and Wildlife Service.

Note: The successful bidder will be required to hold 10 percent of the lump sum in reserve for road repairs required by the refuge. The refuge forester will determine where repairs will be done. The timber buyer will pay for road repairs with this set aside money when notified by the refuge forester. As soon as the permit holder is notified that no more of the set aside funds are required for road repairs, the permit holder will be required to promptly submit payment to the U.S. Fish and Wildlife Service for the remaining set aside funds.

Bids mailed or hand delivered must be securely sealed in an envelope plainly marked:

"Bid: Upper Ouachita NWR Timber Sale 200x-xx"

If you have any questions about this packet, feel free to call [forester's name] (318-726-4222 ext 25) for additional information. If you're not planning on submitting a bid, a negative reply would be greatly appreciated.

7.6 Exhibit 4: Certificate of Independent Price Determination

U.S. DEPARTMENT OF THE INTERIOR
Fish and Wildlife Service

CERTIFICATE OF INDEPENDENT PRICE DETERMINATION
(101-45.4926 Fed. Prop. Mgt. Reg.)

(a) By submission of this bid proposal, each bidder or offerer certifies, and in the case of a joint bid or proposal each party thereto certifies as to its own organization, that is in connection with this sale:

(1) The prices in this bid proposal have been arrived at independently, without consultation, communication, or agreement, for the purpose of restricting competition, as to any matter relating to such prices, with any other bidder or offeror or with any competitor;

(2) Unless otherwise required by law, the prices which have been quoted in this bid or proposal have not been knowingly disclosed by the bidder or offeror and will not knowingly be disclosed by the bidder or offeror prior to opening, in the case of a bid, or prior to award, in the case of a proposal, directly or indirectly to any other bidder or offeror or to any competitor; and

(3) No attempt has been made or will be made by the bidder or offeror to induce any other person or firm to submit or not to submit a bid or proposal for the purpose of restricting competition.

(b) Each person signing this bid or proposal certifies that:

(1) He is the person in the bidder′s or offeror′s organization responsible within that organization for the decision as to the prices being bid or offered herein and that he has not participated, and will not participate, in any action contrary to (a) (1) through (a) (3), above; or

(2) (i) He is not the person in the bidder′s or offeror′s organization responsible within that organization for the decision as to the prices being bid or offered herein but that he has been authorized in writing to act as agent for the persons responsible for such decision in certifying that such persons have not participated, and will not participate, in any action contrary to (a) (1) through (a) (3), above, and as their agent does hereby so certify; and

(ii) He has not participated, and will not participate, in any action contrary to (a) (1) through (a) (3), above.

(c) This certification is not applicable to a foreign bidder or offeror submitting a bid or proposal for a contract, which requires performance or delivery outside the United States, its possessions, and Puerto Rico.

(d) A bid or proposal will not be considered for award where (a) (1), (a) (3), or (b), above, has been deleted or modified. Where (a) (2), above, has been deleted or modified, the bid or proposal will not be considered for award unless the bidder or offeror furnishes with the bid or proposal a signed statement which sets forth in detail the circumstance of the disclosure and the head of the agency, or his designee, determines that such disclosure was not made for the purpose of restricting competition.

7.7 Exhibit 5: Equal Employment Opportunity Clause

"During the performance of this contract, the contractor agrees as follows:

"(1) The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of this nondiscrimination clause.

"(2) The contractor will, in all solicitations or advancements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex or national origin.

"(3) The contractor will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the agency contracting officer, advising the labor union or workers' representative of the contractor's commitments under Section 202 of Executive Order No. 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

"(4) The contractor will comply with all provisions of Executive Order No. 11246 of Sept. 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

"(5) The contractor will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the contracting agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

"(6) In the event of the contractor's noncompliance with the nondiscrimination clauses of this contract or with any of such rules, regulations, or orders, this contract may be cancelled, terminated, or suspended in whole or in part and the contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order No. 11246 of Sept.

24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order No. 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

8.0 APPENDIX B: ENVIRONMENTAL ACTION STATEMENT

U. S. FISH AND WILDLIFE SERVICE

ENVIRONMENTAL ACTION STATEMENT FOR CATEGORICAL EXCLUSION

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 Upper Ouachita 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 Upper Ouachita NWR Comprehensive Conservation Plan (CCP) (2008).

The proposed CCP action was the preferred alternative among three alternatives considered in the Environmental Assessment (EA) (Draft CCP and EA 2008). In the CCP, the proposed action was to manage the refuge *"based on sound science for the conservation of a structurally and species diverse bottomland hardwood habitat for migratory birds and resident wildlife. Upland habitat will be allowed to function and respond to processes mimicking the natural fire regime and disturbances to benefit migratory birds, red-cockaded woodpeckers and resident wildlife. A focused effort will be directed toward reducing invasive species, which are threatening the biological integrity of the refuge. Wintering waterfowl habitat will be maintained as important foraging habitat in the moist soil and forested wetlands."* (Upper Ouachita NWR CCP 2008).

The CCP has defined goals, objectives and strategies to achieve the stated action. The actions further detailed in the HMP have been identified, addressed, and authorized by the Upper Ouachita NWR CCP and accompanying Environmental Assessment (2008). These include:

- Forest Management Strategy: Selectively thin upland and bottomland forests to achieve desired forest conditions stated in CCP objectives (CCP pages 87-89)
- Moist soil Management Strategy: Manipulate water levels and vegetative cover in moist soil habitat to provide wintering waterfowl habitat as stated in CCP objectives (CCP pages 91-

92)

- Fire Management Strategy: Implement prescribed burning to upland pine habitat in a way that mimics historic and natural fire regime to achieve desired habitat conditions stated in CCP objectives (CCP pages 88-89)
- Chemical Management Strategy: Use approved chemicals according to label specifications and Pesticide Use Proposals to control invasive plant species (CCP pages 89-90)
- Waterfowl Sanctuary Strategy: Maintain no hunting areas for wintering waterfowl to rest in bottomland hardwood forest and moist soil habitat according to CCP objective (CCP page 71)
- Beaver and Hog Management Strategy: Control beaver damage to allow for healthy bottomland hardwood forests according to CCP objective (CCP pages 86-87)
- Farming Strategy: Farm for high energy crops to provided needed foods for wintering waterfowl according to CCP objective (CCP pages 91-92)

Categorical Exclusion(s). Categorical Exclusion Department Manual 516 DM 6, Appendix 1 Section 1.4 B (10), which 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. Examples could include an amended public use plan or fire management plan.",* is applicable to implementation to the proposed action.

Consistent with Categorical Exclusion (516 DM 6, Appendix 1 Section 1.4 B (10)) the HMP is a step-down management plan which provides guidance for implementation of the general goals, objectives, and strategies established in the CCP, serving to further refine those components of the CPP specific to habitat management. This HMP does not trigger an Exception to the Categorical Exclusions listed in 516 DM 2 Appendix 2.

Minor changes or refinements to the CCP in this activity-specific management plan include:

- Habitat management objectives are further refined by providing numerical parameter values that more clearly define the originating objective statement.
- Habitat management objectives are restated so as to combine appropriate objectives or split complicated objectives to provide improved clarity in the context of the HMP.
- Specific habitat management guidance, strategies, and implementation schedules to meet the CCP goals and objectives are included (e.g. location, timing, frequency, and intensity of application).
- All details are consistent with the CCP and serve to provide the further detail necessary to guide the refuge in application of the intended strategies for the purpose of meeting the habitat objectives.

Permits/Approvals. Endangered Species Act, Intra-Service Section 7 Consultation was conducted during the CCP process. The determination was a concurrence that the CCP is not likely to adversely affect the endangered red-cockaded woodpecker (signed July 25, 2007 within CCP). Other Items to include that should be listed and can be found in the EAS accompanying the final CCP:

- Executive Orders 11988/11990 - July 17, 2008
- Floodplain Management and Protection of Wetlands, July 17, 2008

Public Involvement/Interagency Coordination. The proposed HMP is a step-down of the approved CCP for Upper Ouachita NWR. The development and approval of the CCP included appropriate NEPA documentation and public involvement. An Environmental Assessment was developed (Draft CCP and EA 2008) which proposed and addressed management alternatives and environmental consequences. Public involvement included public notification (Notice of Intent: Federal Register Vol. 70, No. 133, July 13, 2005) and news releases (*Bastrop Daily Enterprise*, *Ruston Leader*, Farmerville *Gazette*, Monroe *The News-star*, KEDM 90.3FM, KJLO 104 FM, KNOE 102 FM), public scoping (public meetings November 14, 2006, Marion, LA and November 15, 2006, Bastrop, LA) and public review (30-day availability period: March 21, 2008-April 21, 2008). Approximately 15 members of the public attended the public meetings. Written comments were submitted by three members of the general public. Comments were submitted by other federal agencies. Refer to CCP for specific comments and Service response.

Supporting Documents. Supporting documents for this determination include relevant office file material and the following key references:

U.S. Fish and Wildlife Service. 2011. Upper Ouachita National Wildlife Refuge, Fire Management Plan.

U.S. Fish and Wildlife Service. 1988. Upper Ouachita National Wildlife Refuge, Forest Management Plan.

U.S. Fish and Wildlife Service. 2008. Upper Ouachita National Wildlife Refuge, Comprehensive Conservation Plan.

U.S. Fish and Wildlife Service. 2008. Upper Ouachita National Wildlife Refuge, Environmental Assessment for the Draft Comprehensive Conservation Plan.

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Project Leader date